City of Santa Cruz

Overview of Water Planning Tools, Strategies, and Current Directions

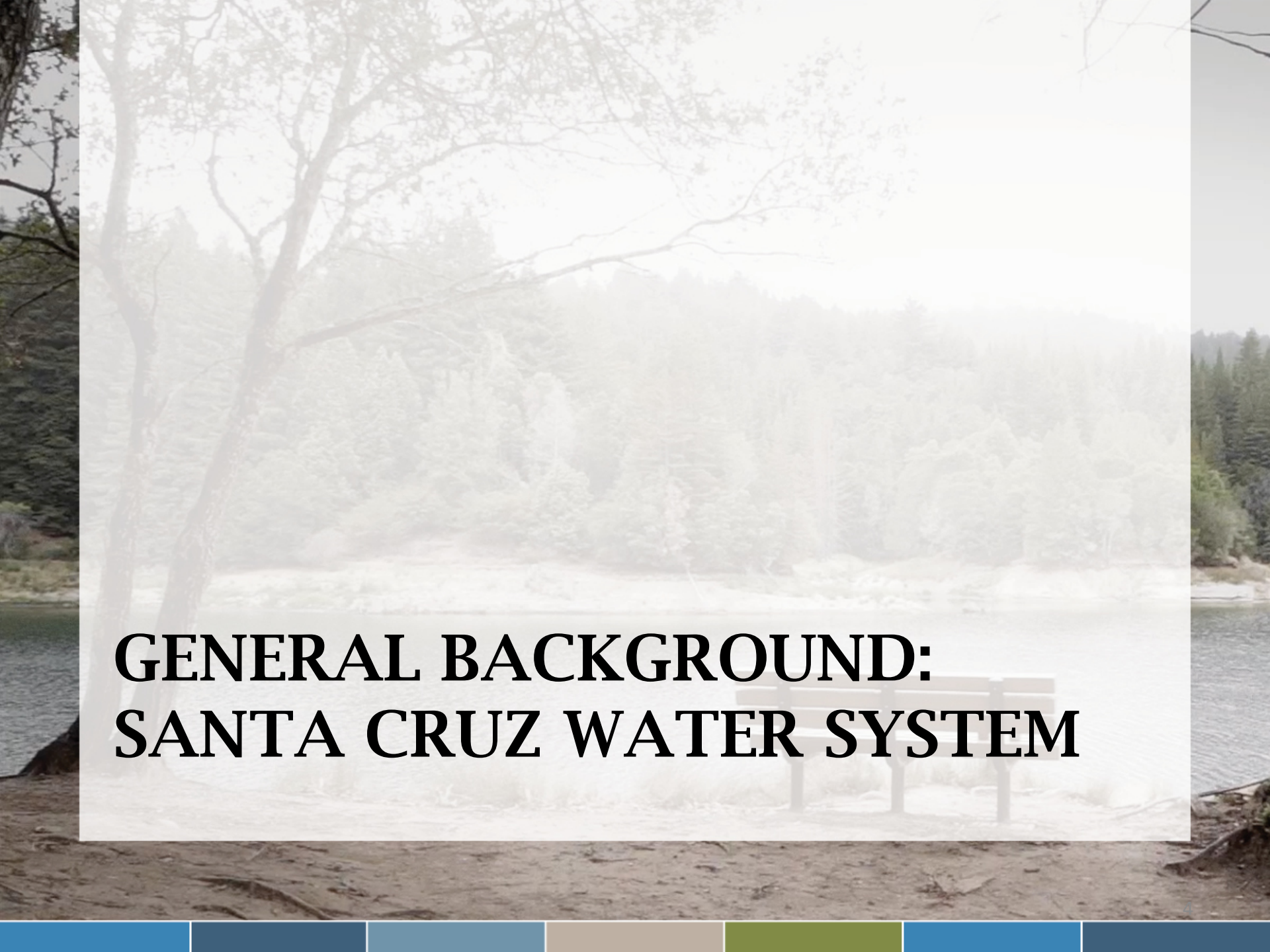
SANTA MARGARITA GROUNDWATER AGENCY
AUGUST 22, 2019

Presentation Objective

- Provide an overview of the City of Santa Cruz's use of surface water resources.
- A companion presentation focusing on the San Lorenzo Valley Water District's use of surface water resources will occur at a later meeting.

Presentation elements include:

- General System Background
- Laying out a Plan for Water Supply Reliability
- Update on supply planning work
- Water demand and climate change
- Fishery restoration
- Modeling Tools and Results
- Water rights

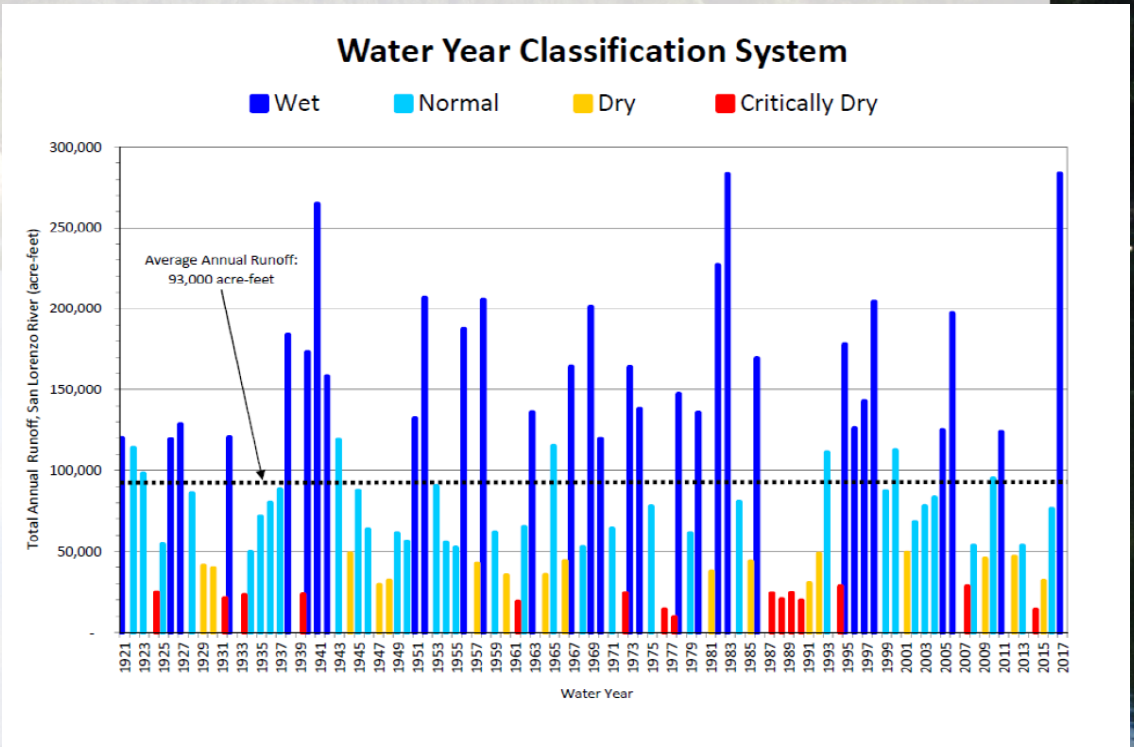


GENERAL BACKGROUND: SANTA CRUZ WATER SYSTEM

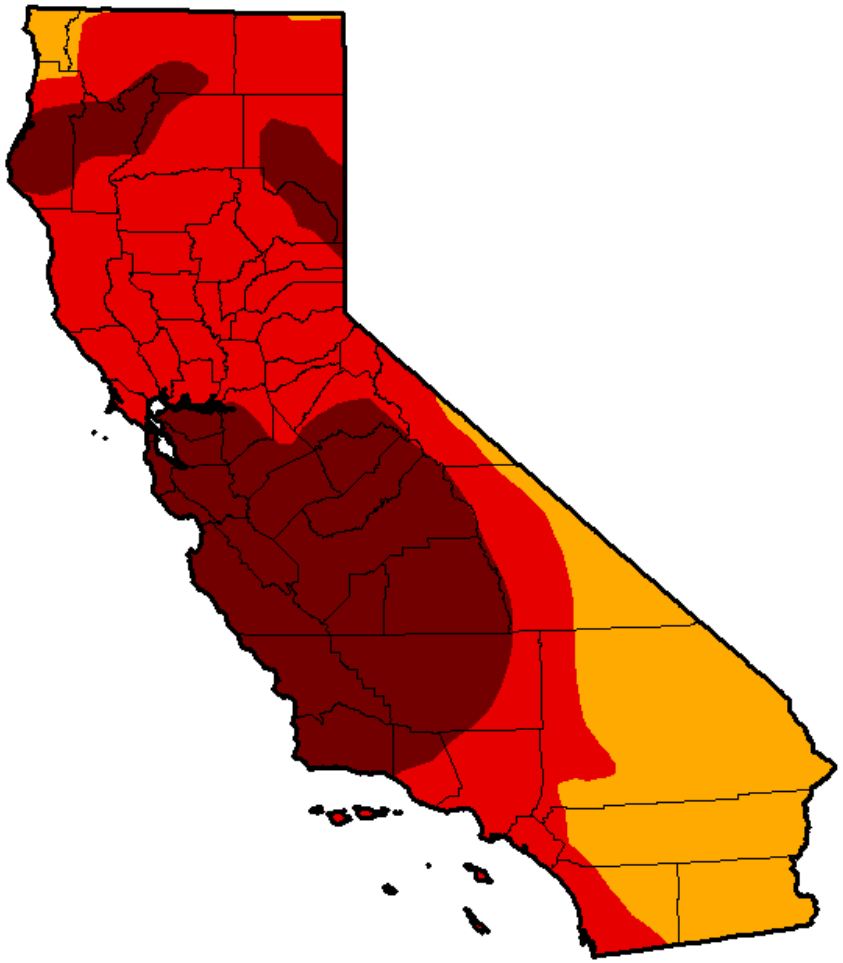
Existing City of Santa Cruz Water Facilities

Characteristics of the Santa Cruz Water System

- Drinking water sources are primarily local surface water;
- System serves approximately 98,000 people;
- Water sources are extremely variable and provide habitat for several “special-status” species.



