



**PUBLIC ACCESSIBILITY TO INFORMATION
ABOUT GROUNDWATER CONDITIONS**

**STATE WATER RESOURCES CONTROL BOARD
REPORT TO THE LEGISLATURE**

Pursuant to Chapter 670, Statutes of 2008

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STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS



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EXECUTIVE SUMMARY AND RECOMMENDATIONS

Californians want to know the answers to these groundwater questions: “How much is there?” “How clean is it?” “How long will it last?” Our ability to understand groundwater is only as good as the data we collect from wells. Data from wells is collected during drilling as shown on well completion reports (well logs), and during collection of water level information and soil and groundwater testing. These data must be collected, interpreted, and explained in a way that the public can understand the information.

Chapter 522, Statutes of 2001, (AB 599, Liu)--the Groundwater Quality Monitoring Act of 2001-- required the State Water Resources Control Board (State Water Board) to establish a comprehensive statewide groundwater quality monitoring program to provide the public with a better understanding of groundwater quality. In accordance with Chapter 522/2001, the State Water Board developed and implemented the Groundwater Ambient Monitoring and Assessment (GAMA) Program, which historically has been funded from a combination of bond funds and fees. To ensure the continued success of the GAMA Program, Chapter 670, Statutes of 2008, (AB 2222, Caballero) requires the State Water Board to identify and recommend to the Legislature funding options that would extend the GAMA Program until January 1, 2024, and to make recommendations to enhance the public accessibility of information on groundwater conditions. This report is being submitted in accordance with the requirements of Chapter 670/2008.

The GAMA Program shares groundwater quality information primarily through its GeoTracker GAMA information management system accessible through the State Water Board’s website. Californians now have access to a Google map-based database that readily provides a wealth of groundwater information including results of water quality testing, water level information, copies of environmental monitoring well logs as well as links to published reports for a specific area of interest. Millions of records of data come from the State Water Board and Regional Water Quality Control Boards (Regional Water Boards) (collectively referred to as “the Water Boards”), the California Department of Public Health (CDPH), the Department of Water Resources (DWR), the Department of Pesticide Regulation (DPR), the U.S. Geological Survey (USGS), and Lawrence Livermore National Laboratory (LLNL). Scientists, regulators, water managers, educators and the public can currently use these data, and as more data are shared through GeoTracker GAMA, the groundwater quality picture for California becomes clearer.

In addition to GeoTracker GAMA, the GAMA Program has three projects that help to answer the question of “How clean is our groundwater?” by testing water quality in wells and provide the information to related stakeholders. As of May 2009, GAMA Program projects have sampled nearly 4,000 wells, for hundreds of chemicals, throughout the state. This has resulted in improved comprehensive groundwater quality monitoring for California and has enhanced our understanding of groundwater conditions. Advanced monitoring techniques, like age-dating and ultra low-level detection limits for chemicals of emerging concern have helped, and continue to help, assess groundwater conditions in the state. The GAMA Program requires outreach by the State Water Board to thousands

of well owners through personal contact and public meetings with public agencies and organizations dedicated to advancing groundwater knowledge.

The report includes recommendations that the Legislature:

1. Continue GAMA Program funding at the level of effort necessary to implement Chapter 522/2001 for \$7.5 million annually. Current funding comes from annual waste discharge fees (\$2.1 million) and from Proposition 50 bond funds which, when expended, will need to be replaced by another fund source for \$5.4 million annually.

Bond funds will need to be replaced in FY 2012-13 in the amount of \$0.4 million for staff costs; in FY 2013-14 in the amount of \$3.3 million for contracts and staff costs; and in FY 2014-15 and annually thereafter in the amount of \$5.4 million (\$5 million in contracts and \$0.4 million for staff costs).

Several potential funding sources could be pursued, all requiring actions outside the State Water Board's authority, including:

- New bond funding;
 - Additional funding from the Waste Discharge Permit Fund, either by increasing the fee or imposing the fee on those not currently paying a fee;
 - Funding from the assessment of a new fee on groundwater use;
 - General Fund moneys; and
 - Federal funds.
2. Appropriate funding to the Department of Water Resources (DWR) to make electronic copies of the remaining hundreds of thousands of paper well logs. The information from well logs will be included in the State Water Board's online GeoTracker GAMA information management system. These data will help improve the availability of information needed to interpret groundwater quality data, and will be available for confidential use as required by statute.

In addition, to enhance public accessibility of information on groundwater conditions, the State Water Board will continue to work cooperatively with other state agencies, water purveyors and other interested parties in continuing the following actions:

1. Support implementation of AB 599 plan through the GAMA Program.
2. Implement the GAMA Program's information sharing through data management and stakeholder coordination by:
 - Supporting GeoTracker GAMA as the system that makes available to the public information on California's groundwater quality and related information;
 - Populating GeoTracker GAMA with groundwater quality and related information, working with the Interagency Task Force (ITF) agencies and other interested parties;
 - Sharing information with the public, ITF and other agencies with a role in groundwater, including continued consultation with the Chapter 670/2008-appointed public advisory committee (PAC).

- Using the groundwater information now being provided by GAMA in planning and other strategic functions to protect groundwater by better understanding its health and challenges to that health.

If replacement funds are not appropriated to replace Proposition 50 bond funds according to the schedule described above, the GAMA Program cannot implement the critical aspects of the GAMA Program implementing Chapter 522/2001, and will only run a minimal program. A minimal GAMA Program will not provide a continuous statewide assessment of groundwater quality, which is needed to better inform decision makers on how to better plan, manage, and regulate waste discharges, and improve groundwater quality. The GAMA Program is needed in the future for the following reasons:

- Many portions of California's groundwater basins are contaminated by man-made and naturally occurring chemicals. California increasingly relies on groundwater for nearly half its water. Many disadvantaged communities rely on it entirely. The GAMA Program was created to document and assess the result of man-made chemicals in groundwater. GAMA studies have also found that both man-made and naturally occurring chemicals have caused significant impacts on groundwater needed for drinking water.
- GAMA groundwater age-dating tests and water quality trend monitoring are critical to understanding the movement of shallow groundwater to deeper groundwater and to determining how to prevent further groundwater degradation.
- GAMA monitoring is essential to the success of current efforts to assess the impacts of contaminated groundwater on California communities including legislatively-mandated studies pursuant to Chapter 1, Statutes of the Second Extraordinary Session of 2008 for nitrate in the Tulare Basin and Salinas Valley and Chapter 670/2008 for a statewide assessment of all contaminants.
- GAMA results are used in studies initiated by industries that affect groundwater quality, by communities solving their water supply problems, and by regulatory case managers determining best technical approaches to prevent or cleanup pollution. In fact, schools are using GAMA data, information, and its geospatial display on the internet-accessible GeoTracker GAMA system to learn about human impacts on the environment.
- GAMA is providing groundwater assessments so that technical and policy decisions can be reliably pursued. The environment and state's economy rely on a stable and clean water supply. The GAMA Program provides a vital link for the public and decision makers to effectively monitor, assess, and communicate groundwater quality information.

CHAPTER 1 – IMPROVING PUBLIC ACCESSIBILITY TO INFORMATION ABOUT GROUNDWATER CONDITIONS

A. Introduction

The importance of understanding groundwater conditions continues to increase. Over 40 percent of water used in California comes from pumping groundwater wells. Nearly 70 percent of Californians drink groundwater. Groundwater is the sole source of water for many high population areas, such as the San Gabriel and San Fernando Valleys. Californians use groundwater for private and public drinking water supply, and also for industrial and agricultural uses. Reliance on groundwater grows with increased municipal, agricultural and industrial demand. Drought and climate change could further increase groundwater use.

Human activities can and have degraded groundwater quality. (Examples of human activities include municipal and industrial wastewater disposal, industrial and commercial chemical uses and associated accidental chemical releases, fuel releases from aboveground and underground storage tanks, urban and agricultural pesticide use, urban and agricultural application of nitrogen fertilizers, septic tank use, and salt accumulation associated with water importation and use). A review of public drinking water well data shows that thousands of public drinking water wells have been shut down since 1980, many due to both naturally occurring constituents like arsenic and man-made chemicals like nitrate, perchlorate, solvents, and the gasoline additive methyl tert-butyl ether (MTBE). Consequently, there are growing concerns regarding groundwater quality in California, and whether decreases in quality will affect its availability for use.

Our ability to observe and understand groundwater and groundwater quality is limited to the information obtained from water wells. Data are collected during well installation as shown on well completion reports (well logs), and during collection of water level information and soil and groundwater sampling and laboratory testing. These data must be collected, interpreted, and explained so it can be understood by the public in order to answer the questions: “How clean is it?” “How much is there?” “How long will it last?”

Chapter 522/2001, the Groundwater Quality Monitoring Act of 2001, added Section 10781 to the Water Code to provide the public a better understanding of groundwater quality. The State Water Board’s GAMA Program implements Chapter 522/2001. The GAMA Program focuses on answering the question of “How clean is our groundwater?” for the public.

To ensure the continued success of the GAMA Program, Chapter 670/2008 added Section 10782 to the Water Code and requires the State Water Board to (1) make recommendations to enhance the public accessibility of information on groundwater conditions and (2) identify and recommend to the Legislature funding options that

would extend until January 1, 2024, the comprehensive groundwater quality monitoring program developed under Chapter 522/2001. This report to the Legislature is being submitted pursuant to the requirements of Chapter 670/2008. (Appendix A). A copy of Chapter 522/2001 is also provided in Appendix B.

B. Development of Information on Groundwater Conditions and Public Accessibility

Groundwater information is accessible to the public from a number of public agencies and other organizations. Chapter 522/2001 focuses on access to groundwater quality information. The law required the State Water Board to establish a 13-person PAC and an ITF to provide input to the State Water Board in developing the plan which is documented in a 2003 Report to the Legislature.

The law required the State Water Board to develop a central information system to provide public information on groundwater quality. In implementing the law, the State Water Board website and its GeoTracker GAMA information system contains interactive links to many of the other groundwater organizations' websites as well as making millions of records of groundwater quality and related data available for integrated queries and reports.

Chapter 522/2001 also required the State Water Board to integrate existing monitoring programs and design new program elements to establish a comprehensive groundwater quality monitoring program capable of assessing each groundwater basin in the state. The monitoring and assessment of the groundwater quality are implemented through the GAMA Program under a number of unique, cutting-edge projects.

The plan is composed of two major efforts, the sharing of information and the development of the information. A description of these efforts as well as significant accomplishments and findings are summarized below as background to this report's recommendations.

Sharing Information: Public Information, Data Management, and Agency and Stakeholder Coordination

The GAMA Program calls for increasing public accessibility to groundwater information and coordination among groundwater agencies and stakeholders. This is conducted primarily through sharing and displaying information using the internet-based information management system, GeoTracker GAMA, and through other outreach and collaboration efforts associated with the GAMA monitoring and assessment efforts.

The law called for development of an information management system compatible with GeoTracker which provides centralized access to multiple data sets and other information from various sources. GeoTracker GAMA was developed for the GAMA

Program to implement the law. The system became available to the public via the internet in July 2009. Californians now have access to a Google map-based database that readily provides a wealth of information including results of groundwater quality testing, groundwater level information as well as links to published reports for a specific area of interest.

The GAMA Program identifies a number of sources of groundwater quality and related information including federal, state, and local agencies, water purveyors, and well owners. GeoTracker GAMA hosts hundreds of millions of records of groundwater related data shared by DWR, CDPH, DPR, nine Regional Water Boards, the State Water Board, the USGS, and LLNL. GeoTracker GAMA can help investigate new sources of well contamination by looking at nearby contaminant sites. GeoTracker GAMA currently shares environmental data from over 14,000 regulated contaminant sites. Display of all these data, and posting of associated published reports, has shown that the more information provided through GeoTracker GAMA, the better the picture of groundwater quality conditions in California.

The State Water Board's website provides the portal to GeoTracker GAMA so that the public has access to introductory information about groundwater and groundwater quality prior to accessing the system. The State Water Board website leverages the resources of other agencies by providing direct links to specific information on the quality of groundwater in California. These links include the Water Boards' water quality regulatory programs and regulated contaminant site information; the GAMA Program; DWR information on groundwater basins including the Integrated Water Resources Information System (IWRIS); CDPH drinking water information on public supply wells; DPR pesticide testing information for private domestic wells; USEPA information on private domestic wells as well as information on public supply wells; and the USGS national water quality database.

