Groundwater Quantity and Quality: Recent Regulations Affecting Growers

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California's Groundwater Future

- California's Ag is essential to the globe
- Groundwater Sustainability….
  - Maintain long-term balance between supply & demand
  - Protect/improve water quality
  - Mitigate/stop undesirable results
- Sustainability involves a continuum of complex, dynamic, ever-increasing challenges

The Agricultural Community's contributions to innovation and technological advances are critical for California's future groundwater sustainability.

Presentation Overview

- **Groundwater in California**
  - Brief overview
- **Sustainable Groundwater Management Act**
  - Key SGMA terms
  - Timelines for DWR and GSAs
  - Basin prioritization
  - Undesirable results
- **Important Information– Basic Data Needs**
  - Examples: groundwater levels
- **Integrating SW/GW Quantity and Quality**
- **Recharge opportunities**

Groundwater in California

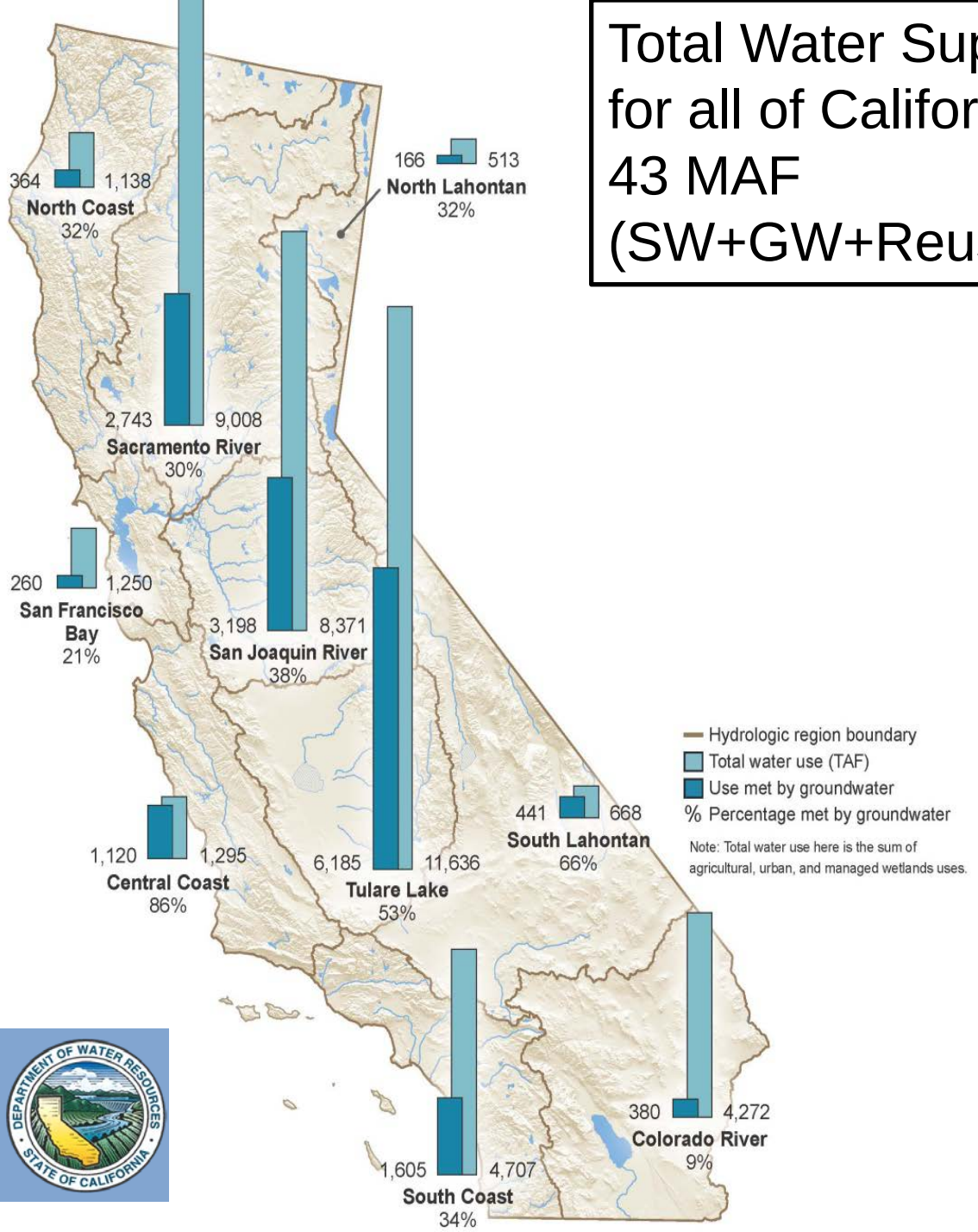
- 515 GW basins & subbasins
- Capacity of GW basins 10 times the capacity of California's surface storage

Groundwater Supply in California

2005-2010 Average

GW comprised 38% of all water used in Calif., totaling >16 million AF.

Total Water Supply for all of California: 43 MAF (SW+GW+Reuse)

