Governing Groundwater

Ruth Langridge
University of California, Santa Cruz

40 Percent of California's Supply is Groundwater
Much of the State's groundwater is used for agricultural irrigation

CA Department of Water Resources, Stanford News 7/7/11

Overdraft

1980

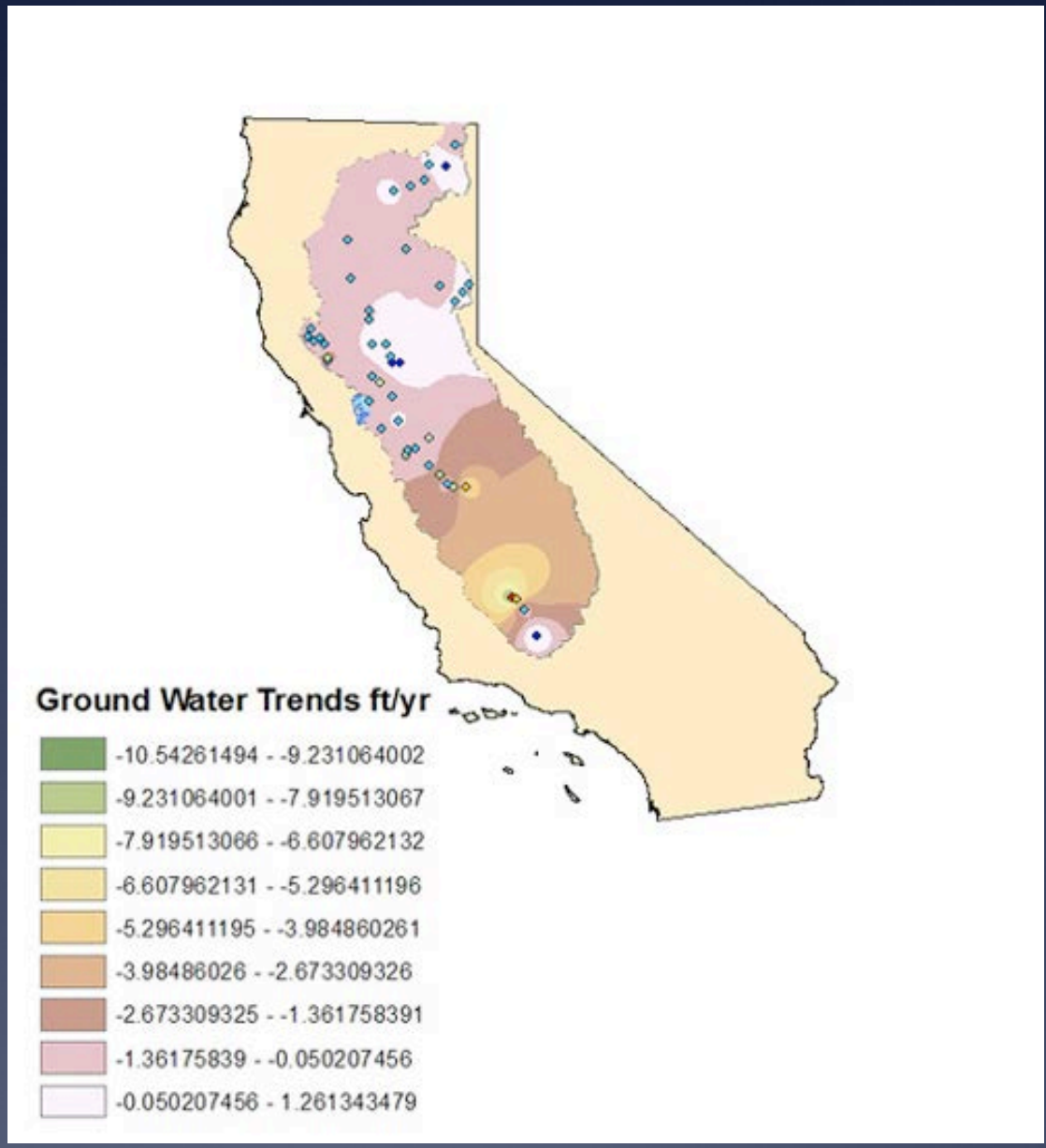
11 basins - critical overdraft;
31 basins - evidence of overdraft;
5 basins - special problems.

DWR Bulletin 118

2013

Many of these basins show signs of continued depletion

DWR CA Water Plan Update 2013



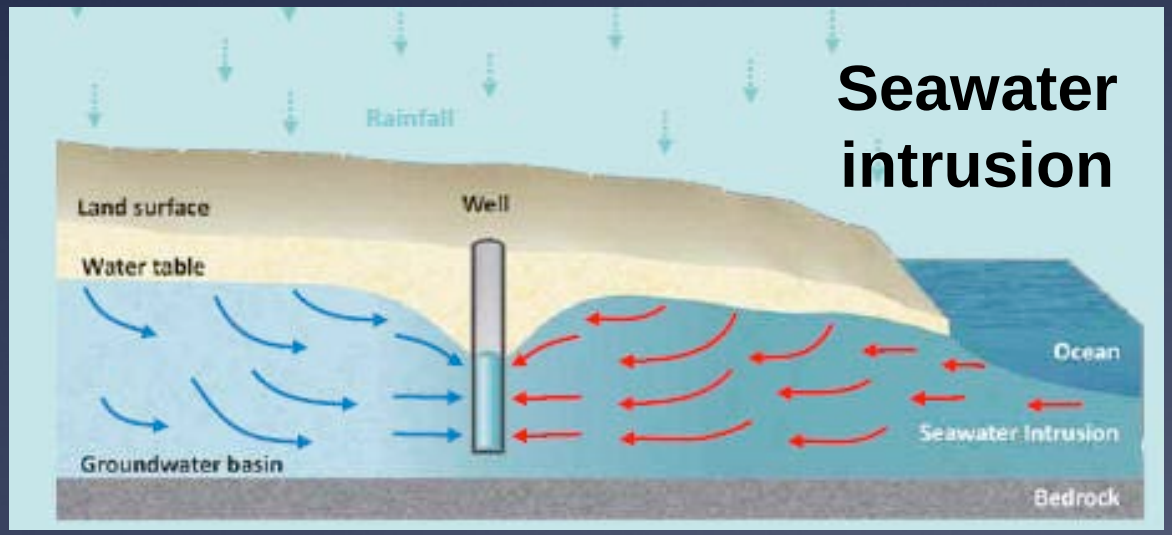
Impacts of groundwater overdraft:

Saltwater intrusion

Subsidence

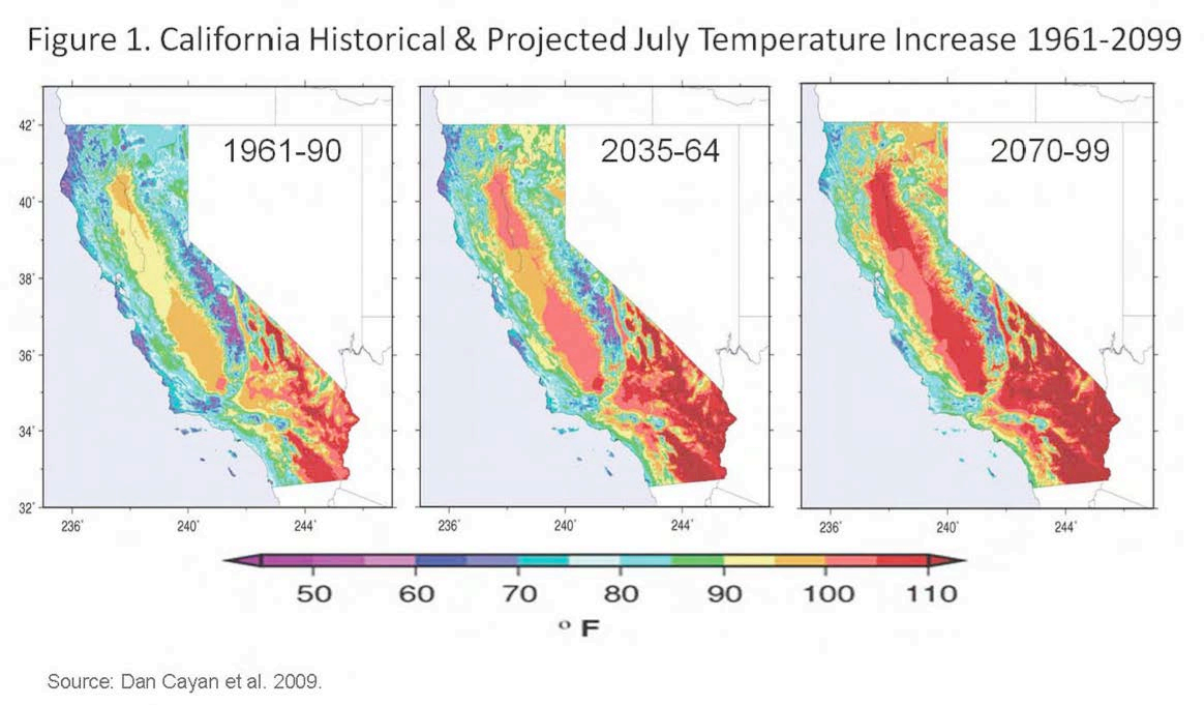
Surface streams going dry

Water quality degradation



Climate Change

Higher temperatures
Diminished snowpack
Changes in extremes
Changes in surface run off
Rising sea levels