The GAMA Program makes significant outreach and collaboration efforts associated with GAMA monitoring and assessment. In its sampling of nearly 4,000 wells as of May 2009, the GAMA Program has received permission to sample from thousands of well owners, and has shared information and coordinated with them as well as local agencies and water purveyors through personal contact and public meetings. Results of the GAMA Program are shared through publication of the analytical data as well as several reports that are available through the GeoTracker GAMA information system.

Developing Information Element: Monitoring and Assessment

Our ability to observe and understand groundwater and groundwater quality is limited to the information obtained from water wells. Data are collected during well installation as shown on well completion reports (well logs), and during collection of water level information and soil and groundwater sampling and laboratory testing. Well logs can help us understand where water-bearing zones (in subsurface soil and rock) are found as well as interpreting the natural water quality that may be encountered. Although rock and soil types do not change, water levels, groundwater flow direction,

and water quality do change, often due to human activities. Therefore, the continued monitoring and assessment of groundwater are critical to providing information to the public about groundwater's baseline as well as changing conditions or trends.

Chapter 522/2001 requires a monitoring and assessment program that integrates existing programs and designs new program elements, as necessary, which is capable of assessing each groundwater basin in the state. The GAMA Program has sampled nearly 4,000 wells statewide as of May 2009. Over one quarter are privately owned domestic wells and about half are public water supply wells. Table 1 summarizes each of the GAMA Projects and work completed through May 2009.

GAMA Program Description

The Domestic Well Project samples private domestic wells, and provides information about the shallow groundwater in California. The quality of water served from domestic wells is not regulated, and well monitoring data provides well owners with information about what they are drinking. Domestic wells tend to be shallower than public supply wells and are at higher risk of being polluted by adjacent septic tank systems and other nearby contaminating activities at the surface. Focusing on one county at a time, the Domestic Well Project sampled nearly 1,100 wells in five county focus areas, providing important information to well owners and local agencies and the public about the quality of the water being consumed as well as groundwater conditions. Sampling in Tulare County in particular found significant water quality problems. Over 60 percent of the 181 domestic wells sampled in Tulare County are tapping groundwater that exceeds drinking water standards that are applicable to public water supply. Over 40 percent tap groundwater that exceeds the nitrate drinking water standard. A more detailed description of the Domestic Well Project and findings to date is provided in Appendix C.

The Priority Basin Project is designed to evaluate the deeper groundwater that tends to be used for public supply. The Priority Basin Project is described in detail in the USGS report: *Framework for a Ground-Water Quality Monitoring and Assessment Program for California, 2003*. The Priority Basin Project tests nearly 3,000 representative wells statewide on a ten-year cycle and a subset of wells on a three-year cycle to help identify trends in groundwater quality. Well owner cooperation is voluntary and, as of May 2009, nearly 2,000 wells have been tested since 2004. A more detailed description of the Priority Basin Project is provided in Appendix D.

The Priority Basin Project is unique nationwide because on a statewide level it tests for hundreds of chemicals, many at very low detection levels, includes groundwater age-dating analysis, and some isotopic characterization to help determine sources of water and contaminants.

The Special Studies Project uses additional cutting-edge tools to investigate a series of groundwater quality issues – such as linking land uses to groundwater quality, assessing the fate and transport of certain contaminants moving downward to

groundwater, and developing new laboratory testing methods for constituents in groundwater. A more detailed description of the Special Studies Project is provided in Appendix E.

GAMA Program Significant Findings

Appendix F provides a summary of significant findings and accomplishments for the GAMA Program. Following are highlights:

- Nitrate detections in domestic wells illustrate the high susceptibility of shallow groundwater to nitrate contamination and the need to better characterize this shallow groundwater resource.
- Coliform bacteria were the most frequently observed contaminant of public health concern in domestic wells, present in 26 percent of the sampled wells.
- Age-dating and low-level Volatile Organic Compound (VOC) testing, pioneered by GAMA, has helped to assess the susceptibility of public-supply drinking water wells to contamination.
- Age-dating results show that much of the groundwater pumped today has recharged after World War II (1945) - post urban and agricultural development.
- Low-level VOC results show that an aquifer's susceptibility to contamination can vary widely. Many deep coastal aquifers are free of VOCs and other contaminants. Central Valley shallow and deep aquifers tend to be more susceptible to surface contaminants.
- Significant attenuation (depletion) of most wastewater-associated "emerging" contaminants has been determined to happen during the groundwater recharge process.

GAMA Program Significant Accomplishments and Benefits

Many portions of California's groundwater basins are contaminated by both man-made and naturally occurring chemical constituents. California increasingly relies on groundwater for nearly half its water. Many disadvantaged communities rely on it entirely.

GAMA was created to document and assess the result of man-made chemicals in groundwater. GAMA studies have found that both man-made and naturally occurring chemicals have caused significant impacts on groundwater needed for drinking water. A continuous statewide assessment of groundwater quality, like GAMA, is helping to inform decision makers on how to better plan, manage, and regulate waste discharges, and improve groundwater quality.

The GAMA Program is over half way through the first 10-year cycle of groundwater quality monitoring and assessment of the primary groundwater basins used for water supply. Nearly 4,000 wells, of which over 1,000 are private domestic wells, have been sampled. GAMA sampling efforts have provided many critical findings to help better understand groundwater conditions in California, and, in turn, make the information

available to the public. Trend sampling is ongoing in order to identify changes in groundwater quality for those basins that have been assessed. Much of the data collected is currently available through GeoTracker GAMA with more being added. Reports summarizing the groundwater quality in the basins are being prepared and posted on GeoTracker GAMA. The GAMA Program is finishing its baseline assessment of California's groundwater, and is monitoring groundwater changes through its trend monitoring.

The GAMA Program has innovated cutting-edge approaches and uses state-of-the-art tools to test groundwater and assess groundwater conditions. The GAMA Program is unique nationwide because on a statewide level it tests for hundreds of chemicals, many at very low detection levels, includes groundwater age-dating analysis, and some isotopic characterization to help determine sources of water and contaminants.

Groundwater age-dating analysis provides information that has many practical uses. Groundwater age shows if pumped groundwater has been recently recharged from ground surface, a nearby river, or from older underground sources.

GAMA Program implementation allows areas to be identified where groundwater supply is most at risk from over-extraction. Thousands of groundwater levels at environmental cleanup sites have been measured as required by Regional Water Boards and are shown on GeoTracker GAMA. To complement these data, the Priority Basin Project groundwater age dating allows water purveyors to gauge whether the groundwater resource being pumped is being replenished or is being over-pumped and thus reducing groundwater reserves. Age-dating information also shows where the groundwater is older than 50 years. In these areas younger water is not able to reach groundwater and recharge the supply. If groundwater is removed at high rates and not allowed to recharge sufficiently, then it is in danger of overdraft where the regional groundwater levels drop (i.e., wells go dry). The GAMA Program is also responsible for the development and use of new tracers that provide information for managing aquifer recharge. These tracers show both the length of time that reclaimed water resides in the subsurface prior to extraction for use and the water quality changes associated with artificial recharge.

Information developed through the GAMA Program, primarily age-dating and low-level detections, helps to identify the groundwater that is most vulnerable to contamination from land use activities. Areas where the groundwater is younger than 50 years can be at risk from contamination by land uses. These areas need greater protection from land use activities. GAMA was created to document and assess the result of man-made chemicals in groundwater.

GAMA studies have also found that naturally occurring chemicals have caused significant impacts on groundwater needed for drinking water, and these have increased in groundwater due to human activities. GAMA's groundwater age-dating tests and water quality trend monitoring are critical to understanding the movement of shallow groundwater to deeper groundwater and helping to determine how to prevent

further groundwater degradation and identify those management decisions that are likely to have success.

Many portions of California groundwater basins are contaminated. As a result, the Legislature has mandated reports pursuant to Chapter 1, Statutes of the Second Extraordinary Session of 2008 for Nitrate Project (Tulare Basin and Salinas Valley Pilot Projects) and Chapter 670/2008 for Statewide Contaminants Project to answer questions about contaminant occurrence, impacts on communities, associated costs and feasibility of options to provide potable water ranging from treating polluted groundwater for drinking, searching for cleaner groundwater, creating new systems to tap into scarce surface water supplies, and long-term efforts to reduce the rate of pollution. Without the GAMA Program information, these studies could not be implemented.

Other important water resources issues rely on GAMA results. GAMA results have been used in studies initiated by industries that affect groundwater quality, communities solving their water supply problems, regulatory case managers determining best technical approaches to prevent or cleanup pollution. In fact, schools are using GAMA data, information, and its geospatial display on the internet accessible GeoTracker GAMA system to learn about human impacts on the environment.

GAMA and its display through GeoTracker GAMA “ground-truths” perceptions about groundwater allowing decisions to be better supported by data. Without GAMA, these studies and technical and policy decisions could not be pursued with reliability. GAMA monitoring, assessment, and communication of this information are being used to support more effective and efficient use of public and private resources to protect the environment and continue a healthy economy.

C. Recommendations to Enhance the Public Accessibility of Information on Groundwater Conditions

The State Water Board makes a number of recommendations, outlined below, to enhance public accessibility of information on groundwater conditions in California. The State Water Board also has outlined below recommended actions for the State Water Board, working cooperatively with other state agencies, water purveyors and interested parties, to further provide public accessibility of information on groundwater conditions in California.

Recommendations to the Legislature:

Recommendation 1: Continue to fund the GAMA Program at the level of effort necessary to implement Chapter 522/2001 in the amount of \$7.5 million annually.

The cost to implement the GAMA Program is \$7.5 million annually. However, long-term funding at this level has not been identified. Current funding comes from annual waste discharge fees (\$2.1 million) and from Proposition 50 bond funds which, when expended, will need to be replaced by another fund source in the amount of \$5.4 million annually. Timing and fund source options are described in Chapter 2 of the report.

If replacement funds are not appropriated to replace Proposition 50 bond funds according to the schedule described above, the GAMA Program will not be able to implement the critical aspects of the GAMA Program implementing Chapter 522/2001, and will only run a minimal program. A minimal GAMA Program will not provide a continuous statewide assessment of groundwater quality, which is needed to better inform decision makers on how to better plan, manage, and regulate waste discharges, and improve groundwater quality. The GAMA Program is needed in the future for the following reasons:

- Many portions of California's groundwater basins are contaminated by man-made and naturally occurring chemicals. California increasingly relies on groundwater for nearly half its water. Many disadvantaged communities rely on it entirely. The GAMA Program was created to document and assess the result of man-made chemicals in groundwater. GAMA studies have also found that naturally occurring chemicals have caused significant impacts on groundwater needed for drinking water, and these have increased in groundwater due to human activities. GAMA's groundwater age-dating tests and water quality trend monitoring are critical to understanding the movement of shallow groundwater to deeper groundwater.
- The Legislature has mandated reports pursuant to Chapter 1, Statutes of the Second Extraordinary Session of 2008 for Nitrate Project (Tulare Basin and Salinas Valley Pilot Projects) and Chapter 670/2008 for Statewide Contaminants Project to understand contaminant occurrence, evaluate impacts on communities, and estimate costs and feasibility of options to provide potable water. GAMA Program results are key to the success of these efforts.
- Other important water resources issues rely on GAMA results. GAMA results have been used in studies initiated by industries that affect groundwater quality, communities solving their water supply problems, regulatory case managers determining best technical approaches to prevent or cleanup pollution. In fact, schools are using GAMA data, information, and its geospatial display on the internet accessible GeoTracker GAMA system to learn about human impacts on the environment.
- The GAMA Program provides groundwater studies so technical and policy decisions can be reliably pursued. The environment and state's economy rely on a stable and clean water supply. The GAMA Program provides a vital link for the public and decision makers to effectively monitor, assess, and communicate groundwater quality information.

Recommendation 2: Appropriate funding in the budget to DWR to make electronic copies of the remaining hundreds of thousands of paper well logs.

Well logs for the million wells drilled in California provide information on the subsurface and are the primary basis for predicting naturally occurring water supply and water quality to agencies with access to this confidential information. Only a small percentage of well logs in southern California are electronically available to GeoTracker GAMA, since the logs have not been scanned due to lack of resources. DWR does not have the funds necessary to complete the scanning process. The cost of completing the scanning process is estimated at \$20,000, which does not include significant staff time to prepare the documents for efficient scanning and organization to match the rest of the state's scanned well logs.

Actions for the State Water Board (working cooperatively with other state agencies, water purveyors and other interested parties):

State Water Board Action 1: Continue to support the GAMA Program's implementation of the AB 599 plan.

