Quality of Groundwater Used for Domestic Drinking Water in the American, Cosumnes, and Mokelumne River Watersheds

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U.S. Geological Survey

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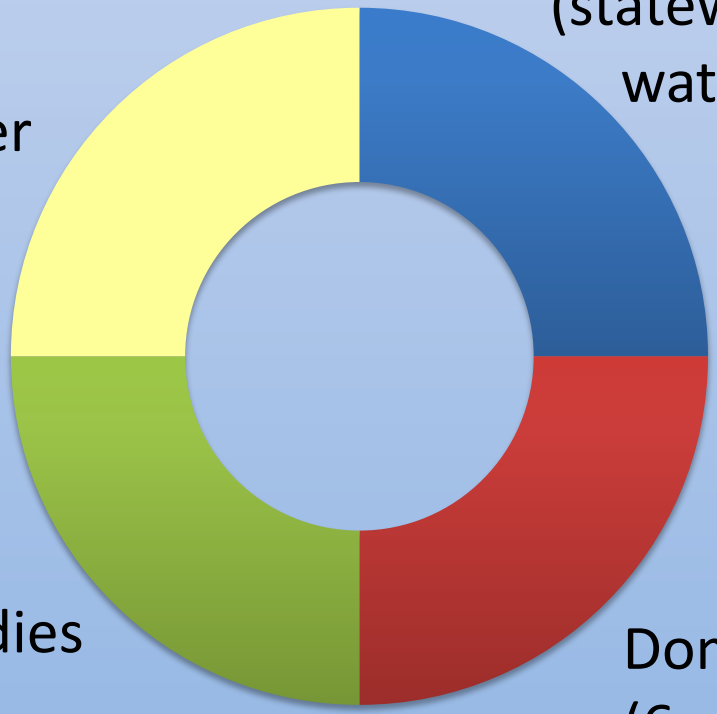
USGS science for a changing world

State Water Board
Groundwater Ambient Monitoring and Assessment (GAMA) Program

Priority Basin Project (USGS)
(statewide study of ground-water used for drinking water supplies)

GeoTracker GAMA online groundwater info system (SWB)