U.S. Drought Monitor
California



June 24, 2014

(Released Thursday, Jun. 26, 2014)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	100.00	100.00	76.69	32.98
Last Week 6/17/2014	0.00	100.00	100.00	100.00	76.69	32.98
3 Months Ago 3/25/2014	0.00	100.00	99.80	95.21	71.78	23.42
Start of Calendar Year 12/31/2013	2.61	97.39	94.25	87.53	27.59	0.00
Start of Water Year 10/1/2013	2.63	97.37	95.95	84.12	11.36	0.00
One Year Ago 6/25/2013	0.00	100.00	98.21	92.61	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Eric Luebehusen
U.S. Department of Agriculture

http://droughtmonitor.unl.edu/

Distribution of Landfalling Atmospheric Rivers on the U.S. West Coast
(From 1 Oct 2016 to 31 March 2017)

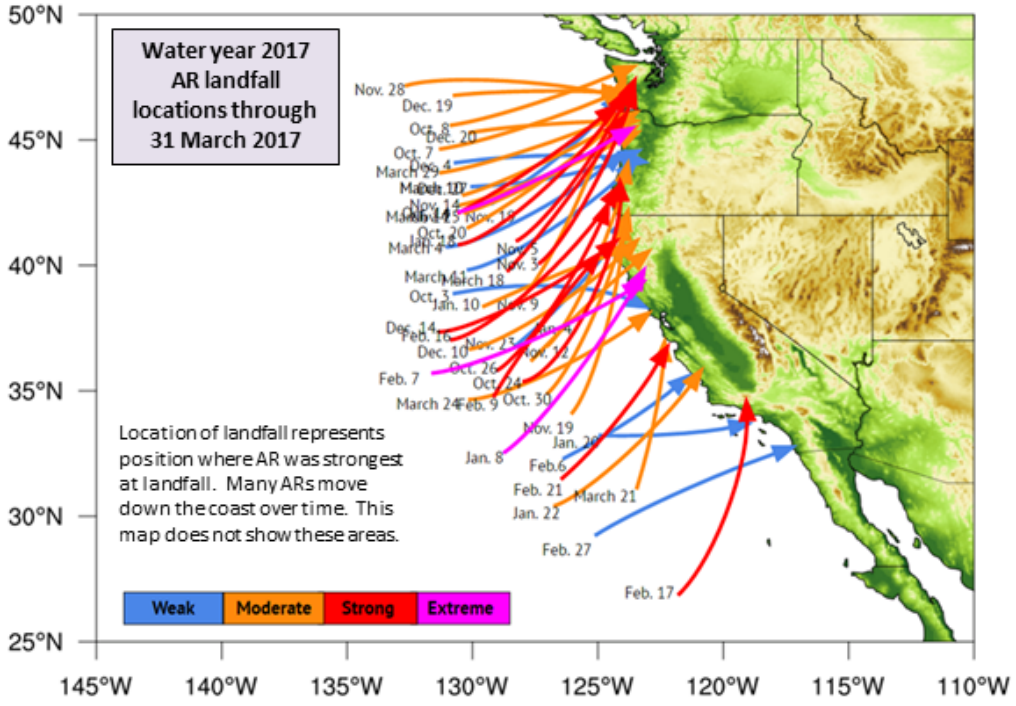
AR Strength	AR Count*
Weak	11
Moderate	20
Strong	12
Extreme	3

Ralph/CW3E AR Strength Scale

- Weak: IVT=250–500 kg m^{-1} s^{-1}
- Moderate: IVT=500–750 kg m^{-1} s^{-1}
- Strong: IVT=750–1000 kg m^{-1} s^{-1}
- Extreme: IVT>1000 kg m^{-1} s^{-1}

*Radiosondes at Bodega Bay, CA indicated the 10–11 Jan AR was strong (noted as moderate based on GFS analysis data) and 7–8 Feb AR was extreme (noted as strong)

- 45 Atmospheric Rivers have made landfall on the West Coast thus far during the 2017 water year (1 Oct. – 31 March 2017)
- This is much greater than normal
- 1/3 of the landfalling ARs have been "strong" or "extreme"



Center for Western Weather and Water Extremes
SCRIPPS INSTITUTION OF OCEANOGRAPHY AT UC SAN DIEGO

By F.M. Ralph, B. Kawzenuk, C. Hecht, J. Kalansky

Experimental

LAYING OUT A PLAN: THE SANTA CRUZ WATER SUPPLY ADVISORY COMMITTEE APRIL 2014 TO OCTOBER 2015

Water Supply Advisory Committee

14 Citizens of Santa Cruz and Live Oak

Appointed by Council

Representing the Chamber, Desal Alts, Sierra Club, Surfrider, Sustainable Water Coalition, the Water Commission and 3 community-at-large members.

Not Pictured Peter Beckman and Charlie Keutmann

WSAC's Problem Statement July 2015

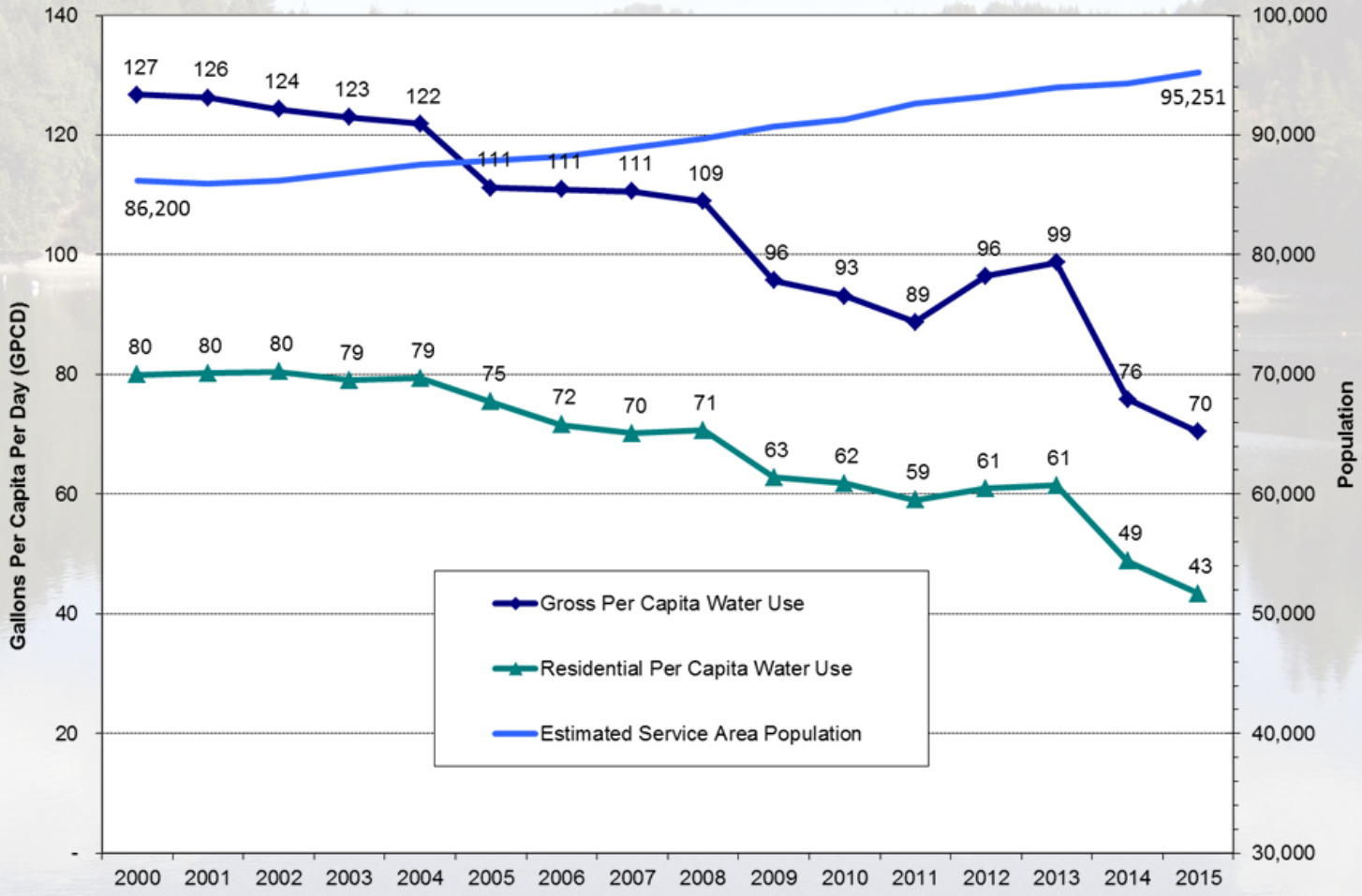
- Limited Storage
- Fish Flow Requirements & Potential climate change impacts
- Resulting peak-season gap: 1.2 billion gallons worst case
- Water conservation alone is not enough