The GAMA Program is designed to meet the goals of sharing groundwater quality information and improving groundwater quality monitoring in California. Information sharing occurs through public outreach and the roll-out and increasing use of GeoTracker GAMA system. Information is developed through data collection efforts of varied organizations that deal with groundwater, and most extensively over the last five years through the GAMA Program monitoring and assessment projects.

The GAMA Program is over halfway through the first 10-year cycle of groundwater quality monitoring and assessment of the primary groundwater basins used for water supply. Groundwater sampling has provided many critical findings to help better understand groundwater conditions in California, and, then make the information available to the public. Sampling the same wells every three years allows us to see changes in groundwater quality (trend sampling). Based on these data, reports summarizing the groundwater quality in the basins are prepared and posted on GeoTracker GAMA. These data, as well as data collected from several other sources, have been made available for the first time on the internet and shown on a map interface through GeoTracker GAMA with more added with each sampling event and each report completion. Continuation of all these efforts on a 10-year cycle will increasingly improve our understanding of groundwater conditions and how humans impact groundwater so that we can make informed decisions concerning sustained groundwater use and management in California.

The GAMA Program provides groundwater studies so technical and policy decisions can be reliably pursued. The environment and state's economy rely on a stable and clean water supply. The GAMA Program provides a vital link for the public and decision makers to effectively monitor, assess, and communicate groundwater quality information.

A monumental step forward has been made by GAMA in providing a wealth of information about groundwater conditions to the public. A California court recently determined that with GeoTracker GAMA “the public retain some ability ... to participate in efforts to protect the water quality of [public water supply] wells from contamination by land activities, and to participate in local land use planning decisions potentially affecting the wells. Researchers ... may ... study and assess groundwater and track toxic plumes ... and may define methods to mitigate contaminating land activities.”

Monitoring groundwater over time helps us to better understand groundwater and pollutant movement to groundwater supplies and into drinking water wells and helps in understanding which contaminating land uses cause groundwater problems and which are less significant in terms of real risk. For instance, tens of thousands of underground storage tanks at gas stations in California have leaked petroleum fuel and are being cleaned up; however, very few have caused wells to be shut down. However, nitrates in groundwater from wastewater and fertilizer have impacted hundreds of the state’s 18,000 water supply wells. This information is beginning to help prioritize planning and regulatory decisions (cleanup projects and waste discharge requirements). The ability to make informed prioritization decisions optimizes limited funding resources and maximizes groundwater protection.

Several water resources issues now rely on GAMA results. GAMA results are being used in studies initiated by the legislature, communities solving their water supply problems, industries that affect groundwater quality, and regulatory case managers determining best technical approaches to prevent or clean up pollution. In fact, schools are using GAMA data, information, and its geospatial display on the internet accessible GeoTracker GAMA system to learn about human impacts on the environment.

Finally, the information developed through the GAMA Program allows areas to be identified where groundwater supply is most at risk from over-extraction. Thousands of groundwater levels have been measured as required by Regional Water Boards. The data are shown geospatially on GeoTracker GAMA. To complement these data, the Priority Basin Project groundwater age dating shows where the groundwater is older than 50 years, which means that if this groundwater is used at high rates, then it is in danger of overdraft. If the age-dating shows older groundwater, then younger water is not able to reach groundwater and recharge the supply.

State Water Board Action 2: Continue to implement the GAMA Program’s information sharing through data management and stakeholder coordination.

- a. Continue to support GeoTracker GAMA as the system that makes available to the public information on California’s groundwater quality and related information.**

GeoTracker GAMA is an internet-accessible groundwater information system to help the public understand groundwater and groundwater quality in California. GeoTracker GAMA, like any such system, requires both routine maintenance as well as upgrading to incorporate new applications and tools.

b. Continue to populate GeoTracker GAMA with groundwater quality and related information, working with the ITF agencies and other interested parties.

Additional groundwater quality and related information would significantly increase and complement the information currently being submitted to GeoTracker GAMA. Groundwater information that is collected includes that required by state agencies (for example, for regulatory compliance), information paid for using public funds (for example, bond funded projects related to groundwater), and information collected by varied agencies and organizations in the business of managing or regulating groundwater. In its 2003 Report to the Governor and the Legislature regarding the GAMA Program, the State Water Board recommended that groundwater quality and related information be submitted electronically to GeoTracker GAMA, and Chapter 727, Statutes 2000 (AB 2886, Kuehl) specified the format and the content of the required data.

c. Continue to share information with the public, the ITF and other agencies with a role in groundwater, including continuing consultation with the Chapter 522/2001-appointed PAC.

Providing groundwater information to the public requires valuable feedback from the groundwater community. This community consists of a broad spectrum of interests including environmental groups, state and federal agencies, water purveyors and groundwater management agencies. The representation on the PAC provides the best model to continue for this forum since all of these groups are represented.

Table 1 – Description of GAMA Projects, Summary of Work Completed and Current Status

| Project | Description | Summary of Work Completed through May 2009 | Current Status |
|---|--|---|--|
| <p>California Aquifer Susceptibility (CAS)</p> | <ul style="list-style-type: none"> • Served as the foundation of the Priority Basin Project. Project duration 2000-2003 • Cutting edge monitoring using age-dating and very low contaminant detection limits to address the relative susceptibility of public drinking water wells to contamination. • Evaluation of groundwater conditions in study areas showing contaminant movement from recharge water. | <ul style="list-style-type: none"> • Tested groundwater samples at over 1,000 water supply wells. • Twelve Focus Areas in high-use groundwater basins were studied. • Two types of groundwater tests were performed: age-dating and low-level volatile organic compound analyses. | <p>Complete</p> |
| <p>Priority Basin Project</p> | <ul style="list-style-type: none"> • Initiated in 2002. US Geological Survey as technical lead, with LLNL and State Water Board • Provides an assessment of groundwater quality in groundwater basins prioritized based on groundwater use. • Has divided 116 high-use groundwater basins into 35 “study units”. • Uses advanced low detection level groundwater testing techniques to identify possible emerging contaminants and assist public and private groundwater well owners and users in managing resources. | <ul style="list-style-type: none"> • 50 public meetings held • 1,703 well owner reports mailed • 13 data reports published (5 pending) • 2 scientific Investigation reports in review • 1,986 wells sampled • >1,200 participants including: 208 water districts, 159 cities and 80 schools | <p>Active, but significantly delayed due to Stop-Work Order in December 2008</p> |
| <p>Domestic Well Project</p> | <ul style="list-style-type: none"> • Initiated in 2002 provides private domestic well owners with information regarding their well water quality. • Tests private domestic wells in county “Focus Areas”, one county at a time. • Selection of county Focus Area is based on domestic well use, interest by participants, susceptibility of wells to contamination, and availability of well records. • Tests for chemicals commonly found in well water, such as bacteria, nitrate, metals, and VOCs. • Additional chemicals of concern for a selected Focus Area may also be tested, such as perchlorate, pesticides and radionuclides. | <ul style="list-style-type: none"> • Five County Focus Areas have been sampled (Yuba, El Dorado, Tehama, Tulare and San Diego) • 1,067 domestic wells have been tested • 1,067 well owner reports have been mailed • All data has been uploaded to GeoTracker GAMA • Where sampling results have shown concentrations above drinking water standards, the State Water Board has recommended the well owner re-test the well water. | <p>Active</p> |

Table 1 – Description of GAMA Projects, Summary of Work Completed and Current Status (cont.)

| GAMA Project | Project Description | Summary of Work Completed through May 2009 | Current Status |
|--------------------------------|--|--|-----------------------|
| Special Studies Project | <ul style="list-style-type: none"> • Initiated in 2002, LLNL conducts state-of-the-art research on nitrate sources to groundwater, wastewater indicators in recycled irrigation water, groundwater age, groundwater recharge and other areas of interest. • Helps in understanding the source, fate and transport and occurrence of chemicals that can affect groundwater quality. • Addresses important and emerging statewide groundwater quality issues using innovative, cutting-edge technology. | <ul style="list-style-type: none"> • Several studies on nitrate in groundwater have been conducted using advanced isotopic techniques to determine the source of nitrogen in groundwater and to evaluate how nitrate in groundwater can transform (denitrify). • Naturally occurring forms of helium and hydrogen in groundwater have been used to measure the age of groundwater to help evaluate drinking water supplies and their susceptibility. • Groundwater recharge studies help determine the origin of groundwater and potential contributors to existing groundwater contamination. • New analytical methods for detection of low-level organic chemicals (wastewater indicators, pharmaceuticals and endocrine disrupting chemicals) in groundwater have been developed. | Active |
| GeoTracker GAMA | <ul style="list-style-type: none"> • Initiated in 2008, GeoTracker GAMA achieves the goal of Chapter 522/2001 to “design a database capable of supporting the monitoring program that is compatible with the State Water Board’s GeoTracker database”. • An environmentally-innovative search engine that allows easy access to publicly available groundwater quality data and information. • Makes searchable a number of groundwater quality databases. • Provides links to other groundwater quality data sources and information. | <ul style="list-style-type: none"> • The GeoTracker GAMA was released to the public in July 2009, allowing users to view groundwater quality data over the internet. • The GeoTracker GAMA (Beta) website has been created by EcolInteractive as software as a service. • Published reports and existing water quality and related data sets from the Water Boards, USGS, LLNL, CDPH, DWR, and DPR are served by GeoTracker GAMA on a Google maps format. | Active |

Note: Additional information regarding description of GAMA Projects and work conducted through May 2009 can be found in Appendices D through I.

VOC = volatile organic compound

USGS = United States Geological Survey

CDPH = California Department of Public Health

LLNL = Lawrence Livermore National Laboratories

DWR = Department of Water Resources

DPR = Department of Pesticides

CHAPTER 2 – FUTURE FUNDING OPTIONS

A. Current GAMA Program Funding

Chapter 670/2008 requires the State Water Board to identify and recommend to the Legislature funding options that would extend the GAMA Program implementing Chapter 522/2001 until January 1, 2024. Implementation of Chapter 522/2001 requires \$7.5 million annually. Funding for GAMA currently comes from two sources:

- Bond sales. Proposition 50 provided \$50 million specifically to fund implementation of the GAMA Program. The State Water Board has chosen to use Proposition 50 to fund primarily the Priority Basins Project. The Priority Basin Project, as defined in the 2003 Report to the Legislature, requires approximately \$5.4 million annually. Replacement funding will be needed when the Proposition 50 bond funds are expended. See discussion below regarding potential sources and timing of future GAMA Program funding needs.
- Annual fees (Waste Discharge Permit Fund – WDPF). The WDPF provides \$2.1 million annually that funds the remainder of the GAMA Program. A surcharge is assessed on the fee paid by those who have been issued waste discharge requirements to fund this part of the GAMA Program. The current surcharge is nearly ten percent.

The GAMA projects, regardless of funding, are primarily implemented through contracts but there are also State Water Board staff dedicated to GAMA Program implementation. Table 2 (below) summarizes the GAMA Program budget by fund source and project averaged over years of full funding. Work has continued uninterrupted on the remainder of GAMA Projects since their funding source is from the WDPF. However, Priority Basin Project work was interrupted for over ten months as result of the Governor's Executive Order to stop work on bond-funded projects between December 2008 and September 2009. The U.S. Geological Survey and Lawrence Livermore National Laboratory had to re-assign 39 staff dedicated to this statewide project for several months and project schedule and production of work products have been significantly delayed.

Table 2 - GAMA Program Annualized Budget

| Project | Current Funding Sources | Current Approximate Annual Contract Budget | Approximate Annual Personal Services Budget | Total Current Annual Budget |
|-------------------------|---------------------------|--|---|-----------------------------|
| Priority Basin Project | Proposition 50 Bond Sales | \$5.0M | \$0.39M | \$5.39M |
| Domestic Well Project | WDPF Fees (\$1.33M/year) | \$0.33M | \$0.77M | \$2.1M |
| Special Studies Project | | \$0.75M | | |
| GeoTracker GAMA | | \$0.25M | | |
| Total | | \$6.3M | \$1.16M | \$7.49M |

B. Future GAMA Program Funding

Both Chapter 522/2001 and Chapter 670/2008 require the State Water Board to identify long-term funding necessary to implement the law. Funding has not been identified for long-term implementation of the Priority Basin Project. Current funding comes from annual waste discharge fees (\$2.1 million) and from Proposition 50 bond funds which, when expended, will need to be replaced by another fund source in the amount of \$5.4 million annually. In order to fund the GAMA Program at its current level, bond funds will need to be replaced in FY 2012-13 in the amount of \$0.4 million for staff costs; in FY 2013-14 in the amount of \$3.3 million for contracts and staff costs; and in FY 2014-15 and annually thereafter in the amount of \$5.4 million (\$5 million in contracts and \$0.4 million for staff costs).