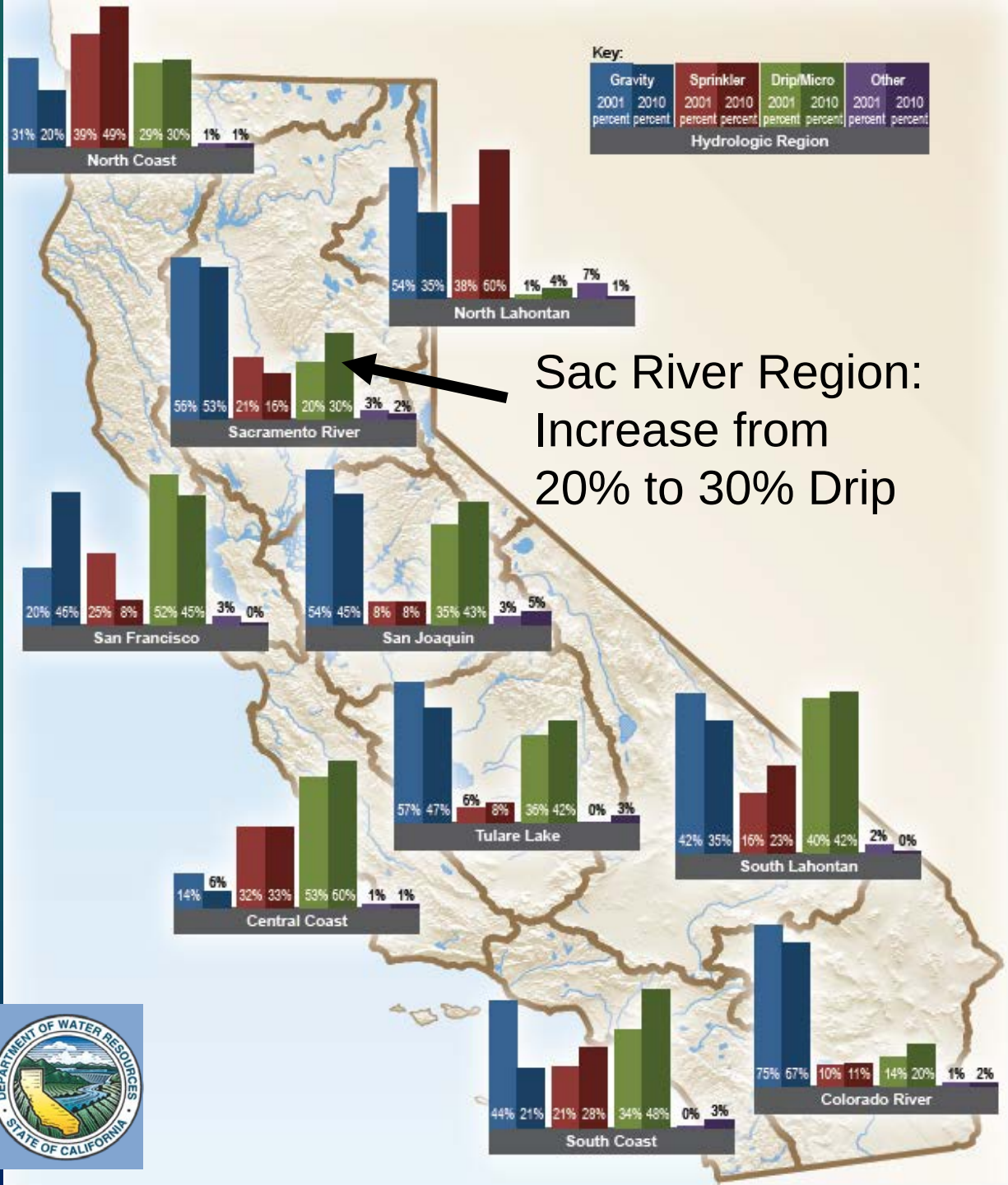


DWR CA Water Plan Update 2013

Statewide Trends in Irrigation Methods

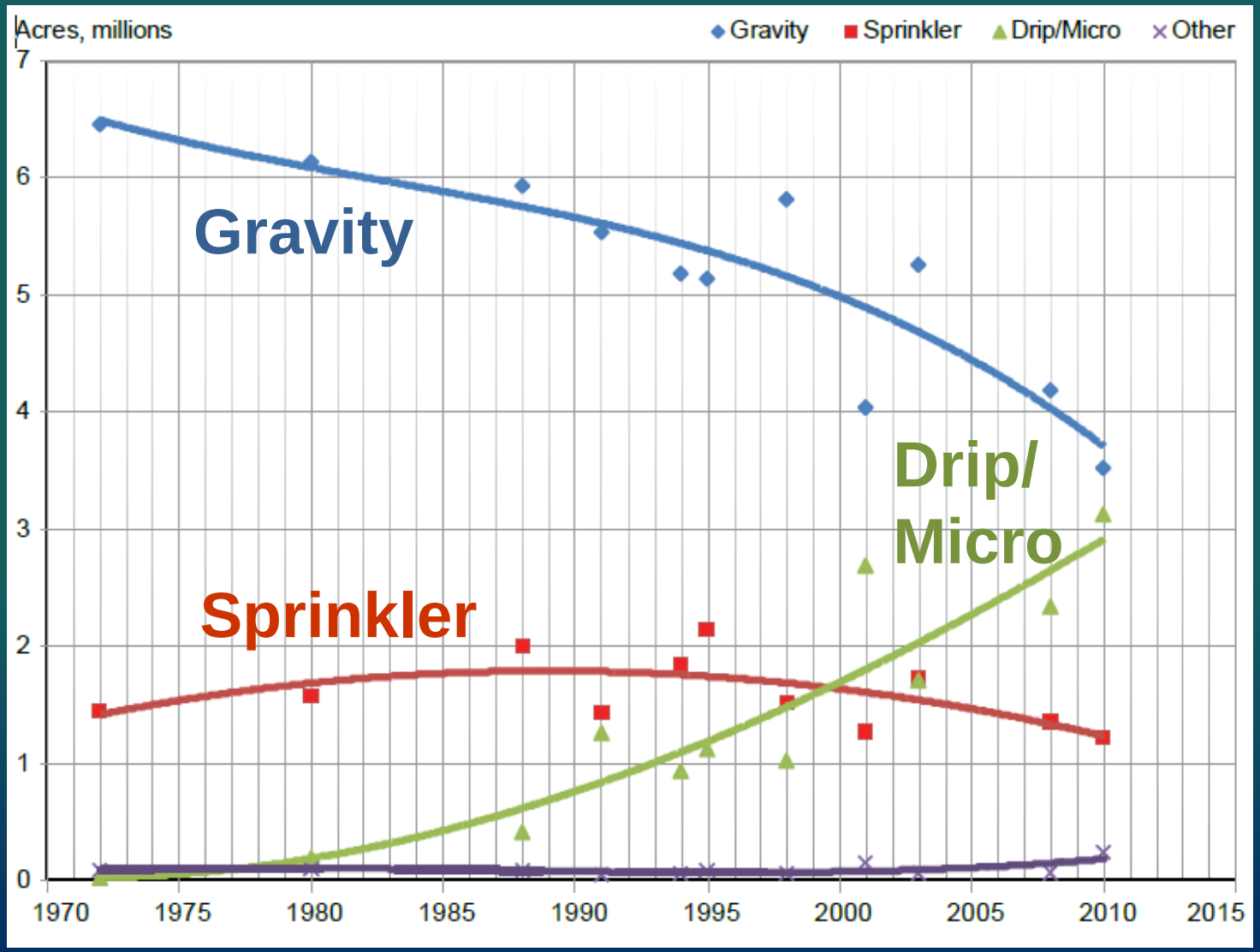
- Gravity
- Sprinkler
- Drip/Micro

Percentages for 2001 and 2010



DWR CA Water Plan Update 2013

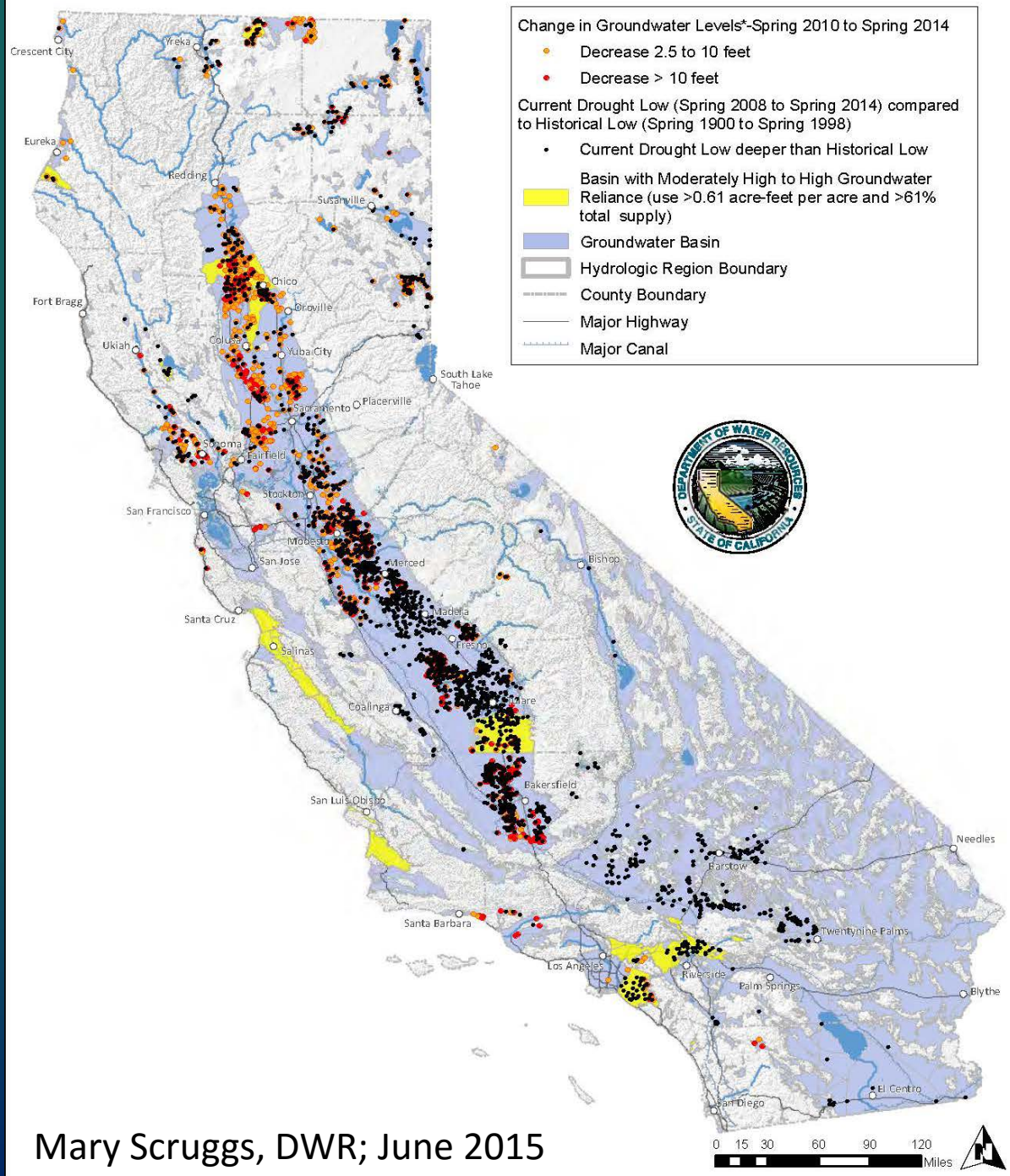
Change in Irrigation Methods in California (1977-2010)



DWR California Water Plan Update 2013

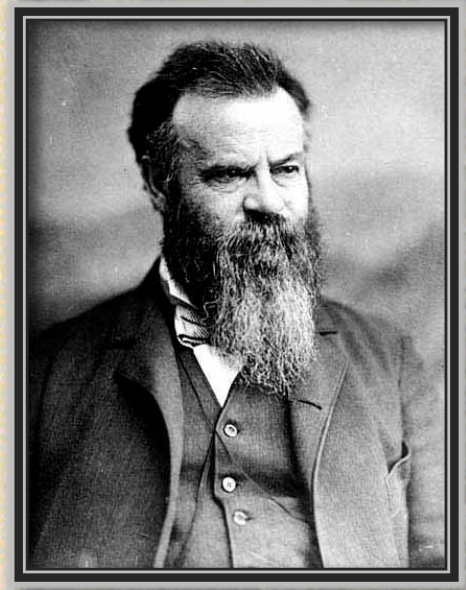
GW Levels During Drought: Historical Lows

● **GW Level (for Spring 2010—2014) Lowest Recorded compared to historical low (Spring 1900— 1994)**



Mary Scruggs, DWR; June 2015

More than 135 years ago, John Wesley Powell, USGS Director 1891-1894, recognized the interconnectedness of the climate, land and water… in the report "Lands of the Arid Region of the US" (1878).



He argued for local institutional control & management and an interface between humans and the forces of nature.

From: Emporia State Univ. The Grand Canyon of the Colorado, showing amphitheaters. (Figure from Powell, 1875)

Key Groundwater Regulations

- **Irrigated Lands Regulatory Program (GW)**
  - GW quality assessment reports (RB approved some; still reviewing others; approval links to timeline for other requirements; Sac Valley WQC to resubmit by Jan. 15, 2016)
  - GW quality management plans (60 days after GAR approval)
  - GW trend monitoring program (1 yr after GAR approval)
  - Management practices evaluation program (1 yr or 2 yrs after GAR approval pending Individual Coalition or Group of Coalitions)
- **Salt and Nutrient Management Plans**
  - Theoretically, every basin in the state
  - Current emphasis on Recycled Water use areas
- **Sustainable Groundwater Management Act**
  - First-ever California GW law; very compressed schedule

Sustainable Groundwater Management Act of 2014: Highlights

Sustainable Yield and Related Terms

Sustainable Yield (Definition; Water Code Section 10721(v)):

- "*Maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually without causing an undesirable result*."

"Undesirable Result" – key term linked to accomplishing sustainability.

"Measurable Objectives" – term related to achieving the sustainability goal in the basin within 20 yrs of plan implementation.

Groundwater Sustainability

Not Causing Undesirable Results:

Means Avoiding Significant and Unreasonable …

Lowering of GW Levels	Reduction of GW Storage	Seawater Intrusion
Water Quality Degradation	Land Subsidence	Depletion of Surface Water

DWR Key Near-Term Actions

Jan. 2015	• Basin Prioritization
Nov. 2015	• Basins in Critical Conditions of Overdraft
Jan. 2016	• Basin Boundary Regulations
Jun. 2016	• Groundwater Sustainability Plan (GSP) & Alternative Regulations (draft ~end Jan. 2016)
Dec. 2016	• Water Available for Replenishment
Jan. 2017	• Bulletin 118 Interim Update (California's GW)
Jan. 2017	• BMPs for Sustainable GW Management

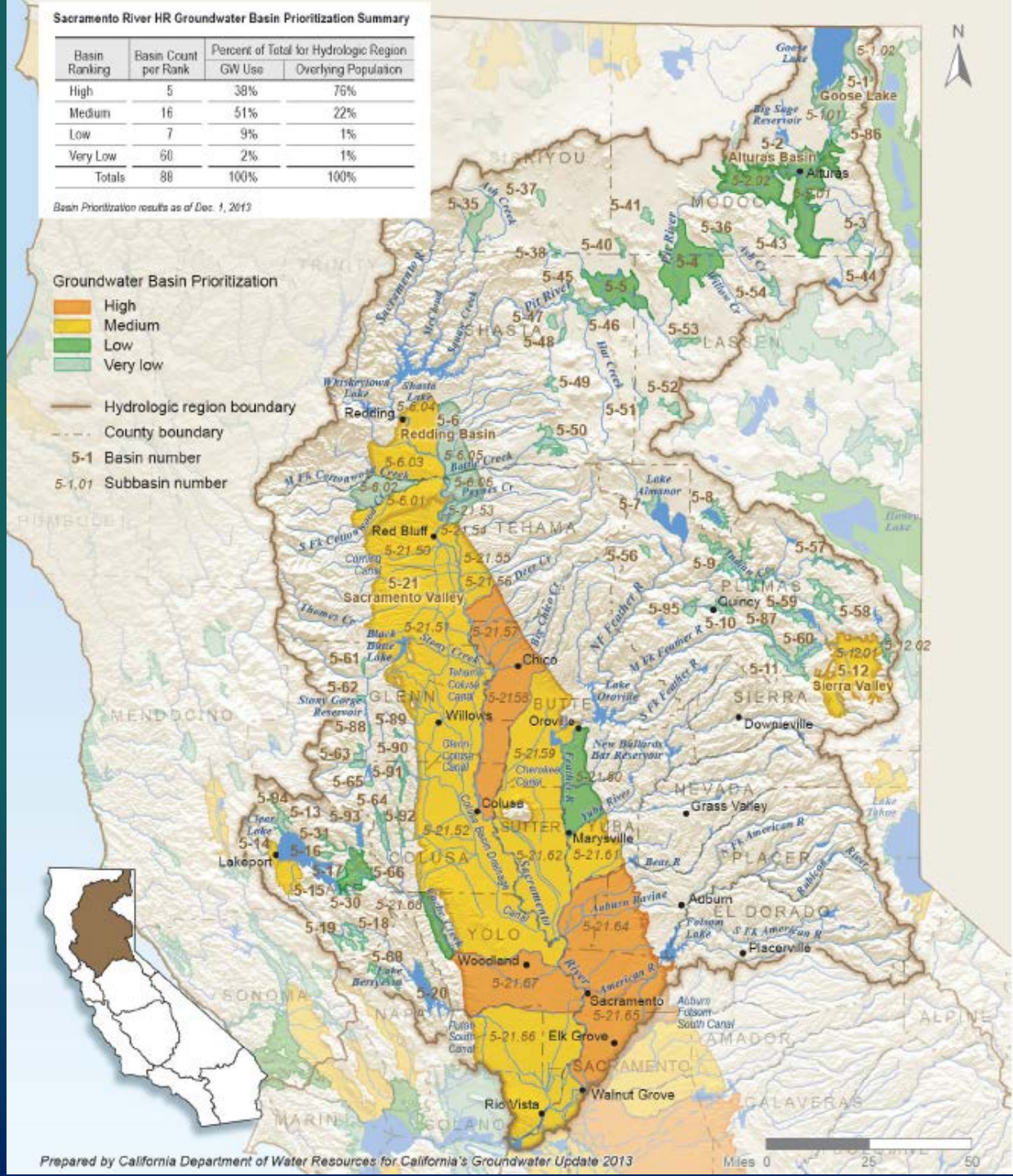
Mary Scruggs, DWR; June 2015 (updated)

