Water Transfers from Agriculture: Estimating the Impact of Foregone Production and Aquifer Decline in Northern California

Sacramento River (Redding, CA)

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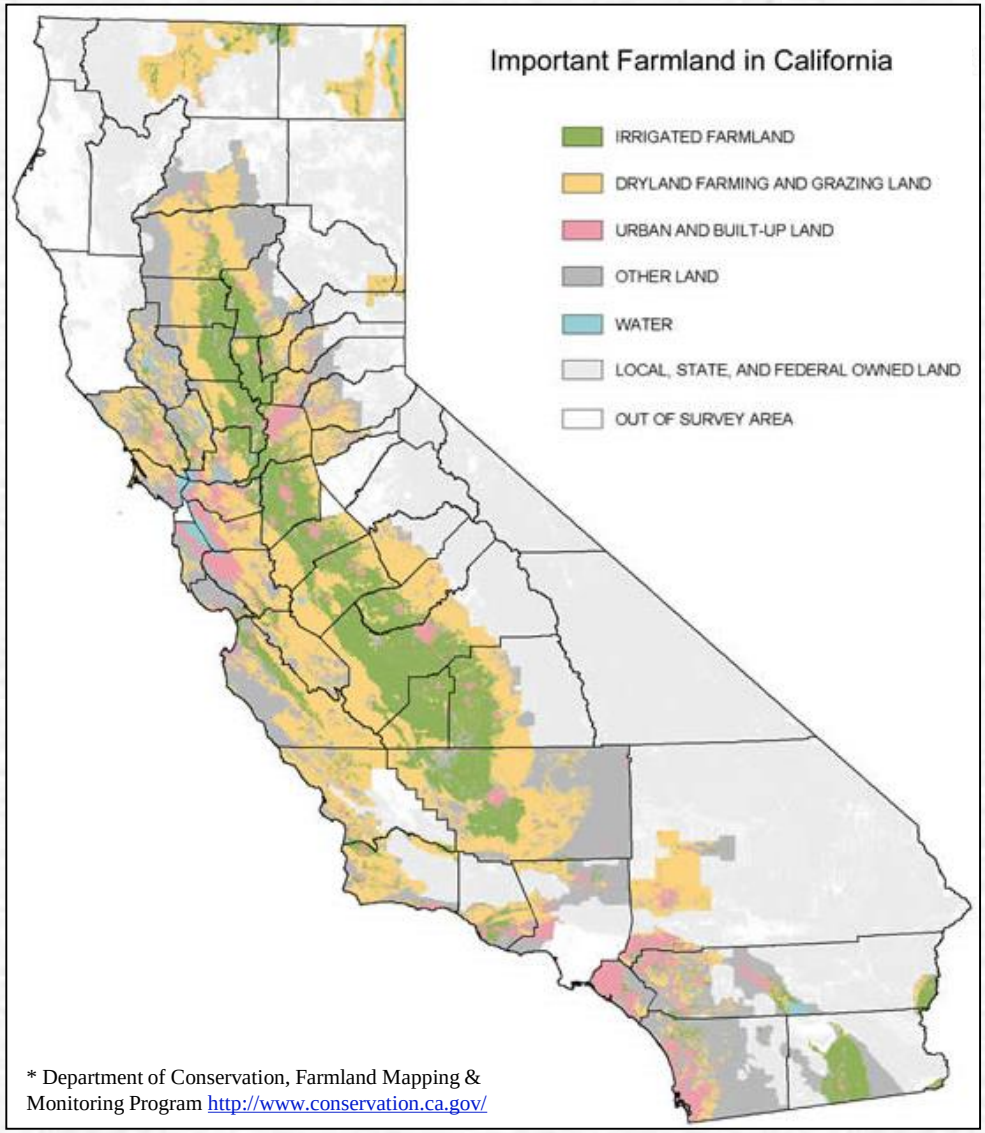
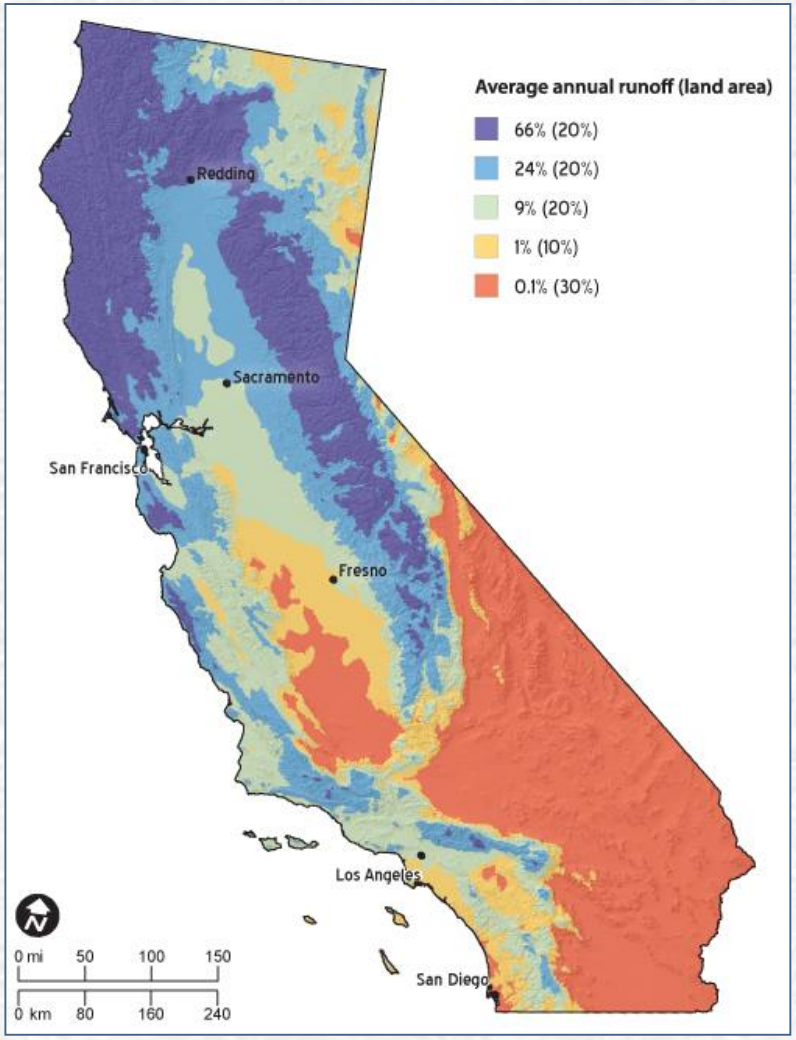
California Agriculture



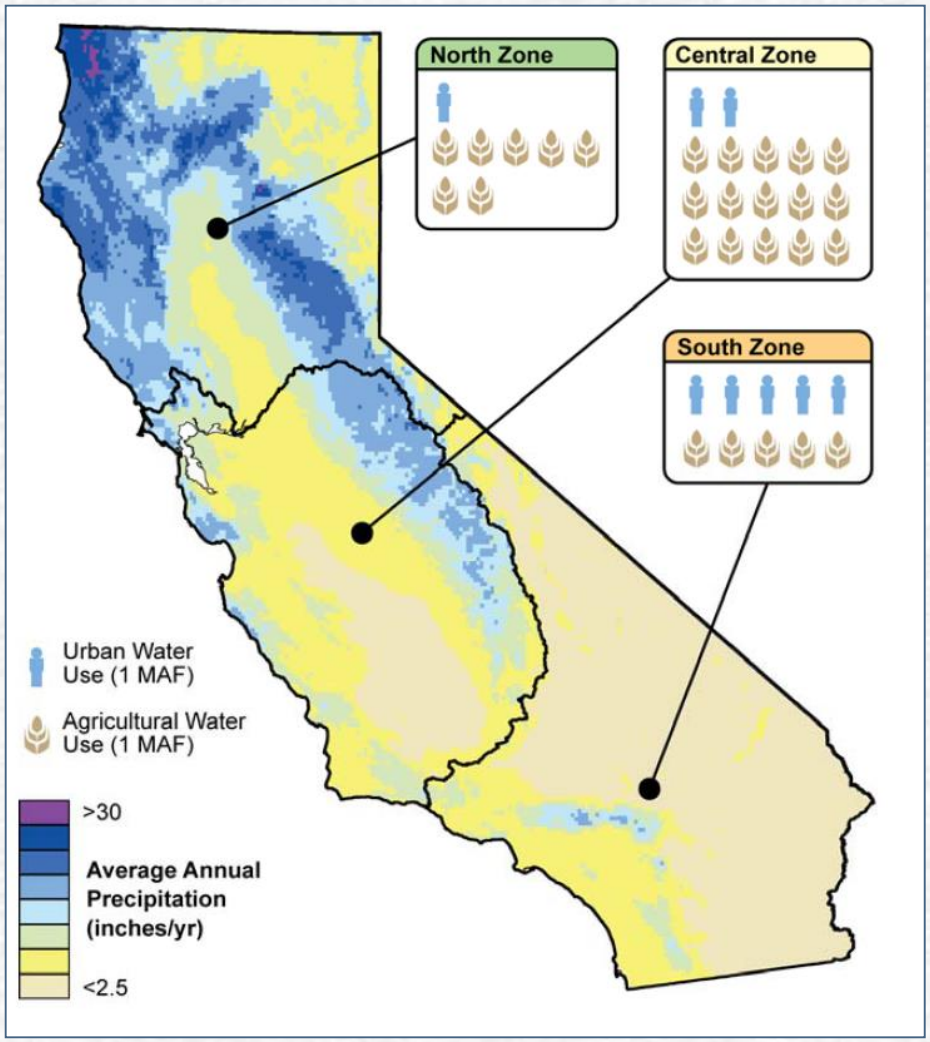
* Department of Conservation, Farmland Mapping & Monitoring Program http://www.conservation.ca.gov/