If no additional funds are appropriated to replace Proposition 50 bond funds, the GAMA Program will only be able to run a minimal program that will include the Domestic Well, Special Studies, and GeoTracker GAMA Projects. Consequences of discontinuing the Priority Basin Project include:

- Loss of basic data provided by a continuous statewide assessment essential to the success of current efforts to assess the impacts of contaminated groundwater on California communities including legislatively-mandated studies pursuant to Chapter 1, Statutes of the Second Extraordinary Session of 2008 for nitrate in the Tulare Basin and Salinas Valley and Chapter 670/2008 for a statewide assessment of all contaminants.
- Loss of ability to pursue studies initiated by industries that affect groundwater quality, by communities solving their water supply problems, schools, and regulatory case managers determining best technical approaches to prevent or cleanup pollution.

- Inability to identify areas where groundwater supply is most at risk from over-extraction. Comprehensive groundwater level data and age dating information provide an untapped resource of information for making better decisions about groundwater supply.
- Inability to provide groundwater assessments so that technical and policy decisions can be reliably made. The environment and state's economy rely on a stable and clean water supply. The GAMA Program provides a vital link for the public and decision makers to effectively monitor, assess, and communicate groundwater quality information.

Recommended Funding Options

Five potential long-term funding options that could be pursued are:

- New bond funding. Bond funds would require legislation and approval by the voters.
- Additional funding from the Waste Discharge Permit Fund. Additional appropriation would require legislative approval as a part of the state budget process. Additional fee revenue could be generated in a number of ways, two of which are described below:
 - Increase the surcharge on the WDPF fee that currently funds a portion of the GAMA Program. The current surcharge on the annual fee from dischargers that have been issued waste discharge requirements would need to increase from 9.5 percent to 29.7 percent; or
 - Impose a fee on those dischargers that could affect groundwater and are not currently paying a fee.
- Funding from assessment of a new fee on groundwater use. Funds generated by assessing a new fee on groundwater use would require legislation that permits an assessment made on actual groundwater pumping or a tiered assessment on water purveyors that rely on groundwater. Developing a new fee that funds only the GAMA Program would result in substantial administrative costs. Such a fee may be more appropriate to fund a number of groundwater programs that have lost General Fund support or have never been sufficiently funded to protect groundwater quality.
- General Fund moneys. General Fund moneys would require an appropriation as part of the state budget process. The General Fund is limited at this time and therefore an unlikely alternative.
- Federal funds. Federal funds would rely on an appropriation by Congress. No federal funding has been identified to date that would be appropriate for GAMA Program funding.

Each of the potential funding options identified in this report would require action that is outside the State Water Board's authority.

Conclusion:

The GAMA Program continues to be successful in providing the public a better understanding of groundwater quality. Californians now can access a Google map-based information system that readily provides a wealth of groundwater data including results of water quality testing, water level information, copies of environmental monitoring well logs as well as links to published reports for a specific area of interest.

This report recommends that the Legislature enhance public accessibility of information on groundwater conditions in California by continuing the GAMA Program at the level of effort necessary to implement Chapter 522/2001 at approximately \$7.5 million annually. Current funding comes from annual waste discharge fees (\$2.1 million) and from Proposition 50 bond funds which, when expended will need to be replaced by another fund source in the amount of \$5.4 million annually.

Bond funds will need to be replaced in FY 2012-13 in the amount of \$0.4 million for staff costs; in FY 2013-14 in the amount of \$3.3 million for contracts and staff costs; and in FY 2014-15 in the amount of \$5.4 million (\$5 million in contracts and \$0.4 million for staff costs).

If replacement funds are not appropriated to replace Proposition 50 bond funds according to the schedule described above, the GAMA Program will not be able to implement the critical aspects of the GAMA program implementing Chapter 522/2001, and will only be able to run a minimal program. A minimal GAMA Program will not provide a continuous statewide assessment of groundwater quality, which is needed to better inform decision makers on how to better plan, manage, and regulate waste discharges, and improve groundwater quality. The GAMA Program is needed in the future for the following reasons:

- Many portions of California's groundwater basins are contaminated by man-made and naturally occurring chemicals. California increasingly relies on groundwater for nearly half its water. Many disadvantaged communities rely on it entirely. The GAMA program was created to document and assess the result of man-made chemicals in groundwater. GAMA studies have also found that both man-made and naturally occurring chemicals have caused significant impacts on groundwater needed for drinking water.
- GAMA groundwater age-dating tests and water quality trend monitoring are critical to understanding the movement of shallow groundwater to deeper groundwater and to determine how to prevent further groundwater degradation.
- GAMA monitoring is essential to the success of current efforts to assess the impacts of contaminated groundwater on California communities including legislatively-mandated studies pursuant to Chapter 1, Statutes of the Second Extraordinary Session of 2008 for nitrate in the Tulare Basin and Salinas Valley and Chapter 670/2008 for a statewide assessment of all contaminants.
- GAMA results are used in studies initiated by industries that affect groundwater quality, by communities solving their water supply problems, and by regulatory case managers determining best technical approaches to prevent or cleanup pollution. In fact, schools are using GAMA data, information, and its geospatial display on the

internet-accessible GeoTracker GAMA system to learn about human impacts on the environment.

- GAMA is providing groundwater assessments so that technical and policy decisions can be reliably pursued. The environment and state's economy rely on a stable and clean water supply. The GAMA Program provides a vital link for the public and decision makers to effectively monitor, assess, and communicate groundwater quality information.

The report recommends that a source of funding be identified for continued funding of the GAMA Program. Several potential funding sources could be pursued, all requiring actions outside the State Water Board's authority, including:

- New bond funding;
- Additional funding from the Waste Discharge Permit Fund, either by increasing the fee or imposing the fee on those not currently paying a fee;
- Funding from the assessment of a new fee on groundwater use;
- General Fund moneys; and
- Federal funds.

Lastly, the State Water Board also recommends that the Legislature appropriate funding to the DWR to make electronic copies of the remaining hundreds of thousands of paper well logs. The well log information is to be included in the State Water Board's GeoTracker, the GAMA information management system accessible through the State Water Board website, in order to improve availability of information needed to interpret groundwater quality data, for confidential use as required by statute.

Table 3 – GAMA Program Level-of-Effort Options for Contracts

| Option | Scope of Work | Pros | Cons | Contract Costs | Unmet Need |
|-----------------|--|--|---|------------------------------|------------|
| Minimal Program | <ul style="list-style-type: none"> • No Priority Basin Project • GeoTracker GAMA will continue to be updated with groundwater quality and related data. • The Domestic Well Project will continue to collect domestic well data county by county. • The Special Studies Project will continue to conduct studies on emerging groundwater issues. | <ul style="list-style-type: none"> • GeoTracker GAMA will continue to receive and provide groundwater quality information to the public. • The GAMA Domestic Well and Special Studies Projects will continue to collect and report groundwater quality data. | <ul style="list-style-type: none"> • Very little of GAMA Program will be implemented. • All work on the Priority Basin Project will be stopped • No statewide systematic groundwater quality monitoring and assessment: <ul style="list-style-type: none"> • No trend monitoring every 3 years to identify changes in groundwater quality through time. • No re-assessment during next 10-year-cycle of groundwater conditions of previously assessed groundwater basins. • No assessment of lower-priority groundwater basins that had not yet been assessed for baseline groundwater quality conditions. | Estimated \$1.3 million/year | None |

Table 3 – GAMA Program Level-of-Effort Options for Contracts (cont.)

| Option | Scope of Work | Pros | Cons | Contract Costs | Unmet Need |
|----------------|--|--|---|------------------------------|------------------------------|
| Medium Program | <p>The Minimal Program option plus:</p> <ul style="list-style-type: none"> • Trend-monitoring part of the Priority Basin Project which tests about 250 wells statewide to identify trends in water quality in the major groundwater aquifers being used in the high-priority groundwater basins. | <ul style="list-style-type: none"> • Trend monitoring information will be collected as part of the Priority Basin Project every 3 years to identify changes in groundwater quality through time. • Same as Minimal Program | <ul style="list-style-type: none"> • Only a small part of the GAMA Program and the Priority Basin Project will be implemented. • Minimal statewide systematic groundwater quality monitoring and assessment. • No re-assessment during next 10-year-cycle of groundwater conditions of previously assessed groundwater basins. • No assessment of lower-priority groundwater basins that had not yet been assessed for baseline groundwater quality conditions. | Estimated \$3.8 million/year | Estimated \$2.5 million/year |

Table 3 – GAMA Program Level-of-Effort Options for Contracts (cont.)

| Option | Scope of Work | Pros | Cons | Contract Costs | Unmet Need |
|--------------|---|---|---|-----------------------------|-----------------------------|
| Full Program | <ul style="list-style-type: none"> • Existing GAMA Program and its current level of effort in implementing the plan outlined in the Report to the Governor and Legislature, including: • Minimal program plus: • The next 10-year cycle implementing Priority Basin Project which includes: <ul style="list-style-type: none"> • Re-assessment of groundwater conditions of previously assessed groundwater basins (over 2500 wells over 10 years). • Trend sampling analyses at 10% of each priority basin's wells will continue to be conducted every three years (over 250 wells over 10 years). • Updated Data Summary Reports, Data Assessment Reports and Fact Sheets for each priority basin. • Submittal to GeoTracker GAMA of all new groundwater quality data collected. | <ul style="list-style-type: none"> • A systematic statewide assessment of groundwater quality will continue to document changes to groundwater quality in California as originally outlined in the Report to the Legislature including all the GAMA Programs: Priority Basin Project, Domestic Well Project, Special Studies Project, and GeoTracker GAMA. • Data will be collected regarding trends in selected groundwater basins and Fact Sheets will be made available to the public summarizing results of the groundwater basin sampling for all previously sampled basins. • All collected groundwater quality data will be made available to GeoTracker GAMA and shared with interested public, federal, state and local agencies. | <ul style="list-style-type: none"> • Higher cost option. • No assessment of lower-priority groundwater basins that had not yet been assessed for baseline groundwater quality conditions. | Estimated \$6.7million/year | Estimated \$5.4million/year |

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7. Department of Pesticide Regulation website <http://www.dpr.ca.gov>
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9. U.S. Geological Survey website <http://www.usgs.gov>

APPENDIX A – ASSEMBLY BILL 2222

CHAPTER 670

An act to add Section 10782 to the Water Code, relating to groundwater.

[Approved by Governor September 30, 2008. Filed with
Secretary of State September 30, 2008.]

Legislative Counsel's digest: AB 2222, Caballero. Groundwater quality: monitoring. The Groundwater Quality Monitoring Act of 2001 requires the State Water Resources Control Board to integrate existing monitoring programs and design new program elements, as necessary, to establish a comprehensive monitoring program capable of assessing each groundwater basin in the state through direct and other statistically reliable sampling approaches.

This bill would require the state board, on or before June 1, 2009, to identify and recommend to the Legislature funding options to extend the comprehensive monitoring program until January 1, 2024, and make recommendations to enhance public accessibility of information on groundwater conditions. The bill would require the state board, on or before January 1, 2012, in consultation with specified agencies, to submit to the Legislature a prescribed report. The bill would require the state board to provide an opportunity for public comment prior to finalizing the report and submitting it to the Legislature.

The people of the State of California do enact as follows:

SECTION 1. Section 10782 is added to the Water Code, to read:

10782. (a) On or before June 1, 2009, the state board shall do both of the following:

(1) Identify and recommend to the Legislature funding options to extend, until January 1, 2024, the comprehensive monitoring program established in accordance with Section 10781.

(2) Make recommendations to enhance the public accessibility of information on groundwater conditions.

(b) On or before January 1, 2012, the state board, in consultation with the State Department of Public Health, the Department of Water Resources, the Department of Pesticide Regulation, the Office of Environmental Health Hazard Assessment, and any other agencies as appropriate, shall submit to the Legislature a report that does all of the following:

(1) Identifies communities that rely on contaminated groundwater as a primary source of drinking water.

(2) Identifies in the groundwater sources for the communities described in paragraph (1) the principal contaminants and other constituents of concern, as identified by the state board, affecting that groundwater and contamination levels.

(3) Identifies potential solutions and funding sources to clean up or treat groundwater or to provide alternative water supplies to ensure the provision of safe drinking water to communities identified in paragraph (1).

(c) The state board shall provide an opportunity for public comment on the report required pursuant to subdivision (b), prior to finalizing the report and submitting it to the Legislature.