Timeline for GSPs or Alternative Submittals

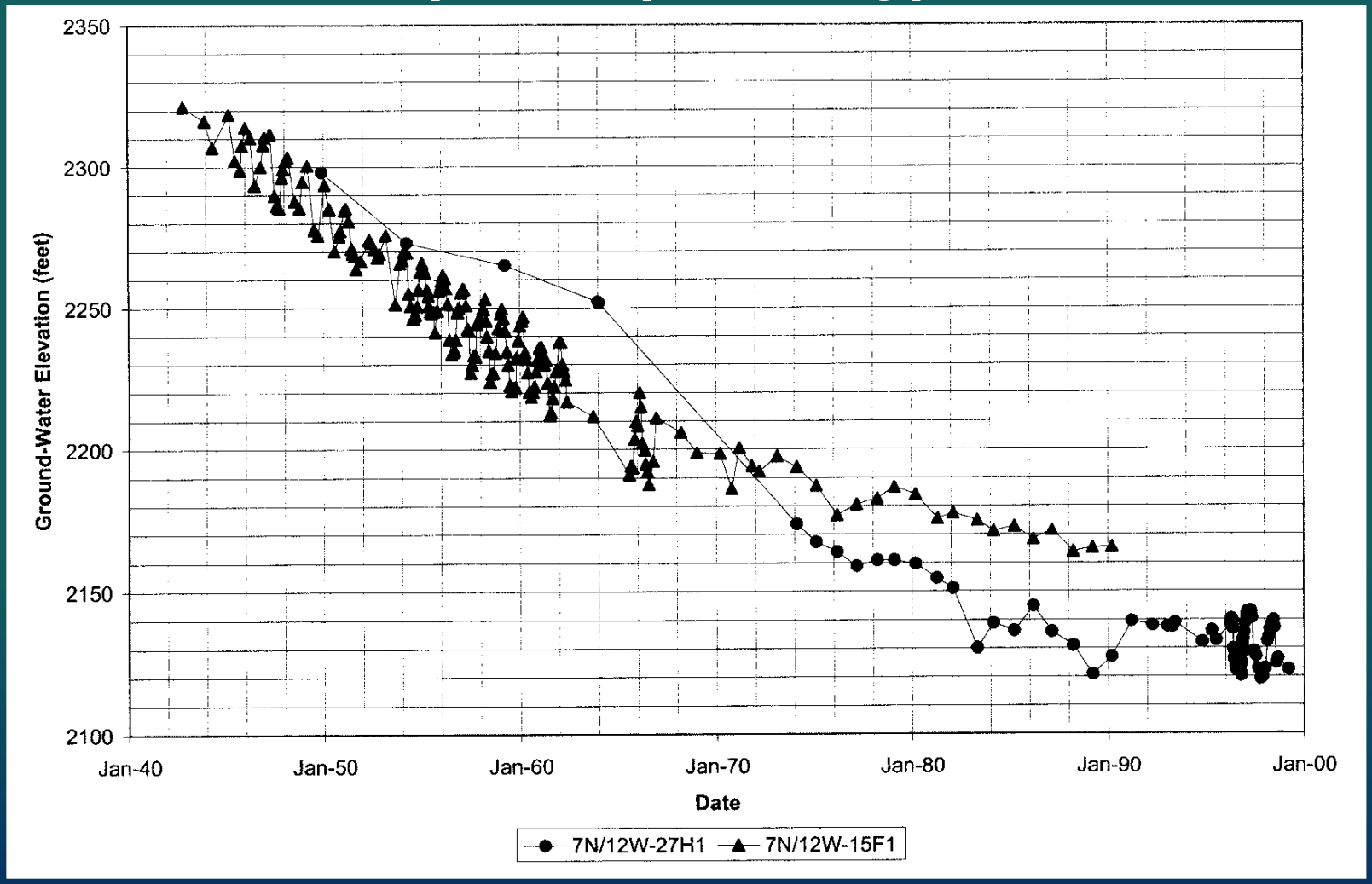
- **January 1, 2017 (Alternative)**
  - Existing GMP
  - Management pursuant to adjudication action
  - Basin operated within sustainable yield for at least 10 years
- **January 31, 2020 (GSP)**
  - 21 basins listed as subject to critical conditions of overdraft required
- **January 31, 2022 (GSP)**
  - All other high and medium priority basins

CASGEM Basin Prioritization

- **127 High and Medium Priority Basins (all of CA)**
  - Sac River (88 Total GW Basins): 5 High; 16 Med; 67 Low/Very Low
- 96% of GW Use
- 88% of population overlying the basins
- May or may not have undesirable results from use

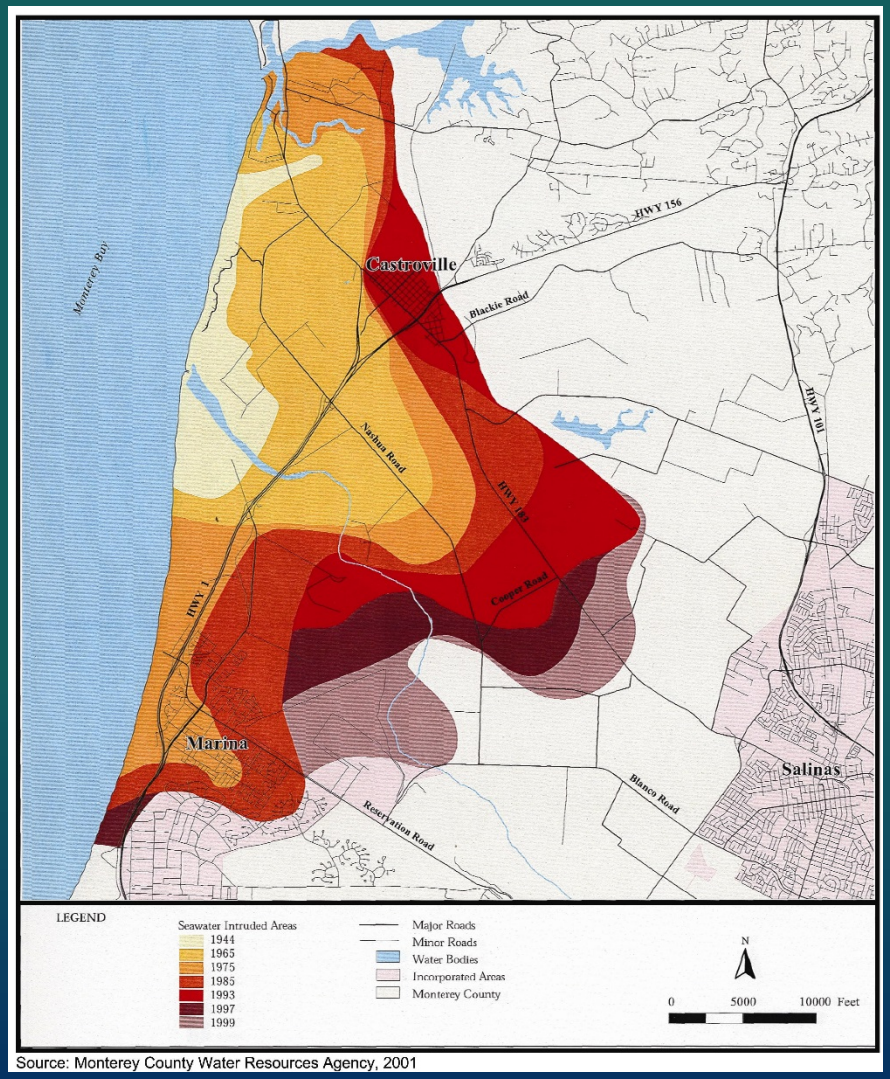


Undesirable Result: Chronic Decline in Groundwater Levels (Antelope Valley)



(from USGS Database, Antelope Valley)

Undesirable Result: Seawater Intrusion (Salinas Valley)

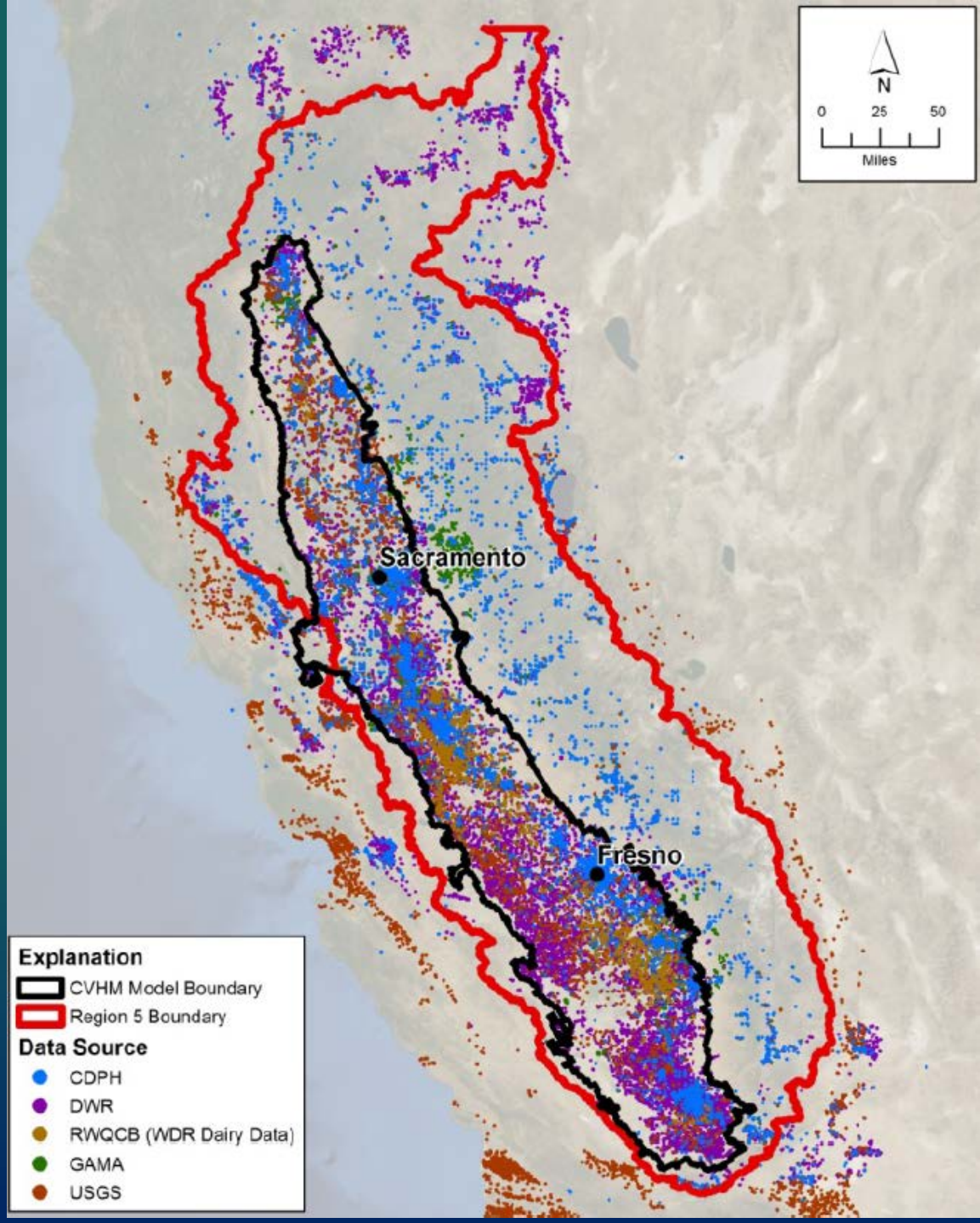


(from MCWRA, 2001, Salinas Valley Water Project Summary Report)