WSAC Supply Augmentation Recommendations Approved by City Council November 2015

- Implement Additional Water Conservation Efforts
  - Continued and increased conservation programs
- Explore the Feasibility of Winter Water Harvest
  - In-lieu water transfers/exchange with Soquel Creek and/or Scotts Valley Water Districts
  - Aquifer storage and recovery (ASR)
- Explore the Feasibility of Alternative Water Supplies
  - Recycled water
  - Desalination

UPDATE ON SUPPLY PLANNING WORK

The GPCD Trend is Definitely Downward

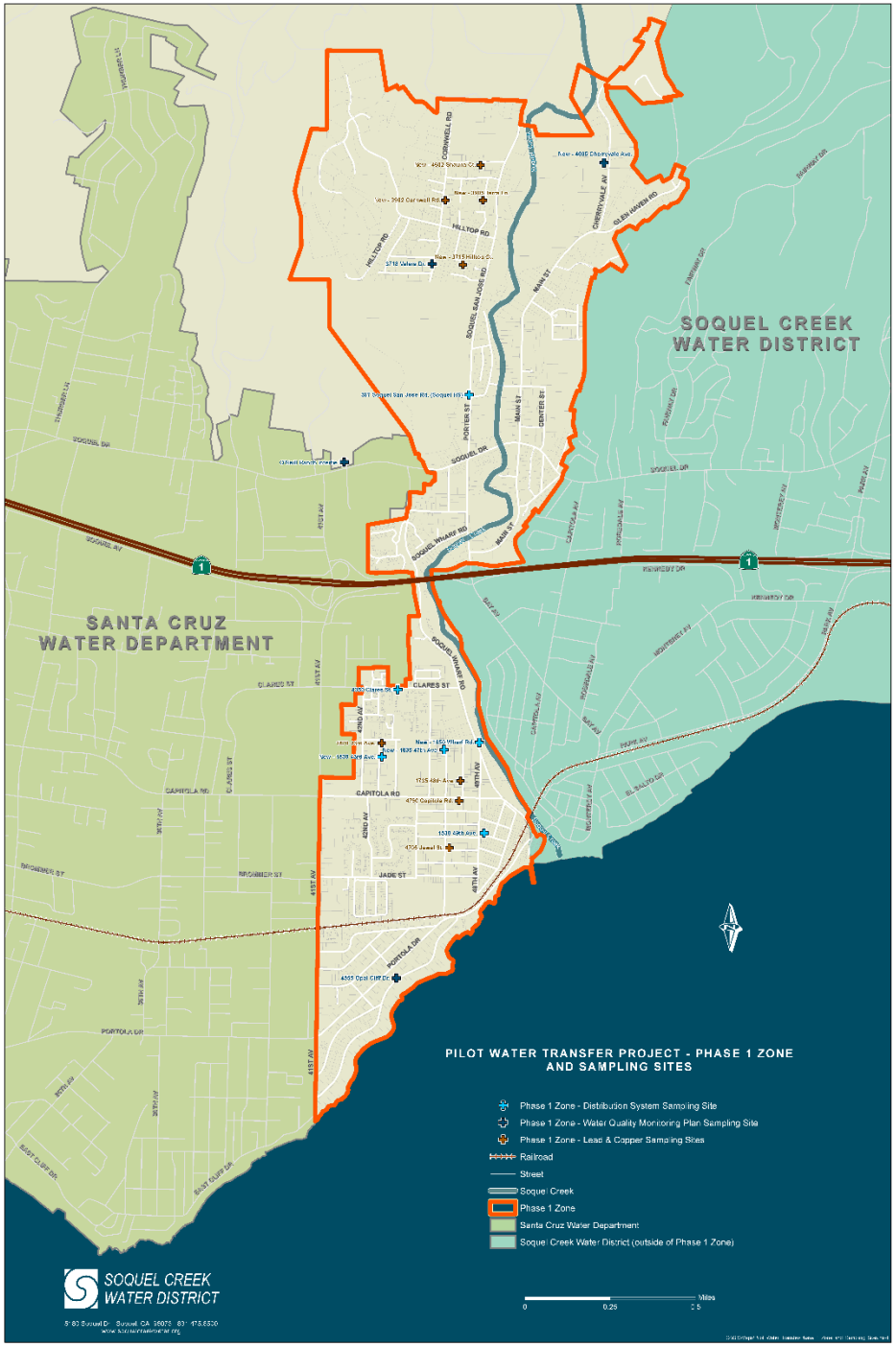


In-Lieu: Transfers & Exchanges

- Explore Water Transfers and/or Exchanges with Soquel Creek, Scotts Valley and/or San Lorenzo Valley water district
- Initial work performed by Kennedy/Jenks for the County of Santa Cruz in 2013.
- Kennedy/Jenks did not look at the ability of those agencies and the basins to return water; i.e., transfers only.
- 2016 Agreement with Soquel Creek Water District to evaluate the feasibility of water transfers.
- October 2017 – July 2018 study assessed compatibility of surface and groundwater resources .

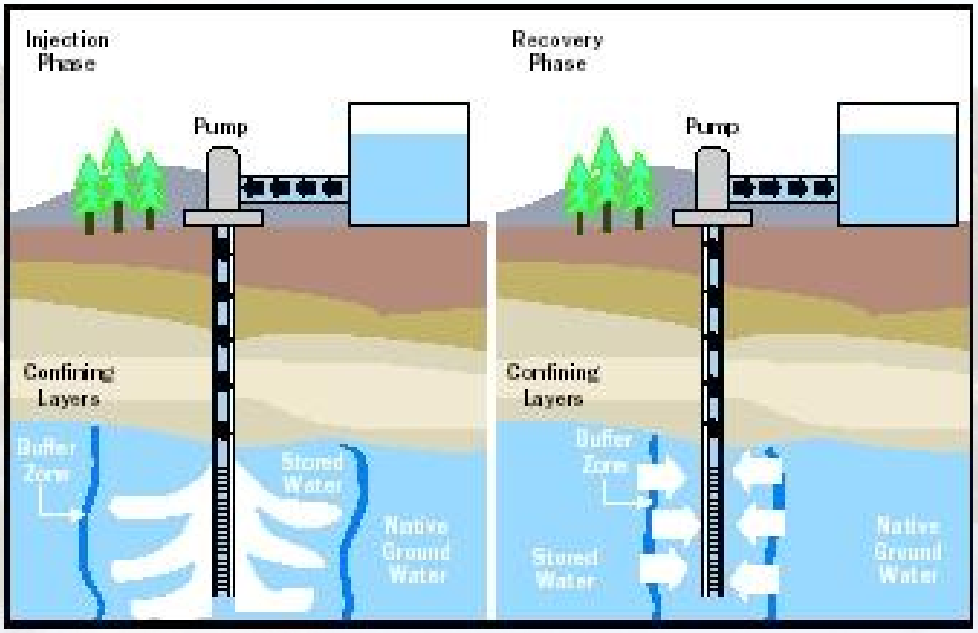
December 3, 2018
City/Soquel Intertie

- Water Transfers Pilot and Next Steps:
  - Successfully completed first year pilot water transfer to Soquel Creek; second year expanded pilot transfer planned for the upcoming winter;
  - Continue discussions with other agencies concerning their ongoing interest in water transfers.
  - Continue to refine groundwater modeling work to determine benefits to the basin(s) and ability to return water to Santa Cruz via an exchange.