- Agricultural production was worth approximately $44.7 billion in 2012, highest level in the country.
- 9.6 million irrigated acres.
- Produces over 400 commodities and half of all US-grown fruits, nuts and vegetables.
- 39 million people, most populated state.

Water Supply/Demand in California

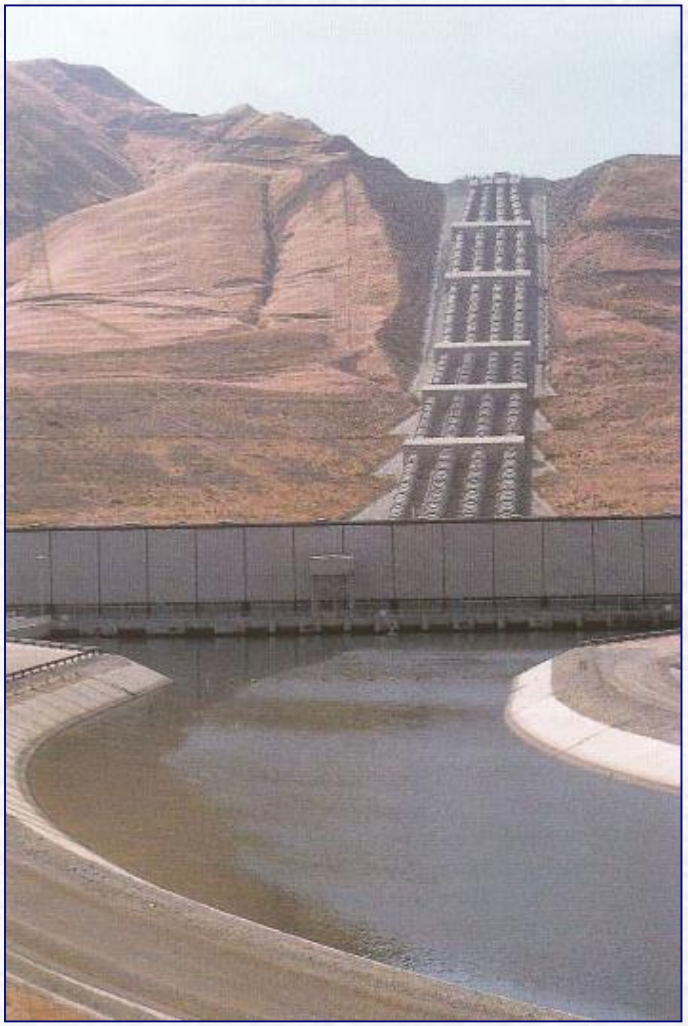


Hanak, et al. "Managing California's Water From Conflict to Reconciliation." Public Policy Institute of California, 2011.



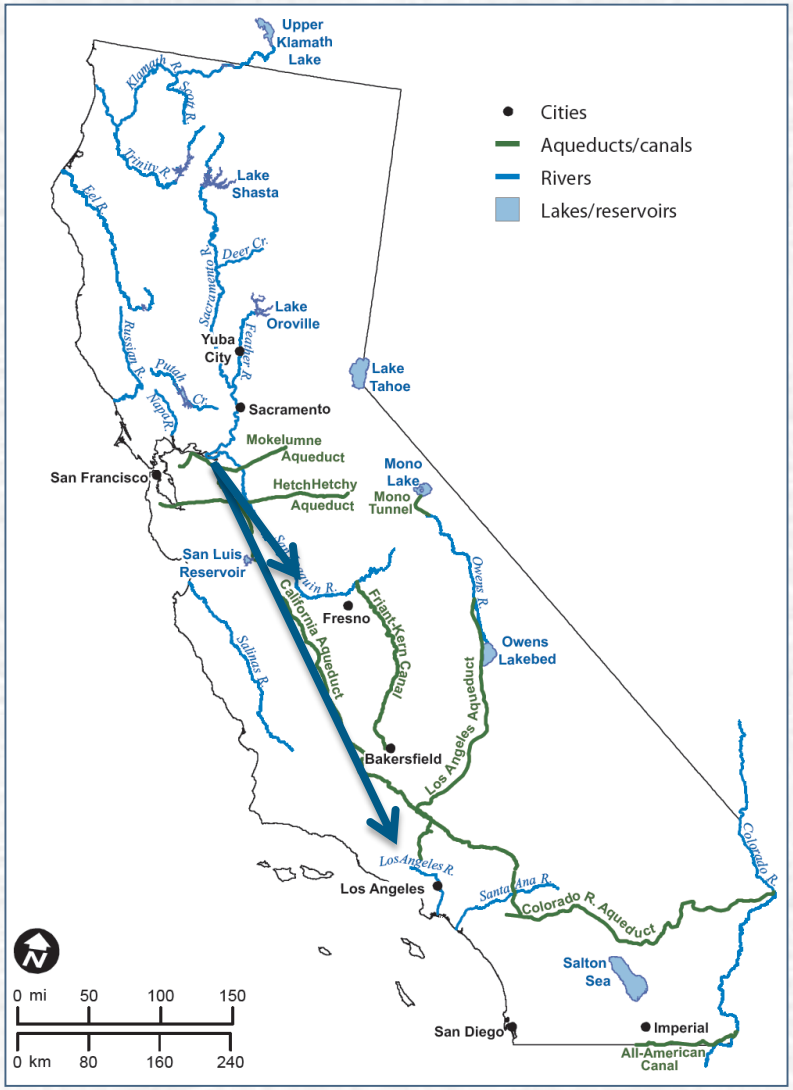
Bureau of Reclamation. "Water Supply and Yield Study", Mid-Pacific Region, 2008.

Water Transfer Infrastructure



California Aqueduct

Water Transfer Infrastructure



Hanak, et al. "Managing California's Water From Conflict to Reconciliation." Public Policy Institute of California, 2011.

California Aqueduct (SWP) has the capacity to deliver approximately 4.2 million acre-feet in total.

However, this allocation is often curtailed…

2015: 20% (current estimate)
2014: 5% allocation
2013: 35% allocation
2012: 65% allocation
2011: 80% allocation
2010: 50% allocation
2009: 40% allocation
2008: 35% allocation
2007: 60% allocation
2006: 100% allocation

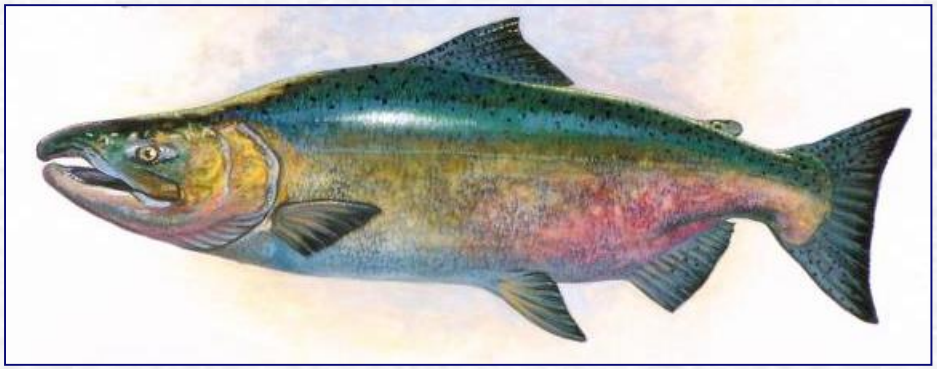
* The Central Valley Project (CVP) expects 0% for Farmers and 25% for M&I (2015).