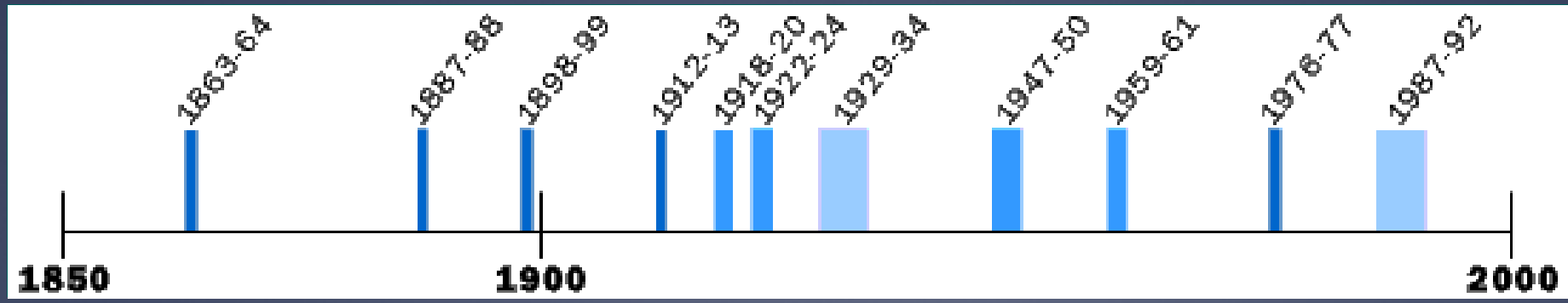


Less Freshwater Availability

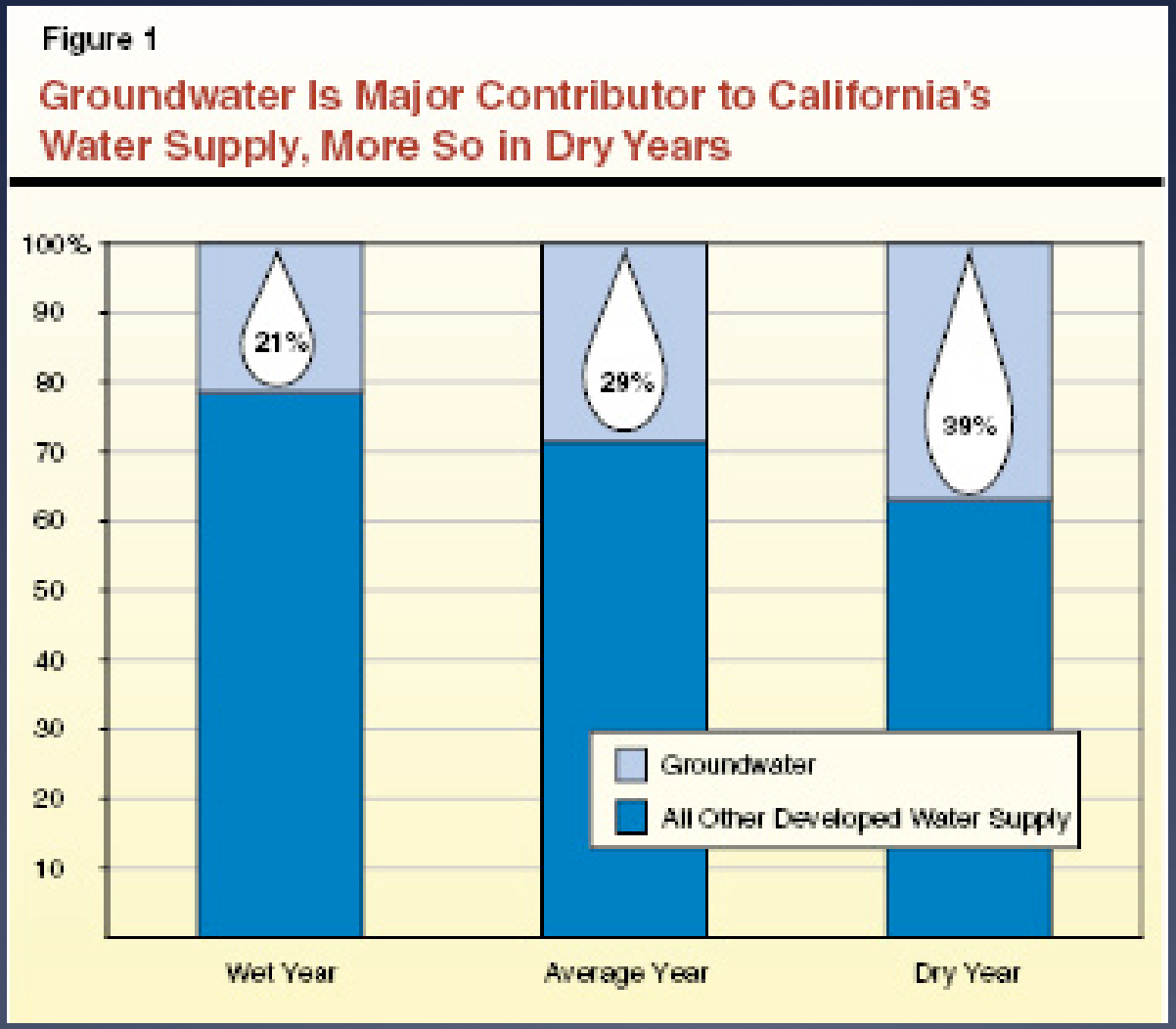
Drought

Less Freshwater Availability

California Droughts: 1850-2000

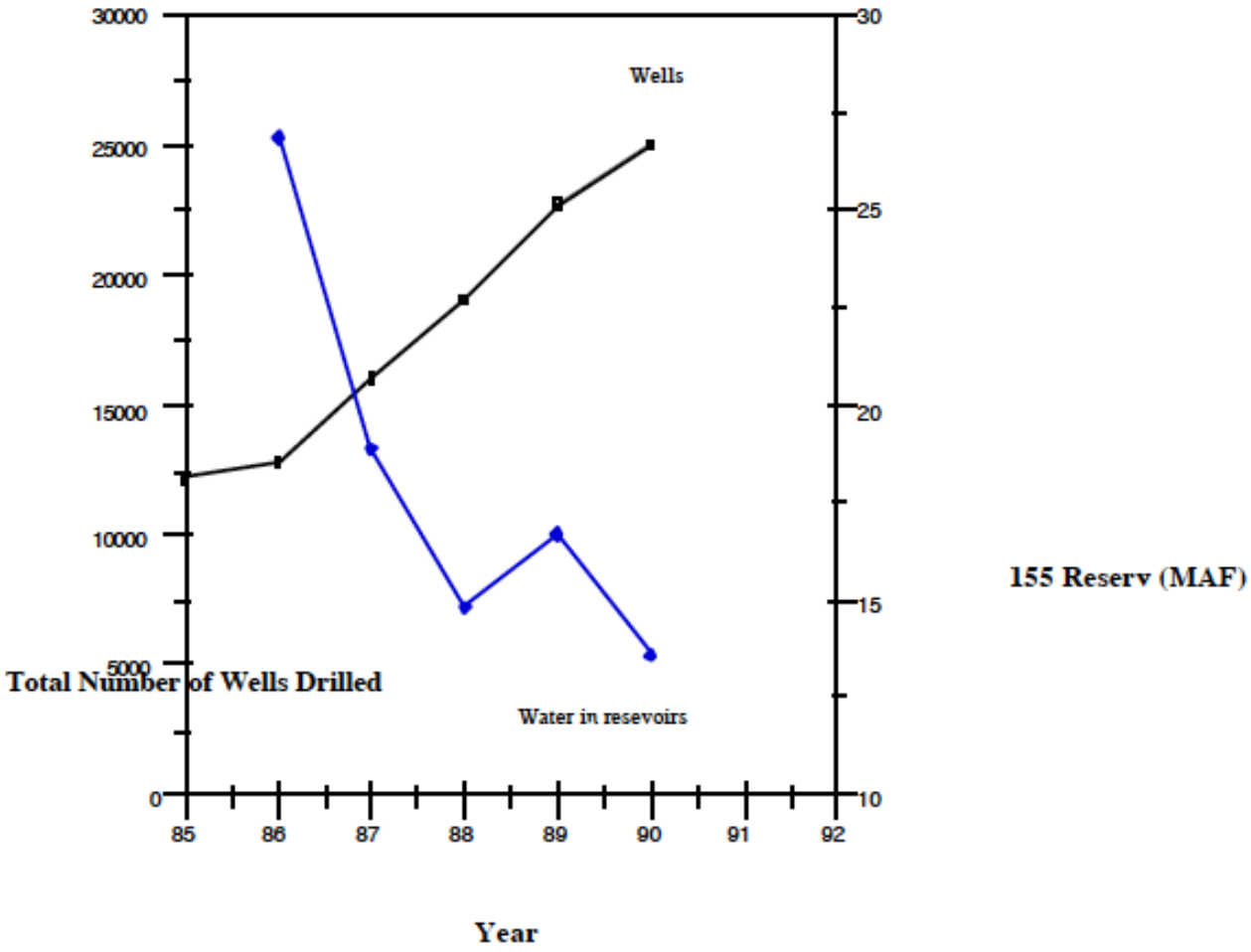


Groundwater pumping is likely to increase to compensate for reduced surface supplies



Legislative Analysts Office (2010)