Water Transfers Pilot Phase 1 Isolated zone

Aquifer Storage and Recovery



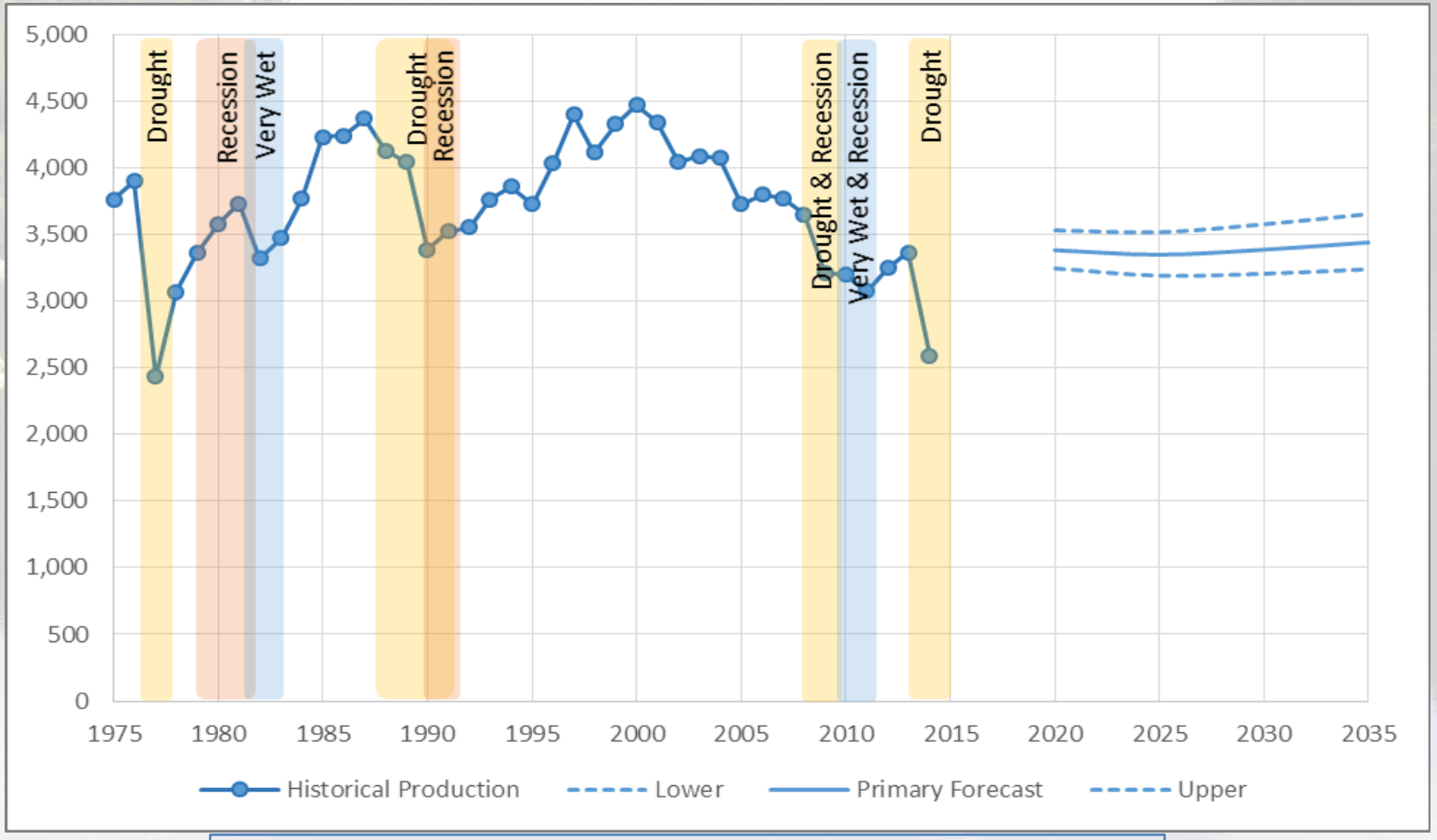
- Evaluate the feasibility of storing water in regional aquifers for future use during drought.
- Contracted with Pueblo Water Resources in February 2016 to complete feasibility analysis (Phase 1) and in October 2018 to complete Pilot Testing of ASR at Beltz 12 (Phase 2).

Current Direction of City Water Supply Planning Activities

- Develop ASR in the Mid-County Basin using existing Beltz system and possible new infrastructure;
- Continue to analyze demands and climate change and their impacts on the supply gap
- Continue evaluating opportunities for In-Lieu and ASR in Santa Margarita Groundwater Basin;
- Continue evaluation of recycled water groundwater replenishment alternatives; and
- Develop recommendation to the Water Commission and City Council to adjusts the WSAC Work Plan.

