Sacramento Valley Groundwater: A Brief Overview
Speaking of Education...

• The general public’s view on water:

I don’t know much about this part

Source: Lund 2014
Speaking of Education...

- The general public’s view on **food**: 

Source: http://www.dailymail.co.uk/
Speaking of Education...

- The general public’s view on **groundwater**: Hard to say

Source: Amazon Geology Flashcards
Speaking of Education...

- The general public’s view on groundwater:
  
  *Best Guess: Dwarves??*

Source: Middle Earth
Outline

1. Sacramento Valley Setting and Historical Development
2. Examples of Existing Groundwater Management
3. Effects of Increasing Groundwater Use
4. 2014 Groundwater Legislation
Sacramento River Basin

- 17.4 million acres
- 22 million acre-feet average unimpaired runoff
- 1/3 of State runoff
- Largest component of Bay-Delta inflow
- CVP and SWP projects
Sacramento and Redding Groundwater Basins

- 4.3M acres total area
  - Roughly coincident with “Valley floor”
  - About 1.8 M to 2.0 M acres irrigated agriculture
- ±50MAF in GW storage (DWR Bulletin 118)
- 8 MAF/yr applied water demand
  - 5.5 MAF surface water
  - 2.5 MAF groundwater
  - 6 MAF consumptively used
  - 2 MAF returns to system
Ongoing Expansion of Irrigated Agriculture

Sacramento Valley Estimated Irrigated Acres (Thousands)

- Landsat NDVI Analysis
- Ag. Commissioner Reports (NASS)
Ag and Urban Diversions & Pumping

Sacramento Valley surface water diversions have leveled off while groundwater pumping has continued to increase, primarily to meet agricultural water demands.
Declining GW Levels in Some Areas

• Conventional wisdom: Sacramento Valley aquifers are drawn down seasonally but fully recover each spring

• Reality: recently, groundwater levels are not fully recovering in all areas
  • Reduced recharge
  • Increased pumping
Examples of Groundwater Management Successes in the Sacramento Valley

Yuba County

1949 to 1982: Groundwater Use Only; Steadily Declining Groundwater Levels

1983 to Date: Surface Water Delivered to the South Basin; Groundwater Levels Recovered to Pre-1949 Elevations

1977 to Date: Indian Valley Reservoir Completed; Recovery and Steady Groundwater Levels

Yolo County

1956 to 1976: Clearlake Surface Water and Groundwater Use Combined; Declining Groundwater Levels

1977 to Date: Indian Valley Reservoir Completed; Recovery and Steady Groundwater Levels

In both cases, sustainable groundwater levels have been achieved by increasing surface water supplies.
What Happens When You Pump a Well?

• **Concept of Capture** as formulated by Theis (1940) in his “The Source Of Water Derived From Wells.”

• Well water comes from a combination of:
  1. Change in Storage
  2. Induced Recharge
  3. Reduced Discharge

• “Time To Full Capture” (Bredehoeft and Durbin 2009) on the order of years to centuries; typically decades
Interactions between Aquifers and Streams

- Groundwater levels impact interactions between aquifers and streams
- The uppermost groundwater sustains rivers and streams
- Delayed effects: challenge to adaptive management
- Lake Tahoe analogy

Source: The Nature Conservancy
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Lake Tahoe Analogy

Truckee River

Sustainable Storage:
0.93 Billion M$^3$ (0.75 MAF)

148 Billion M$^3$
(120 MAF)
Sacramento Valley Stream Gains from Groundwater

According to DWR’s C2VSim model, Sacramento Valley streams have gone from net “gainers” to net “losers” over recent decades.
New Groundwater Legislation

• “Sustainability” as a management principle
  • Sustainable yield = quantity of withdrawal over time without “undesirable results”

• New Groundwater Sustainability Agencies with broad authorities

• Groundwater Sustainability Plans by 2022 for most Sacramento Valley sub-basins

• Many details and lots of room for interpretation and local adaptation
Challenges in Complying with New Legislation

• How will Groundwater Sustainability Agencies be formed?
• How to define “sustainability” with sensitivity to interconnected streams?
• Can recharge keep up, or will groundwater pumping restrictions be needed? Supply augmentation or demand management?
• Soon enough or too little too late?
Thank You!