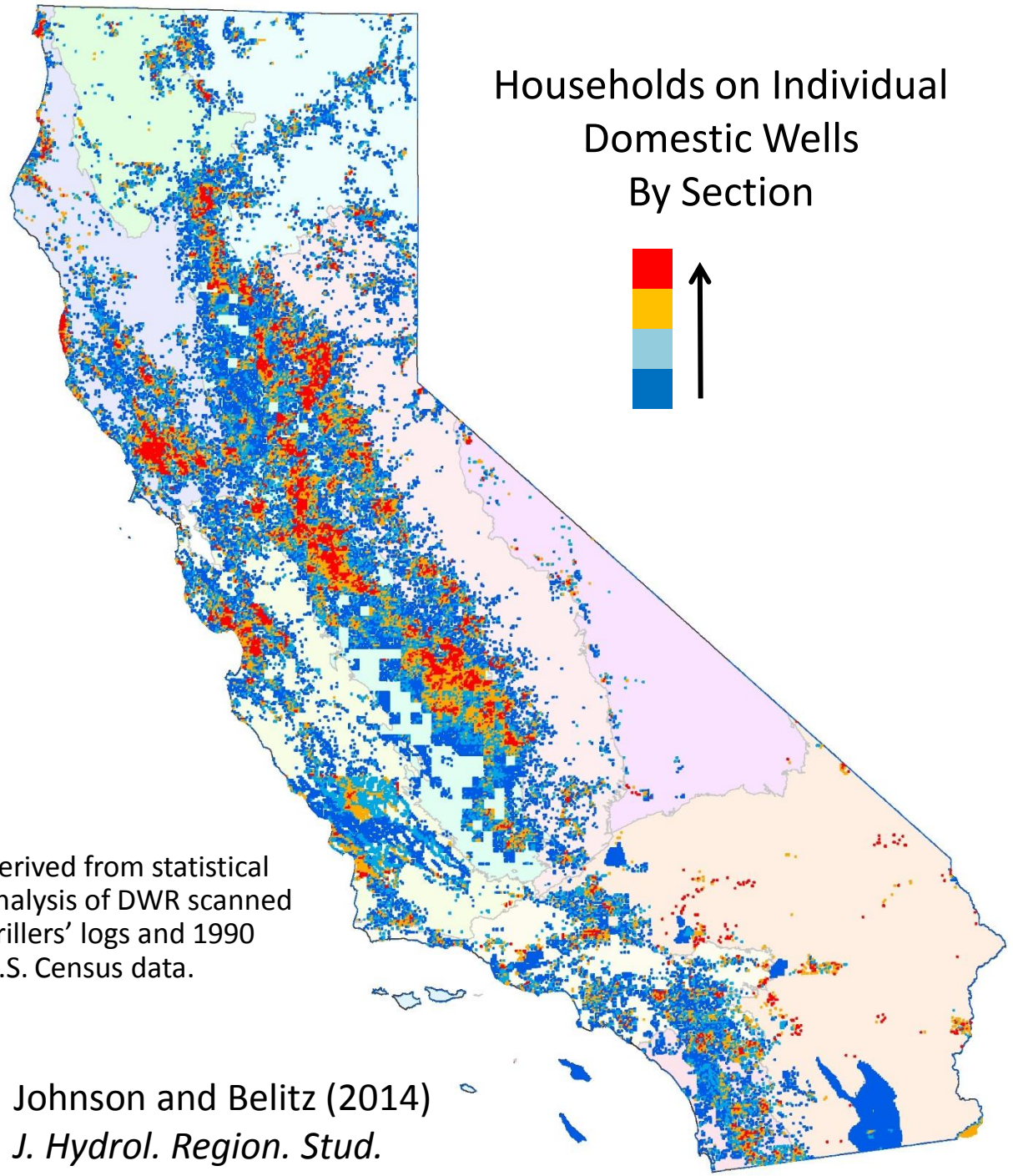


Special Studies (LLNL)

Domestic wells (SWB)
(6 counties, 2002-2011)

GAMA Priority Basin Project

- Public-supply assessments
  - USGS sampled 2,300 wells in 2004-2012
  - Assessed 95% of used resource
  - Public drinking water quality regulated by EPA and by State
- Domestic supply assessments
  - Plan is 2,000 wells 2012-2023
  - Typically shallower than public supply
  - Domestic drinking water quality not regulated
- Trends monitoring
  - 20% of baseline wells resampled every 5 years