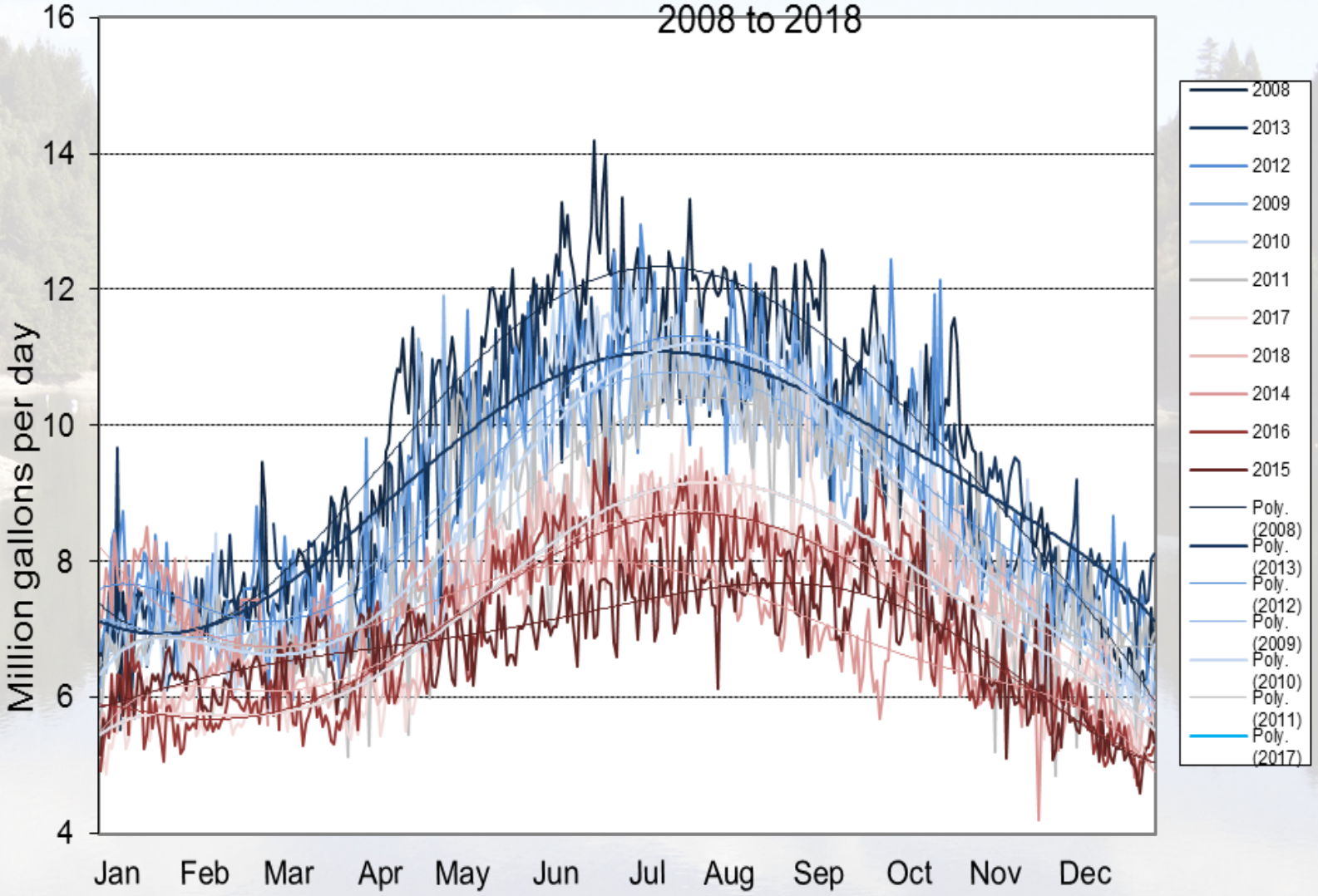
WATER DEMAND AND CLIMATE CHANGE

WSAC Agreed Upon Demand Forecast



Historical & Forecast Production in Millions of Gallons

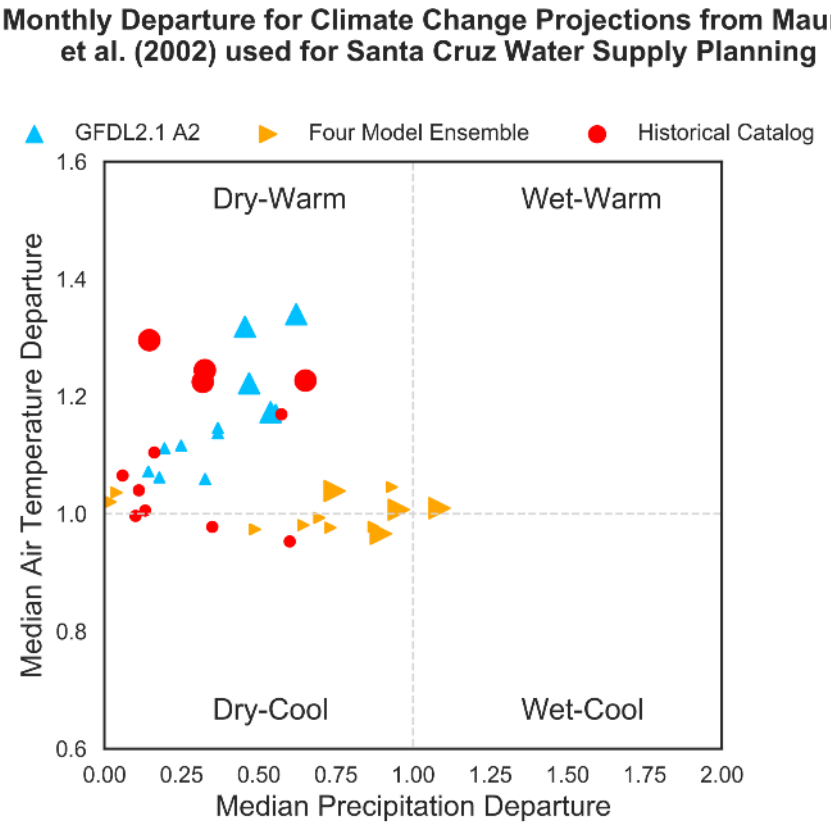
Gross Daily Water Consumption

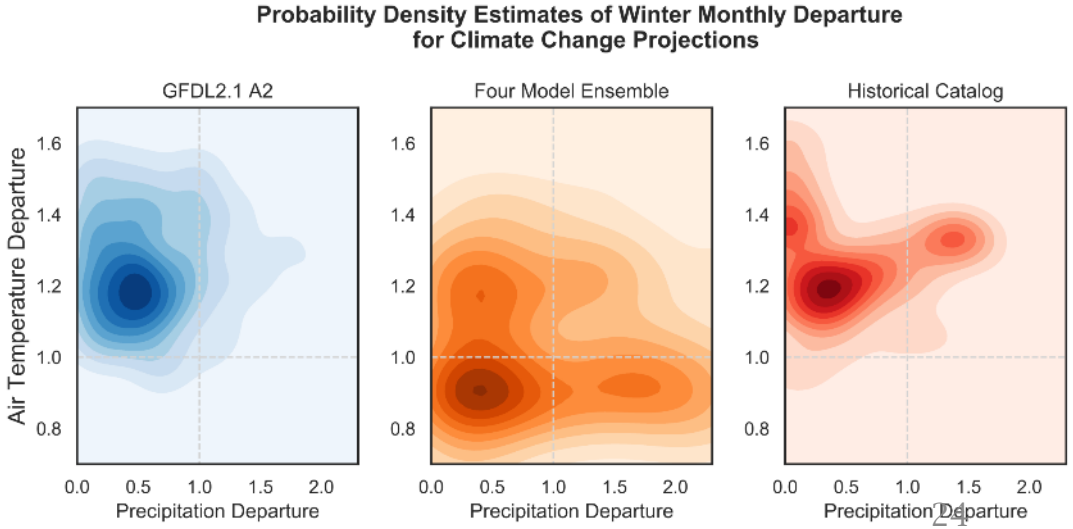


What's Happening with Demand?

- Water demand continues to be low 3 years after end of drought
- Water consumption is slightly below the 2.5 BGY level of sales assumed in long range financial plan
- Large discontinuity between actual and forecast water production, possibly influencing amount/timing of new supply

Climate Change – New Scenarios Developed and Evaluated





FISHERY RESTORATION

Endangered Species Act Issues Requirements:

The ESA requires agencies to "avoid, minimize and mitigate impacts to the maximum extent practicable."

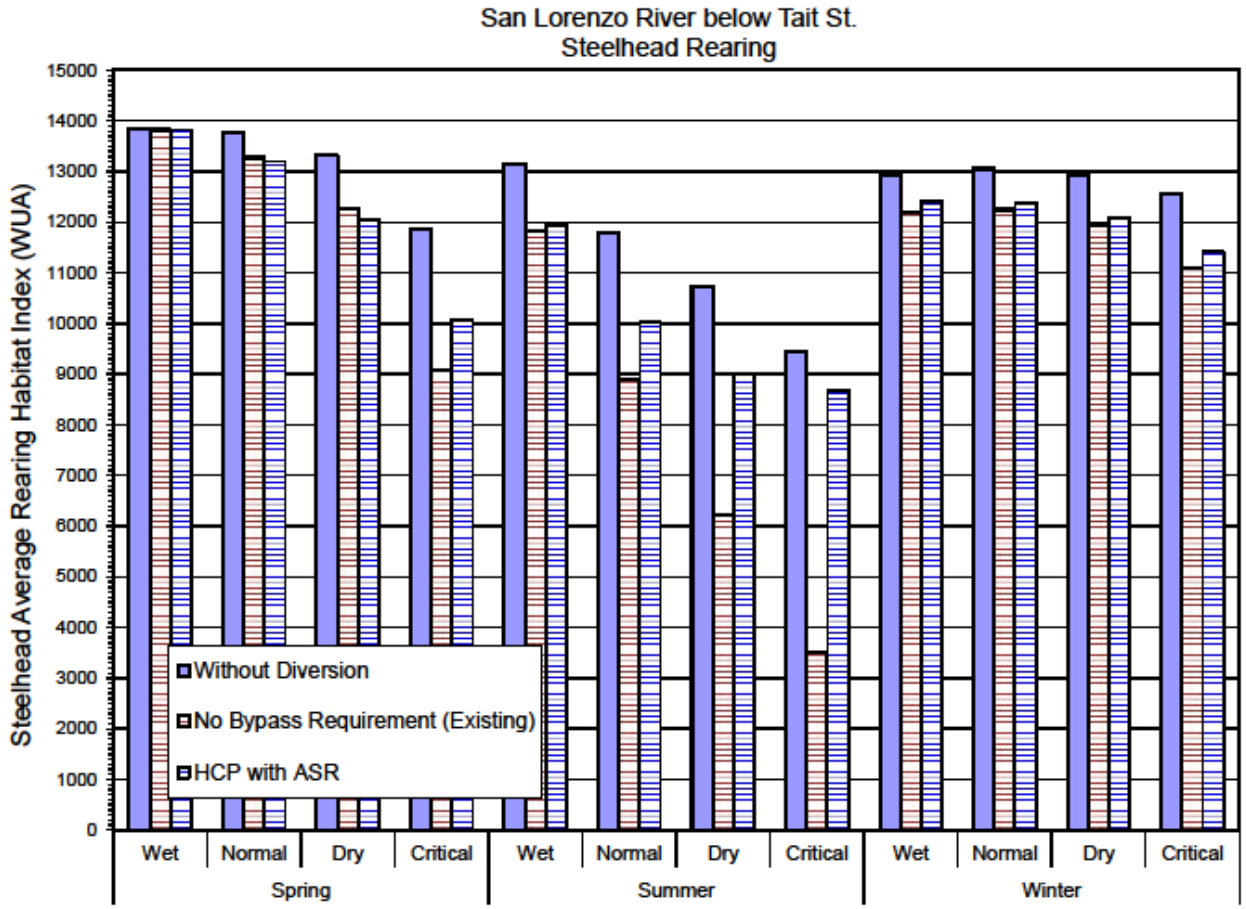
Impacts can include any operating or construction related activity that may result in "taking" (i.e., harming individuals or their habitat).

The first time flow was released to Laguna Creek for fish from the City's water diversion…

The City's Commitments to Protecting Fish:

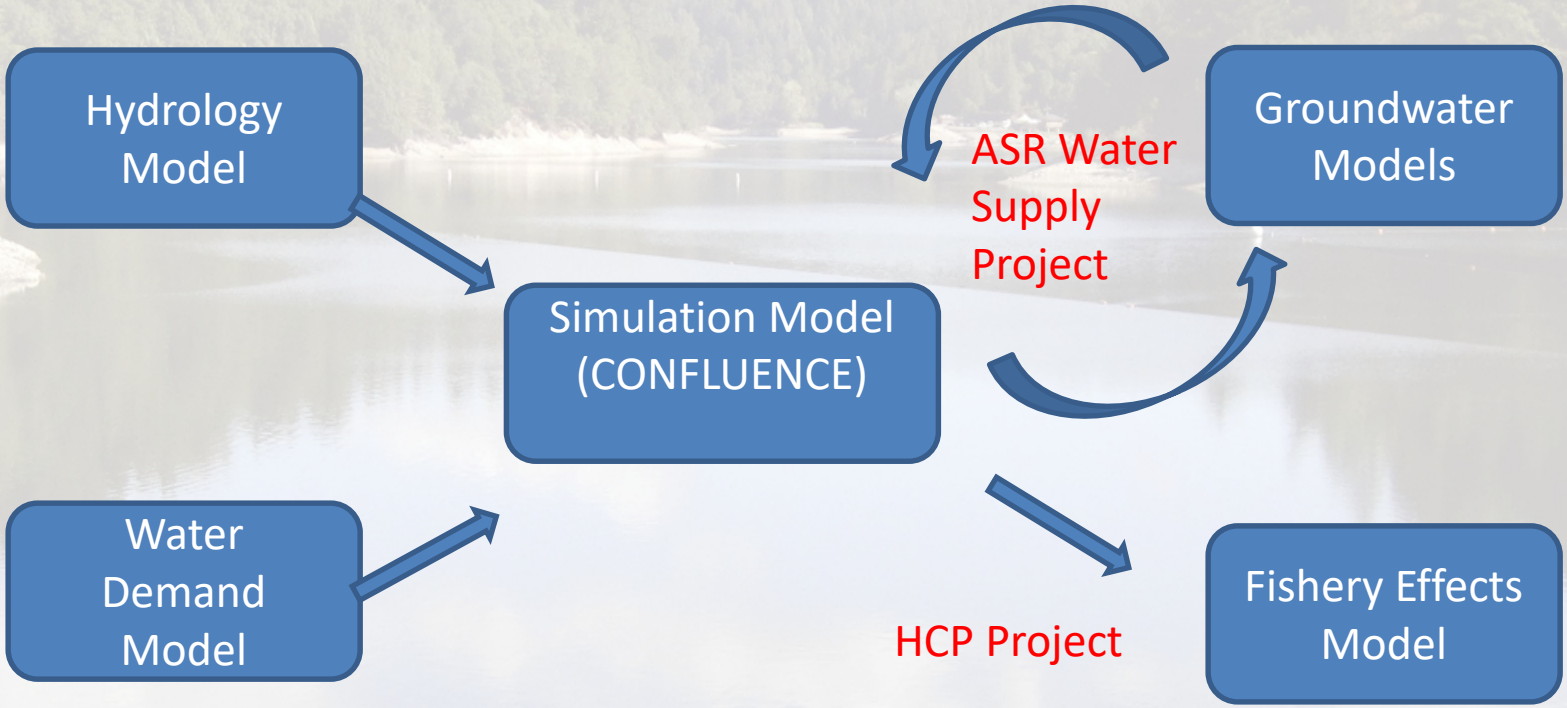
- Avoidance and Minimization
  - Instream Flow Improvements
  - Construction/Maintenance best practices, etc.
- Compensation for Remaining Biological Effects
  - Non-Flow Conservation Fund

