

California Groundwater Ambient Monitoring and Assessment (GAMA) Program Priority Basin Project: Domestic-Supply Assessment

What is the GAMA Priority Basin Project (GAMA-PBP)?

The GAMA-PBP is a comprehensive assessment of statewide groundwater quality in California. The first phase of the GAMA-PBP in 2004–15 assessed groundwater resources used for public drinking-water supplies. The second phase is assessing groundwater resources used for domestic drinking-water supplies. An estimated 2 million Californians rely on individual domestic wells or State small-system wells for drinking water, and far less information is available about these resources than about public-supply resources. The U.S. Geological Survey (USGS) began sampling wells for this second phase in 2012. Domestic wells typically are drilled to shallower depths in the groundwater system than public-supply wells. Shallow groundwater may respond more quickly and be more susceptible to contamination from human activities at the land surface than groundwater in deeper aquifers.

The California State Water Resources Control Board's (SWRCB) GAMA-PBP was developed in response to the Groundwater Quality Monitoring Act of 2001 (Water Code sections 10780–10782.3): a public mandate to assess and monitor the quality of groundwater resources used for drinking-water supplies, and to increase the availability of information about groundwater quality to the public. The USGS is leading the GAMA-PBP, in cooperation with the SWRCB.

Well-owner participation in the GAMA-PBP is voluntary. Stewardship of California's groundwater resources is a responsibility shared between well owners, communities, and the State. Participants and collaborators in the GAMA-PBP include Regional Water Quality Control Boards, Department of Water Resources, SWRCB Division of Drinking Water, local and regional groundwater management entities, county and local water agencies, community groups, and private citizens.



Well sampling in Coachella Valley, California

How Will Data Collected by the GAMA-PBP Be Used?

The project will provide many benefits to State, local, and community participants, as well as individual well owners. Project results will

- Provide well owners with water-quality and water-level data for their well and assist with locating well depth information,
- Establish baseline groundwater quality for comparison with future conditions,
- Identify areas of California where domestic households rely upon poor-quality groundwater for drinking-water supplies,
- Improve understanding of local, regional, and statewide hydrogeology,
- Produce groundwater-quality reports for each study area,
- Provide new information for local, regional, and statewide groundwater stakeholders,
- Provide new data for the SWRCB's GAMA Groundwater Information System (GAMA GIS) publicly accessible online database, and
- Compare water quality in the shallow and deeper aquifer systems.

GAMA Priority Basin Project Domestic-Supply Assessment Study Design

The locations of domestic wells across California were identified from well-drillers' logs. Areas of the State with the greatest numbers of households that rely on domestic wells were prioritized for sampling for this project (see map). These areas will be grouped into 20 to 25 study units. A chicken-wire-like grid is overlain on the study unit, and one well is sampled per grid cell. About 30–100 domestic wells will be sampled in each study unit to provide an assessment of the groundwater quality. Wells are identified by door-to-door canvassing, and participation is voluntary. Groundwater level in the well will be measured and water samples will be collected for analysis of many water-quality parameters, including nutrients, human-made organic constituents, naturally occurring trace elements, and tracers used to help identify the source of recharge and relative age of groundwater (table 1).

Reporting Results

The USGS will provide results to individual well owners. Well owner information will be kept confidential in published data and reports released to the public. Data summary and interpretive reports and web tools for exploring and downloading the data are available on the SWRCB and USGS websites (https://www.waterboards.ca.gov/water_issues/programs/gama/ and <https://ca.water.usgs.gov/gama>).