APPENDIX B – ASSEMBLY BILL 599

CHAPTER 522

An act to add Part 2.76 (commencing with Section 10780) to Division 6 of the Water Code, relating to water.

[Approved by Governor October 4, 2001. Filed with Secretary of State October 5, 2001.]

LEGISLATIVE COUNSEL'S DIGEST

AB 599, Liu. Groundwater contamination: quality monitoring program.

Existing law declares that groundwater is a valuable natural resource in the state and should be managed to ensure its safe production and its quality. Existing law authorizes specified local agencies to adopt and implement groundwater management plans.

This bill would require the State Water Resources Control Board to integrate existing monitoring programs and design new program elements, as necessary, for the purpose of establishing a comprehensive monitoring program capable of assessing each groundwater basin in the state through direct and other statistically reliable sampling approaches, and to create an interagency task force to identify actions necessary to establish the monitoring program and to identify measures that would increase coordination among state and federal agencies that collect groundwater contamination information. The bill would require the state board to convene a described advisory committee to the task force. The bill would require the state board, in consultation with other specified agencies, to submit to the Governor and the Legislature, on or before March 1, 2003, a report that includes a description of a comprehensive groundwater quality monitoring program for the state.

The people of the State of California do enact as follows:

SECTION 1. The Legislature finds and declares the following:

- (a) The importance of maintaining and monitoring a safe groundwater supply in this state for purposes of maintaining a healthy environment and a safe supply of drinking water cannot be minimized.
- (b) The lack of information about groundwater contamination greatly impairs the ability of regulators and the public to protect and restore the state's groundwater basins.
- (c) The Groundwater Quality Monitoring Act of 2001 enacted by this act is necessary to protect and restore groundwater as a valuable natural resource in California.

SEC. 2. Part 2.76 (commencing with Section 10780) is added to Division 6 of the Water Code, to read:

PART 2.76. GROUNDWATER QUALITY MONITORING

10780. This part shall be known and may be cited as the Groundwater Quality Monitoring Act of 2001.

10781. In order to improve comprehensive groundwater monitoring and increase the availability to the public of information about groundwater contamination, the state board, in consultation with other responsible agencies, as specified in this section, shall do all of the following:

(a) Integrate existing monitoring programs and design new program elements as necessary to establish a comprehensive monitoring program capable of assessing each groundwater basin in the state through direct and other statistically reliable sampling approaches. The interagency task force established pursuant to subdivision (b) shall determine the constituents to be included in the monitoring program. In designing the comprehensive monitoring program, the state board, among other things, shall integrate projects established in response to the Supplemental Report of the 1999 Budget Act, strive to take advantage of and incorporate existing data whenever possible, and prioritize groundwater basins that supply drinking water.

(b) (1) Create an interagency task force for all of the following purposes:

(A) Identifying actions necessary to establish the monitoring program.

(B) Identifying measures to increase coordination among state and federal agencies that collect information regarding groundwater contamination in the state.

(C) Designing a database capable of supporting the monitoring program that is compatible with the state board's geotracker database.

(D) Assessing the scope and nature of necessary monitoring enhancements.

(E) Identifying the cost of any recommended measures.

(F) Identifying the means by which to make monitoring information available to the public.

(2) The interagency task force shall consist of a representative of each of the following entities:

(A) The state board.

(B) The department.

(C) The State Department of Health Services.

(D) The Department of Pesticide Regulation.

(E) The Department of Toxic Substances Control.

(F) The Department of Food and Agriculture.

(c) Convene an advisory committee to the interagency task force, with a membership that includes all of the following:

(1) Two representatives of appropriate federal agencies, if those agencies wish to participate.

(2) Two representatives of public water systems, one of which shall be a representative of a retail water supplier.

(3) Two representatives of environmental organizations.

(4) Two representatives of the business community.

(5) One representative of a local agency that is currently implementing a plan pursuant to Part 2.75 (commencing with Section 10750).

(6) Two representatives of agriculture.

(7) Two representatives from groundwater management entities.

(d) (1) The members of the advisory committee may receive a per diem allowance for each day's attendance at a meeting of the advisory committee.

(2) The members of the advisory committee may be reimbursed for actual and necessary travel expenses incurred in connection with their official duties.

10782. On or before March 1, 2003, the state board, in consultation with the other task force agencies specified in Section 10781, shall report to the Governor and the Legislature. The multiagency report shall include all of the following:

- (a) A detailed description of a comprehensive groundwater quality monitoring program for California that accomplishes the goals and objectives of the act adding this part.
- (b) A description of how the program takes maximum advantage of existing information and an assessment of additional monitoring necessary to support the program.
- (c) A specific set of recommendations for coordinating and, as necessary, restructuring existing monitoring programs to efficiently achieve the goals of this part.
- (d) An estimate of funding necessary to implement the comprehensive program and the factual basis for the estimate.
- (e) Recommendations with regard to an ongoing source of funds to pay for the program.
- (f) A ranked list of actions that, if implemented independently, would increase the effectiveness of monitoring efforts.

10782.3. The state board shall use existing resources to carry out this part, and the operation of the program set forth in this part shall not supplant the operation of any other program required to be undertaken by the state board.

APPENDIX C – DOMESTIC WELL PROJECT DESCRIPTION

Since 2002, the Domestic Well Project has provided domestic well owners with information on their well water quality. The State Water Board is the project lead. Domestic wells are for private use and consumption – typically for single family homeowners. Although domestic well water is not regulated by the State of California, the quality of that water is still a concern to local health and planning agencies, and to State agencies charged with maintaining water quality.

The GAMA Domestic Well Project samples domestic wells in County “Focus” Areas. The County Focus Area is selected in cooperation with the local environmental health agency, using available knowledge of water quality and land use. Factors in the selection of a County Focus Area include:

- Relative reliance on water wells for domestic consumption
- Interest from local focus area participants
- Susceptibility of wells to contamination
- Availability of well records

Once a County Focus Area is selected, a pamphlet is mailed to domestic well owners requesting their participation. After written permission is received from the well owners, groundwater samples are collected and are tested by a certified laboratory at no expense to the well owners. The GAMA Domestic Well Project tests for chemicals that can be found in well water and can be of concern such as:

- Bacteria (Total and Fecal Coliform)
- General minerals (e.g., sodium, bicarbonate, calcium)
- General chemistry parameters (e.g., pH, TDS)
- Inorganics, including metals (such as lead, arsenic) and nutrients (nitrate)
- Organics (e.g., MTBE, PCE, toluene, benzene, and others)

Additional chemicals of concern can occur in groundwater in some areas of California, including alpha and beta radioactivity, perchlorate and pesticides amongst others.

Laboratory results are shared with each individual well owner and are used by GAMA to evaluate the quality of shallow groundwater used by private well owners. Participation is voluntary and the names and addresses of well owners are kept confidential.

Domestic Well Project - Work Completed and Current Status

Work is currently on-going as part of the Domestic Well Project. Since 2002, 1,067 domestic wells have been sampled in five County Focus Areas. Table C-1 summarizes the work that has been completed to date on the Domestic Well Project.

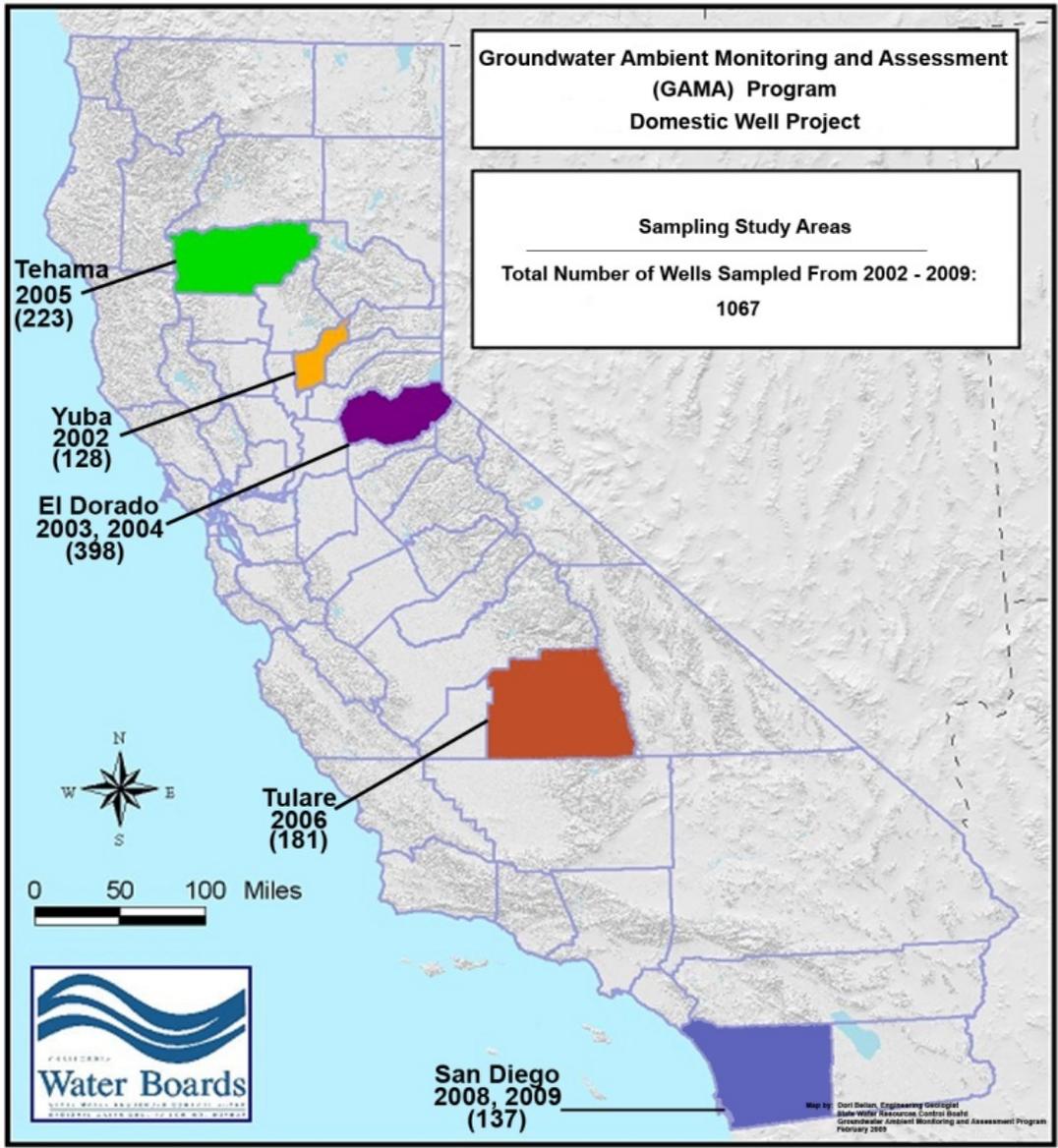
Table C-1 Domestic Well Project 2002-2009

| County Focus Area | Field Study Conducted | Sampling Status | Number of Wells Sampled | Data Verified and Uploaded to GeoTracker GAMA | Laboratory Analytical Reports Submitted to Well Owners | Data Summary Report Posted on GAMA Web Page |
|-------------------------------------|------------------------------|--|--|--|---|--|
| Yuba | 2002 | Completed | 128 | Completed | Completed | In Progress |
| El Dorado | 2003 - 2004 | Completed | 398 | Completed | Completed | Completed |
| Tehama | 2005 | Completed | 223 | Completed | Completed | Completed |
| Tulare | 2006 | Completed | 181 | Completed | Completed | In Progress |
| San Diego | 2008 - 2009 | Completed | 137 | Completed | Completed | In Progress |
| Summary | | | | | | |
| 5 County Focus Areas Sampled | 2002 to 2009 | In the Process of Selecting Next Focus Area | 1067 Domestic Wells Sampled to Date | Completed | Completed | In Progress |

Figure C-1 shows the locations of the County Focus Areas sampled from 2002-2009. Sampling results were verified and entered into the GeoTracker GAMA database. All well owners received test results and documents explaining the results. Where sampling results showed concentrations above a drinking water standard, the State Water Board recommended that the owner re-test the well water and to test annually thereafter.

A summary of results for each focus area is included in Table C-2. The quality of sampled domestic well water is evaluated by comparing test results to drinking water standards established by CDPH for public water supplies. Because CDPH does not regulate private domestic well water quality, drinking water standards are used for comparison purposes only.

Figure C-1 - GAMA Domestic Well Project County Focus Areas Sampled



Significant findings for each County Focus Area:

Yuba County

The Domestic Well Project sampled 128 domestic wells in Yuba County in 2002. The most common chemicals detected above drinking water standards in those wells were total coliform bacteria (31 of 128 wells), manganese (above the secondary contaminant level (SMCL) in 39 of 128 wells), aluminum (above the maximum contaminant level (MCL) in 25 of 128 wells), and iron (above the SMCL in 21 of 128 wells).