Providing Water for Fish When It Matters Most



MODELING TOOLS FOR SURFACE WATER, AND GROUNDWATER

Confluence is a Bridge Between Various Models



Confluence: What it is and isn't

Confluence is a daily time step water system model used for:

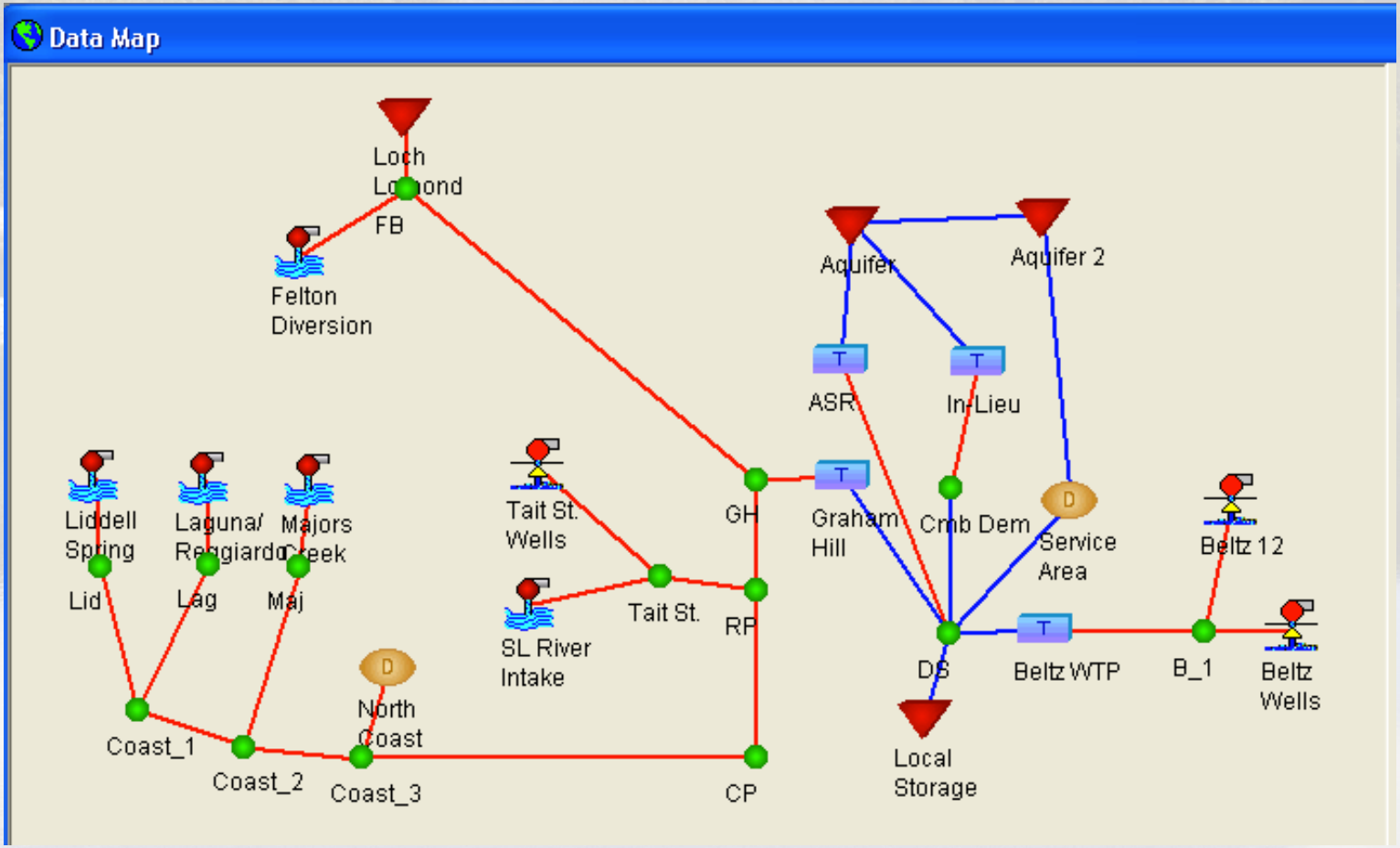
- System planning and simulations
- Confluence can compare scenarios

Confluence isn't:

- Operations model
- Optimization tool

Confluence can't identify the "best" scenario

Confluence Interactive Data Map



Source of Supply Daily Dispatch Order

1. North Coast
2. Tait Street Diversion
3. Tait Street Wells
4. Beltz Wells
5. Surface and GW Storage

Daily source dispatch may be constrained by:

- Infrastructure Capacities
  - Diversion, transmission, treatment
- Available Flows
- Water Rights
- Water Quality/Turbidity
- First Flush Flow Requirements
- Production Limits
- Etc.

Updates on the "Gap" Current-System Worst-Drought Peak-Season Shortages (mg)

Drought Year	Historical		GFDL Clim Chg		CMIP 5 Clim Chg		Catalog Clim Chg	
	3.2 bg	2016-18	3.2 bg	2016-18	3.2 bg	2016-18	3.2 bg	2016-18
Yr 1	728	0	1,109	419	816	241	1,067	315
Yr 2	1,141	781	956	570	864	454	1,276	834
Yr 3	--	--	--	--	794	408	--	--
Total	1,869	781	2,066	989	2,474	1,103	2,343	1,149

ASR Infrastructure Required to Eliminate Worst-Drought Peak-Season Shortages*

	Historical		GFDL Clim Chg		CMIP5 Clim Chg		Catalog Clim Chg	
Demand	3.2 bg	2016-18	3.2 bg	2016-18	3.2 bg	2016-18	3.2 bg	2016-18
Injection (mgd)	5.0	1.0	6.0	1.5	3.5	1.0	N/A	3.0
Extraction (mgd)	4.5	2.5	6.0	3.5	7.5	3.0	N/A	3.5
Max Aquifer Storage (mg)	2,500	1,000	2,700	1,200	2,400	1,100	N/A	1,400

* With 3-year pre-drought fill period

Ability to Achieve Soquel Creek Transfer Volume Targets

- Given the following dispatch order:
  - Releases for Fish
  - Santa Cruz Demands
  - Santa Cruz Storage (Loch Lomond & Groundwater)
  - Neighboring Agencies

Ability to Achieve Soquel Creek Transfer Volume Targets

FLOWS	DEMAND	FRACTIONS OF WATER YRS ACHIEVING VOLUME TARGETS					
		Current GHWTP			Improved GHWTP		
		Annual 1500 AF	Off-Pk 500 AF	Off-Pk 300 AF	Annual 1500 AF	Off-Pk 500 AF	Off-Pk 300 AF
Historical	3.2 bg	0%	15%	60%	15%	70%	90%
	2016-18	30%	95%	98%	45%	96%	99%
GFDL CC	3.2 bg	0%	2%	3%	15%	85%	100%
	2016-18	10%	98%	100%	55%	100%	100%
CMIP5 CC	3.2 bg	15%	45%	55%	40%	55%	80%
	2016-18	45%	95%	100%	55%	99%	100%
Catalog CC	3.2 bg	N/A	N/A	N/A	N/A	N/A	N/A
	2016-18	0%	5%	20%	20%	80%	85%