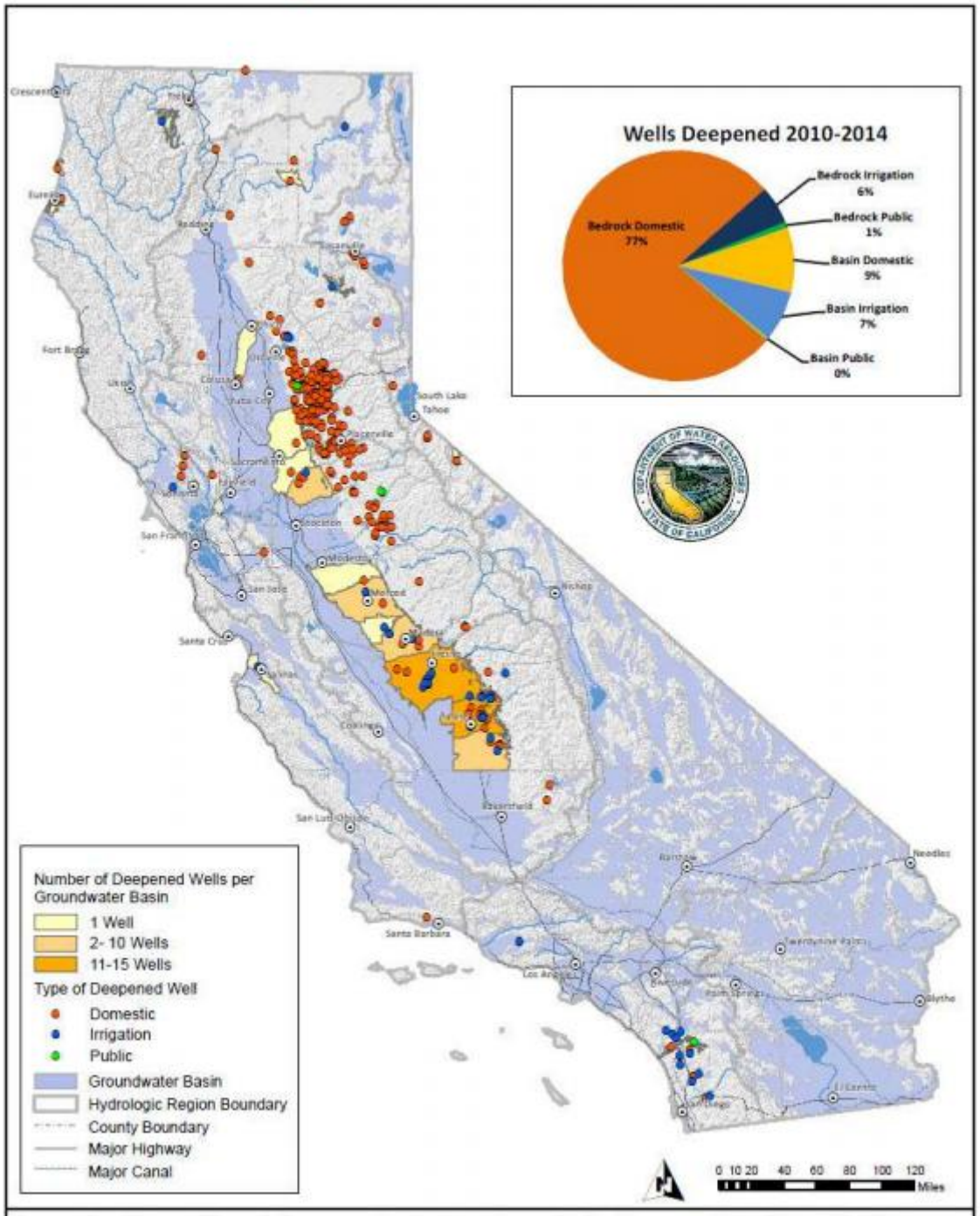
Derived from statistical analysis of DWR scanned drillers' logs and 1990 U.S. Census data.

Johnson and Belitz (2014)
J. Hydrol. Region. Stud.

