

Ground-Water Ambient Monitoring and Assessment Program

What is the Ground-Water Ambient Monitoring and Assessment Program (GAMA)?

The GAMA program is a comprehensive assessment of statewide ground-water quality. The program is designed to help better understand and identify risks to ground-water resources. Ground water will be sampled at many locations across the State in order to characterize its constituents and identify trends in ground-water quality. The results of these tests will provide information for water agencies to address a variety of issues ranging in scale from local water supply to statewide resource management.

The GAMA program was developed in response to the Ground-Water Quality Monitoring Act of 2001 (Sections 10780-10782.3 of the Water Code): a public mandate to assess and monitor the quality of ground water used as public supply for municipalities in California. The goal of the Ground-Water Quality Monitoring Act of 2001 is to improve statewide ground-water monitoring and facilitate the availability of information about ground-water quality to the public.

Who is GAMA?

Stewardship of the State's ground-water resources is a shared responsibility



Radon sampling in Temecula, California.

between all levels of the government and community. Participants include representatives from State and Regional Water Boards (SWRCB/RWQCB), Department of Water Resources, Department of Health Services (DHS), U.S. Geological Survey (USGS), Lawrence Livermore National Laboratory, regional water-management entities, and county and local water agencies. A key aspect of the GAMA program is interagency collaboration and cooperation with local water agencies and well owners. Local participation in the GAMA program is entirely voluntary.

Why is GAMA Important?

The GAMA program is important because the data collected during the study include analyses for chemical constituents that are not normally available; these data will be especially useful for providing an early indication of potential water-quality problems. The data also will be used to identify the natural and human factors affecting ground-water quality. An understanding of these factors is important for the long term management and protection of California's ground-water resources.

What Will Participants Gain from the GAMA Program?

The GAMA program will provide many benefits to State, local, and community participants. The program will

- provide agencies with knowledge of ground-water trends that may be useful in long-term water-quality management, and planning for municipal growth;
- improve the understanding of local, regional, and statewide hydrogeology;
- establish baseline ground-water conditions for comparison with future ground-water analyses;
- produce summary data reports and interpretive reports of ground-water quality for each study unit;
- create a secure ground-water database as an archive and a tool for completing ground-water assessments;
- provide agencies with better information to respond to concerns of consumers and consumer-advocate groups;
- help agencies evaluate basin-wide or regional ground-water management objectives;
- unite local, regional, and statewide ground-water programs in a common effort to understand and manage ground-water resources effectively; and
- facilitate interagency communication and data-sharing between Federal, State, and local agencies.

Study Approach

There are 476 identified ground-water basins and subbasins in California (Belitz and others, 2003). For the purposes of this study, these ground-water basins were ranked in groups of sampling priority (figure 1) on the basis of the number of public-supply wells, ground-water usage, and potential sources of ground-water contamination (for example, leaking underground fuel tanks or pesticide applications) in each basin. The 116 identified priority basins collectively include more than 75 percent of the public-supply wells in California. For the GAMA program, the priority basins were combined into 50 study units. In each study unit, 60 to 120 public-supply wells will be sampled.

Three types of water-quality assessments will be conducted for each study unit:

- (1) Status: the assessment of current ground-water quality;
- (2) Trends: the detection of changes in water quality; and
- (3) Understanding: the assessment of natural and human factors that affect ground-water quality.

These assessments will integrate existing water-quality data (such as DHS public-supply well water-quality data), with data collected specifically as part of this study. In addition, the GAMA program will monitor a much broader suite of constituents, at much lower detection limits, than required by DHS. Samples will be analyzed for chemical constituents that include major ions, trace elements, nutrients, volatile

organic compounds, pesticides, and pharmaceuticals, to define the quality of water in the ground-water basins (table 1). Naturally occurring isotopes (tritium, carbon-14, and helium-4) also will be measured in these samples to help identify the source and age of the sampled ground water (table 1). A tiered analytical approach will be used to balance spatial coverage and analytical intensity (number of constituents analyzed).

GAMA Program Results Reporting

The GAMA program is committed to facilitating interagency communication and data sharing. Preliminary results will be discussed with participants at the local Groundwater Basin Assessment “Wrap-Up” meetings. The SWRCB and USGS will post a summary data report on the program internet web-site, to be followed by the Groundwater Basin Assessment report. Prior to the public release of any data or reports, the SWRCB and USGS will consult with local water agencies and well owners to ensure that information is communicated in an appropriate manner. The SWRCB and the USGS will provide additional explanation of results upon request.