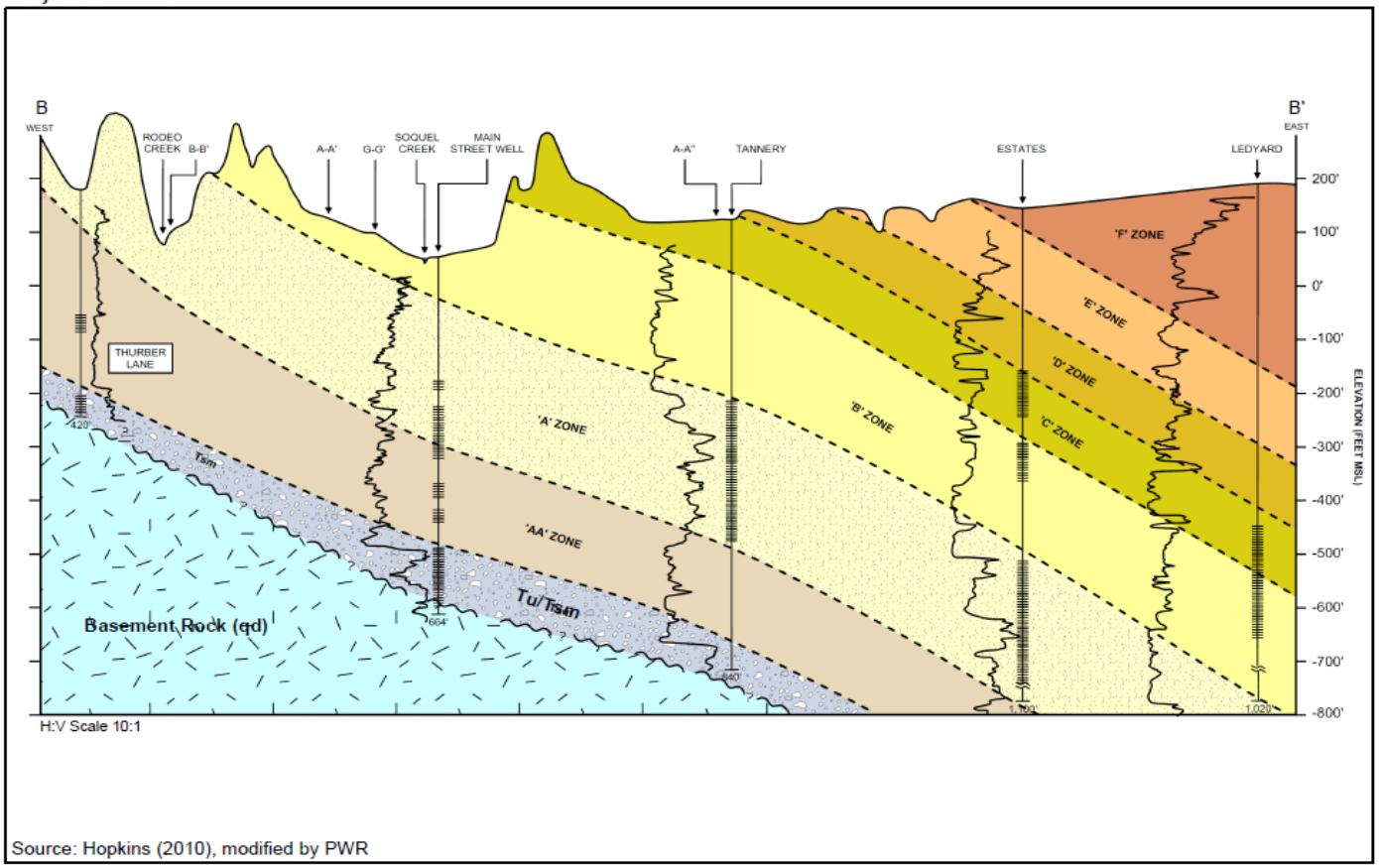
Groundwater Modeling

- **Overview**
  - Two independent models:
    - Santa Margarita Groundwater Basin (SMGWB)
    - Santa Cruz Mid-County Groundwater Basin (MCGB)
  - Calibrated against historical periods

Mid-County Groundwater Agency Modeling of City ASR and In-Lieu

- Primary Purpose – Validate WSAC assumptions regarding feasibility of groundwater storage
  - GW Basin Storage Capacities (1 to 1.5 bg)
  - Storage Losses (20%)
  - Per-Well Injection Rates (0.3 - 0.5 mgd avg)
- Example not specifically designed to meet Groundwater Sustainability Criteria

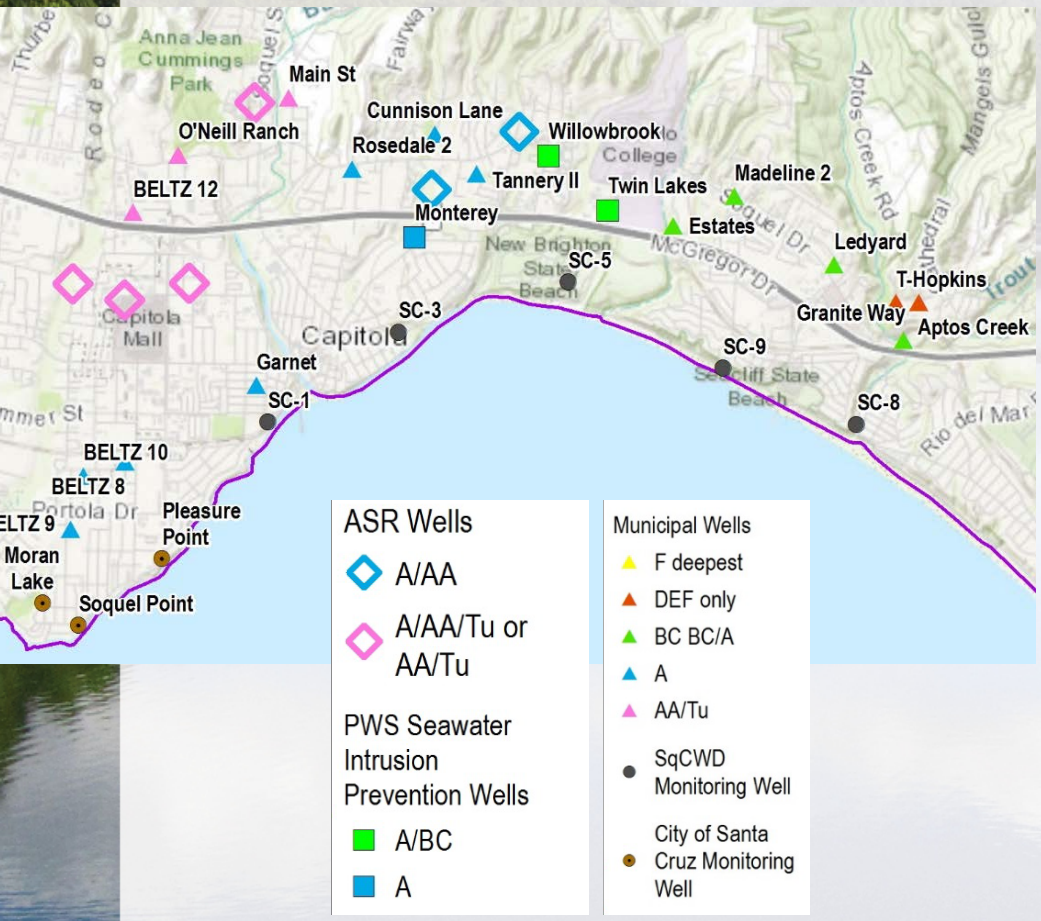
Mid-County Groundwater Basin Hydrogeology



PUEBLO water resources

FIGURE 4. CROSS-SECTION B - B'
Reconaissance-Level ASR Study
Stratus Consulting / City of Santa Cruz

City MCGB Groundwater Storage Phase I Feasibility Scenarios



In-Lieu only

- Reduced pumping at SqCWD Purisima wells
- Recovery pumping at new City wells

ASR only

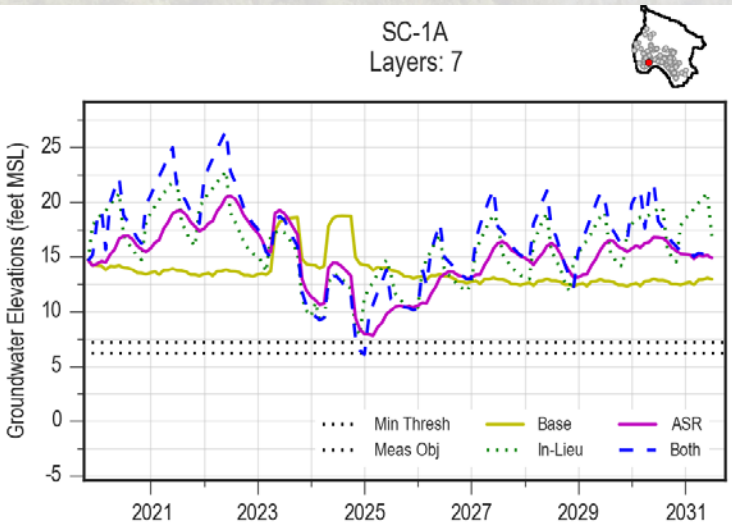
- Injection at new City wells
- Recovery pumping at same wells as injection