From DWR 2014 report on Drought

Recently deepened wells as indicator of water shortages

Figure 4 - Water Wells Deepened 2010-2014



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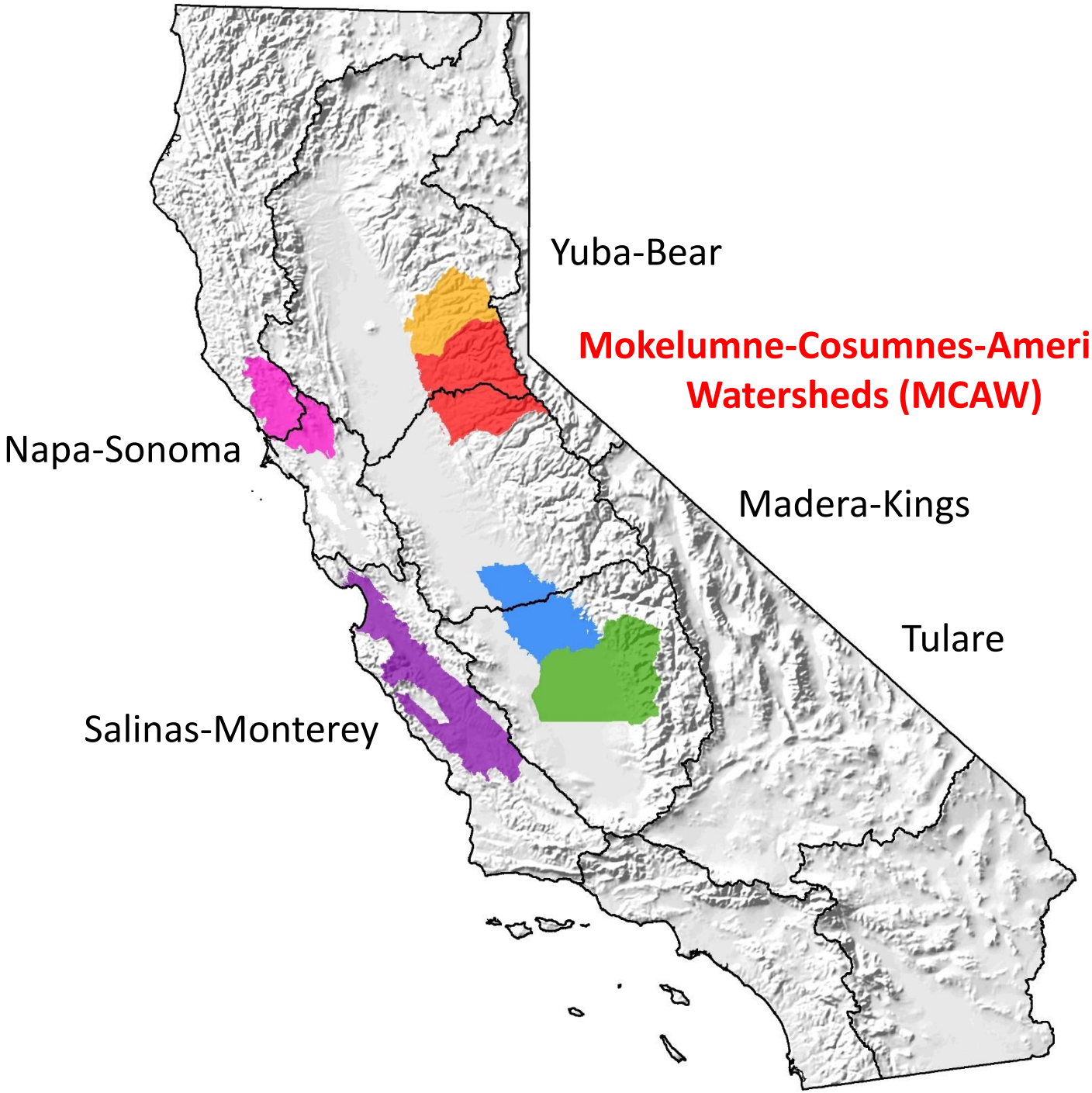
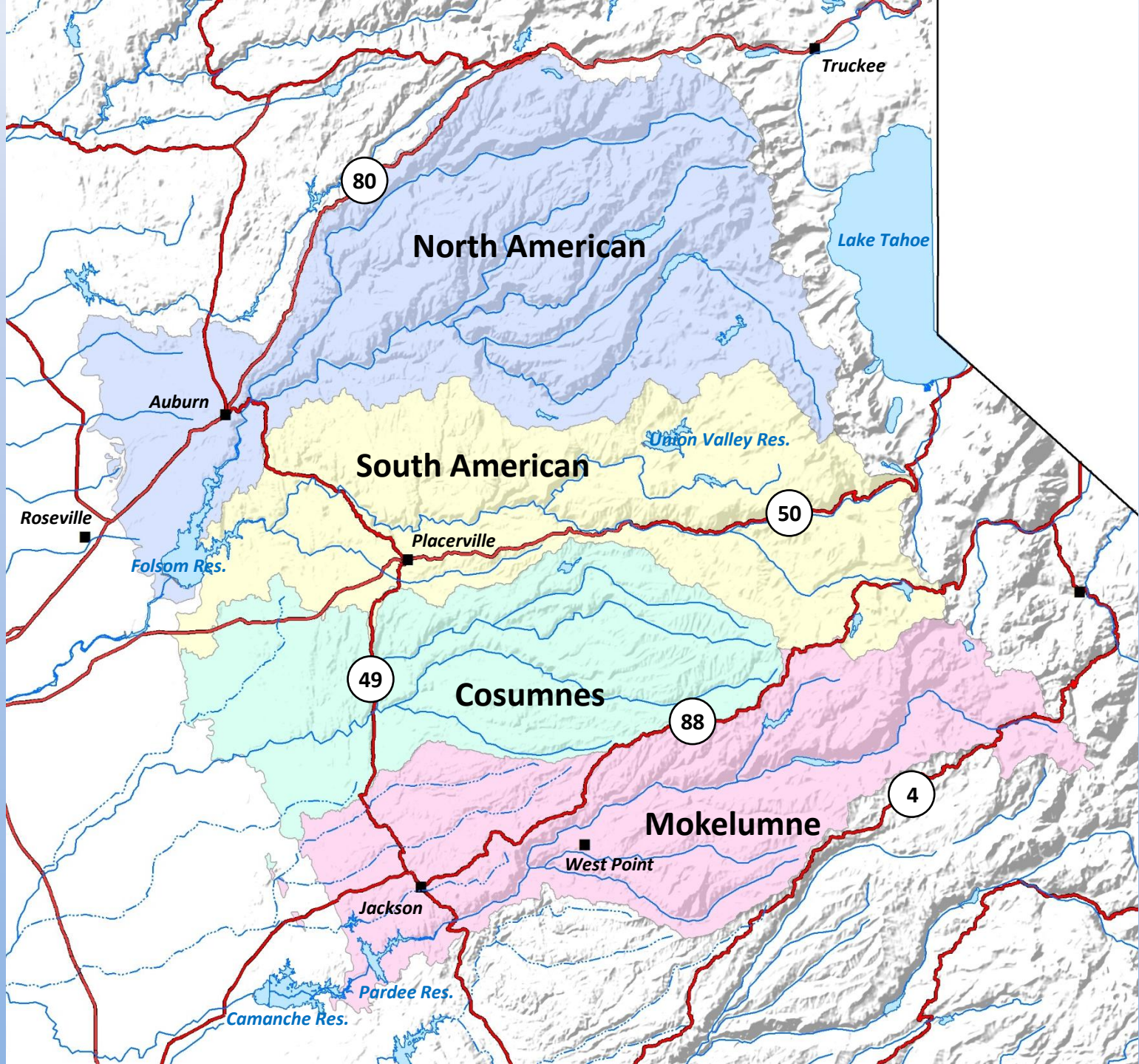
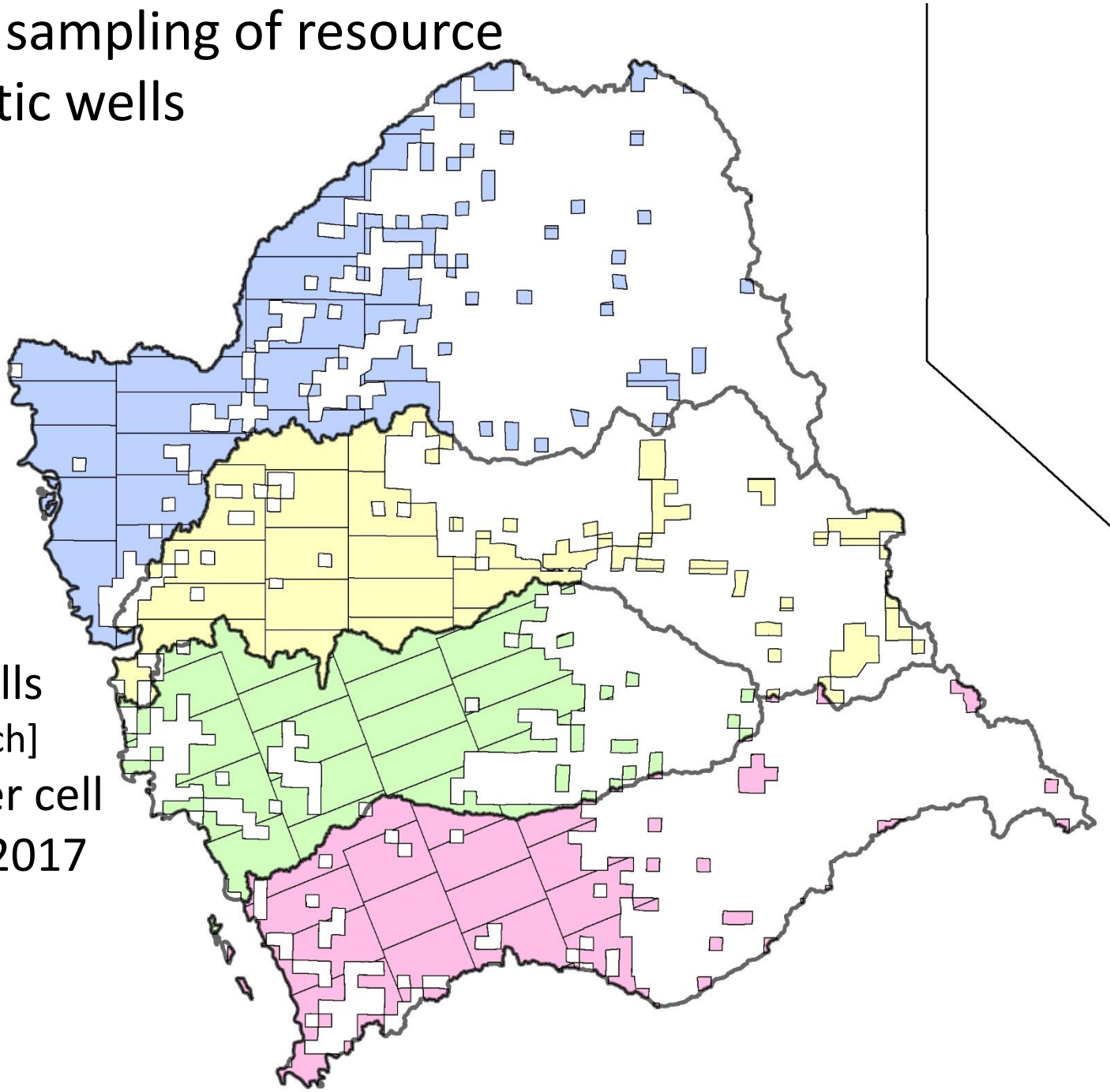
Water Boards