References: Belitz, Kenneth, Dubrovsky, Neil M., Burow, Karen, Jurgens, Bryant, and Johnson, Tyler, 2003, Framework for a ground-water quality monitoring and assessment program for California: U.S. Geological Survey Water-Resources Investigations Report 03-4166, 78 p.

GAMA Priority Basins in California

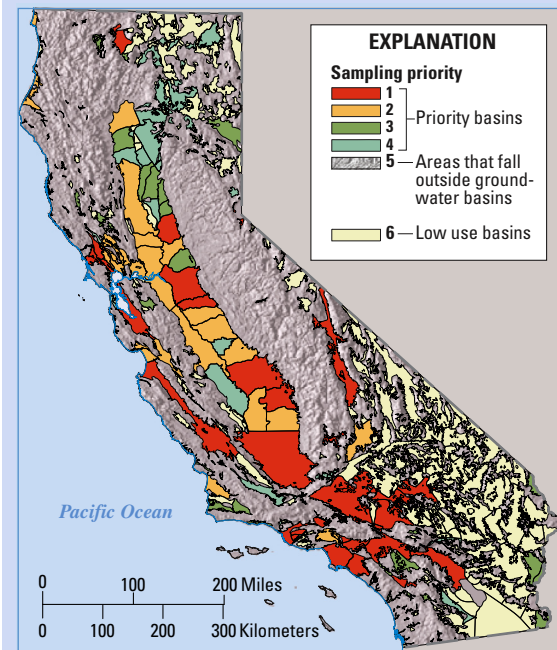


Figure 1.

For more information

Technical reports and hydrologic data collected for the GAMA program can be obtained from:

GAMA Project Chief
 U.S. Geological Survey
 Water Resources Division
 5735 Kearny Villa Road, Suite O
 San Diego, CA 92123
 Telephone number: **858-637-9005**

SWRCB: <http://www.swrcb.ca.gov/gama/>
 USGS: <http://ca.water.usgs.gov/gama/>

Table 1. List of Analytes

Sampled Constituents	Why are They of Interest?
Alkalinity, pH, and dissolved oxygen	The cation and anion activity, and oxygen concentration in water. These properties affect the mobility of dissolved chemical compounds
Specific conductance	The ability of a water sample to transmit an electrical current. It is related to the salinity of the water
Temperature	Temperature can influence the concentration of dissolved gases (e.g. oxygen, nitrogen, carbon dioxide) in water
Stable isotopes ($\delta^{18}O$, δD)	Naturally occurring isotopes of oxygen and hydrogen are used to track water through the hydrologic cycle
Major cations and anions	Naturally occurring salts that influence water quality
Trace elements	Elements that occur naturally in low concentrations; however, at high concentrations may pose health concerns
Nutrients	Elevated concentrations of nitrogen and phosphorous can degrade water quality
Dissolved organic carbon (DOC)	DOC compounds affect water chemistry (O_2 concentrations and pH), biological productivity, and trihalomethane formation
Volatile organic compounds (VOC)	Anthropogenic chemicals of potential effect to humans and the environment
Methyl tert-Butyl Ether (MTBE)	A compound added to gasoline to improve air quality. At high concentrations it can degrade water quality
1-4 Dioxane	Anthropogenic solvent recently identified as a potential water-quality concern
Pesticides	Used to control weeds, insects, and other pests, and may degrade water quality
Perchlorate (ClO_4^-)	Anthropogenic compound recently identified as a potential water-quality concern
N-nitrosodimethylamine (NDMA)	Byproduct of water treatment from the reaction of dimethylamine and chloramines which can degrade water quality
Pharmaceutical products	Anthropogenic compounds that can enter ground water from discharge of treated waste water, recycled water or reclaimed water
Chromium (total and VI)	Naturally occurring and industrial element that can degrade water quality
Radon (Rn)	A naturally occurring radioactive gas which, at high levels, can cause health problems such as lung cancer
Radium (Ra)	A naturally occurring radioactive element that is present in varying amounts in the Earth's crust
He and the Noble Gases	Dissolved gases used to trace ground-water movement, for chronology, and to indicate climate change
Tritium	Isotope of hydrogen used to identify water masses less than 50 years of age
Coliphage and Escherichia coli (E. coli)	Used as microbial indicators of fecal pollution