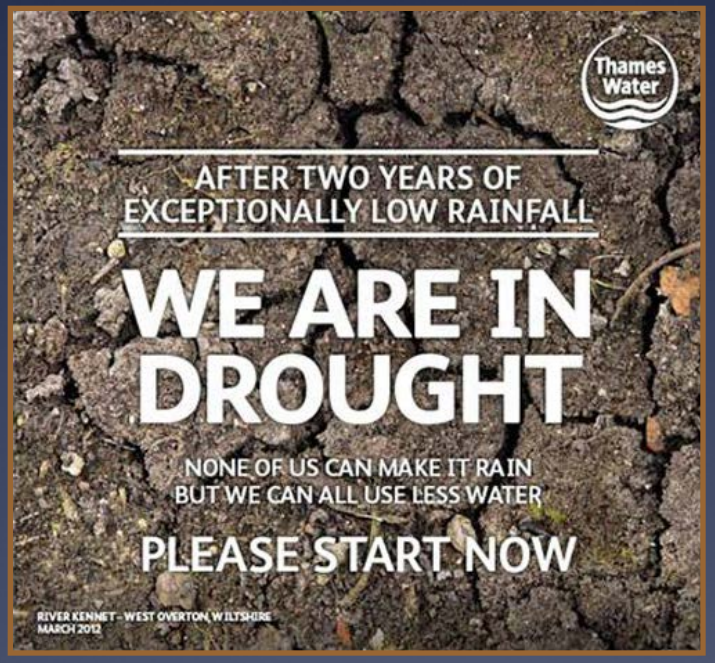
re 16.1: Water in Reservoirs and Wells Drilled During the 1987-1992 California Drought



Lee et. al. 2002

California's Response to Droughts and Water Shortages

Water Curtailment After a Drought Occurs
Water Conservation



"U.S. urges conservation as Colorado River hit by drought"

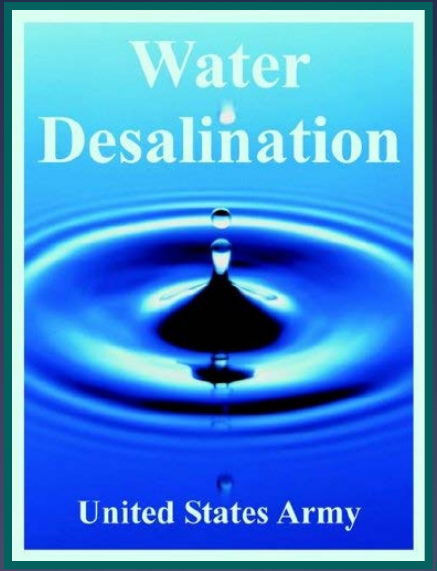
May 27, 2013 | Tony Perry, LA Times

And Strategies to Generate More Supply

Conjunctive Management

89 (operating) programs
Majority in Tulare Lake
And South Coast Regions

Desalination



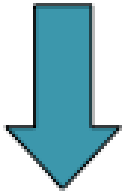
Recycled Water

Caution!

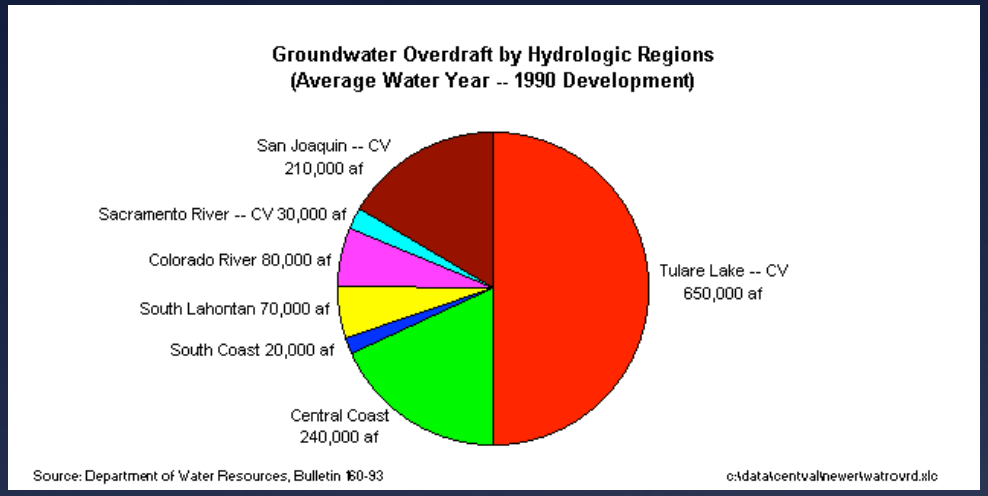
Increase Water Supply During Dry Years

In Wet Years, Extra Water Can Lead
to More Development

No Reserve
and
Hardening of Demand Strategies



Increased Vulnerability in Future Droughts



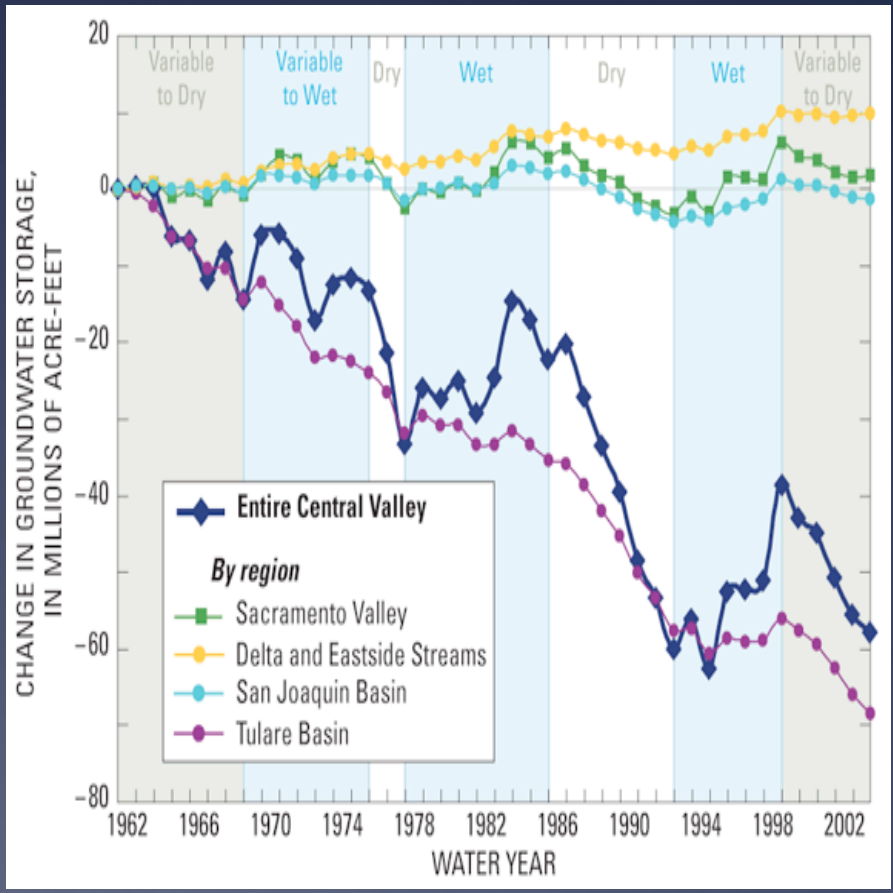
Groundwater Overdraft
1990

Change in GW Storage
1962 - 2002

Faunt et.al.
2009

Since ~1960, groundwater has been depleted by almost 60 million acre-feet

USGS 2009



Significant efforts have been made to improve groundwater management, but

Bolder Actions Are Needed

DWR CA Water Plan Update 2013

What incentives can support more sustainable groundwater management?

How can California communities *proactively* adapt to future droughts and water shortages?

"..it never failed that during the dry years the people forgot about the rich years, and during the wet years they lost all memory of the dry years. It was always that way.

John Steinbeck 1952

Local Groundwater Drought Reserves

Reduce overdraft impacts

Serve as a buffer during droughts

Support groundwater dependent ecosystems

Less energy intensive

Climate Change and Water Supply Security:
Managing Groundwater to Increase Drought Resilience

PI - Ruth Langridge*

Co-PIs – Nigel Quinn,* ***Ben Crow,**** *Andrew Fisher**

Graduate Students - K. Rudestam, Abigail Brown, Peter Towbin,
*Bruce Daniels, Andrew Racz**

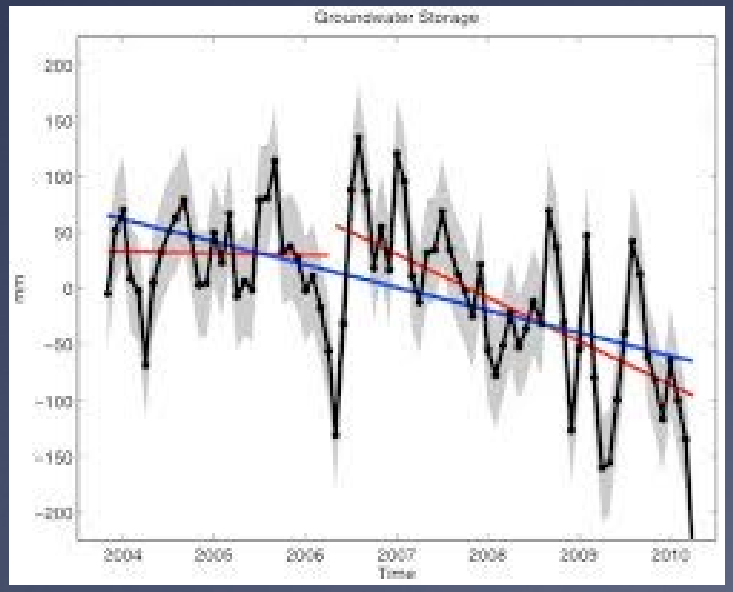
Advisors – Marcelle DuPraw,** ***Emmanuel Asinas******

University of California, Santa Cruz, **University of California, Merced and LBL, ***Sacramento State Center for Collaborative Policy,****California Department of Water Resources*

How does this differ from current groundwater banking?