GAMA-PBP reports and data can be obtained from:

GAMA-PBP Project Chief
 U.S. Geological Survey
 California Water Science Center
 6000 J Street, Placer Hall
 Sacramento, California 95819-6129
 Telephone: (916) 278-3000
<https://ca.water.usgs.gov/gama>

GAMA Program Unit
 State Water Resources Control Board
 Division of Water Quality
 1001 I Street, 15th Floor
 Sacramento, California 95814
 Telephone: (916) 341-5577
<https://www.waterboards.ca.gov/gama>

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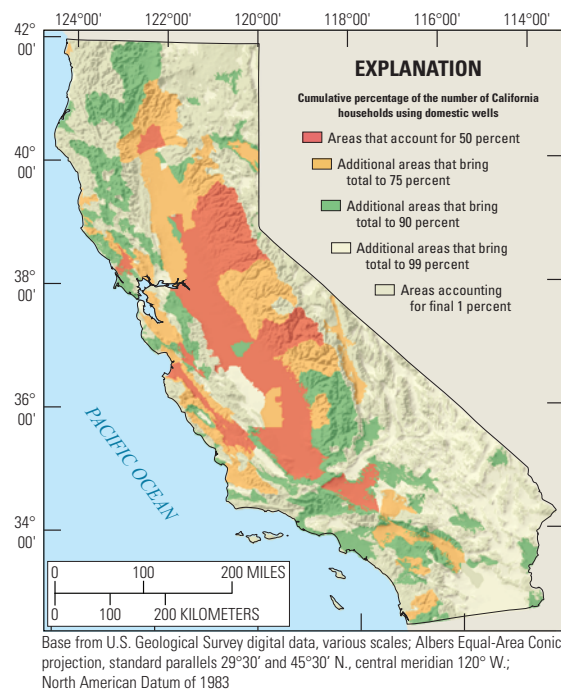


Table 1. Samples collected at each domestic well by the GAMA-PBP.

| Parameter | Description |
|---|--|
| Groundwater level | Depth from the land surface to groundwater inside the well. |
| Specific conductance, pH, dissolved oxygen, and temperature | Properties measured in the field that describe general water quality conditions of salinity, acidity, oxidation state, and temperature. These properties affect the mobility of dissolved chemical compounds. |
| Microbial indicators | Total coliforms, <i>Escherichia coli</i> (<i>E. coli</i>), and enterococci are used as indicators of the vulnerability of the well to contamination from surface water or human or animal waste. |
| Per- and polyfluoroalkyl substances (PFAS) | Human-made compounds used in fire-fighting foams, industrial applications (such as metal plating), and many consumer products (such as carpeting, clothing, upholstery, nonstick cookware, and food wrappers). |
| Major ions, alkalinity, and total dissolved solids (TDS) | Calcium, magnesium, sodium, potassium, chloride, sulfate, and alkalinity are the major components of TDS. |
| Nutrients | Elevated concentrations of nitrate or other forms of nitrogen or of phosphorous generally indicate contributions from fertilizer, animal waste, or septic sources. |
| Trace elements | Arsenic, hexavalent chromium, uranium, manganese, and other trace elements generally are naturally present with concentrations controlled by water quality conditions, aquifer geology, and groundwater age. |
| Volatile organic compounds (VOCs) | Human-made volatile compounds including fumigants (such as 1,2-dibromo-3-chloropropane [DBCP] and 1,2,3-trichloropropane [1,2,3-TCP]), solvents (such as tetrachloroethene [PCE]), gasoline additives (such as methyl <i>tert</i> -butyl ether [MTBE]), hydrocarbons (such as benzene), and trihalomethanes. |
| Pesticides | Human-made pesticide compounds including herbicides, insecticides, and fungicides and degradation products of those compounds. |
| Perchlorate | Inorganic compound found in rocket fuel, fireworks, flares, and some fertilizers, and also occurs naturally at low concentrations in groundwater. |
| Tritium | Isotope used to help determine groundwater age, in particular to identify “modern” groundwater (water recharged more recently than about 1950). |
| Carbon-14 | Isotope used to help determine groundwater age, in particular to identify “premodern” groundwater (water recharged hundreds to tens of thousands of years ago). |
| Noble gases | Dissolved gases used to trace groundwater movement, help determine groundwater age, and to help study potential effects of climate on groundwater quality. |
| Stable isotopes of water | Naturally occurring hydrogen and oxygen isotopes used to track the movement of water through the hydrologic cycle. |