Why are Allocations Curtailed?

- Fluctuations in precipitation, snowpack, etc. (drought/climate change)
  - Threatened and Endangered Species

Delta Smelt (Threatened)

Central Valley Spring-run Chinook (Threatened)
Sacramento River Winter-run Chinook (Endangered)



Problem

- Not enough water when/where it is needed for all uses.
- Water transfers from Agriculture in Northern California are often used to meet the shortages in Central/Southern CA.
- These water transfers can result in **fallowed land** and/or **increased groundwater pumping**.
- The impact of these transfers are often not well known.

Rice Fields in Northern California (CA Water Plan).

Objectives

1. Estimate the Impact of *Land Fallowing* (Foregone Production) for Water Transfers from Agriculture in Northern California.
2. Estimate the Impact of *Additional Groundwater Pumping* (Aquifer Decline) for Water Transfers from Agriculture in Northern California.

Lake Oroville (Rich Pedroncelli, Associated Press)

Study Area

- Butte County (Sacramento Valley).
- Located along the Sacramento River.
- Top three commodities are Walnuts, Rice, and Almonds.
- Rice is mostly irrigated with surface water, orchards are mostly irrigated with groundwater.
- Voluntary water transfers have resulted in water moving south.
- These transfers are often accompanied with land fallowing (Chapter 33, Butte County Code).

Hanak, et al. "Managing California's Water From Conflict to Reconciliation." Public Policy Institute of California, 2011.

2014 Water Transfers (Butte County)

- Water price $600/AF.
- Rice growers can only sell the consumptive use (3.3 AF/acre).
- Districts kept .3 AF/acre and growers received ~$1,800/acre.
- 74,052 AF was sold/transferred.
- In these cases, the water seller fallows their land (Chapter 33, Butte County Code).
- 22,440 acres of rice were fallowed (Approx. 20%)

Rice Fields in Northern California (Anthony Dunn Photography)

Value of Foregone Production (Butte County)

Acres	$/acre*	Total Foregone Production	Forgone Production per AF (transferred)
22,440	$2,038	$45,728,436	$617.52

* Based on 2013 Butte County Crop Reports

Producers decide whether or not they want to participate in voluntary water transfers and give up rice production for water sales income, but…

What about the Third Party Impacts?

Third Party Impacts

- When farmers stop producing crops and start selling water it can impact the local economy.
- Indirect impacts occur in sections of the economy due to their inter-industry linkages to the direct impact.
- Induced impacts include all impacts that are not linked to the direct impact but are dependent upon the success of the local economy in general.
- IMPLAN (IMpact Analysis for PLANnning) was used to estimate the indirect and induced impacts associated with the foregone production.

Third Party Impacts (Foregone Production)

- For every $1 of lost rice production there was an additional $.65 of lost economic activity ($.50 Indirect and $.15 Induced).

Negative Impacts
Support Activities for Ag and Forestry
Wholesale Trade
Maintenance/Repair Nonresidential Structures
Limited-Service Restaurants
Hospitals
Banking/Credit

However, the income that producers receive selling/ transferring water can also benefit third parties!

Must look at the impact of increased water sales.

Third Party Impacts (Water Sales Income)

- For every $1 of Water Sales Income there was an additional $.49 of gained economic activity ($.00 Indirect and $.49 Induced).

Positive Impacts
Limited-service restaurants
Hospitals
Full-service restaurants
Retail - Food and beverage stores
Retail - General merchandise stores
Offices of physicians

Overall, the net impacts were **negative**. There was a net loss in jobs/output from Support Activities for Ag, Truck Transport, Maintenance/Repair Nonresidential Structures, etc.

However, there was a net gain in jobs/output in sectors like Restaurants, Hospitals, Merchandise Retail, etc.

Land Fallowing (Conclusions)

- When farmers stop producing crops and start selling water it can impact the local economy.
- It is important to include both the costs of the foregone production and the benefits from the water sales.
- With current prices, production, and assumed economic linkages, the net effect of 2014 transfers appear negative in Butte County.
- It is important for policymakers to better understand how specific sectors of the economy might be affected.

What if they don't fallow their lands and pump additional groundwater instead?

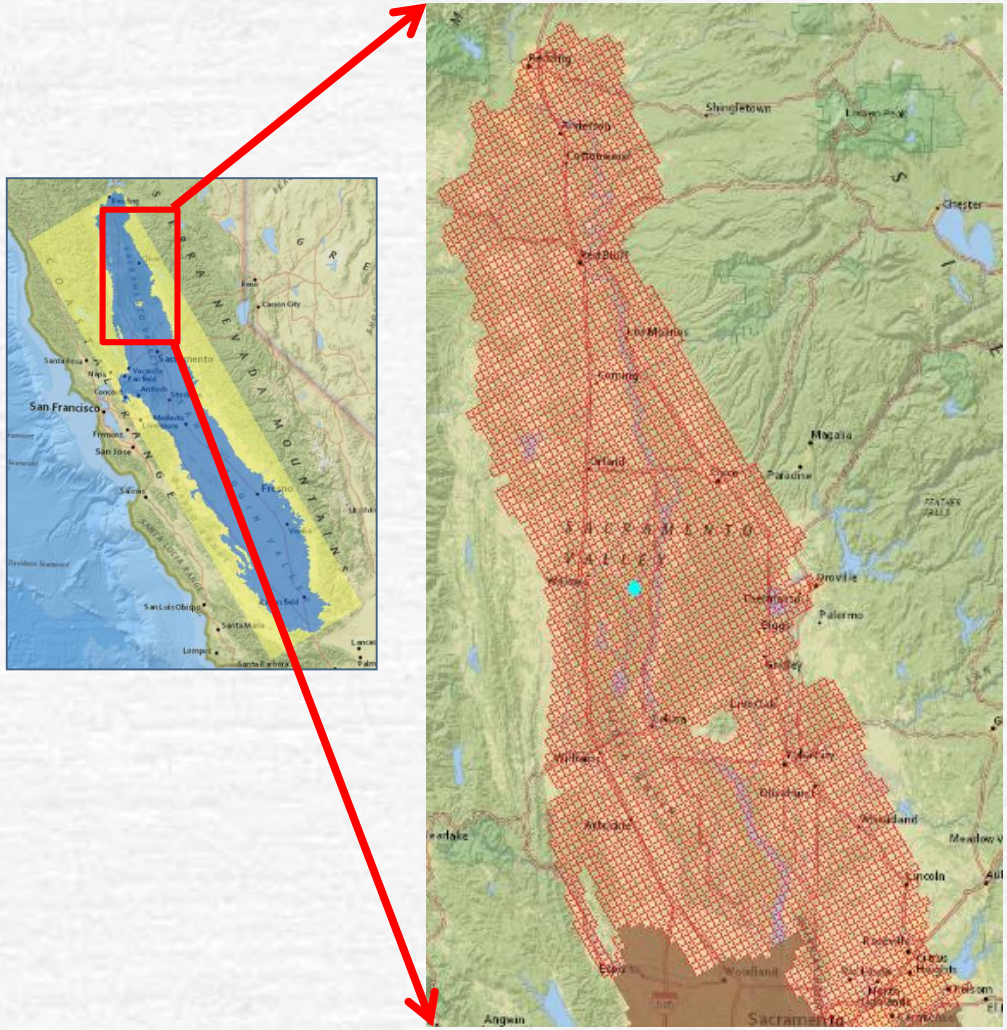
Additional Groundwater Pumping

- Groundwater Substitution Transfer: When additional groundwater is pumped to offset a surface water transfer.
- Understanding the impact of additional groundwater pumping on regional aquifer levels is needed to better understand these transfers.

Water Education Foundation

Hydrologic Model

- USGS Central Valley Hydrologic Model (CVHM)
- MODFLOW
- 3D model of the hydrologic system that simultaneously accounts for changing water supply/demand and simulates surface & groundwater flow.