Local sources of water - Stored locally
Used for local communities

Focus is on recovering groundwater levels to avoid further declines during a drought



Central Valley-Groundwater Storage Trends
10/04 - 10/09
J. S. Famiglietti et. al. (2010)

Our Approach

Factors that affect drought resilience

Factors that motivate regions to address long-term overdraft

Case Studies

Impacts & costs of a groundwater drought reserve versus a no-reserve option

Tools to assist regions in determining parameters for a local groundwater drought reserve

Physical Context

Sources of water
Condition of groundwater basin

Legal-Institutional Context

Water Rights, Governance

Socio-Political Context

Stakeholder conflicts
Agency/Board leadership

Legal – Institutional Context for Groundwater Management

Federal

Endangered Species Act

Clean Water Act

State

Water Quality

Reasonable Use Doctrine

Public Trust Doctrine

GAMA – Groundwater Ambient Monitoring & Assessment Program

Collects data & compiles results from other agencies into a publicly-accessible database, GeoTracker GAMA.

Unsettled Legal Issues

DEFINITION OF GROUNDWATER

Permit required - Surface waters & underground streams "flowing through known and definite channels"

No permit required - Percolating groundwater

What is the definition of a "known & definite channel"?

PUBLIC TRUST DOCTRINE

State has continuing duty to protect PT values where feasible

If applicable to streams that feed Mono Lake,

Is PTD also applicable to groundwater that "feeds" a surface waterbody?

No State Permit System for Percolating Groundwater

Overlying Landowners

Correlative Rights Doctrine

Local Agencies are Primary Managers of Groundwater

Local Management

Agencies - Districts

Fix & collect fees, regulate & monitor extraction & overdraft, establish recharge programs

City and County Ordinances

May adopt ordinances to manage groundwater

Adjudicated Basins

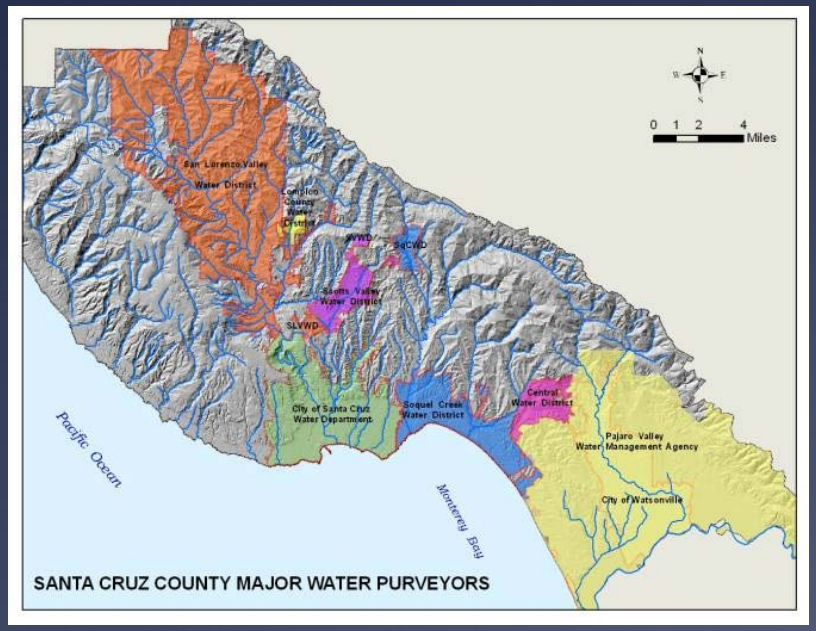
Mandates to reduce overdraft

How is local management working with respect to alleviating overdraft and building resilience to water shortages?