Yuba-Bear
Mokelumne-Cosumnes-American Watersheds (MCAW)
Napa-Sonoma
Madera-Kings
Tulare
Salinas-Monterey


Truckee
80
North American
Lake Tahoe
Auburn
Union Valley Res.
South American
50
Roseville
Placerville
Folsom Res.
49
Cosumnes
88
4
Mokelumne
West Point
Jackson
Pardee Res.
Camanche Res.

Representative sampling of resource used by domestic wells



Divide into 67 cells
[60 km^2 (23 mi^2) each]
Sample 1 well per cell
Aug 2016 – Feb 2017

MCAW Well Selection

- Permission – program is VOLUNTARY
- Priority order
  - Small systems registered with counties
  - El Dorado County SWB GAMA wells (2003-2004)
  - Volunteers
  - Wells with drillers' logs in USGS or DWR records
  - Other wells
- Sampling criteria
  - Sampling point before tank or treatment
  - Well can pump about 1 hour
  - Water level measurement access
  - Drillers' log or other well documentation

What are we going to analyze and why: How have human activities at the land surface affected groundwater quality?

- Anthropogenic organic compounds at very low concentrations
  - Volatile organic compounds (e.g., MTBE, solvents, disinfection byproducts)
  - Pesticides and degradates (herbicides, insecticides)
  - Pharmaceutical compounds
- Nitrate and other nutrients, and nitrate isotopes
- Mercury
- Microbial indicators

What are we going to analyze and why: How do local geology and hydrology affect groundwater quality?

- Major ions and total dissolved solids
- Trace elements (e.g., arsenic, iron, manganese, uranium, hexavalent chromium)
- Radioactivity
- Geochemical conditions (oxidation-reduction, pH)

What are we going to analyze and why: How vulnerable is the groundwater resource to hydrologic change?

- Groundwater age-dating
  - Tritium and tritium-helium
  - Carbon-14
- Tracers of groundwater recharge sources
  - Stable isotopes
  - Noble gases
  - Strontium isotopes

Sierra Nevada groundwater commonly “younger” and from more local recharge than valley groundwater.

What will happen to the data we collect?

- Well owner name and address are CONFIDENTIAL
- Well owner receives the data first

- Data will be publically available on GeoTracker GAMA and USGS NWIS Web (water-quality results, well depth, water level, lat/long location)
- USGS reports presenting the results for different audiences
  - Web map applications
  - Summary fact sheets designed for interested public
  - Comprehensive USGS technical reports
  - Scientific journal articles

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