El Dorado County

The Domestic Well Project sampled 398 domestic wells in El Dorado County in 2003-04. The most common chemicals detected above drinking water standards those wells were total coliform bacteria (111 of 398 wells), iron (above the SMCL in 79 of 398 wells), and manganese (above the SMCL in 95 of 398 wells).

Tehama County

The Domestic Well Project sampled 223 domestic wells in Tehama County in 2005. The most common chemicals detected above drinking water standards in those wells were total coliform bacteria (56 of 223 wells), arsenic (above the MCL in 30 of 223 wells), and iron (above the SMCL in 31 of 223 wells).

Tulare County Focus

The Domestic Well Project sampled 181 domestic wells in Tulare County in 2006. The most common chemicals detected above drinking water standards those wells were nitrate (75 of 181 wells), total coliform bacteria (60 of 181 wells), fecal coliform bacteria (15 of 181 wells), vanadium (14 of 181 wells), and volatile organic compounds (10 of 181 wells). Tulare County had the highest percentage of any study area sampled to date, with concentrations of nitrate, total coliform bacteria, fecal coliform bacteria, and volatile organic compounds that exceeded CDPH health standards. Concentrations of nitrate exceeded the California MCL of 45 mg/L (as NO₃⁻) in over 40percent of the sampled wells. Dibromochloropropane (DBCP), a man-made pesticide, was detected in 22 of 181 samples (eight samples were above the MCL).

San Diego County

The Domestic Well Project sampled 137 domestic wells in San Diego County in 2008 and 2009. The most common chemicals of concern detected above drinking water standards in those wells were total coliform (34 of 137 wells), nitrate (above the MCL in 25 of 137 wells), gross alpha activity (above the MCL in 19 of 54 wells), and uranium (above the MCL in 16 of 54 wells).

Table C-2 GAMA Domestic Well Project Testing Results – Number of Samples Above CDPH Drinking Water Standards ¹

| <i>Compound</i> | <i>Drinking Water Standard</i> | Yuba (2002) 128 Wells | EI Dorado (2003-04) 398 Wells | Tehama (2005) 223 Wells | Tulare (2006) 181 Wells | San Diego (2008-09) 137 Wells | Cumulative Domestic Well Project Totals 1067 Wells |
|--|--------------------------------|--|----------------------------------|----------------------------|----------------------------|----------------------------------|---|
| BACTERIA INDICATORS | | | | | | | |
| Total Coliform | Present ³ | 31 (24%) | 111 (28%) | 56 (25%) | 60 (33%) | 34 (25%) | 282 (26%) |
| Fecal Coliform | Present ³ | 4 (3%) | 14 (4%) | 3 (1%) | 15 (8%) | NAS ² | 35 (3%) |
| GENERAL MINERALS & IONS | | | | | | | |
| Nitrate | 45 mg/L ³ | 2 (2%) | 7 (2%) | 2 (1%) | 75 (41%) | 25 (18%) | 111 (10%) |
| Perchlorate | 6 µg/L ³ | Not Sampled | Not Sampled | Not Sampled | 2 of 30 (7%) | 5 (4%) | 7 of 167 (4%) |
| Chloride | 500 mg/L ⁴ | NAS ² | NAS ² | NAS ² | NAS ² | 2 (1%) | 2 (<1%) |
| Sulfate | 500 mg/L ⁴ | NAS ² | NAS ² | NAS ² | NAS ² | 3 (2%) | 3 (<1%) |
| Total Dissolved Solids | 1,000 mg/L ³ | 2 (2%) | 5 (1%) | 5 (2%) | 4 (2%) | 22 (16%) | 41 (4%) |
| METALS | | | | | | | |
| Aluminum | 1,000 µg/L ³ | 25 (20%) | 12 (3%) | 6 (3%) | 2 (1%) | NAS ² | 38 (4%) |
| Arsenic | 10 µg/L ⁴ | 7 (5%) | 14 (4%) | 30 (14%) | 3 (2%) | 3 (2%) | 55 (5%) |
| Chromium | 50 µg/L ³ | 1 (<1%) | NAS ² | 1 (<1%) | 2 (1%) | NAS ² | 4 (<1%) |
| Iron | 300 µg/L ⁴ | 21 (17%) | 79 (20%) | 31 (14%) | 2 (1%) | NAS ² | 123 (12%) |
| Lead | 15 µg/L ^{5,6} | 2 (2%) | 3 (<1%) | 2 (1%) | NAS ² | NAS ² | 6 (<1%) |
| Manganese | 50 µg/L ⁴ | 39 (30%) | 95 (24%) | 19 (9%) | 2 (1%) | 45 (33%) | 178 (17%) |
| Vanadium | 50 µg/L ⁵ | NAS ² | NAS ² | NAS ² | 14 (8%) | 2 (1%) | 16 (1%) |
| Zinc | 5,000 µg/L ⁴ | NAS ² | 1 (<1%) | NAS ² | 1 (<1%) | 2 (1%) | 4 (<1%) |
| ORGANICS | | | | | | | |
| Volatile Organic Compounds | Varies by compound | NAS ² | 1 (<1%) | NAS ² | 10 (6%) | NAS ² | 11 (1%) |
| <i>Compound</i> | <i>Threshold Level</i> | Yuba (2002) 128 Wells | EI Dorado (2003-04) 398 Wells | Tehama (2005) 223 Wells | Tulare (2006) 181 Wells | San Diego (2008-09) 137 Wells | Cumulative Domestic Well Project Totals 1067 Wells |
| RADIONUCLIDES | | | | | | | |
| Gross Alpha | 15 pCi/L ³ | Radionuclides not routinely sampled in these Focus Areas | | | 3 of 13 wells | 19 of 54 wells | 22 of 67 (33%) |
| Radium 226+228 | 5 pCi/L ³ | | | | 1 of 13 wells | 2 of 54 wells | 3 of 67 (4%) |
| Uranium | 20 pCi/L ³ | | | | 1 of 13 wells | 16 of 54 wells | 17 of 67 (25%) |
| Notes: | | | | | | | |
| 1. Drinking water standards established by the California Department of Public Health (CDPH) are used for comparison purposes only, since domestic well water quality is not regulated. The MCL is the highest concentration of a contaminant allowed in public drinking water. "Primary" MCLs address health concerns. "Secondary" MCLs (SMCLs) address esthetics, such as taste and odor. Notification Levels (NLs) are health-based advisory levels for chemicals in public drinking water that have no regulatory standards. | | | | | | | |
| 2. None Above Standard: Domestic wells were analyzed for this chemical – however, the chemical was not observed at a concentration greater than a CDPH Drinking Water Standard. | | | | | | | |
| 3. MCL | | | | | | | |
| 4. SMCL | | | | | | | |
| 5. NL | | | | | | | |
| 6. NL cannot be exceeded in more than 10% of samples at the tap. | | | | | | | |

APPENDIX D – PRIORITY BASIN PROJECT DESCRIPTION

The GAMA Priority Basin Project was initiated in 2002 and provides an assessment of groundwater quality in key groundwater basins throughout the state. The project prioritizes groundwater basins based on groundwater use. The United States Geological Survey (USGS) is the project technical lead.

GAMA Priority Basins are made up of 116 of the 472 Department of Water Resources (DWR) defined groundwater basins in the state. GAMA Priority Basins are defined as groundwater basins that account for:

- 95percent of all public supply wells
- 99percent of all municipal groundwater pumping
- 90percent of agricultural groundwater withdrawals
- 90percent of all leaking underground storage tank sites
- 90percent of all pesticide application in the state
- 60percent of the land area in California

Many groundwater sources are located outside the boundaries of a DWR-defined groundwater basin. To address these drinking water sources, the GAMA Priority Basin Project has included areas outside basins, such as the Sierra Nevada region.

The Priority Basin Project divided the state into 35 high-use groundwater basin groups called “study units” (Figure D-1). Groundwater collected in each study unit was tested for hundreds of analytes, including those that are regulated by the CDPH (Title 22) as well as unregulated chemicals. The analytes are tested at detection levels well below those achieved by most laboratories. Table D-1 shows the comparison of typical Title 22 analyte laboratory method detection limits and the lower detection limits used in the Priority Basin Project. The advanced monitoring techniques used in the GAMA Project help to reveal emerging contaminants, and in turn, assist groundwater users and well owners in managing their groundwater resources.

Chemical constituents sampled by the GAMA Priority Basin Project include:

- Low-level Volatile Organic Compounds (VOCs)
- Low-level pesticides
- Stable Isotopes of oxygen and hydrogen
- Emerging Contaminants (pharmaceuticals, perchlorate, chromium VI)
- Carbon isotopes
- Radon, radium, and gross alpha/beta radioactivity
- Major ions and elements (calcium, magnesium, bicarbonate, etc.)
- Nutrients – including nitrate, nitrite, and phosphates.
- Total and fecal coliform bacteria

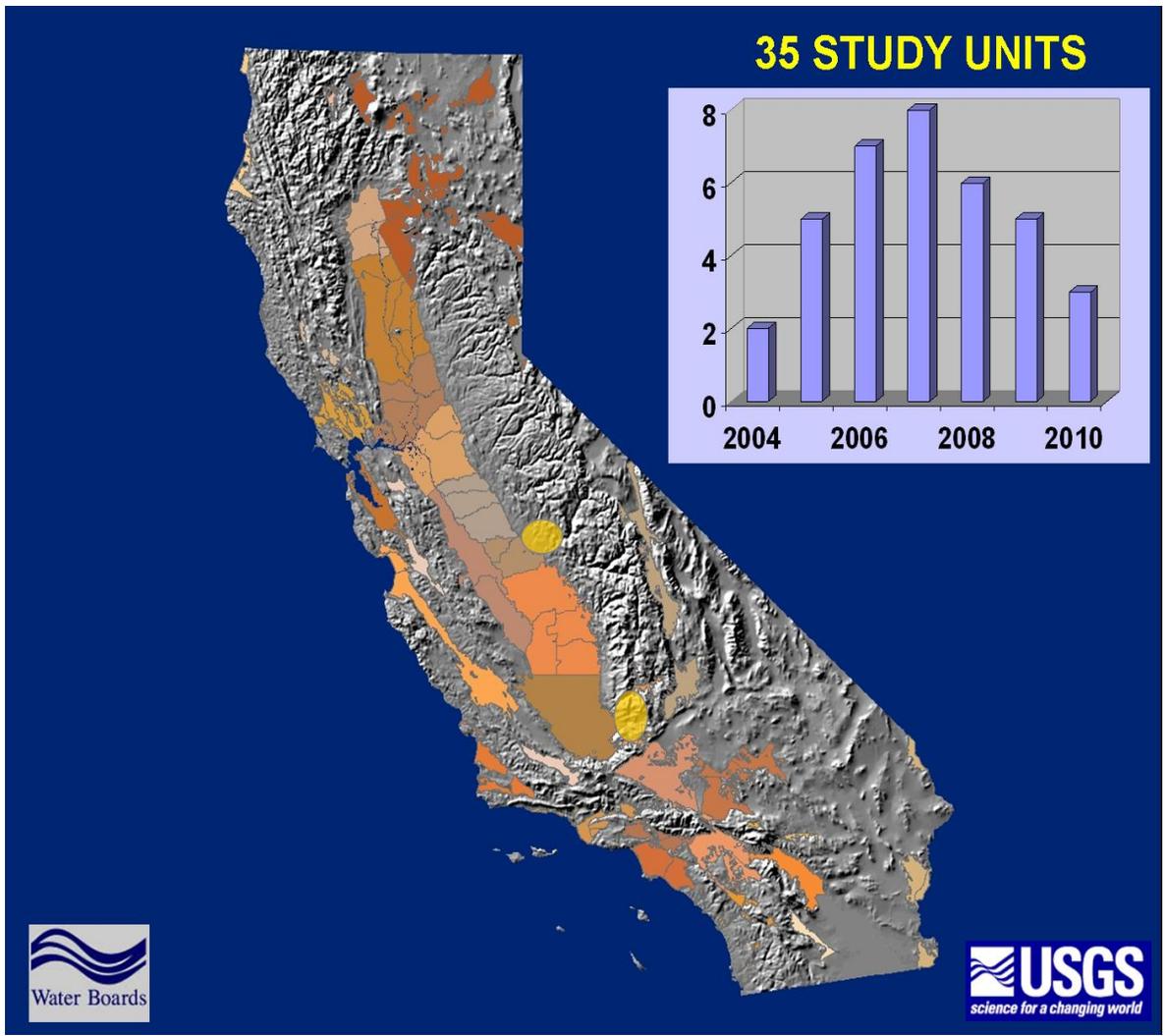


Figure D-1 GAMA Priority Basin Project Study Units

**Table D-1 Comparison of Title 22 and
GAMA**

| Constituent Class | DHS – Title 22 | | GAMA | |
|--|---------------------|------------------|---------------------|------------------|
| | Number of Compounds | Median DLR, µg/L | Number of Compounds | Median LRL, µg/L |
| Volatile organic compounds | 32 | 0.5 | 88 | 0.06 |
| Pesticides plus NDMA, 1,2,3-TCP | 34 | 1 | 142 | 0.012 |
| Inorganic (no major ions) | 28 | 5 | 28 | 0.02 |
| Radionuclide | 7 | 2* | 7 | 1* |
| Pharmaceutical Constituents | – | – | 10-20 | 0.021** |

* Picocuries per liter

** Method detection limit

Priority Basin Project – Work Completed and Current Status

Work was significantly delayed on the GAMA Priority Basin Project from December 2008 to Sept 2009, as a result of the stop-work order for bond funded projects.