Groundwater Quality Data

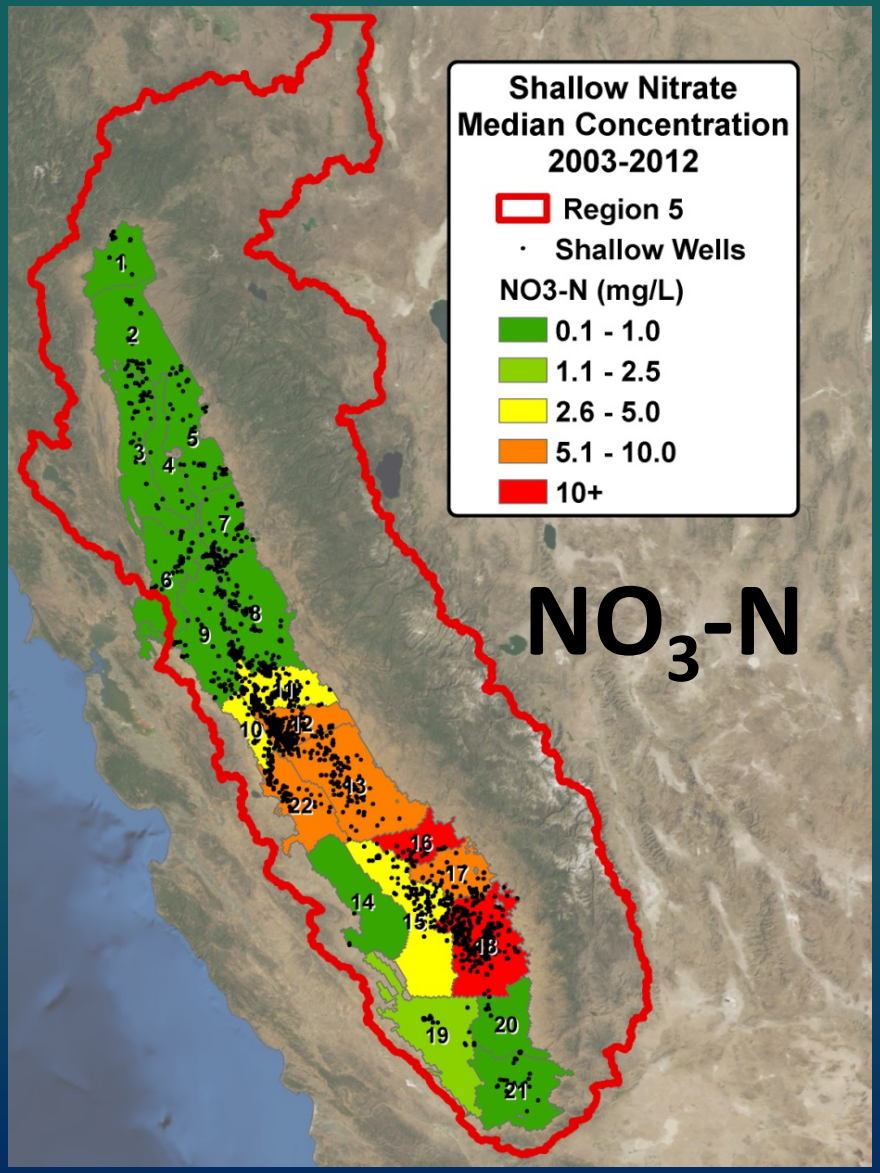
All Wells with Salt or Nitrate Data

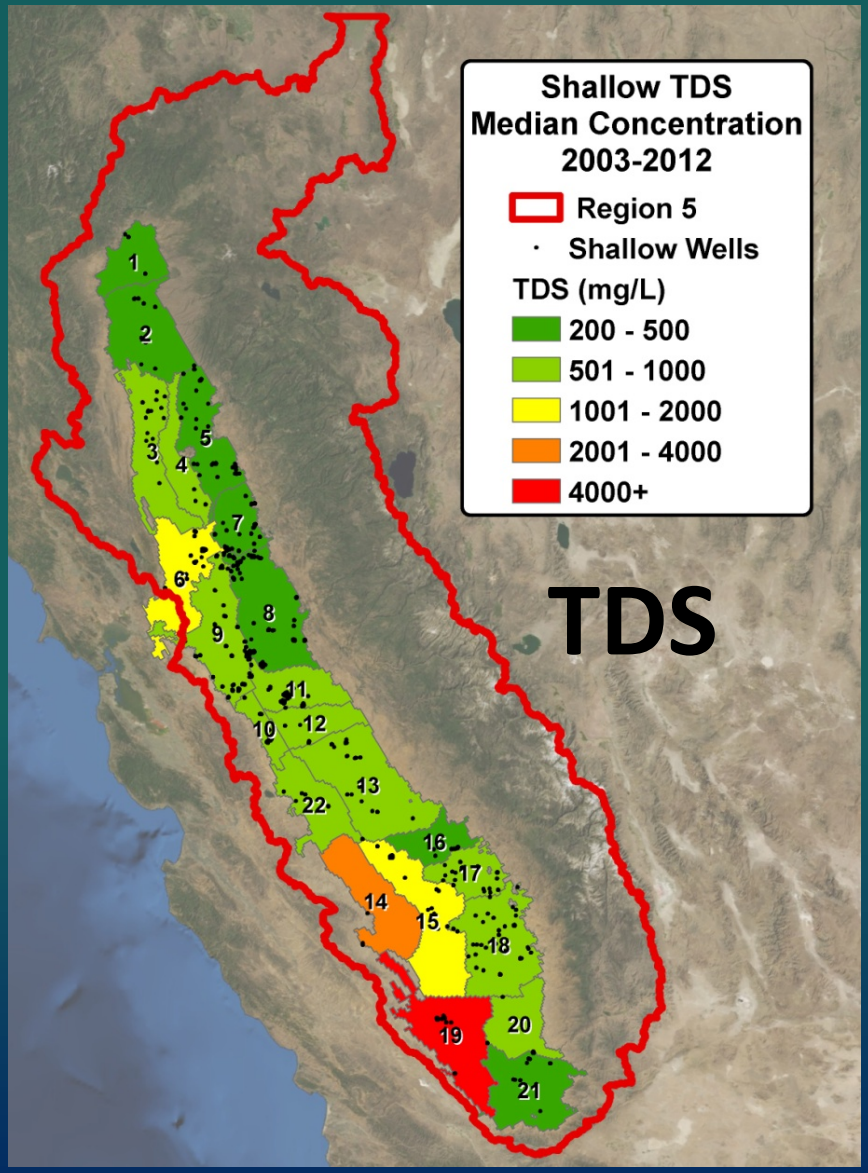
Full dataset = 46,228 wells (32,597 wells on Central Valley Floor)