Central Coast

Scotts Valley Water District

Pajaro Valley Water Management Agency



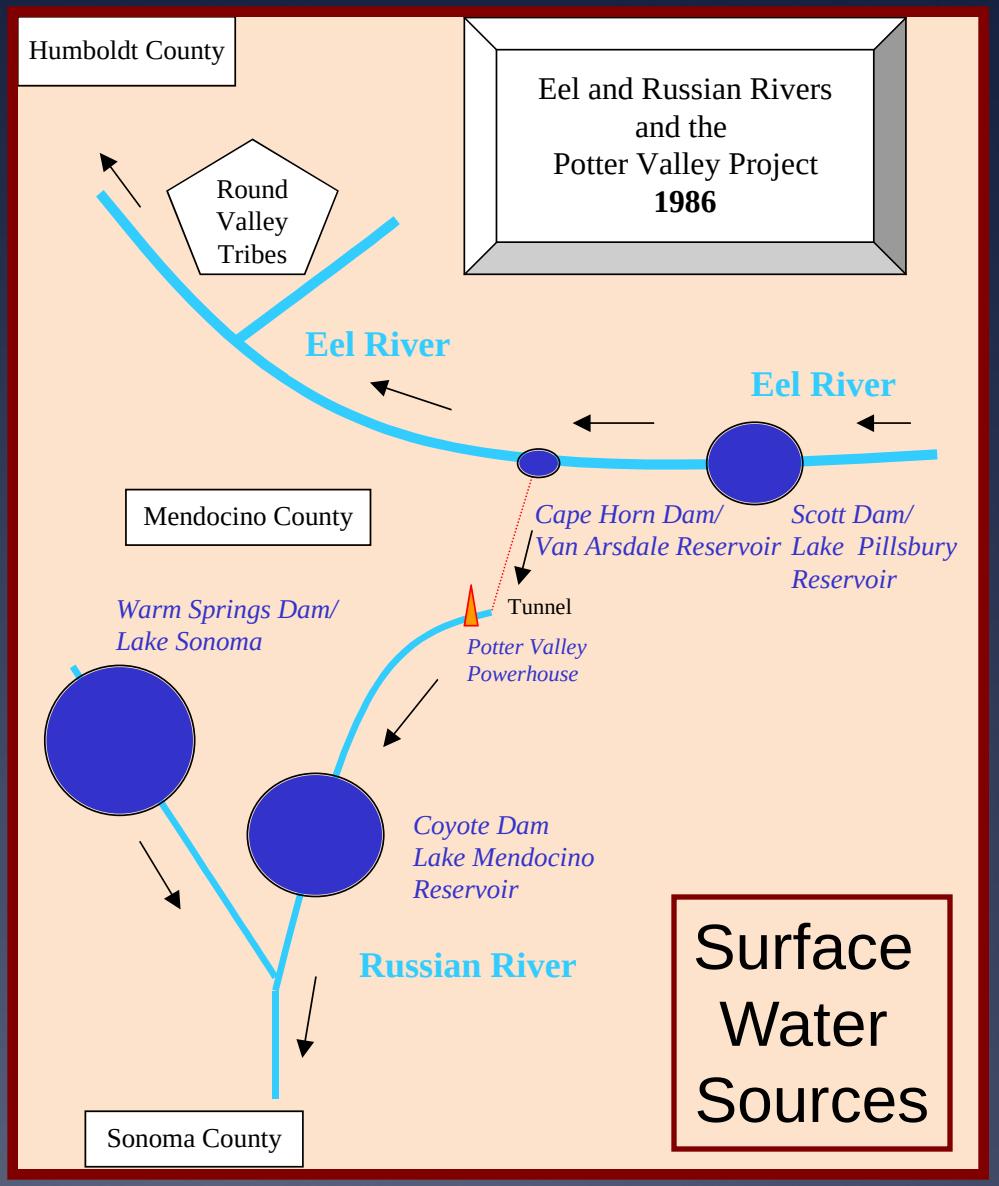
Santa Cruz Water Department

Soquel Creek Water District

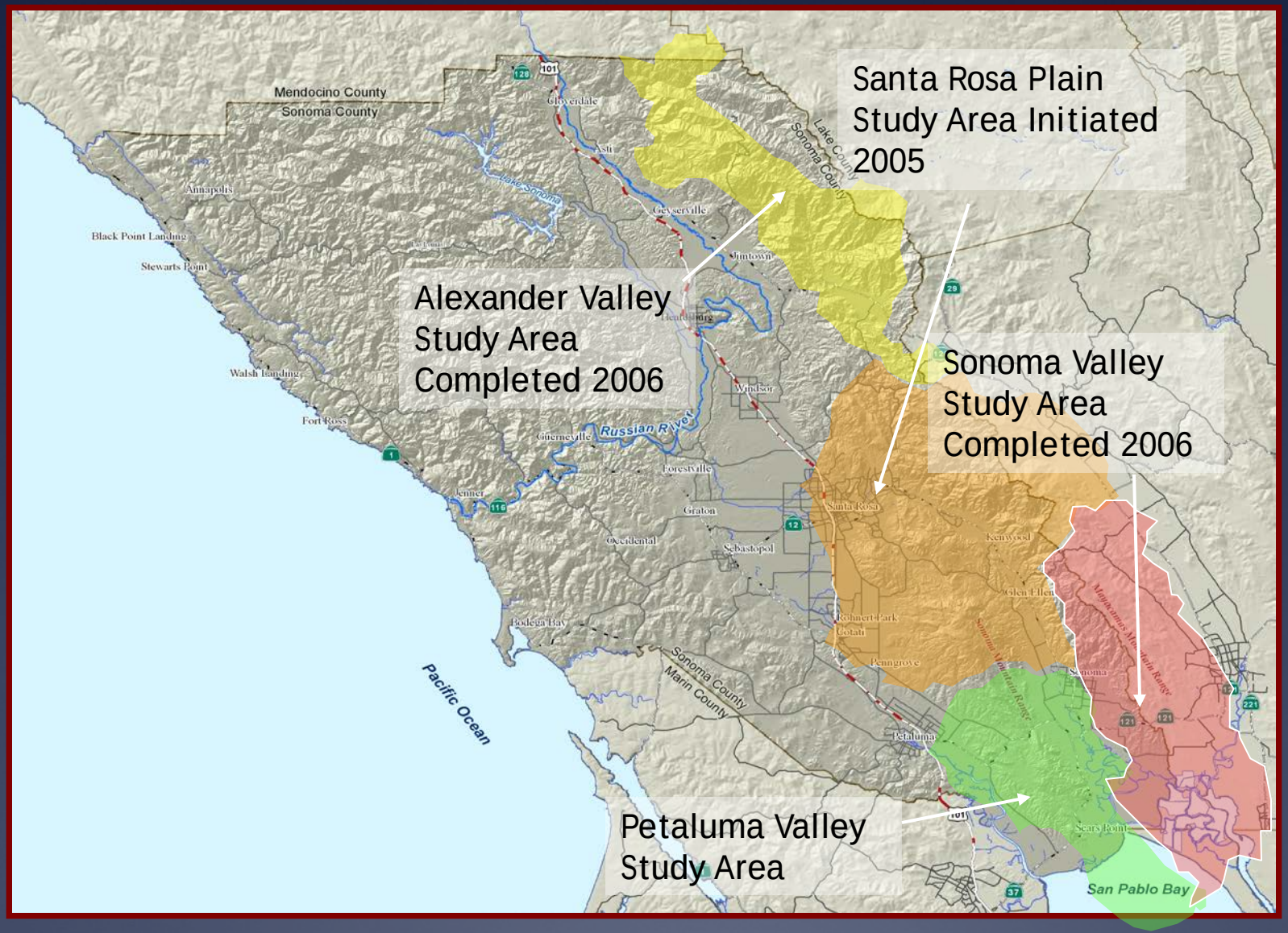
North Coast

Sonoma County Water Agency

Sonoma County Water Agency



SCWA Groundwater Basins



Sonoma Valley Groundwater Management Program

2006: Convened Stakeholder Group

2007: Groundwater Management Plan

Adopted by:

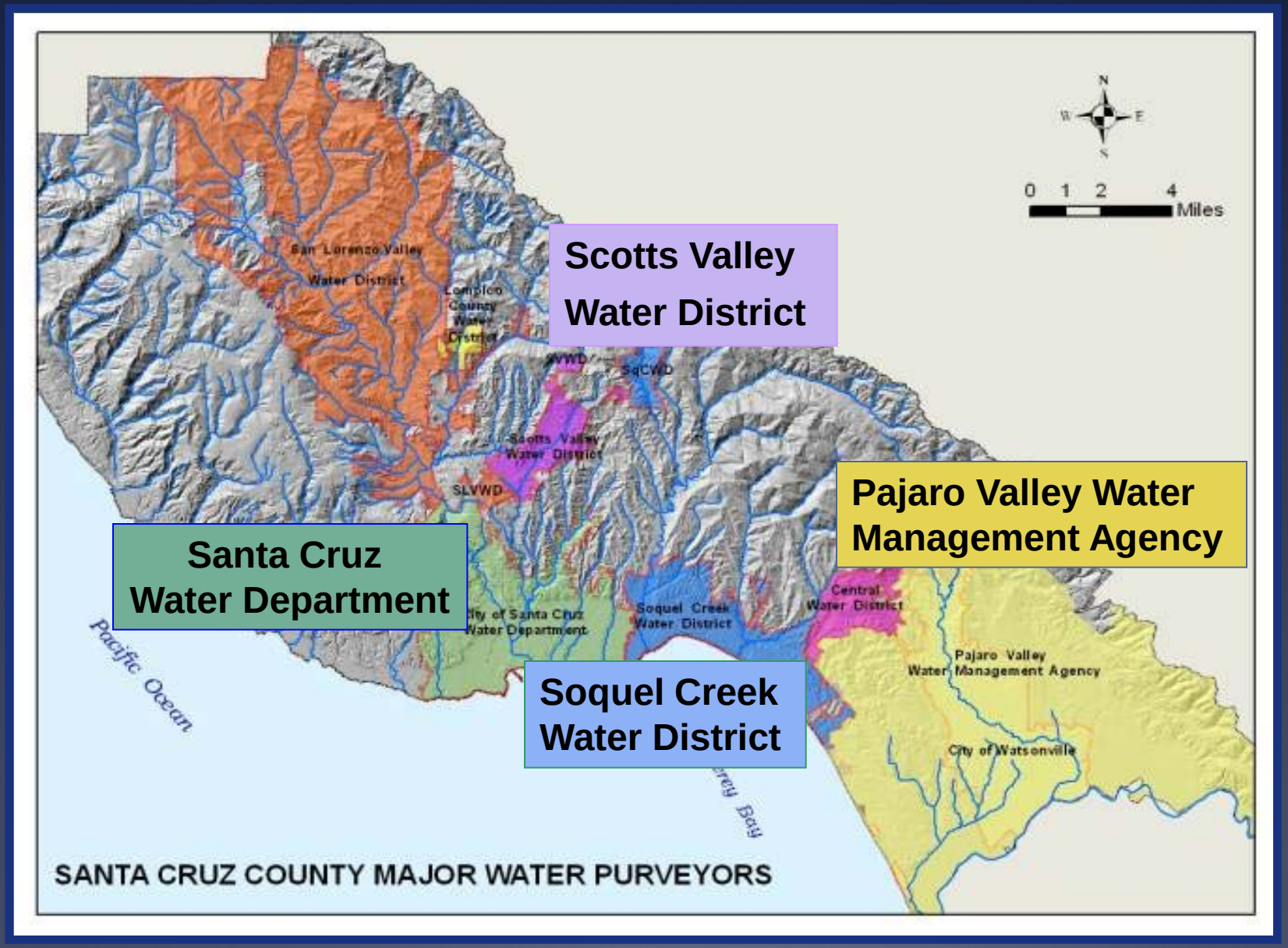
Sonoma County Water Agency

City of Sonoma

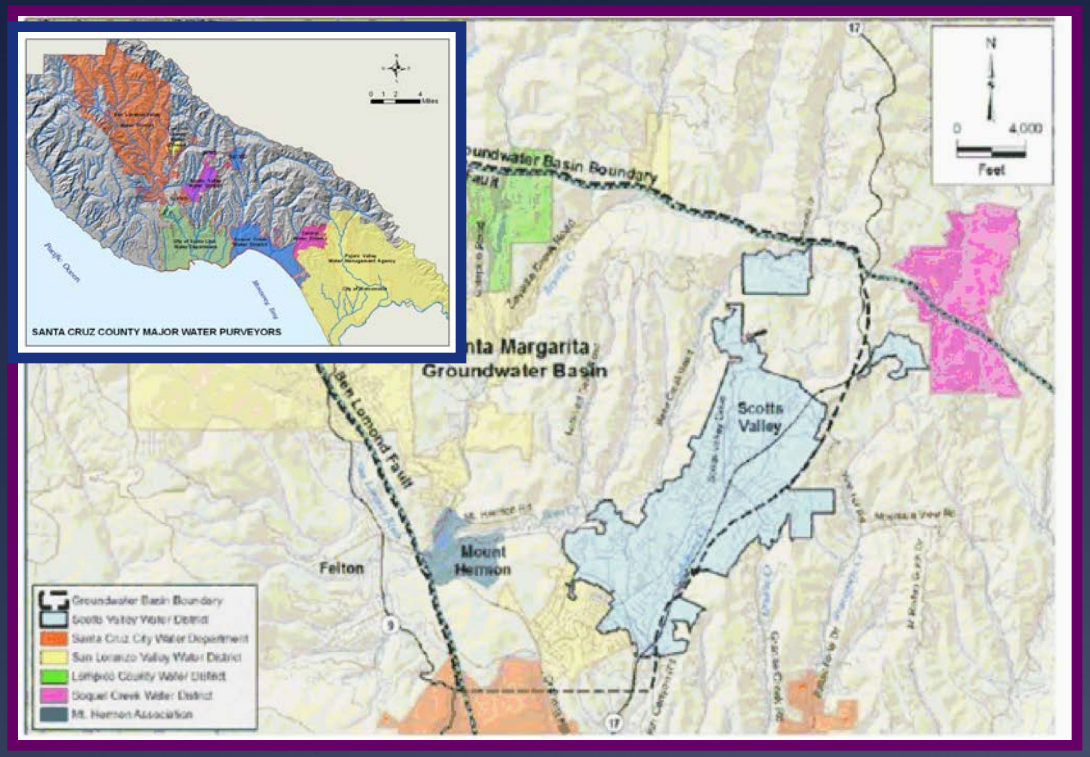
Valley of the Moon Water District

Non-Regulatory and Collaborative Process

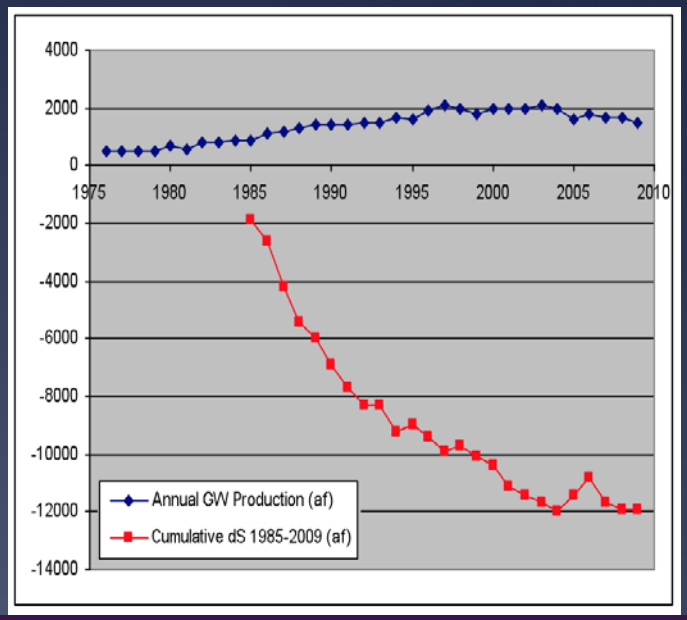
Central Coast Study Areas



Scotts Valley Water District



Groundwater from the Santa Margarita Groundwater Basin Is sole source of potable water for SVWD



1975-2010 : Change in GW Production & Storage

Strategies to Reduce GW Production

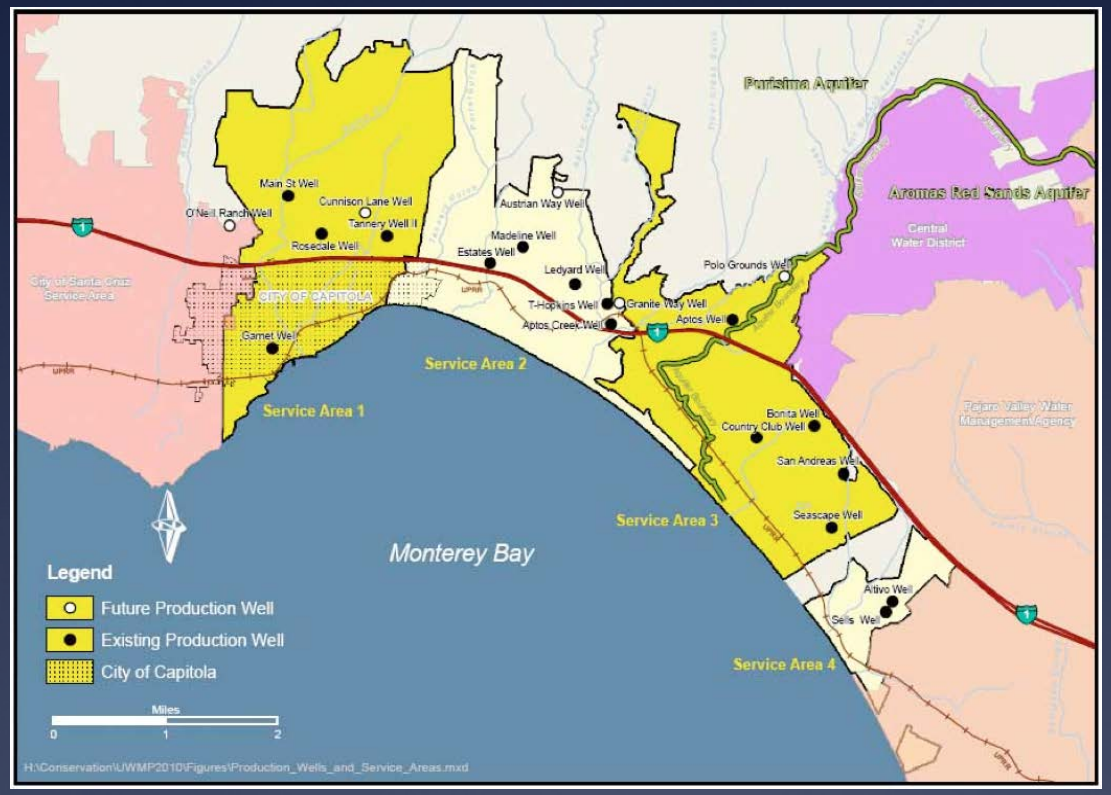
Water Conservation

Recycled Water

Gray Water

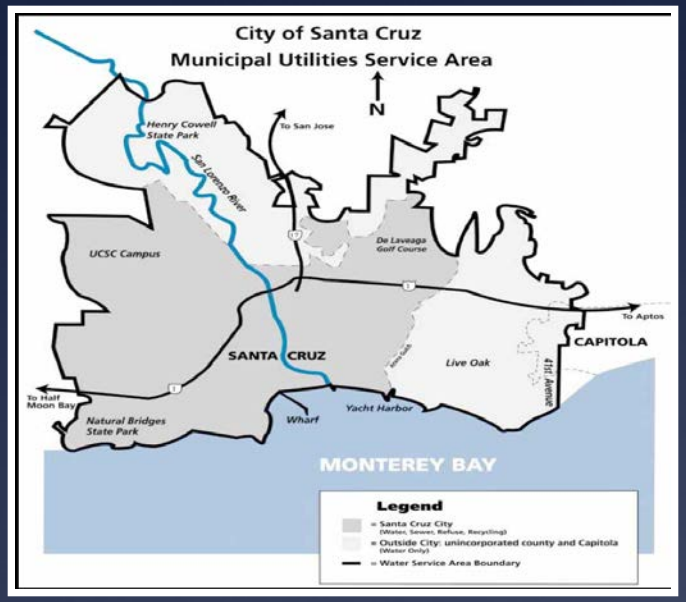
Rebates

Soquel Creek Water District



The Purisima and Aromas Red Sands Aquifers provide all of SqCWDs water and are at risk for seawater intrusion