As of mid-December, 2008 the Priority Basin Project completed the following:

- 50 public meetings held
- 1,703 well owner reports mailed
- 13 Data Reports Published (5 pending)
- 2 Scientific Investigation Reports in review (additional 4 are 80 percent complete)
- 1,986 wells sampled
- >1,200 participants including:
 - 208 districts
 - 159 cities
 - 80 schools

Table D-2 provides a summary of the work that has been completed, including sampling 27 study units located in 52 different counties and 83 different groundwater basins have been sampled. As of May 2009, two study units (Central Desert and Borrego) have been partially sampled due to the stop-work order. Sampling has not been conducted in 6 remaining study units. Figures D-2 and D-3 show the locations of the study units that were sampled to date (2002-2008). Figure D-4 shows the locations of the study units that have yet to be sampled.

Table D-2 Summary of Sampling Conducted from 2004 to 2008, Priority Basin Project

| | Study Unit | Kickoff Meeting | Last Sample Collected | # Wells sampled | Well Owner Report | Wrap Up Meeting | Data Report Published | SIR Status | Trends (3 year resample) | # Wells sampled | |
|----|-------------------------------------|-----------------|-----------------------|-----------------------------|-------------------|-----------------|-----------------------------------|------------|--------------------------|-----------------|--|
| 1 | San Diego | 6/14/04 | 7/29/04 | 58 | 5/1/05 | 5/20/05 | 11/1/05 | | 9/27/07 | 22 | |
| 2 | North San Francisco Bay | 9/21/04 | 11/18/04 | 97 | 9/1/05 | 9/29/05 | 6/12/06 | 80% | 11/16/07 | 28 | |
| 3 | Northern San Joaquin Basins | 11/1/04 | 2/18/05 | 67 | 9/27/06 | 1/18/06 | 11/3/06 | in review | 4/3/08 | 5 | |
| 4 | Southern Sacramento Valley | 3/3/05 | 6/15/05 | 96 | 4/1/06 | 4/19/06 | 1/30/08 | | 4/10/08 | 7 | |
| 5 | Upper Los Angeles Basin | 6/29/05 | 7/20/05 | 52 | 3/8/07 | 3/28/07 | 10/17/08 | | 6/17/08 | 6 | |
| 6 | Salinas/Monterey | 6/1/05 | 9/23/05 | 97 | 12/1/06 | 12/13/06 | 7/2/07 | | 11/14/08 | 13 | |
| 7 | Southeast San Joaquin Valley | 9/22/05 | 12/15/05 | 126 | 4/25/07 | 4/25/07 | 9/25/08 | 70% | 11/4/08 | 13 | |
| 8 | Kern Basin | 12/13/05 | 3/2/06 | 64 | 4/27/07 | 4/27/07 | 7/15/08 | | | | |
| 9 | Central Eastside San Joaquin Valley | 2/1/06 | 6/11/06 | 79 | 5/9/07 | 5/23/07 | 4/16/08 | in review | | | |
| 10 | Central Sierras | 4/11/06 | 5/31/06 | 30 | 2/1/08 | 6/6/07 | 5/22/08 | | | | |
| 11 | Southern Sierras | 5/31/06 | 6/30/06 | 50 | 5/22/07 | 6/12/07 | 10/24/07 | 80% | | | |
| 12 | Central Sacramento Valley | 6/21/06 | 8/25/06 | 108 | 1/14/08 | 3/9/07 | 12/31/08 | | | | |
| 13 | Southern Cal Coastal Plain | 7/10/06 | 11/16/06 | 69 | 7/13/07 | 7/25/07 | 12/5/08 | | | | |
| 14 | Owens | 8/22/06 | 12/14/06 | 108 | 9/26/07 | 11/16/07 | 99% | 80% | | | |
| 15 | Santa Ana | 10/26/06 | 3/28/07 | 99 | 9/21/07 | 10/4/07 | 99% | | | | |
| 16 | Coachella | 2/13/07 | 3/29/07 | 35 | 11/29/07 | 11/29/07 | 99% | | | | |
| 17 | Santa Clara River (Ventura) | 3/1/07 | 6/7/07 | 54 | 12/4/07 | 1/31/08 | 99% | 90% | | | |
| 18 | SF Bay | 4/6/07 | 6/21/07 | 79 | 1/30/08 | 2/22/08 | 99% | | | | |
| 19 | Tahoe | 6/20/07 | 9/20/07 | 52 | 5/8/08 | 5/27/08 | | | | | |
| 20 | Northern Sacramento Valley | 9/26/07 | 1/17/08 | 66 | 7/14/08 | 9/16/08 | | | | | |
| 21 | Colorado River | 9/26/07 | 12/20/07 | 28 | 5/1/08 | 5/15/08 | | | | | |
| 22 | Antelope Valley | 1/9/08 | 4/10/08 | 57 | | | | | | | |
| 23 | Mojave | 1/10/08 | 4/2/08 | 59 | 8/22/08 | 12/10/08 | | | | | |
| 24 | Madera-Chowchilla | 3/25/08 | 5/22/08 | 35 | | | | | | | |
| 25 | South Coast Ranges Coastal | 4/30/08 | 11/19/08 | 70 | | | | | | | |
| 26 | Sierra Regional | 5/27/08 | 10/22/08 | 84 | | | | | | | |
| 27 | South Coast Ranges Interior | 8/6/08 | 11/17/08 | 54 | | | | | | | |
| 28 | Central Desert, Borrego, Low-Use | 12/3/08 | SWO | 19 | | | | | | | |
| 29 | Western San Joaquin | | | | | | 13 Data Reports Published | | | | |
| 30 | North Coast Ranges Coastal | | | | | | 2 SIR in review | | | | |
| 31 | North Coast Ranges Interior | | | | | | | | | | |
| 32 | Klamaths | | | | | | | | | | |
| 33 | Cascades/Modoc | | | | | | | | | | |
| 34 | Big Bear | | | | | | | | | | |
| | | | | Wells Sampled: 1,892 | | | | | Wells Sampled: 94 | | |
| | | | | | | | Total Wells Sampled: 1,986 | | | | |