Ambient GW Quality

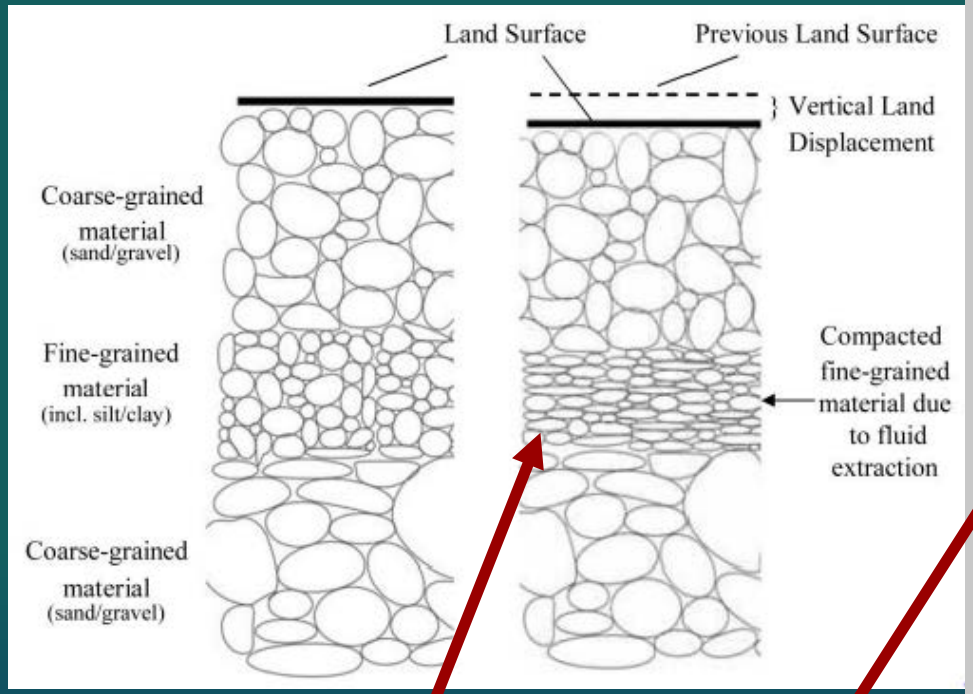
Upper Aquifer System Wells 2003-2012

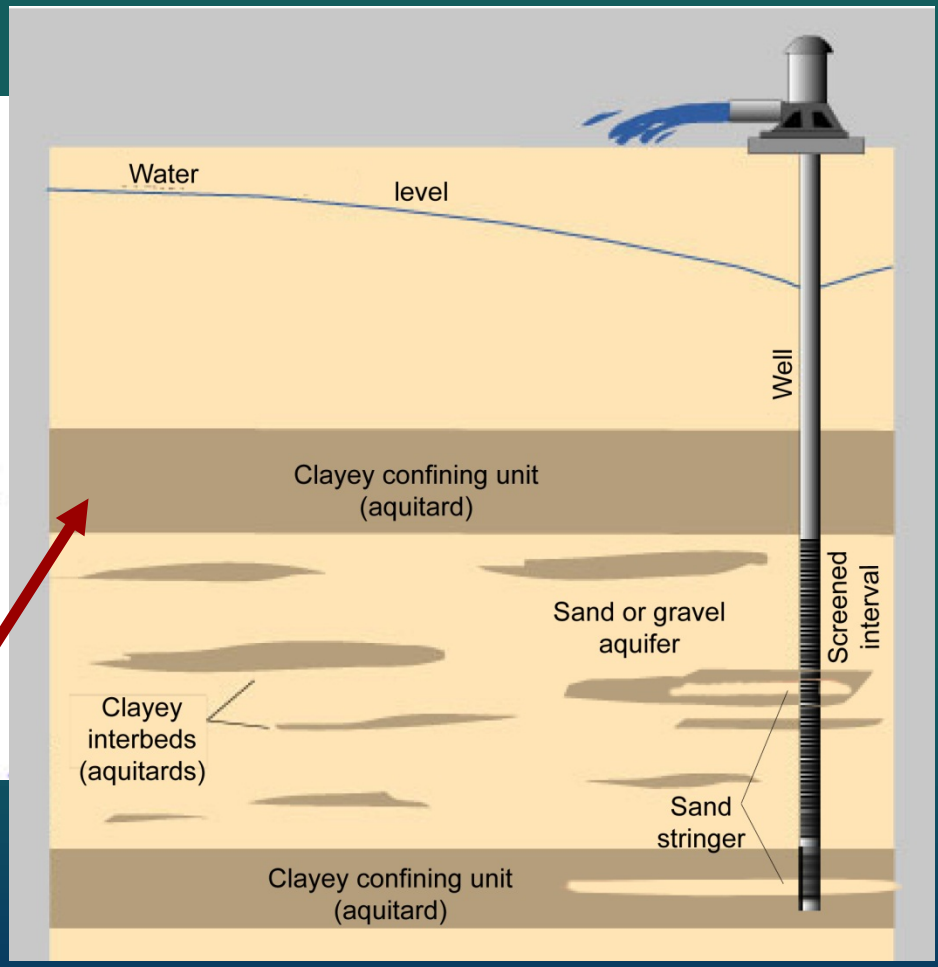




From: CV-SALTS Initial Conceptual Model (Phase I) Report, 2013

Mechanics of Aquifer System Compaction

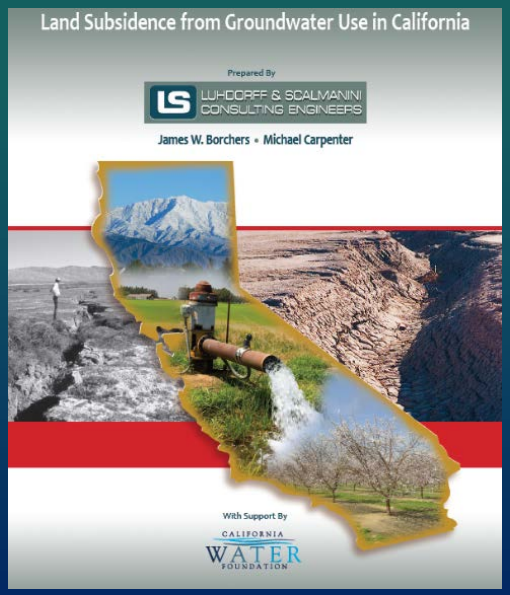




Compaction of fine-grained material

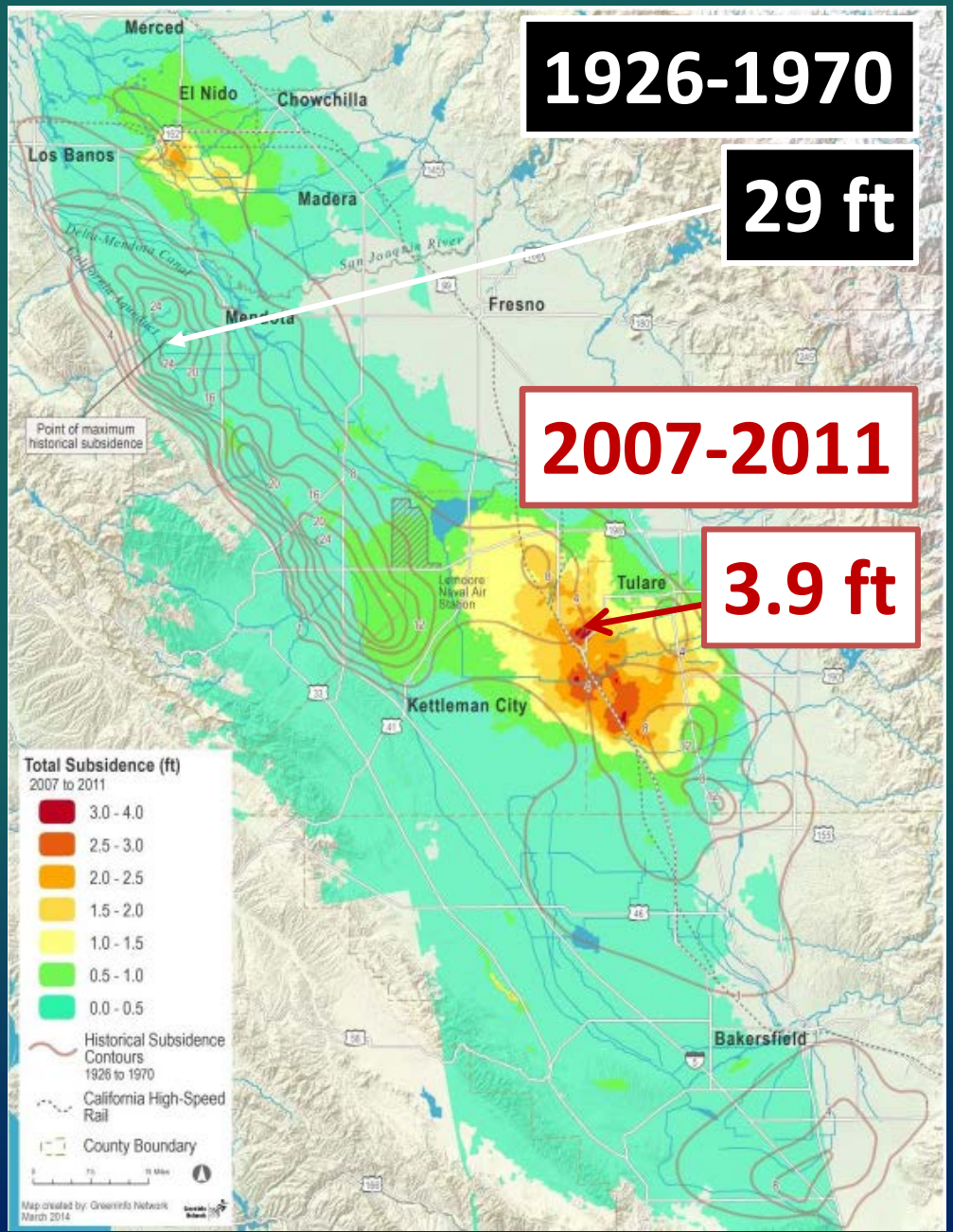
Subsidence from Groundwater Extraction

- Historic
- Historic & Recent
- Recent

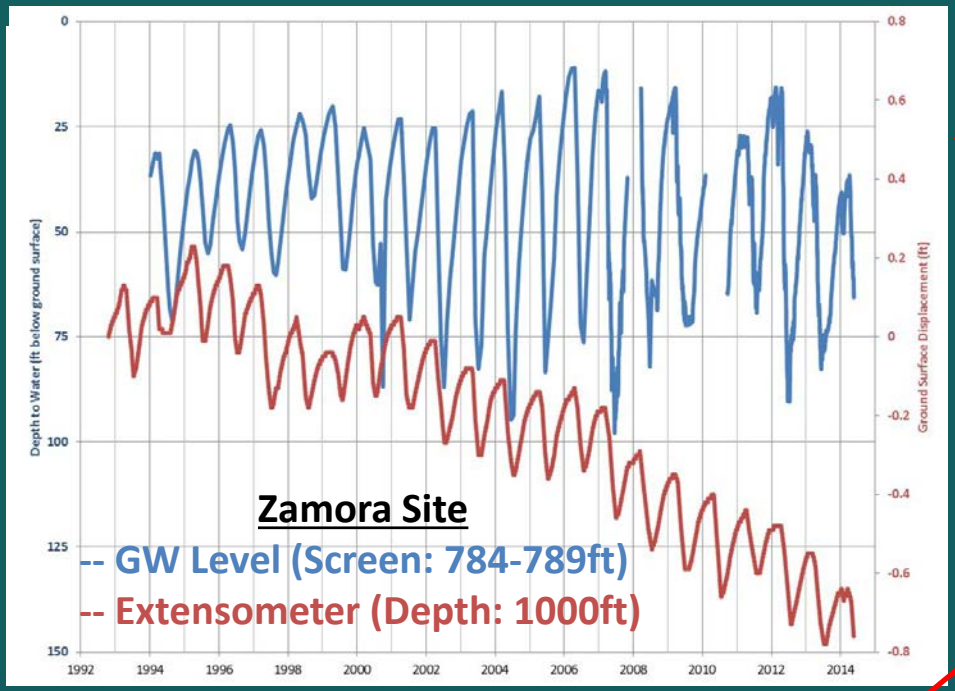


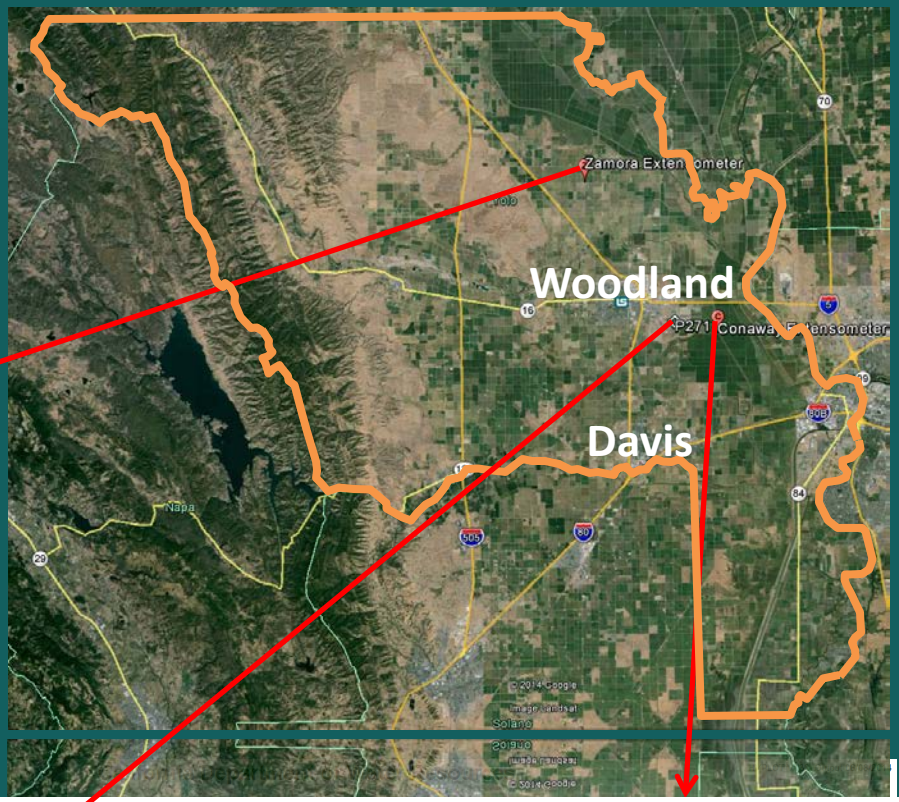
Subsidence – Historic and Recent

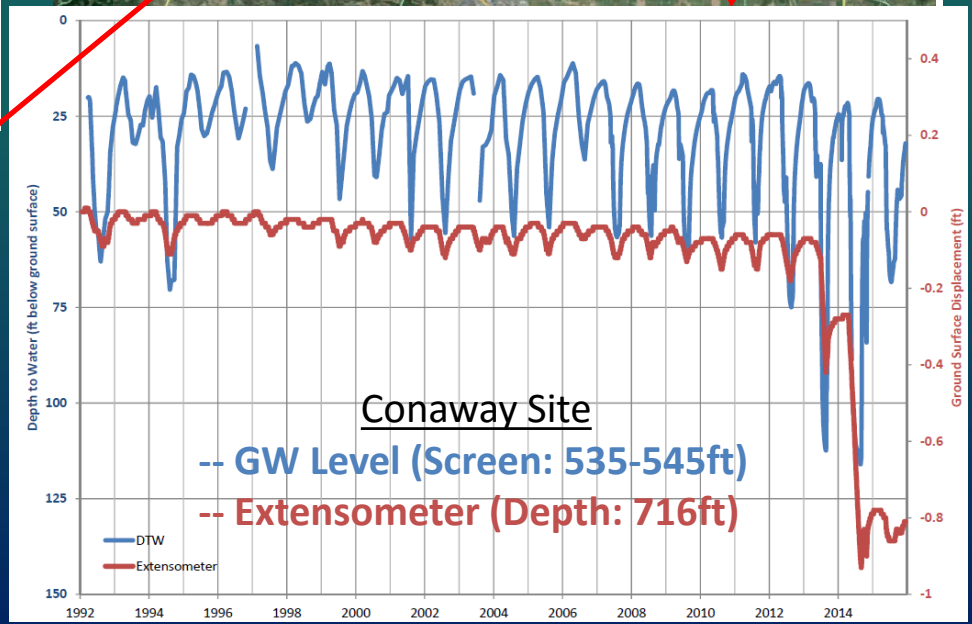
Joseph Poland 1977

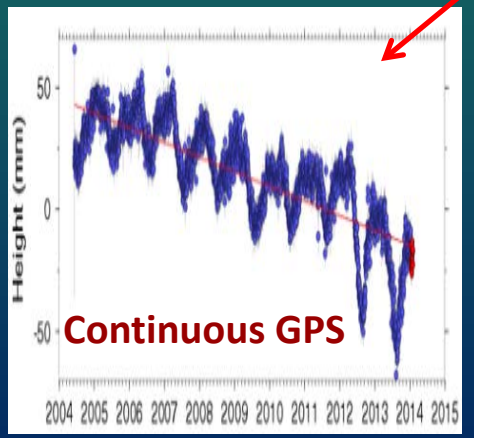


Extensometers/CGPS in Yolo County









1992-2014:
Zamora 0.64ft/22yrs

2004-2014:
P271 0.18ft/10yrs

Conaway
1992-2012: 0.06ft.
2013-2015: ~0.74ft
(~0.5ft in 2014)

Yolo County Well Casings Damaged by Subsidence

- 80 damaged wells videotaped 1974-1981
- Damage costs ~ $7.2 million (est. 2013 $)

Using down-well television surveys to evaluate land subsidence damage to water wells in the Sacramento Valley, California

Some Important Information: How Growers Can Help

Need to <u>Measure</u> in order to <u>Understand</u> and <u>Manage</u> Water Resources

- Local hydrogeology
  - Well construction info
  - Aquifer testing: aquifer characteristics
- GW levels
  - Trends in aquifer system
- GW use
  - Quantity applied; effectiveness of application
- GW quality
  - Nutrients: quantity applied; effectiveness of application
  - Salts: potential accumulation
  - Other