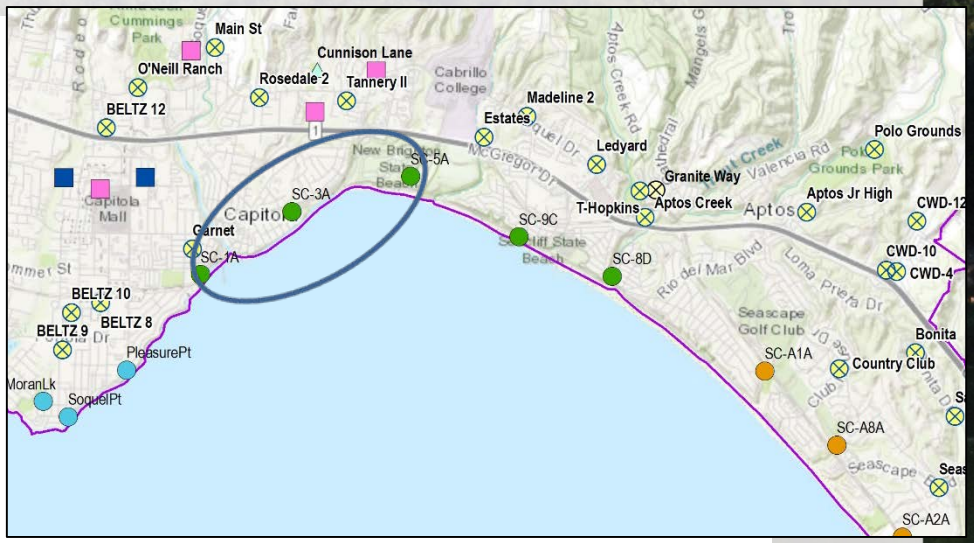
In-Lieu + ASR

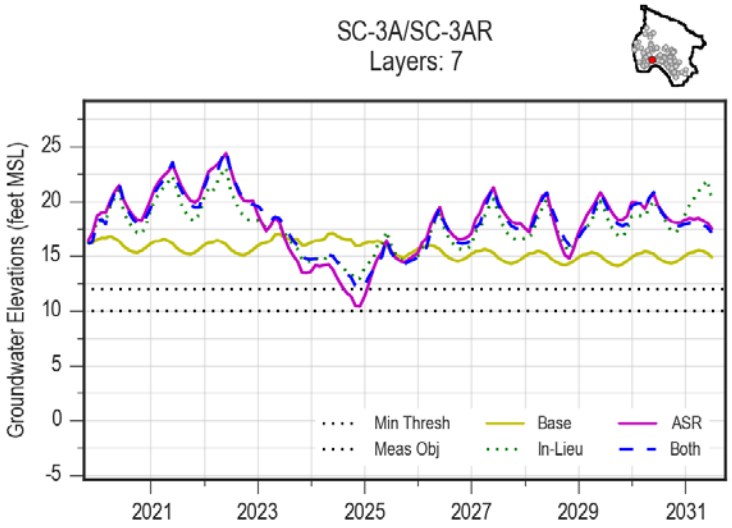
Baseline (No Projects)

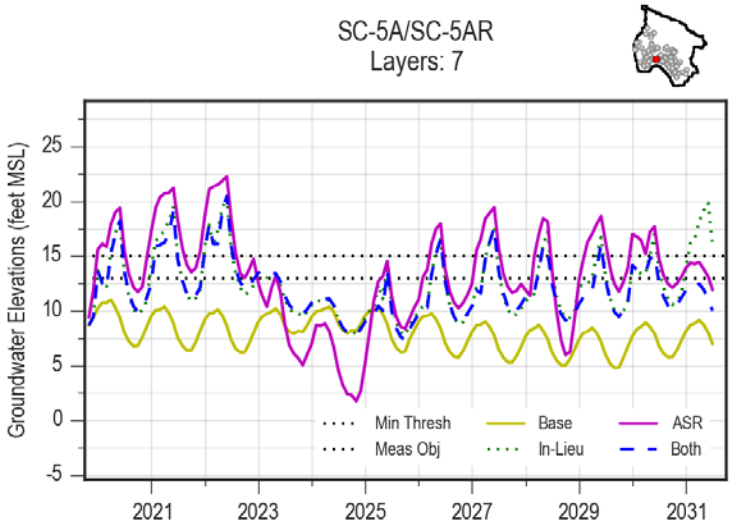
Scenarios developed by Pueblo Water Resources for Phase I feasibility study

Coastal Groundwater Levels Purisima A Unit (SqCWD Wells)









Baseline
In-Lieu
ASR
Both

Current Direction of City Water Supply Planning Activities

- Develop ASR in the western part of the Mid-County Basin using existing Beltz system and possible new infrastructure;
- Continue to analyze demands and climate change and their impacts on the supply gap
- Continue evaluating opportunities for In-Lieu and ASR in regional groundwater basins;
- Continue evaluation of recycled water groundwater replenishment alternatives; and
- Develop recommendation to the Water Commission and City Council to adjust the WSAC Work Plan.

CITY OF SANTA CRUZ WATER RIGHTS CONFORMANCE PROJECT

Overview of the City of Santa Cruz's Water Rights

Source	License/ Permit Number	Period	Maximum Diversion Rate (cfs)	Fish Flow Requirement (cfs)	Annual Diversion Limit (mil gal)
North Coast	Pre-1914	Year round	No limit	None	None
San Lorenzo River:					
Tait Street Diversion and Wells	1553, 7200	Year-round	12.2	None	None
Felton Diversion to Loch Lomond Reservoir	16601, 16123	Sept	7.8	10	977
		Oct	20	25	
		Nov-May	20	20	
		Jun-Aug	0	--	
Newell Creek:	9847				
Collection to storage (max amount/year)		Sept-Jun	No limit	--	1,825
Withdrawal		--	--	1	1,042

Santa Cruz
Water Rights Project

- The Proposed Project involves modifying existing City water rights to increase the flexibility and improve the City's ability to utilize surface water within existing allocations.
- No new allocations of water are being requested.
- Fish flow commitments are being incorporated into the City's San Lorenzo river rights.

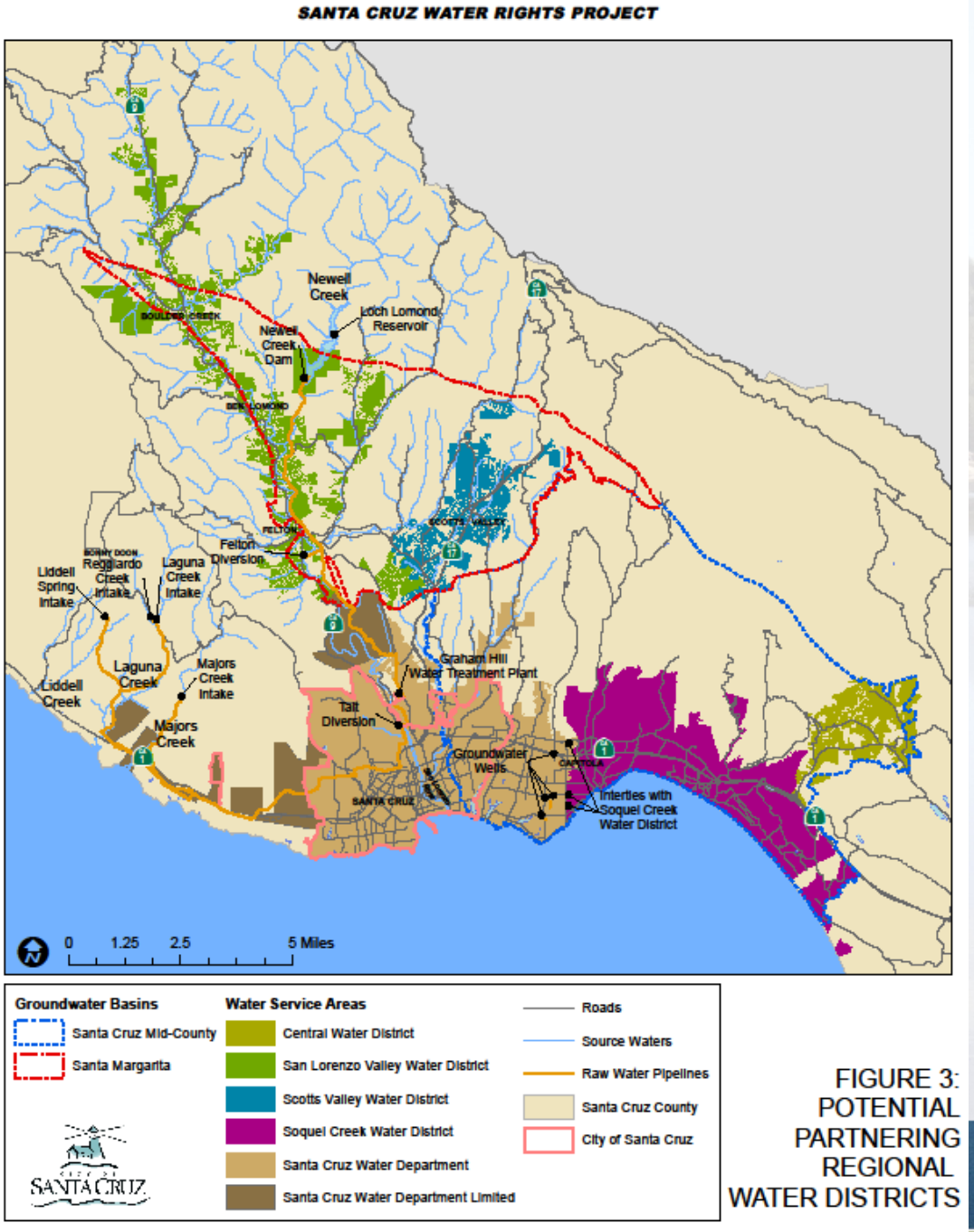


FIGURE 3: POTENTIAL PARTNERING REGIONAL WATER DISTRICTS

The City is working with regional Groundwater Sustainability Agencies on implementing the Sustainable Groundwater Management Act.

The City's proposed water rights changes could support local efforts to create and maintain sustainable groundwater resources in two important local aquifers.


QUESTIONS