Figure D-2 GAMA Priority Basin Study Units Sampled from 2004-2006

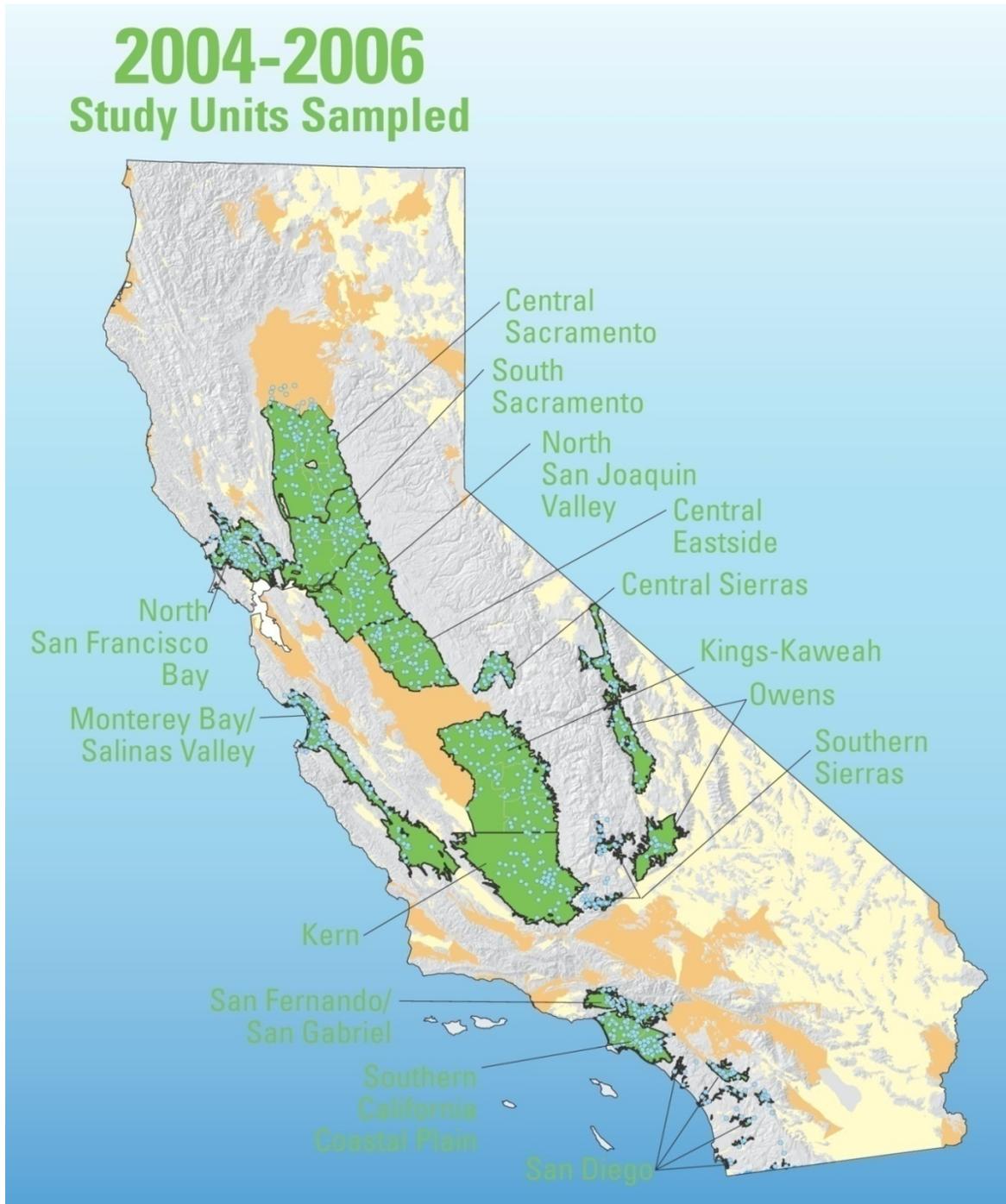


Figure D-3 GAMA Priority Basin Study Units Sampled from 2007-2008

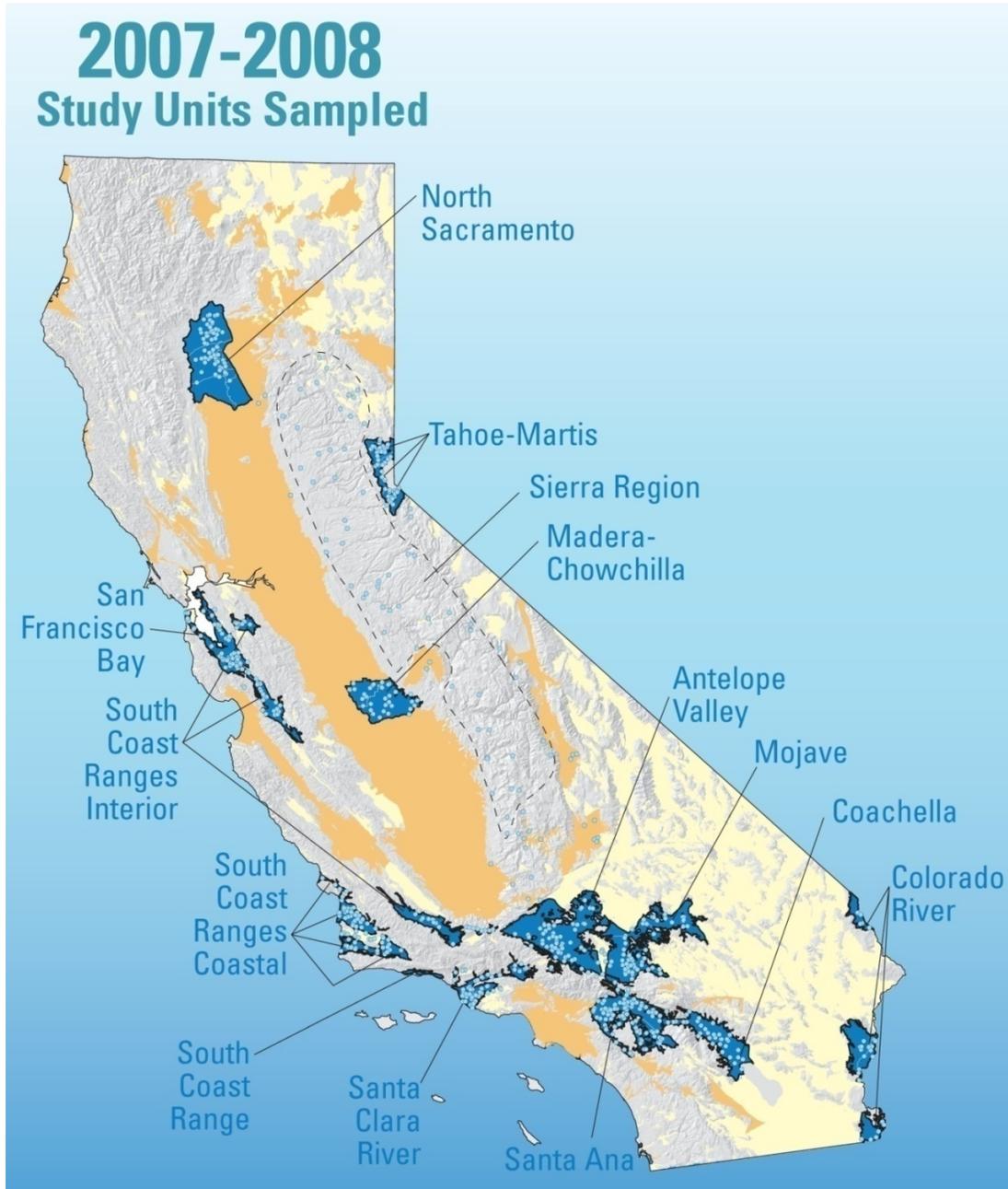
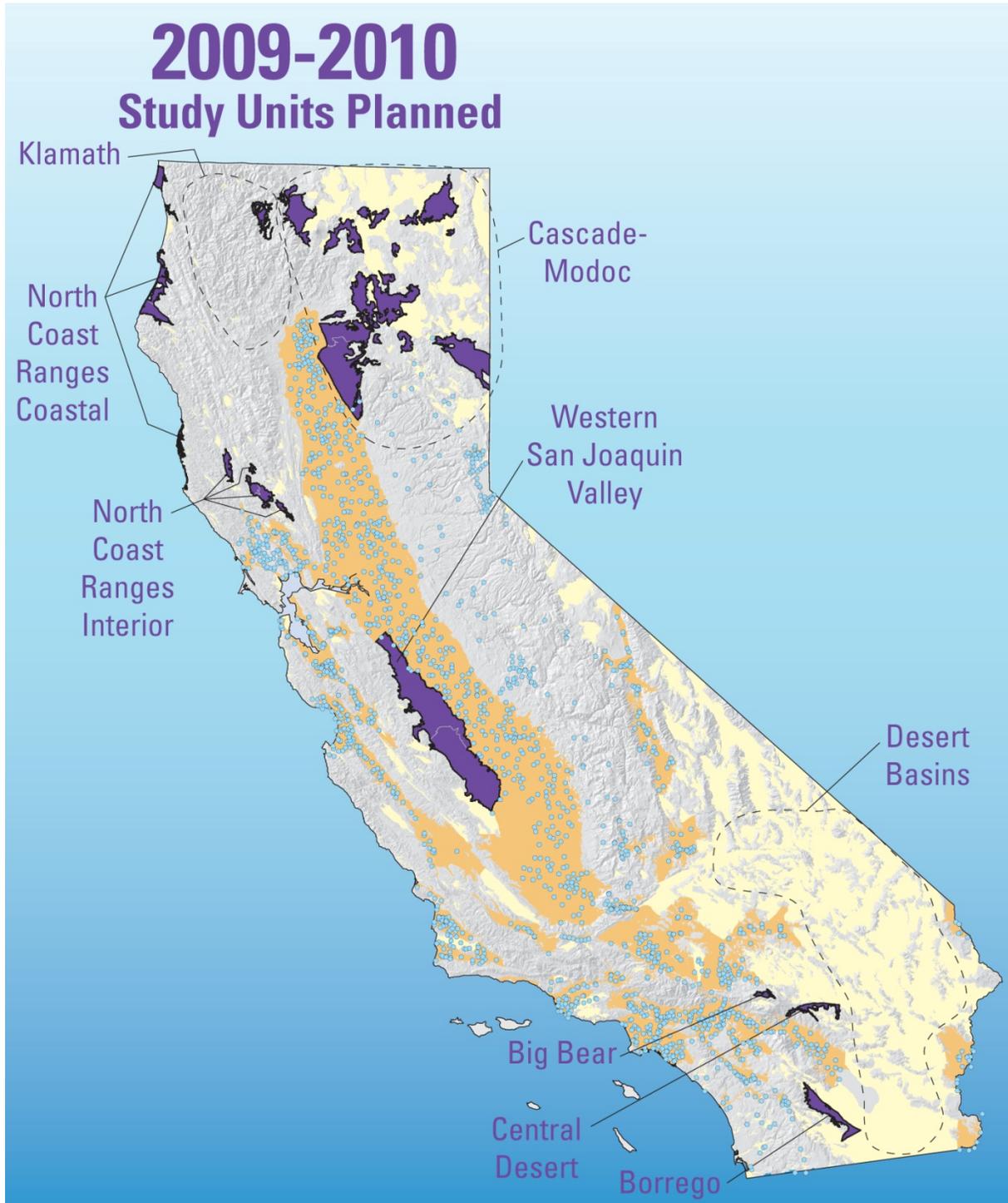


Figure D- 4 GAMA Priority Basin Study Units Planned to be sampled in 2009-2010



APPENDIX E – SPECIAL STUDIES PROJECT DESCRIPTION

The GAMA Special Studies Project looks at several aspects of groundwater quality, and address the need for better groundwater characterization tools and the impacts of basin management decisions on groundwater quality. The State Water Board partners with Lawrence Livermore National Laboratory (LLNL) to conduct research on nitrate sources to groundwater, wastewater indicators in recycled irrigation water, groundwater age, groundwater recharge, and other areas of interest. As the project technical lead, LLNL conducted special studies that:

- Help our understanding in the source, fate and transport and occurrence of chemicals that can affect groundwater quality.
- Address important and emerging statewide groundwater quality issues using innovative, cutting-edge technology.
- Assess nitrate in groundwater, and include efforts to distinguish between natural, septic, fertilizer and dairy sources.
- Study wastewater indicators in recycled irrigation water and in domestic wells.

Special Studies Project - Work Completed and Current Status

Work is currently on-going as part of the Special Studies Project. The stop-work order issued in mid December 2008 did not affect the scope of work or schedule.

Some of the Special Studies Projects that have been completed are highlighted below.

Nitrate and Nitrogen

LLNL has managed several studies on the behavior and effects of nitrate in groundwater. These studies have used advanced isotopic techniques to determine sources of nitrate in groundwater, and to evaluate how nitrate in groundwater can transform (denitrify) through time. Study subjects have included:

- Dairies and Nitrate
- Nitrate sources, fate, and transport
- Effects of nitrate management plans on groundwater quality; Llagas and Chico Basins
- Fate, transport, and relation to land use; Orange County and Livermore, CA
- Septic Systems and recycled water, Gilroy and Livermore, CA

Groundwater Age Dating

Groundwater age dating helps evaluate whether drinking water supplies are susceptible to contamination. Younger groundwater is typically more susceptible to contamination than older groundwater. LLNL scientists use naturally occurring forms of helium and hydrogen in groundwater to measure the age of that groundwater.

Groundwater Recharge

LLNL is currently investigating characteristics of groundwater recharge. These studies will help determine the origin of groundwater, when that groundwater first entered the ground and potential contributors to existing groundwater contamination.

Endocrine Disruptor Analysis Development

Endocrine disruptors are chemicals that can mimic and interfere with hormones in animals. Endocrine disruptors have been detected at very low concentrations in some surface and groundwater in California. A team of UC Davis scientists are developing a method employing species of fish (*Medaka*) as a biologically-based screening tool that could be used to detect the presence of endocrine disruptors in water.

Future Special Studies Projects

Currently proposed Special Studies projects include:

- Nitrate in California groundwater
- Surface water-groundwater interaction and nitrate in Central Coast streams
- Wastewater Indicators in Groundwater
- Development of new wastewater indicator methods
- Expanded support for Domestic Wells Project
- Groundwater Recharge and Transport (development of a new short-term tracer for managed aquifer recharge)
- Preparation of GAMA Special Studies Fact Sheets

APPENDIX F – GAMA PROGRAM SIGNIFICANT FINDINGS AND ACCOMPLISHMENTS

Domestic Well Project

- Nitrate detections in domestic wells illustrate the high susceptibility of shallow groundwater to nitrate contamination and the need to better characterize this shallow groundwater resource.
- Coliform bacteria were the most frequently observed contaminant in domestic wells, and were present in 26 percent of the sampled wells. Detection of coliform bacteria indicates a possible connection between surface activities, well construction issues (i.e., a poor or cracked surface seal), and water quality.
- Elevated detections of chemicals such as perchlorate, uranium and other radionuclides in domestic well water indicate a possible relationship between human-related surface activities and groundwater quality. Uranium and other radionuclides were frequently detected at levels greater than drinking water standards; however, these compounds can occur naturally.

Priority Basins and Special Studies Projects

- The use of groundwater age-dating and low-level VOC occurrence has been pioneered by GAMA to assess the susceptibility of California's public-supply drinking water wells to contamination.
- Age dating results show that much of the groundwater pumped for California's public drinking water supply has recharged post urban and agricultural development after World War II (1945).
- Low-level VOC results show that an aquifer's susceptibility to contamination can vary widely. Many coastal aquifers are completely free of VOCs and other contaminants. Central Valley aquifers tend to be much more susceptible to surface contaminants.
- New analytical methods for detection of emerging contaminants in groundwater have been developed by GAMA (wastewater indicators, pharmaceuticals and endocrine disrupting chemicals).
- Significant attenuation (depletion) of most wastewater-associated emerging contaminants has been determined to happen during groundwater recharge and transport.
- Wastewater compounds have been identified that do not significantly attenuate (deplete) and will be useful as tracers of wastewater recharge in future studies.
- State-of-the-art tools have been used to assess nitrate in groundwater, including isotopic characterization of nitrate and water, quantification of denitrification, groundwater age dating and low-level detection of nitrate co-contaminants.
- Innovative tools for collecting, analyzing and interpreting dissolved gases in groundwater have been developed by GAMA. These tools are used to evaluate

groundwater recharge sources and mechanisms, and to quantify nitrate degradation in aquifers.

- New tracers for managing aquifer recharge have been developed by GAMA. These tracers allow better understanding of residence times of reclaimed water in the subsurface and of water quality changes associated with artificial recharge.
- Numerous public meetings have been held that involve GAMA scientists, public and private agencies, well owners and media. These meetings have helped to educate citizens of California about water quality and existing or potential threats to groundwater.

GeoTracker GAMA

- One of the main goals of Chapter 522/2001 was achieved: “Design a database capable of supporting the monitoring program that is compatible with the State Board’s GeoTracker database”.
- The public internet site provides user-friendly access to several sources of groundwater quality information.
- Data sets from the California Department of Public Health, US Geological Survey, Lawrence Livermore National Laboratories, Department of Water Resources, Department of Pesticide Regulation, Regional Water Quality Control Boards and the State Water Board have been standardized into one searchable data set.
- Tools and tutorials have been developed to help analyze GeoTracker GAMA data. These tools include data querying based on chemical of interest within a region of interest and links to published water quality reports and relevant websites.
- Information and answers to groundwater quality have been provided by analyzing tens of millions of groundwater quality results that represent more than 100,000 well locations.