Example: Groundwater Levels

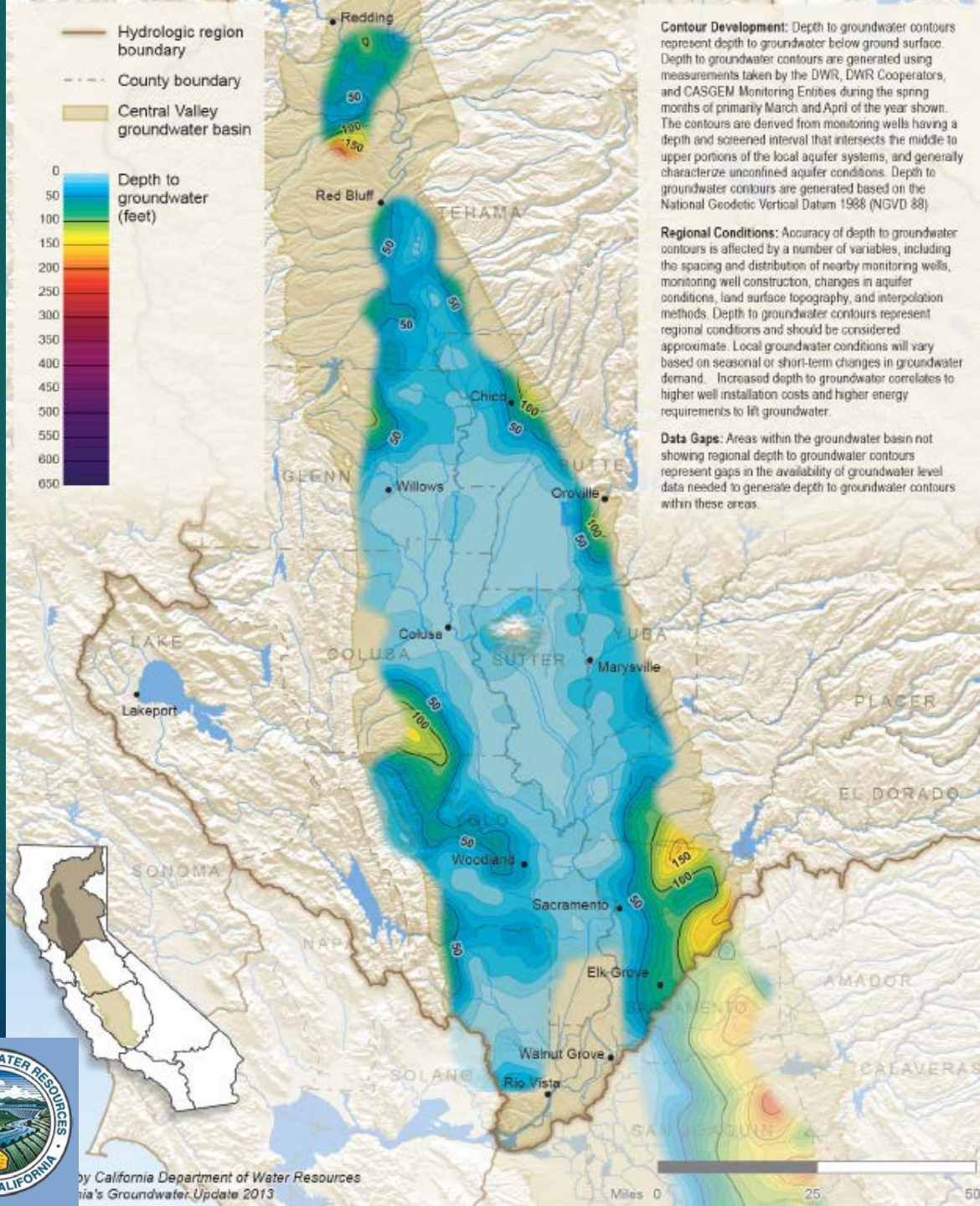
DWR Database: GW Levels and Online Contour Mapping Tool

Selection Criteria	Well Count
Wells in database	39,995
Wells with depth and screen info	3,989
And wells with drillers' report	2,484
And measured between 2005 & 2010	893
And located in Central Valley	419
And wells with perforations in unconfined aquifer	296
And are dedicated observation wells	89

From : Brewster, Presentation on CA Water Plan Update 2013, September 2015

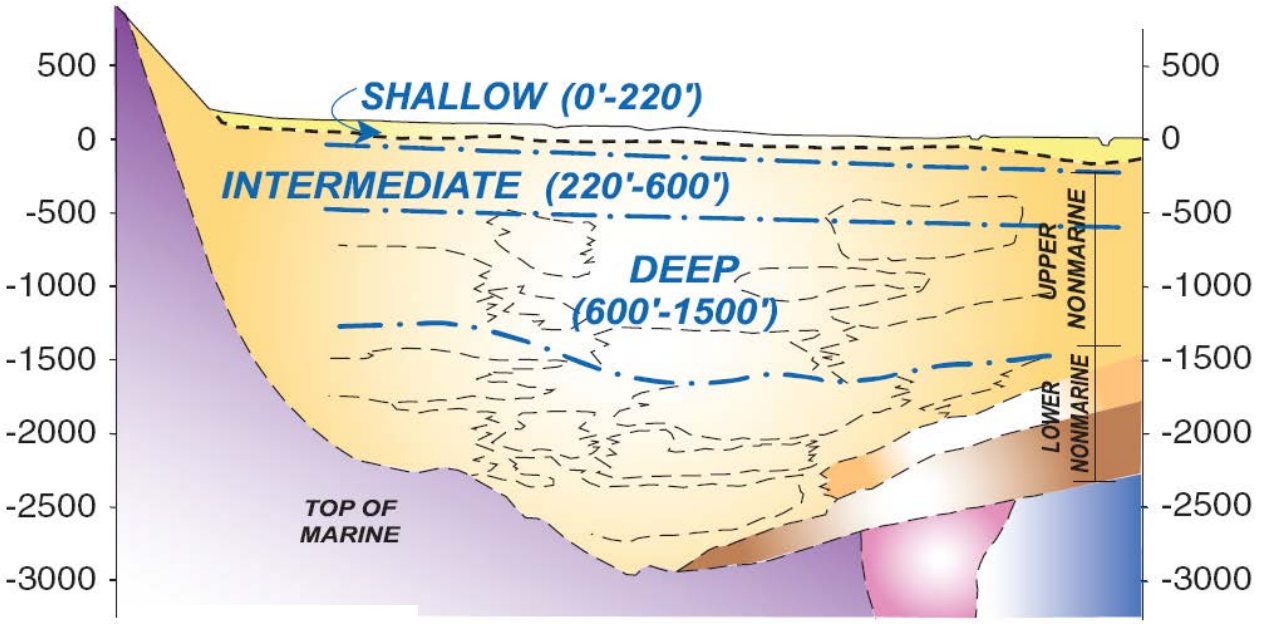
Spring 2010 Depth to GW

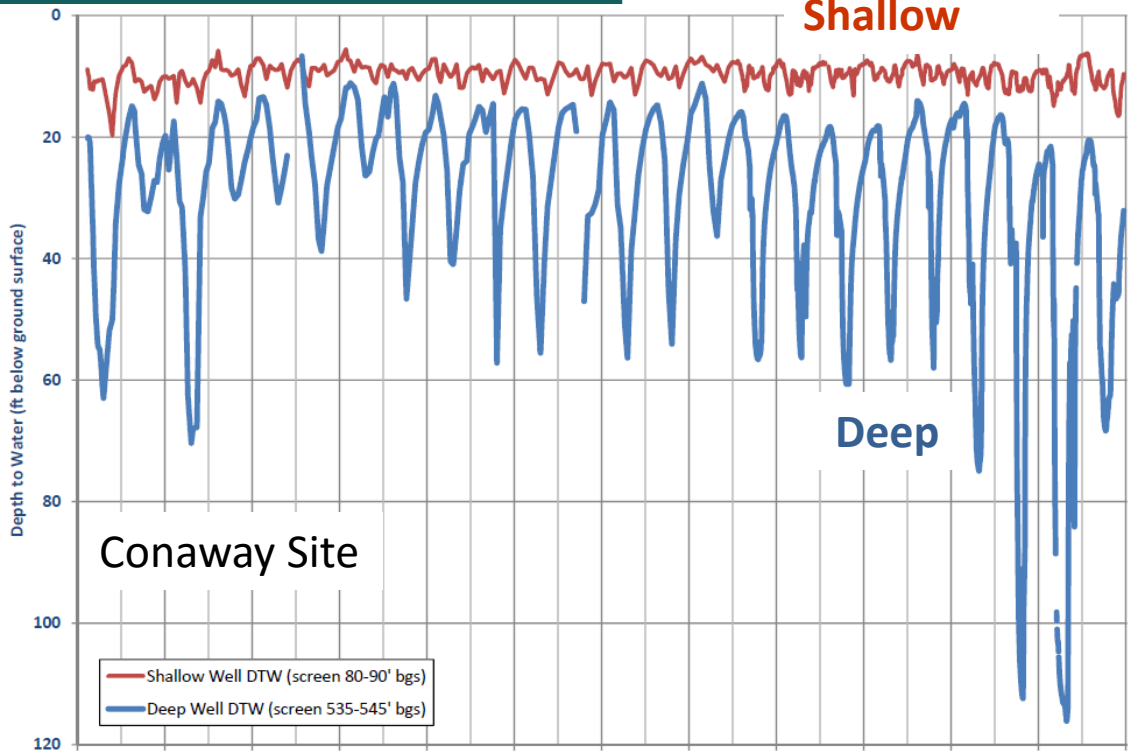
- Unconfined conditions (based on DWR data assumptions)