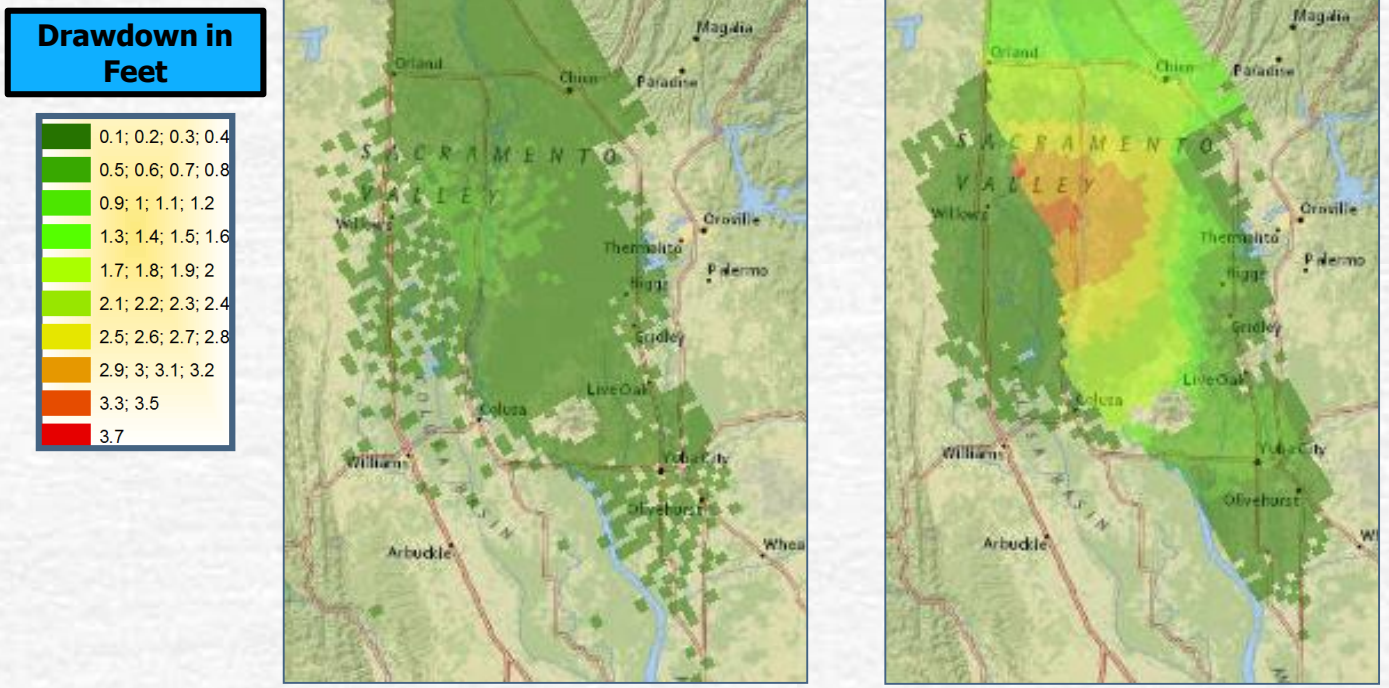
Groundwater Pumping Scenarios

- We examined three different groundwater substitution transfers (75K AF, 300K AF, 600K AF).
- The location of the additional groundwater pumping was placed just outside of Butte County (County proposition effectively prohibits GST).
- The impact of a single year groundwater substitution transfer was estimated on aquifer levels over a 10 year period assuming “average” precipitation.

Aquifer Decline

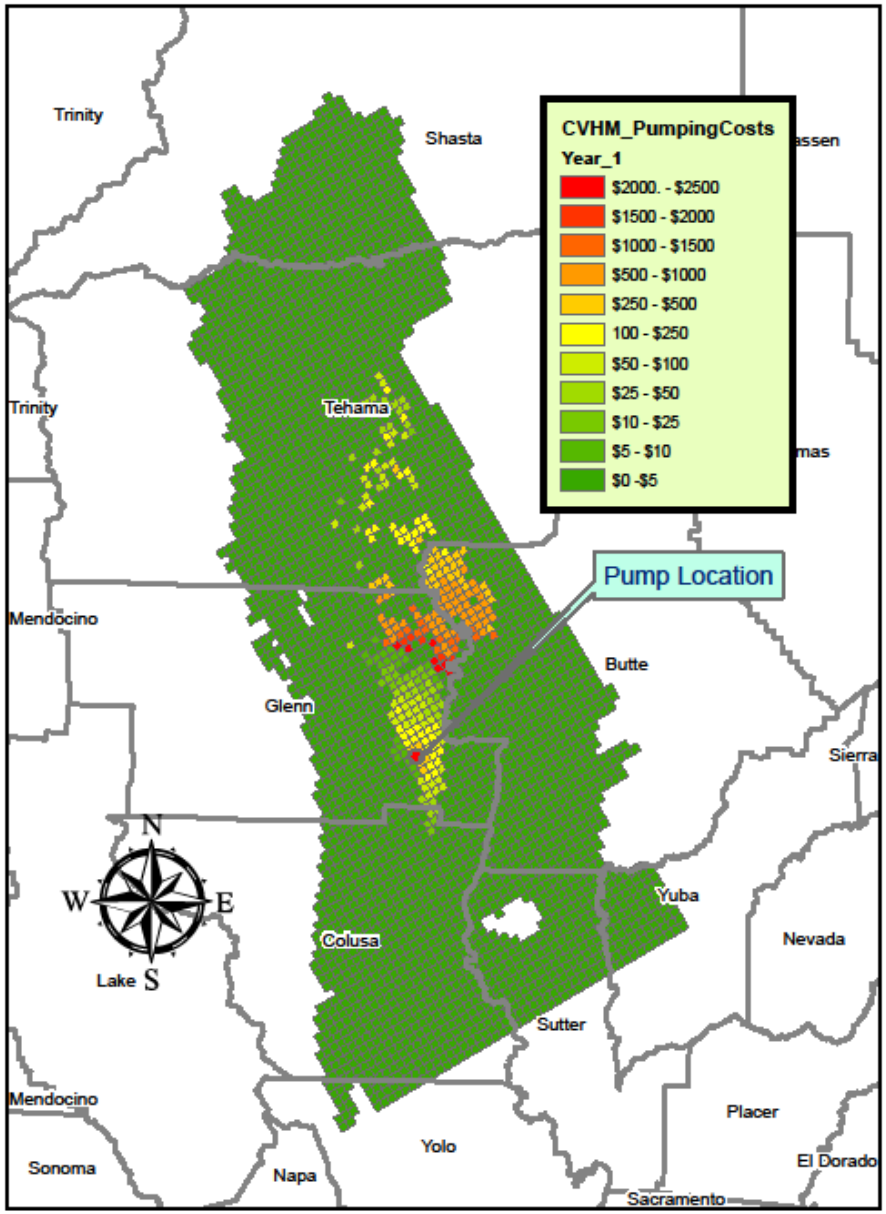
75,000 AF pump scenario
(End of Year 1)

600,000 AF pump scenario
(End of Year 1)

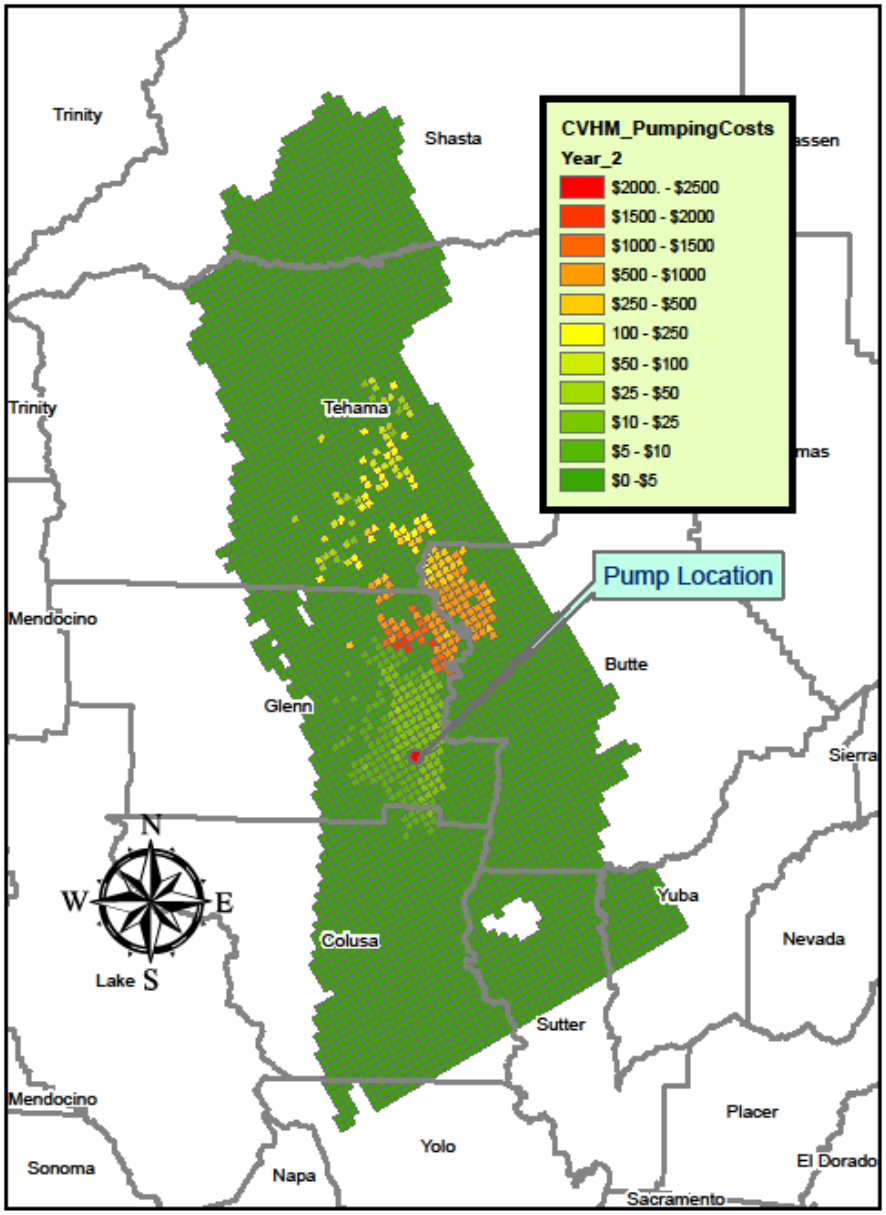


What are the additional third party pumping costs associated with these declines?