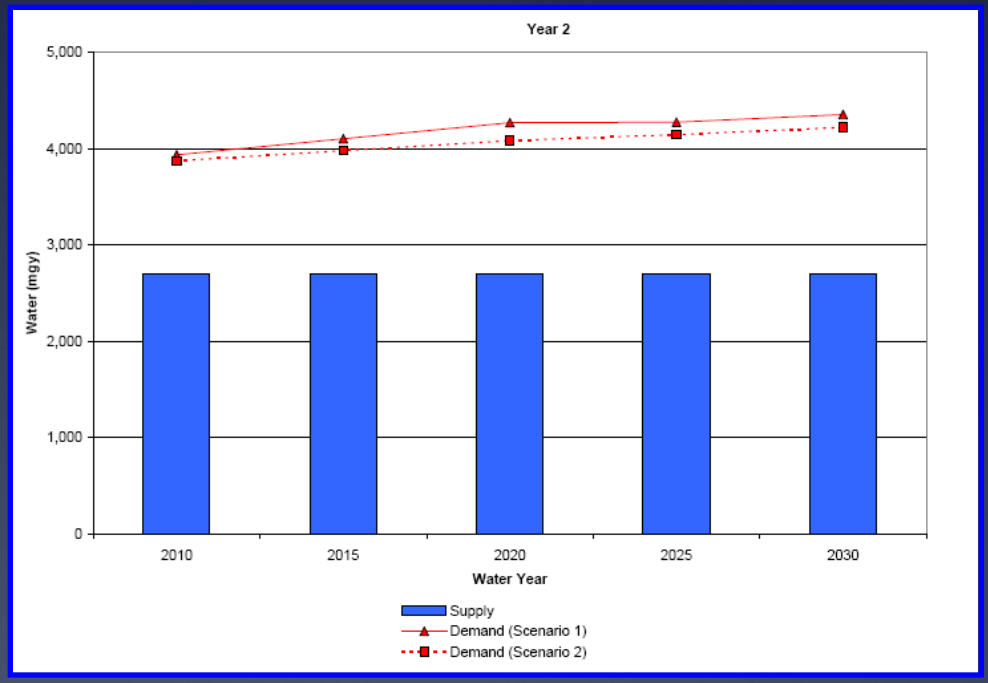
Santa Cruz Water Department



Water Sources

Rivers, streams
and reservoirs 66%
Groundwater 4%

Multiple Dry Water Years

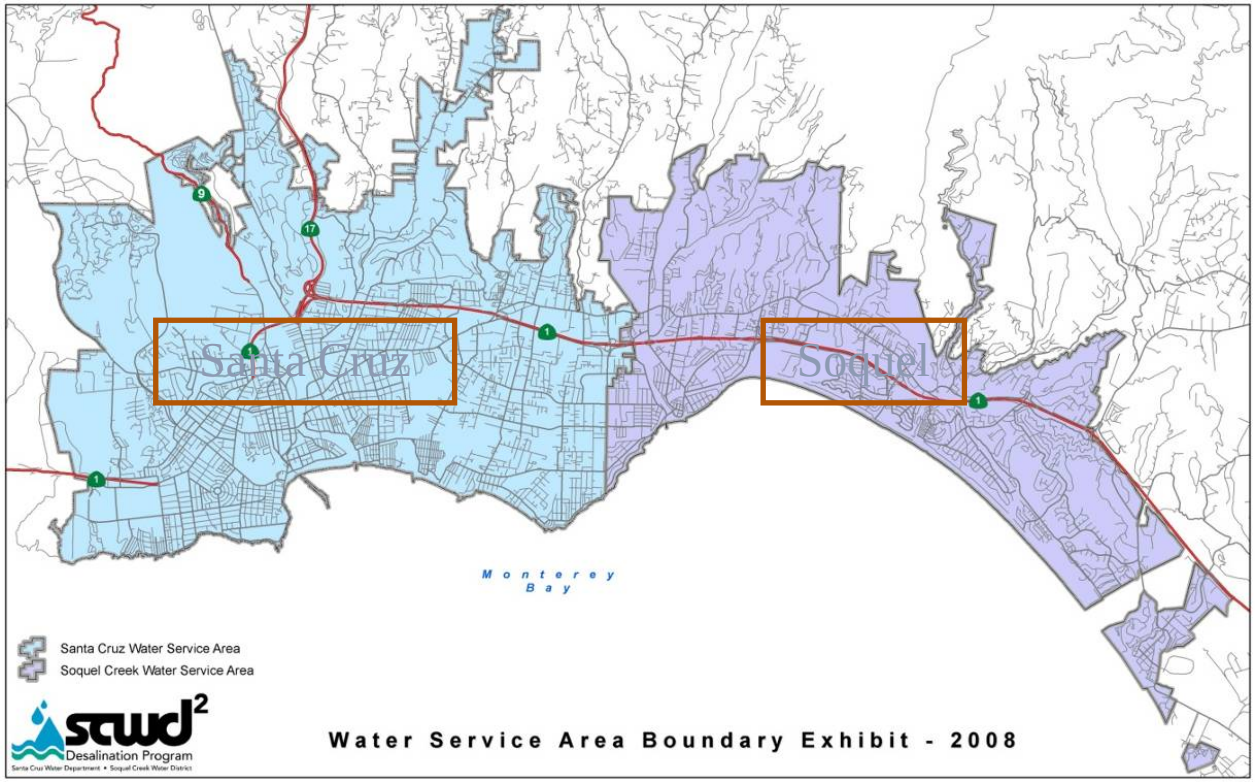


Endangered Species Act

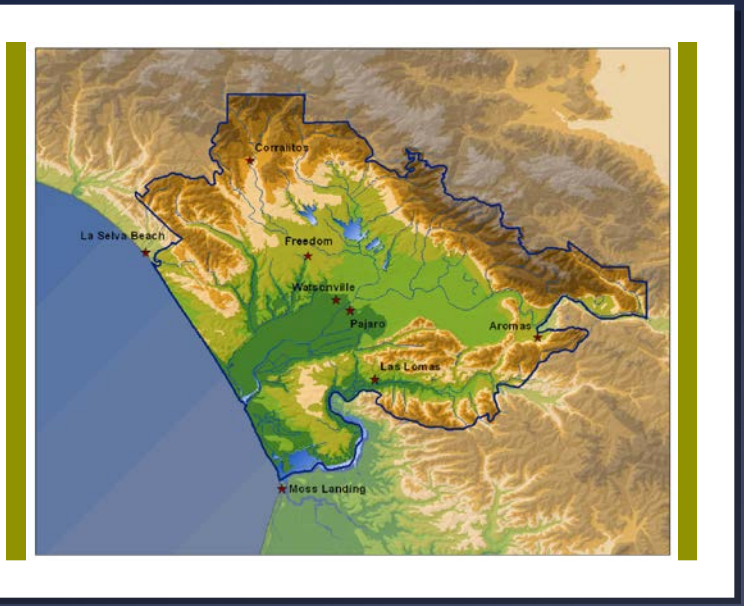
Need to reduce existing surface water diversions for endangered salmon and steelhead

Drought Reserve Project

Collaboration Between
Santa Cruz Water Department
and Soquel Creek Water District