DWR CA Water Plan Update 2013

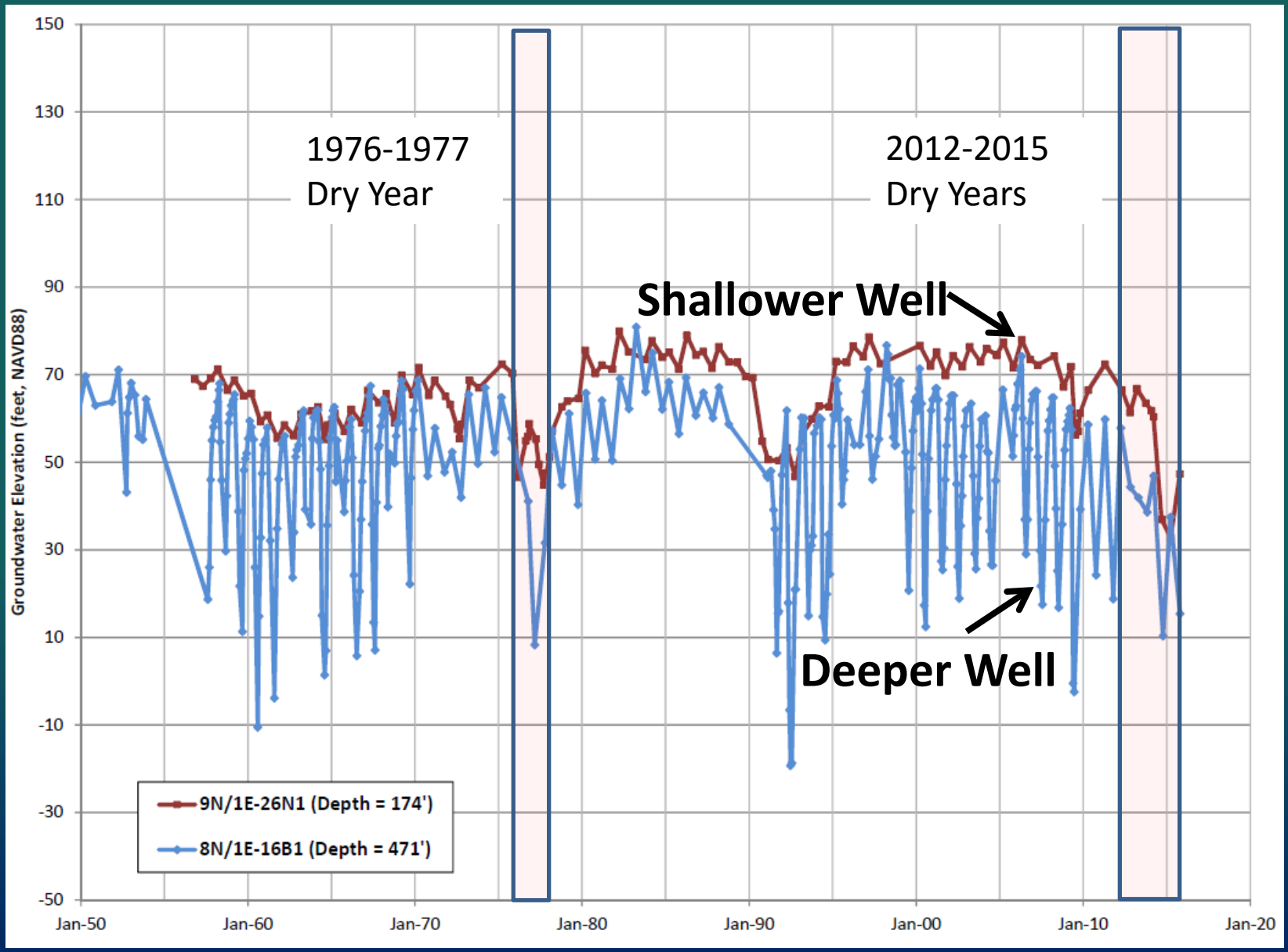
Yolo Hydrographs



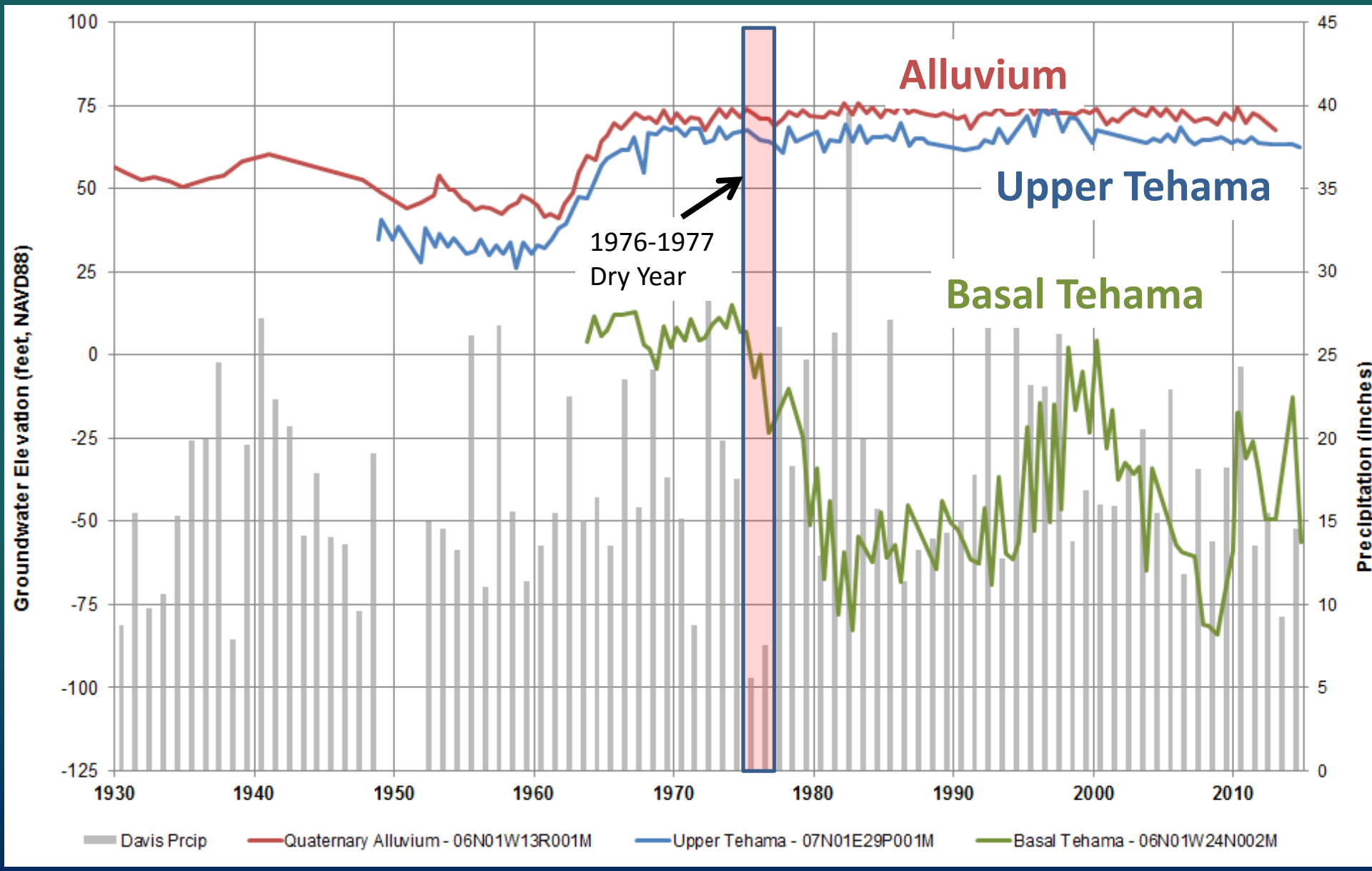


Data organization by hydrogeologic info

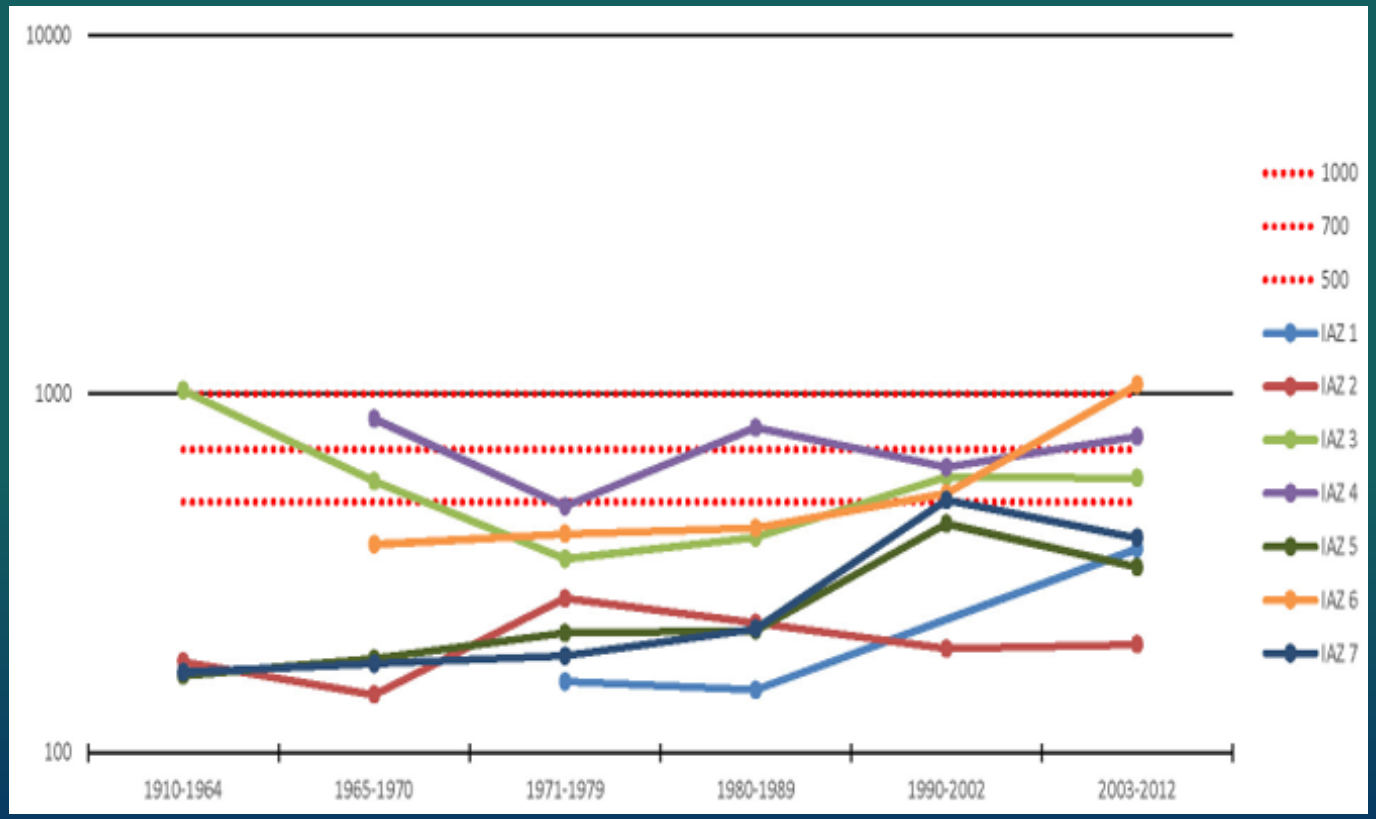
Groundwater Trends: Yolo County

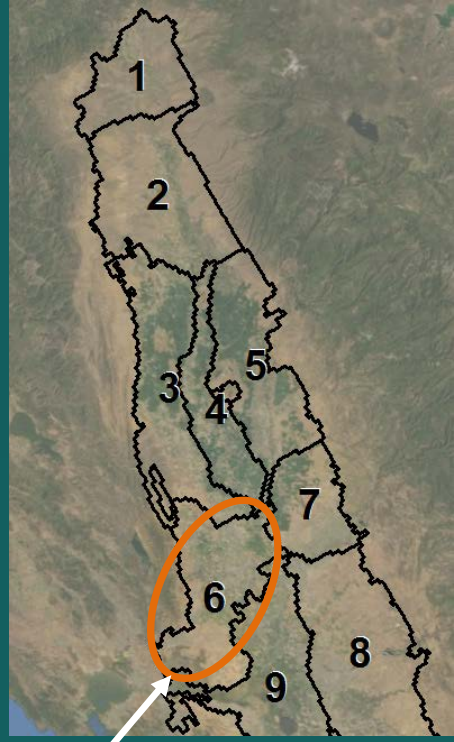


GW Levels: Different Aquifer Units, Different Story



Northern Central Valley TDS Trends: Upper Aquifer





IAZ 6 – Cache/Putah Area

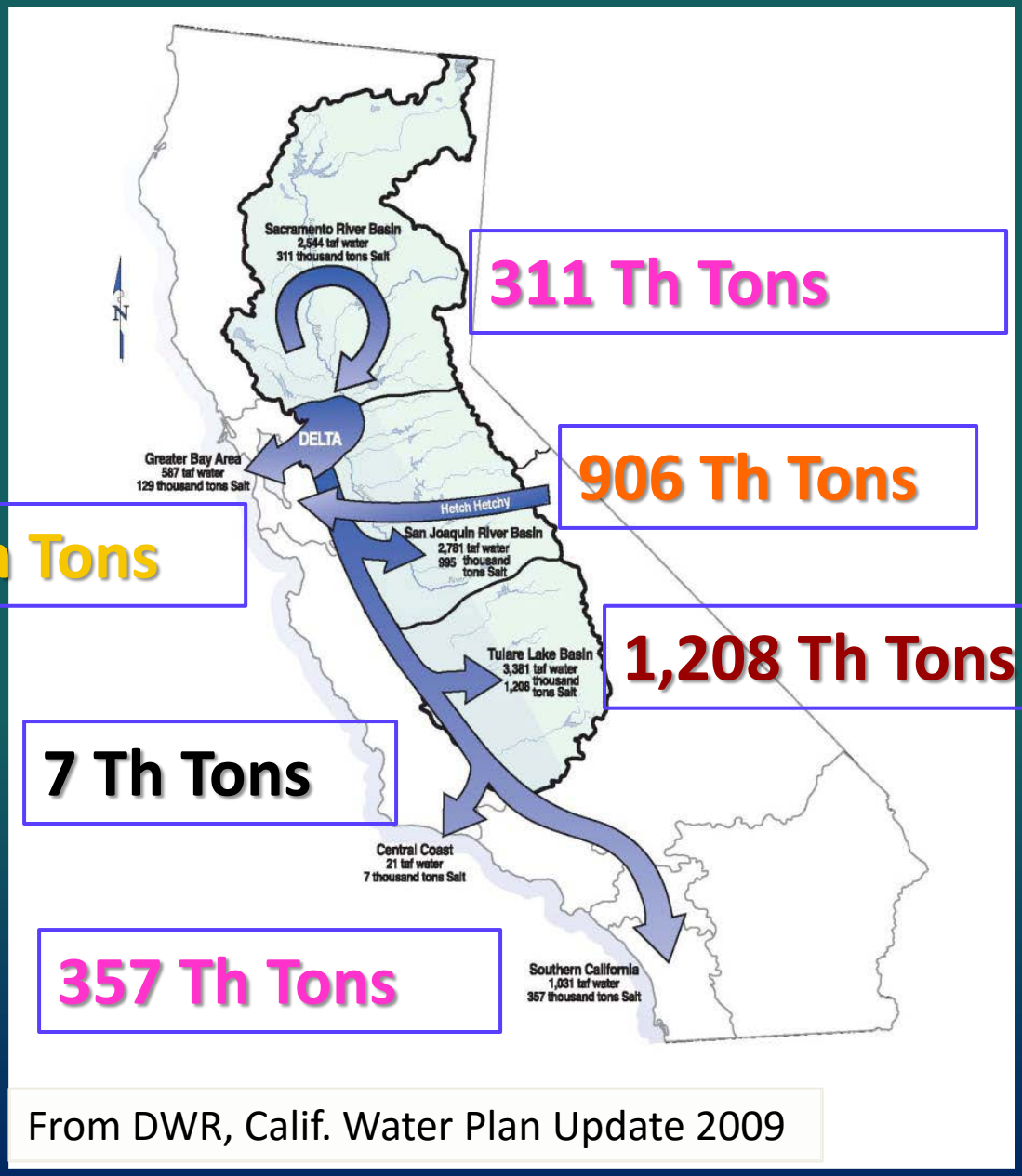
[Median Concentrations]