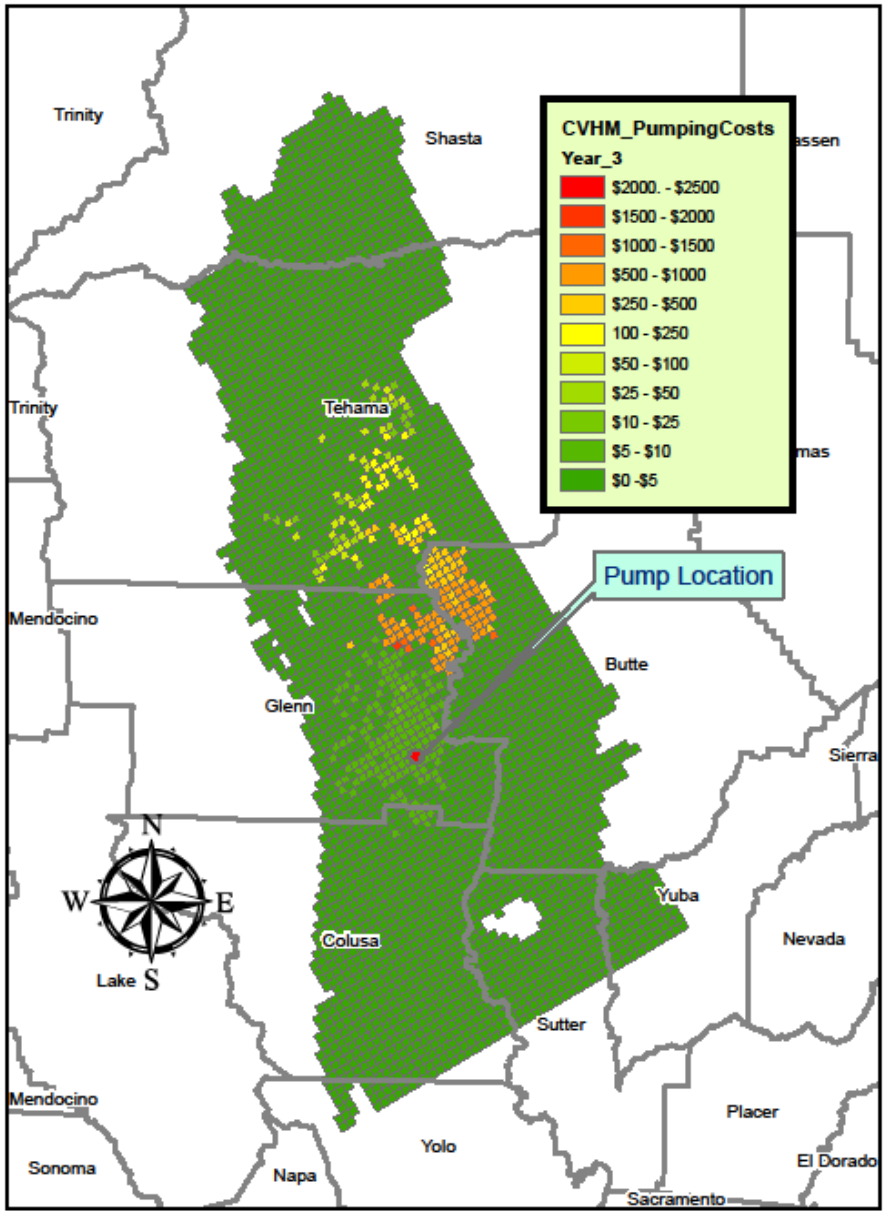
Pumping Scenario 600,000 afa- 1st Year



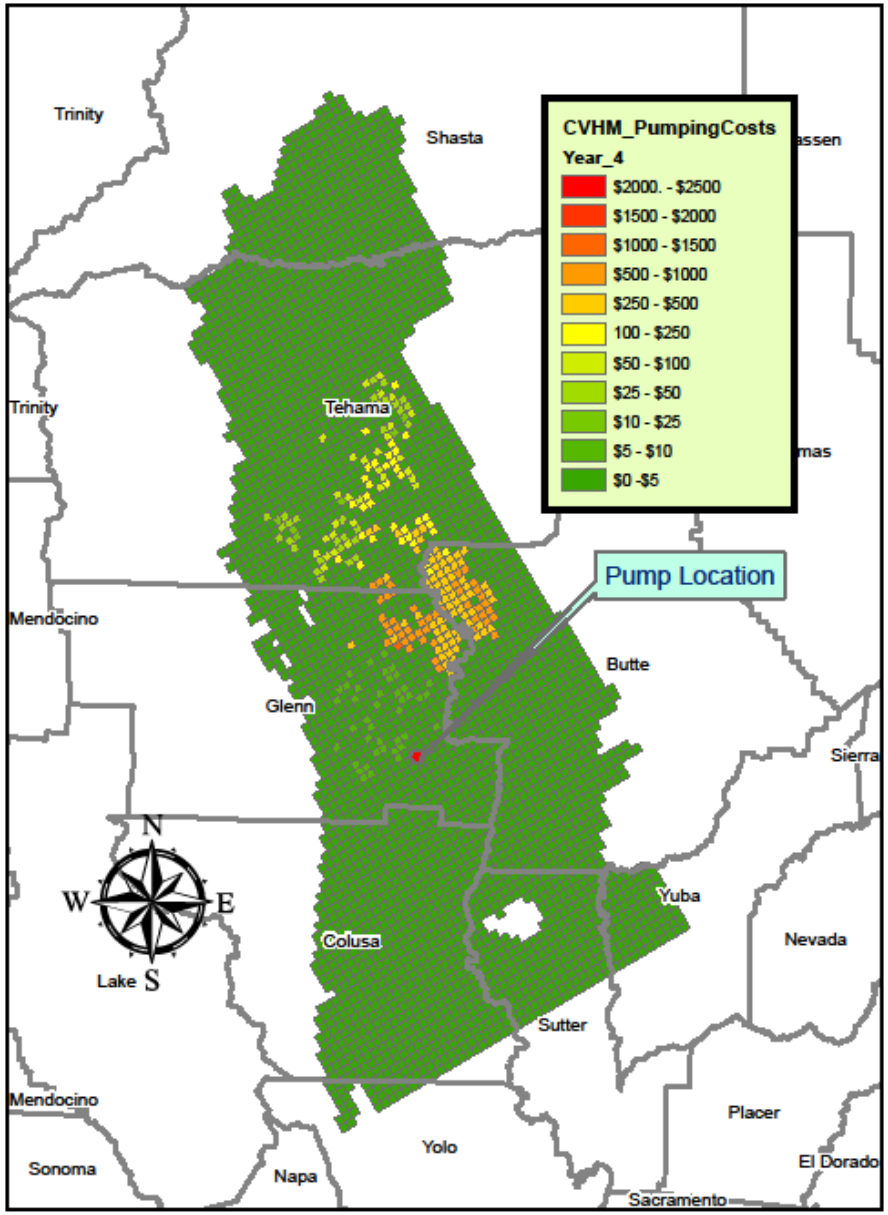
Pumping Scenario 600,000 afa- 2nd Year



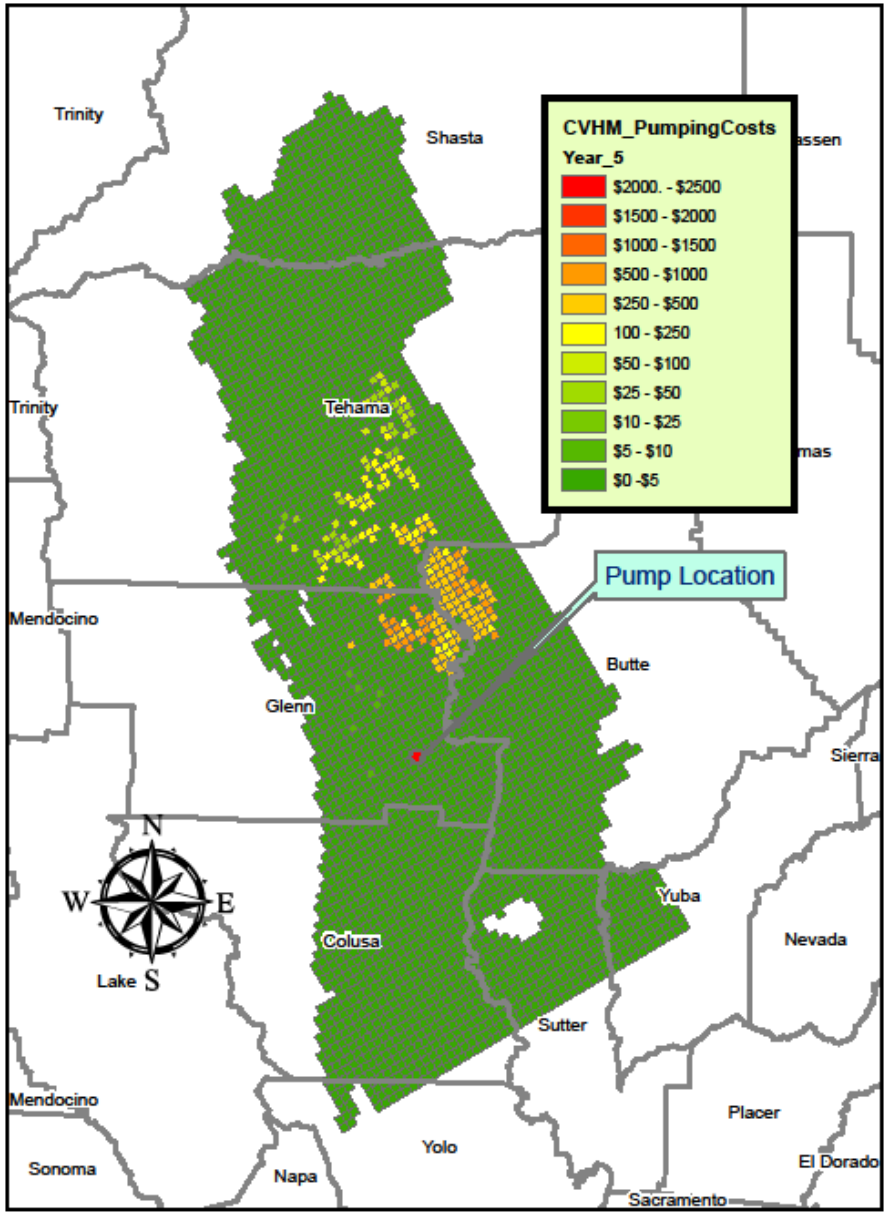
Pumping Scenario 600,000 afa- 3rd Year



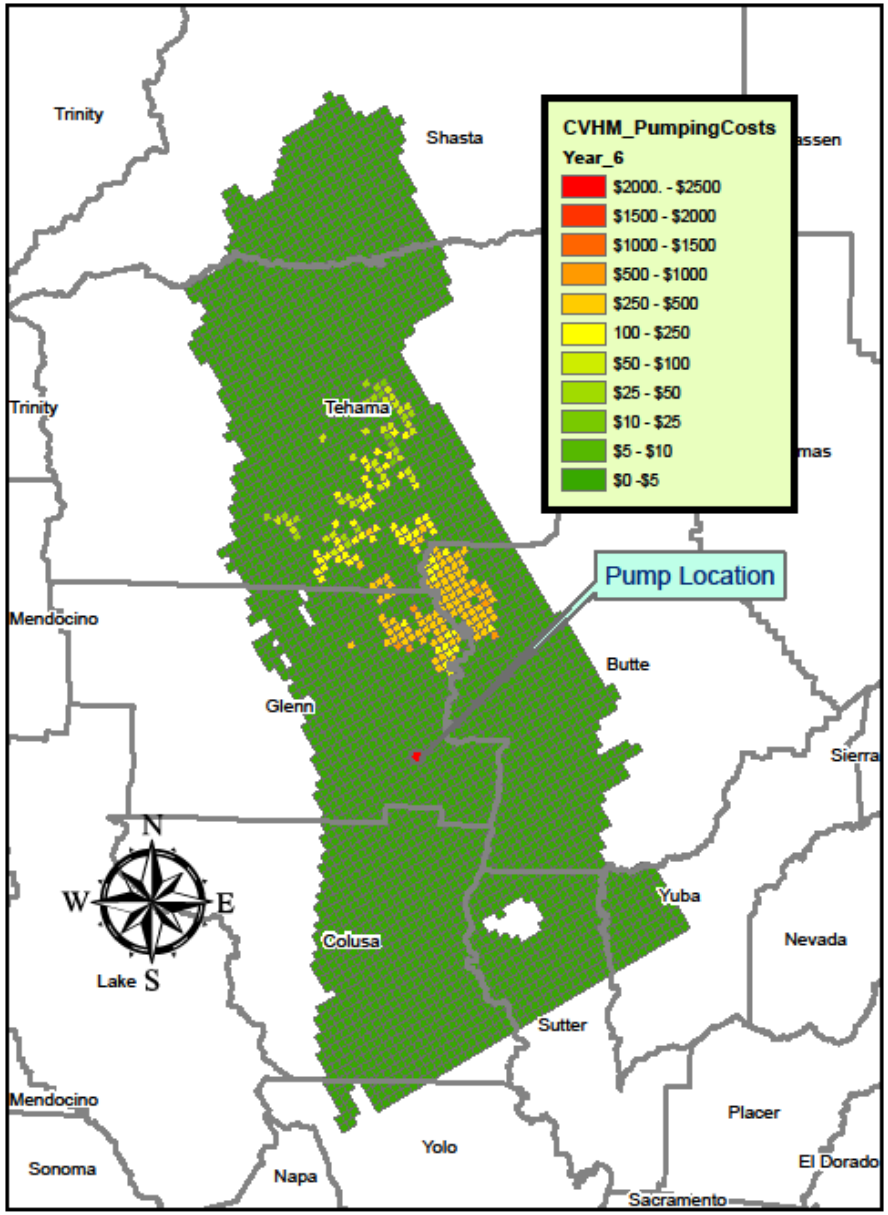
Pumping Scenario 600,000 afa- 4th Year



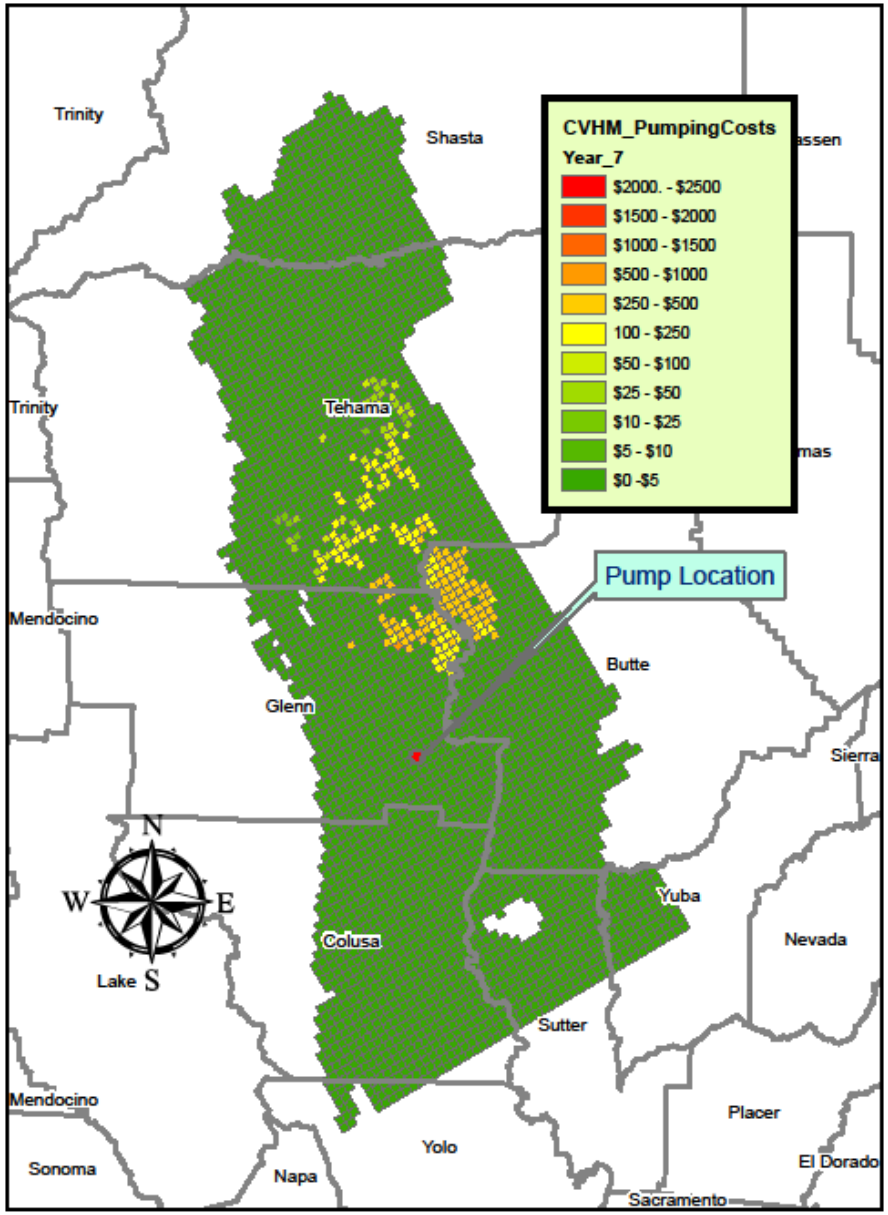
Pumping Scenario 600,000 afa- 5th Year



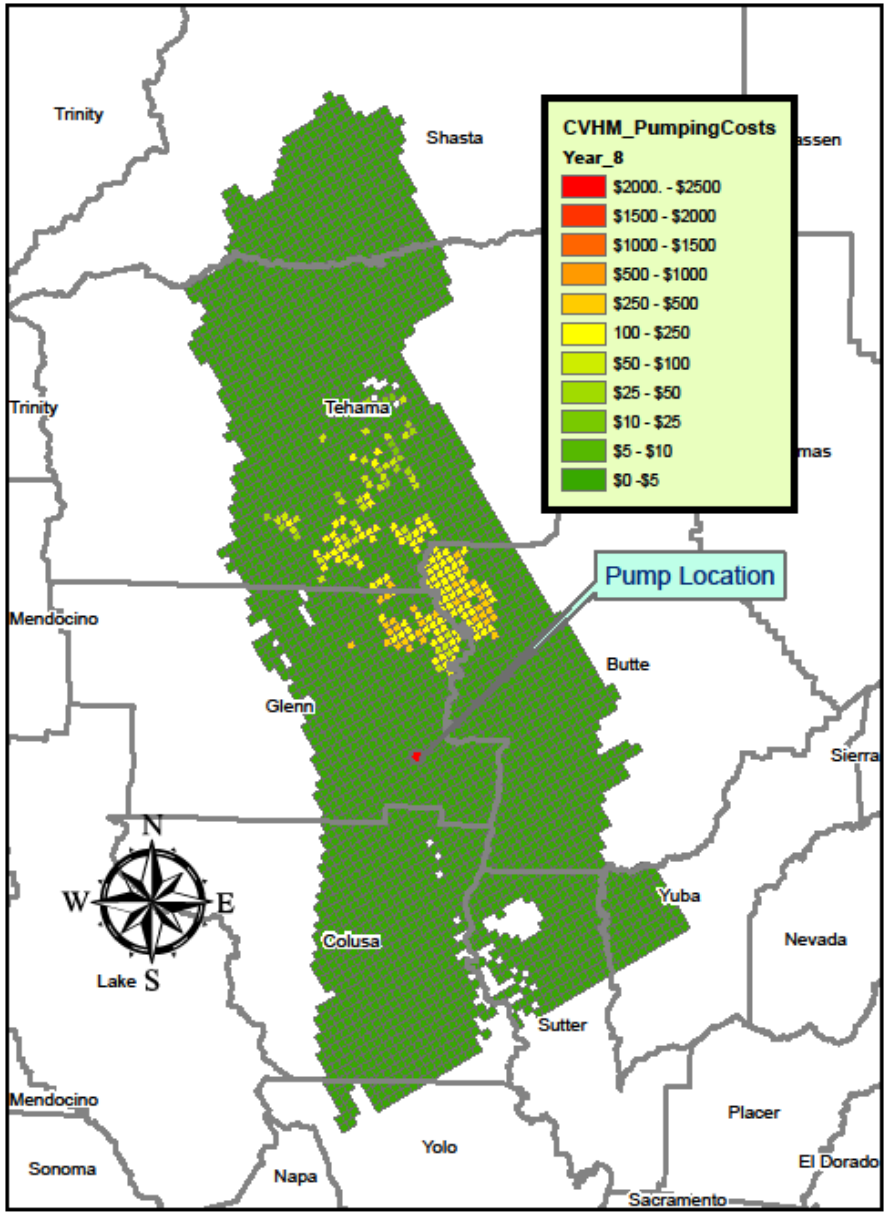
Pumping Scenario 600,000 afa- 6th Year