Pajaro Valley Water Management Agency



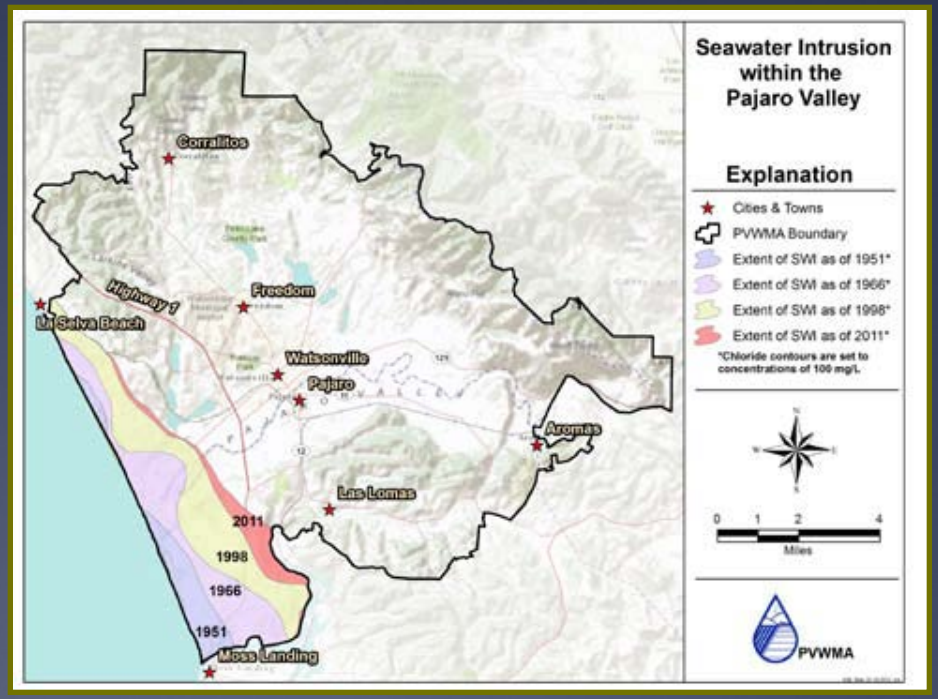
Seawater Intrusion

~ 1,900 afa in Upper & Lower Aromas aquifers

1998-2011 - 12% increase

Total intruded area has increased ~ sevenfold fold since 1951

Largest increases correspond with periods of drought

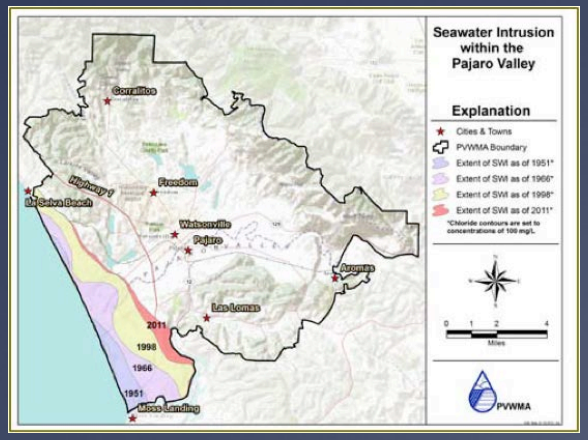


Pajaro Valley Water Management Agency

Present Strategies to Reduce Overdraft

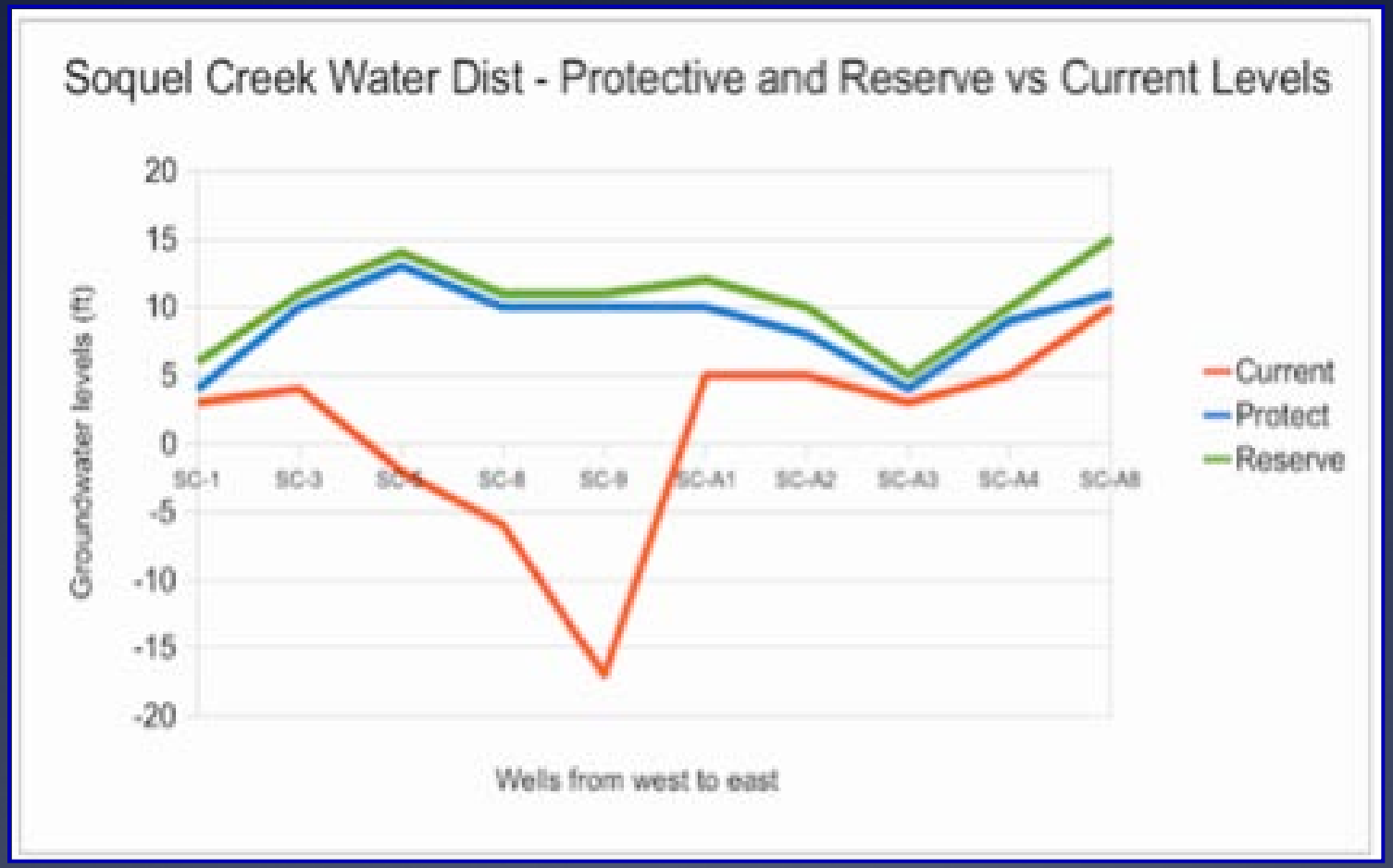
Recycled Water And Recharge Facilities

Stakeholder Conflicts Litigation



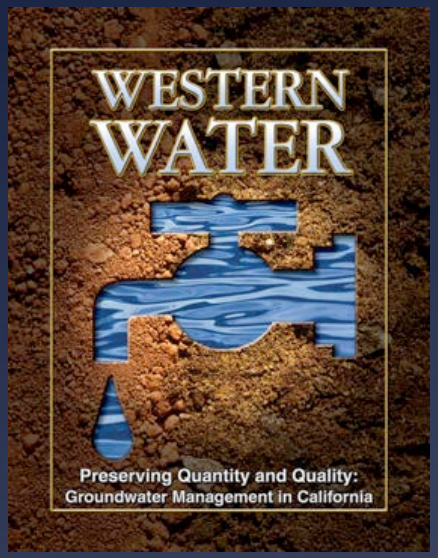
Coastal Distribution System

Calculating a Drought Reserve for Soquel Creek



Source: Data from Soquel Creek Water District. 2009. Groundwater level metrics can be converted into acre-feet

How can California better address groundwater overdraft?



Association of California Water Agencies
Since 1910
ACWA Leadership Advocacy Information

SUSTAINABILITY FROM THE GROUND UP
GROUNDWATER MANAGEMENT IN CALIFORNIA
– A FRAMEWORK –

Stanford University Water in the West

DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

2013: District awarded $225,000 Local Groundwater Assistance Program grant

California Roundtable on Water and Food Supply

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

LAO
65 YEARS OF SERVICE

Legislative Analyst's Office
California's Nonpartisan Fiscal and Policy Advisor

The State's Role

California Water Code § 12922

"…the people of the State have a primary interest in the correction and prevention of irreparable damage to, or impaired use of, the ground water basins of this State caused by critical conditions of overdraft, depletion, sea water intrusion or degraded water quality."

California Constitution: Article X, Section 2

…….

The right to water or to the use or flow of water …. shall be limited to such water as shall be *reasonably required* for the beneficial use to be served*…..*

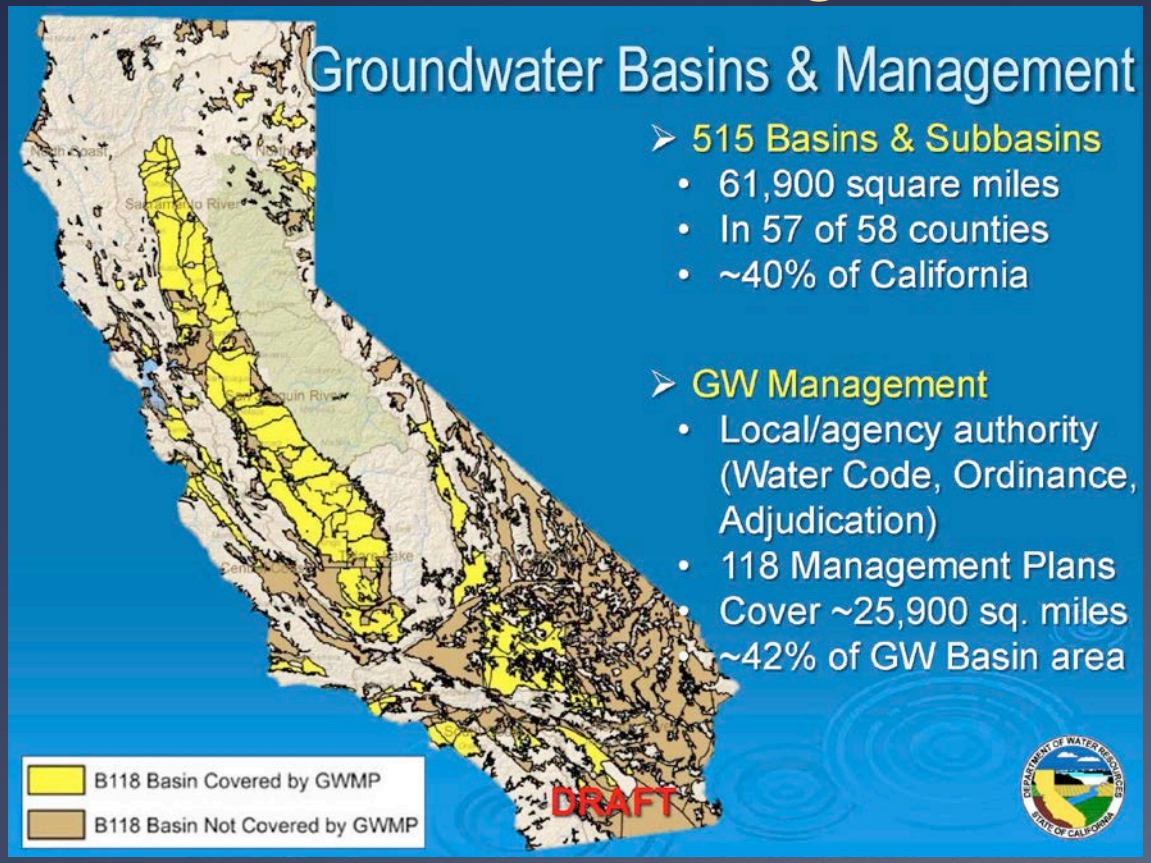
Water Code- Section 275

The department and board **shall** take all appropriate proceedings or actions before executive, legislative, or judicial agencies to prevent waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of water in this state

State – Local Governance

1992 "AB 3030" Groundwater Management Plans

Voluntary Approach to Groundwater Management



Local governments ***may*** create groundwater management districts with authority to raise revenues

No requirements for implementation of plans or to improve overdraft

119 GWMPs compiled as of August 2012
~ 60 address overdraft

2009 (SBx7-6) CA Statewide Groundwater Elevation Monitoring

Mandates a groundwater elevation monitoring program
Intent is to establish a permanent, *locally-managed* program of regular and systematic monitoring

Local parties ***may*** monitor & report groundwater elevations.
DWR reviews submittals, & makes information available to the public.
If local parties do not volunteer, then DWR assumes those functions, AND local parties are ineligible for water grants or loans from the state.

2009 (SBx7-7) Agricultural Water Management Planning Act

Adoption of an agricultural water management plan
-Measurement of volume of water delivered to customers
-Water Pricing based in part on volume of water delivered

Applies to ~ 79 agricultural water suppliers
BUT, as of 8/2013, DWR had only 25 plans

Some success stories
- Conservation programs
- Tiered pricing
- Conjunctive use

BUT
Low compliance level

Improving Groundwater Management

What Local Agencies Are Doing

Water Neutrality Program

Rebates for Conservation

Awards for Demand Reduction

Promotion of Recharge

Cooperative Partnerships

What More Can Be Done

Public education

Collaboration & coordination–between agencies & with the public

Availability and sharing of GW information

Dedicated funding for CASGEM

Legislature authorize DWR to evaluate & develop groundwater management & implementation guidelines

Legislation to include disincentives to overdraft groundwater basins and **incentives for increasing storage**

DWR CA Water Plan Update 2013

Sustainable thresholds for water level drawdown & water quality

Monitoring & assessment – are thresholds are being met?

Governance structures & mechanisms

- prevent impacts *before* they occur
- ensure that groundwater level & quality thresholds are met over the long term

Funding to support monitoring & governance/management

Oversight & enforcement in basins where ongoing management efforts are not protecting groundwater

State Water Board Groundwater Workplan Concept Paper

Significant local efforts to improve groundwater management, but

Bolder Actions Are Needed

DWR CA Water Plan Update 2013

To receive state funding, require local development and implementation of overdraft reduction strategies

To enable reduction of overdraft in affected areas, develop state-local cooperative structures to establish enforceable standards for groundwater withdrawals

Thank You

http://droughtreserves.ucsc.edu/

“The limiting factor is water — that is true of all civilizations.”
Dana Bartholomew, Los Angeles Daily News