CV-SALTS Initial Conceptual Model Report, 2013

Integrating SW/GW Quantity and Quality

Salt – Transbasin Transport Per Year

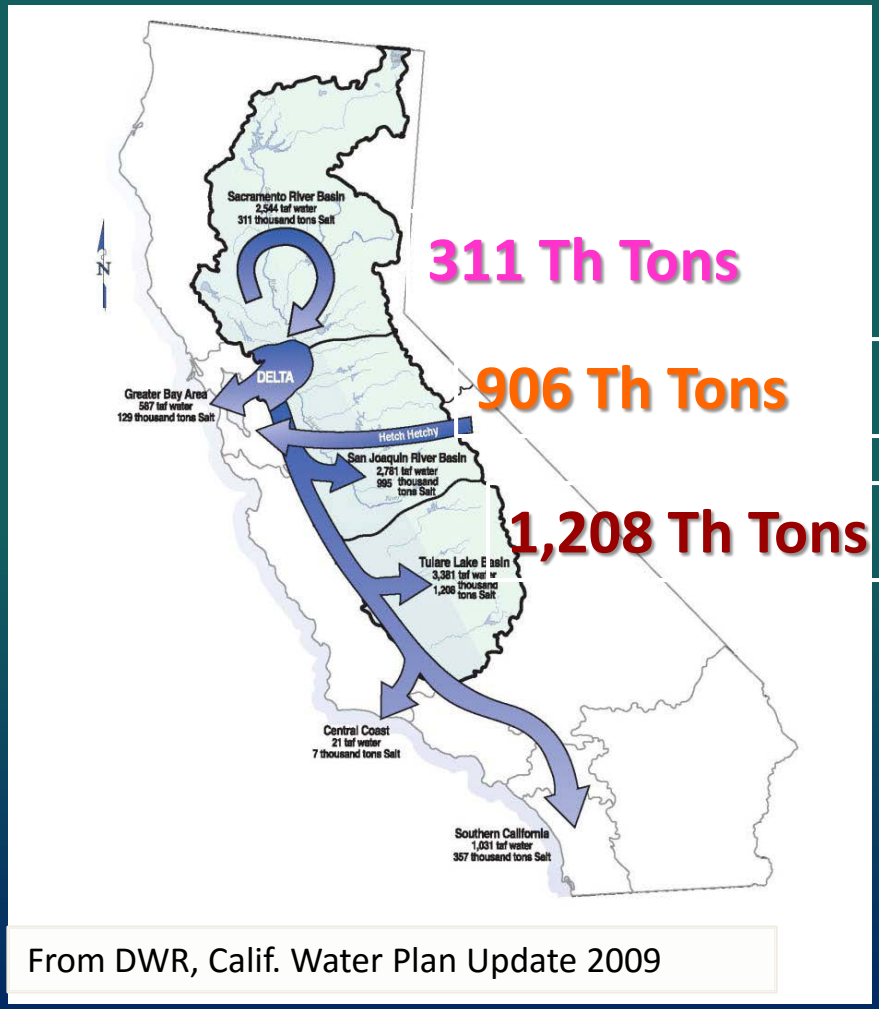
SURFACE WATER salt transfer



From DWR, Calif. Water Plan Update 2009

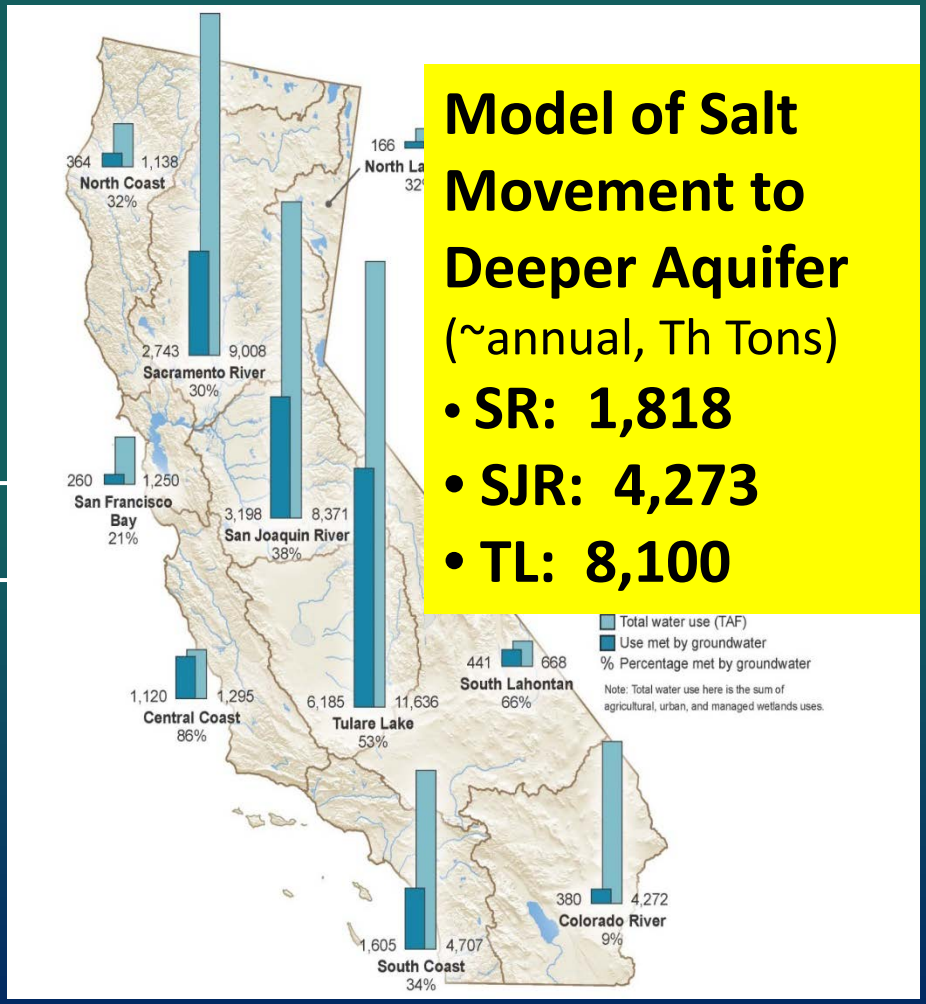
Transbasin and Interaquifer Movement of Salt

Surface Water Transbasin Movement (Annual)



From DWR, Calif. Water Plan Update 2009

GW Use & Salt Movement to Deeper Aquifer (Annual)



Model of Salt Movement to Deeper Aquifer
(~annual, Th Tons)

- **SR: 1,818**
- **SJR: 4,273**
- **TL: 8,100**

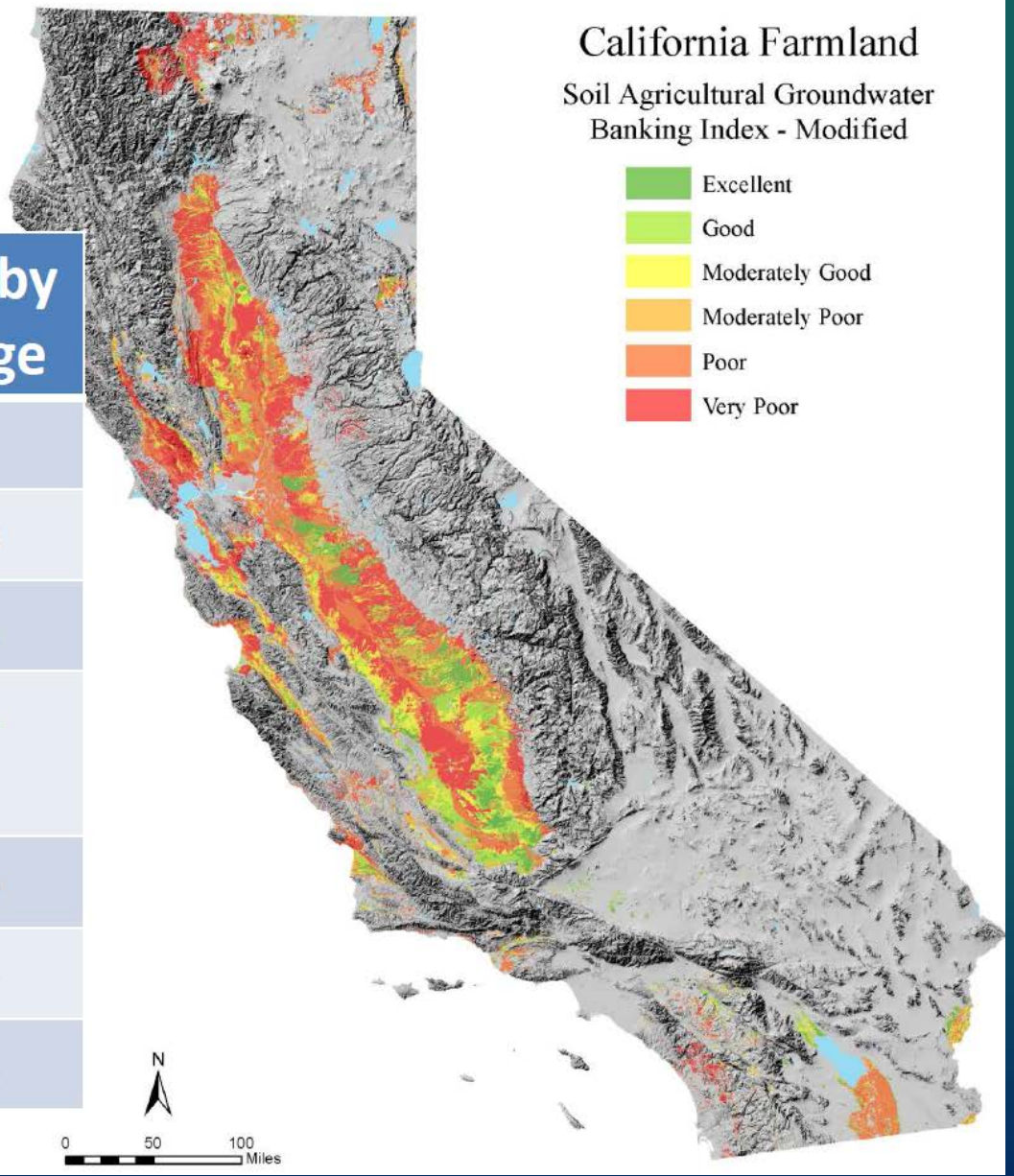
Growers and Lands for Potential Recharge Opportunities

- Toby O'Geen (UC Cooperative Extension Specialist) and others develop new interactive mapping tool
- Preliminary assessment of potential for deep percolation & recharge

O'Geen and Dean Helene Dillard; CA&ES Outlook Fall/Winter 2015

Potential Recharge Opportunities

SAGBI group	Modified by deep tillage
	acres
Excellent	1,557,035
Good	2,020,921
Mod. Good	1,984,414
Mod. Poor	1,364,066
Poor	4,586,645
Very poor	6,084,142



Toby O'Geen, PhD, UCD, California Agriculture 69:75-84

What is Recommended to Support Groundwater Sustainability?

- Improve data quality for more meaningful results
- Provide more meaningful assessments, including baseline conditions
- Develop more meaningful measurable objectives
- Identify data gaps and design effective monitoring programs
- Increase opportunities for successful local groundwater management

Thank You