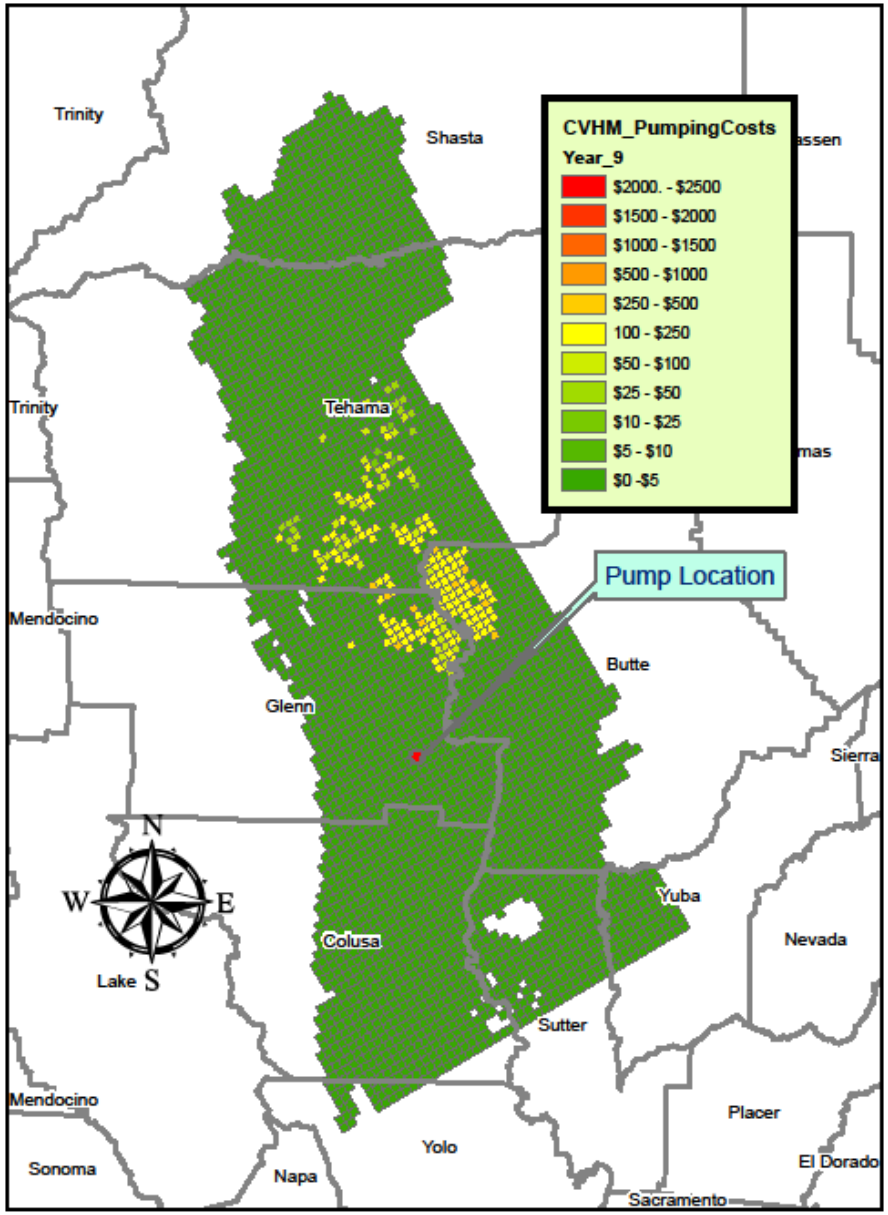
Pumping Scenario 600,000 afa- 7th Year



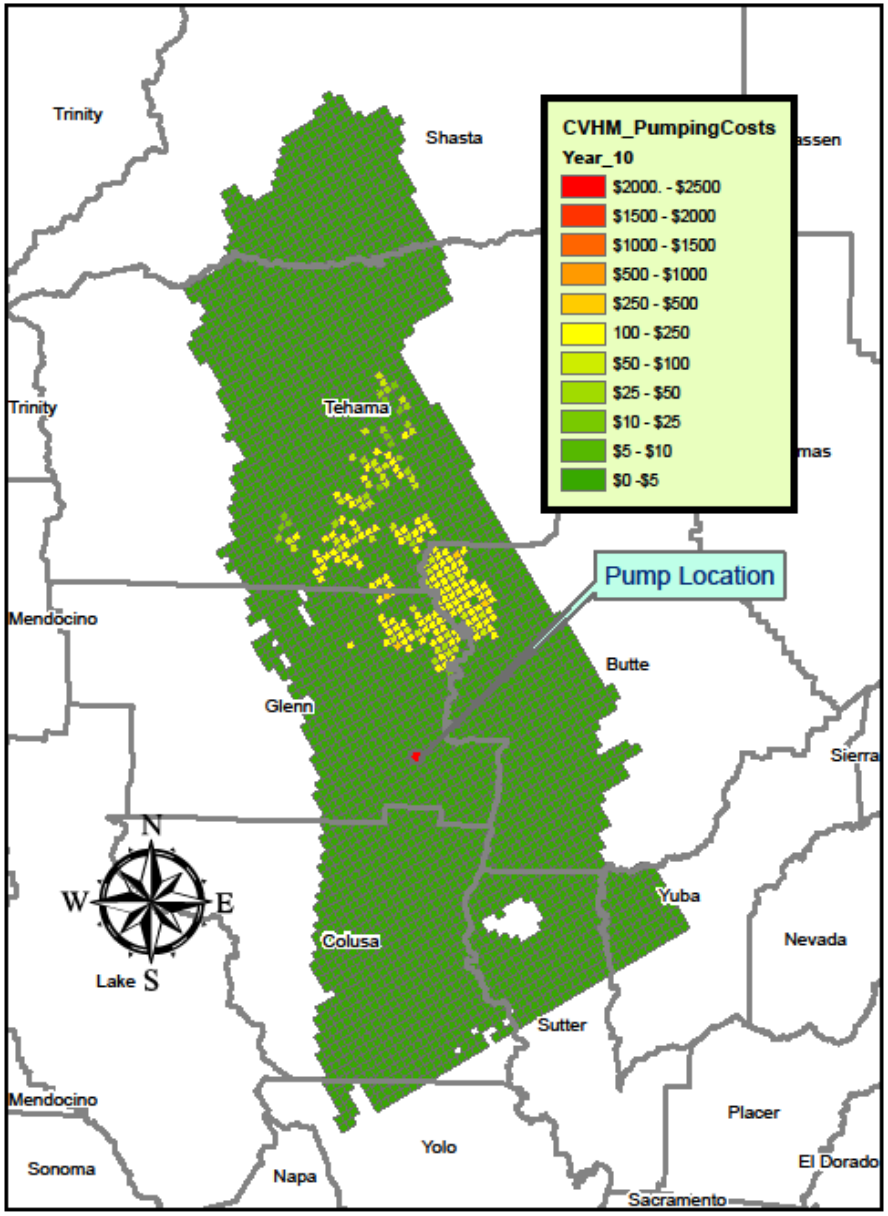
Pumping Scenario 600,000 afa- 8th Year



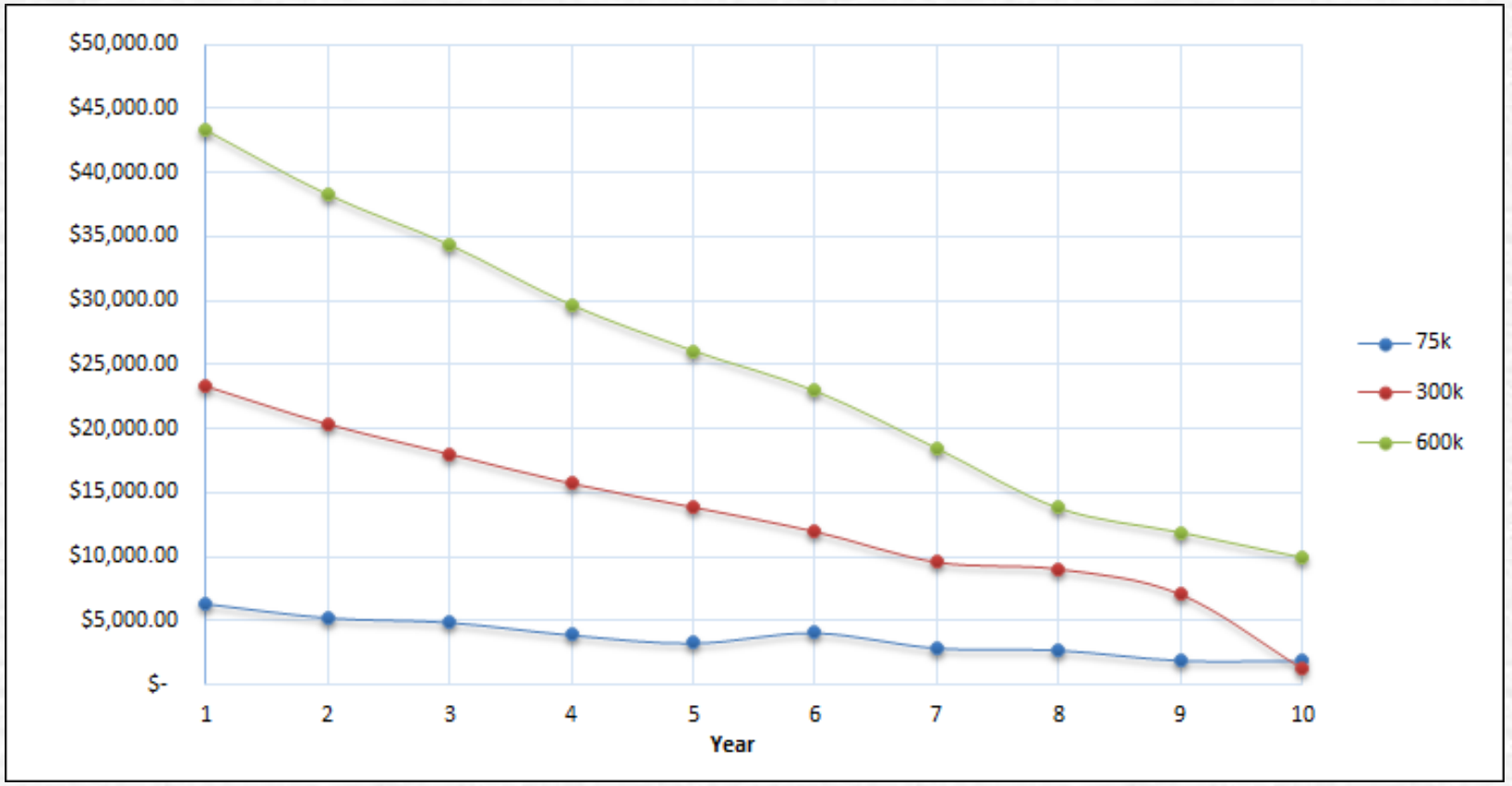
Pumping Scenario 600,000 afa- 9th Year



Pumping Scenario 600,000 afa- 10th Year



Third Party Pumping Costs
(Butte County Only)



Ten Year Totals

75K = $37,220 ; 300K = $130,070 ; 600K = $248,528

Additional Groundwater Pumping (Conclusions)

- Groundwater Substitution Transfers in Northern California can impose external pumping costs on surrounding farms.
- The external costs decline over time, but there was still some impacts after 10 years of "average" precipitation.
- The external costs are not necessarily higher in areas immediately adjacent to the pumping location.
- Groundwater substitution transfers in one county can impact agriculture in neighboring counties (are county based restrictions the best approach?)
- At what point are these external costs significant enough to cause concern (no harm requirements)? Should these costs require compensation?

Current/Future Work…

- "Ground Truth" basic IMPLAN results. What exactly do rice farmers do when they fallow their fields? How do farmers spend their water transfer income?
- Examine additional impacts of aquifer decline. When will specific wells run dry, what are the impacts on stream flow, is this sustainable under the SGMA?



Thank You!

Rice Fields in Northern California (Anthony Dunn Photography)