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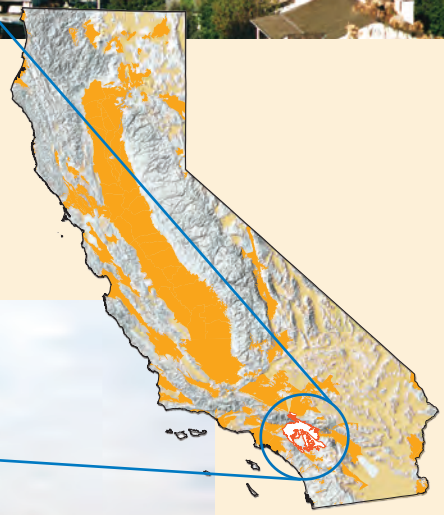
Ground-Water Quality Data in the Upper Santa Ana Watershed Study Unit, November 2006–March 2007: Results from the California GAMA Program



Data Series 404

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Cover:
Upper photo: Urban development overlooking the Santa Ana River near Yorba Linda. (Photo credit: Phil Contreras, U.S. Geological Survey, 1998)

Lower photo: Production well in Riverside County (Photo credit: Mike Judd, U.S. Geological Survey, 2007)

Ground-Water Quality Data in the Upper Santa Ana Watershed Study Unit, November 2006–March 2007: Results from the California GAMA Program

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U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Suzette M. Kimball, Acting Director

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Abbreviations and Acronyms

AB	Assembly Bill (through the California State Assembly)
CAS	Chemical Abstracts Service (American Chemical Society)
CSU	combined standard uncertainty
E	estimated or having a higher degree of uncertainty
GAMA	Groundwater Ambient Monitoring and Assessment program
GPS	Global Positioning System
HAL-US	Lifetime Health Advisory Level (USEPA)
HPLC	high-performance liquid chromatography
LRL	laboratory reporting level
LT-MDL	long-term method detection level
MCL-CA	maximum contaminant level (CDPH)
MCL-US	maximum contaminant level (USEPA)
MDL	method detection limit
MRL	minimum reporting level
MU	method uncertainty
N	Normal (1-gram-equivalent per liter of solution)
na	not available
nc	sample not collected
NL-CA	California notification level (CDPH)
NWIS	National Water Information System (USGS)
PCFF-GAMA	personal computer field forms program designed for GAMA sampling
QC	quality control
RPD	relative percent difference
RSD	relative standard deviation
RSD5	risk-specific dose at 10^{-5} (USEPA)
SMCL-CA	secondary maximum contaminant level (CDPH)
SMCL-US	secondary maximum contaminant level (USEPA)
SSMDC	sample-specific minimum detectable concentration
TML	Trace Metal Laboratory
TT-US	Treatment Technique (USEPA)
US	United States
USAW	Upper Santa Ana Watershed GAMA study unit
V	analyte was detected in sample and an associated blank; thus, data are not included in ground-water quality assessment

Abbreviations and Acronyms—Continued

Organizations

CDPH	California Department of Public Health
DWR	California Department of Water Resources
LLNL	Lawrence Livermore National Laboratory
MWH	Montgomery Watson-Harza Laboratory
NAWQA	National Water Quality Assessment (USGS)
NWQL	National Water Quality Laboratory (USGS)
SWRCB	State Water Resources Control Board (California)
USEPA	U.S. Environmental Protection Agency
USGS	U. S. Geological Survey

Selected Chemical Names

$CaCO_3$	calcium carbonate
CO_3^{-2}	carbonate
DOC	dissolved organic carbon
HCl	hydrochloric acid
HCO_3^-	bicarbonate
MTBE	methyl *tert*-butyl ether
NDMA	*N*-nitrosodimethylamine
PCE	tetrachloroethene
TCP	trichloropropane
TDS	total dissolved solids
VOC	volatile organic compound

Units of Measure

cm^3 STP/g	cubic centimeters at standard temperature and pressure (0 degrees Celsius and 1 atmosphere of pressure per gram of water)
ft	foot (feet)
L	liter
mg	milligram
mg/L	milligrams per liter
mi^2	square mile
mL	milliliter
µg/L	micrograms per liter
µL	microliter
µm	micrometer
pCi/L	picocuries per liter
$\delta^i E$	delta notation, the ratio of a heavier isotope of an element (^iE) to the more common lighter isotope of that element, relative to a standard reference material, expressed in per mil (per thousand)

Abbreviations and Acronyms—Continued

Notes

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F = (1.8 \times °C) + 32$$

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25°C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

Ground-Water Quality Data in the Upper Santa Ana Watershed Study Unit, November 2006–March 2007: Results from the California GAMA Program

By Robert Kent and Kenneth Belitz

Abstract

Ground-water quality in the approximately 1,000-square-mile Upper Santa Ana Watershed study unit (USAW) was investigated from November 2006 through March 2007 as part of the Priority Basin Project of the Groundwater Ambient Monitoring and Assessment (GAMA) Program. The GAMA Priority Basin project was developed in response to the Groundwater Quality Monitoring Act of 2001, and is being conducted by the U.S. Geological Survey (USGS) in cooperation with the California State Water Resources Control Board (SWRCB).

The Upper Santa Ana Watershed study was designed to provide a spatially unbiased assessment of raw ground-water quality within USAW, as well as a statistically consistent basis for comparing water quality throughout California. Samples were collected from 99 wells in Riverside and San Bernardino Counties. Ninety of the wells were selected using a spatially distributed, randomized grid-based method to provide statistical representation of the study unit (grid wells). Nine wells were selected to provide additional understanding of specific water-quality issues identified within the basin (understanding wells).

The ground-water samples were analyzed for a large number of organic constituents (volatile organic compounds [VOCs], pesticides and pesticide degradates, pharmaceutical compounds, and potential wastewater-indicator compounds), constituents of special interest (perchlorate, *N*-nitrosodimethylamine [NDMA], 1,4-dioxane, and 1,2,3-trichloropropane [1,2,3-TCP]), naturally occurring inorganic constituents (nutrients, major and minor ions, and trace elements), radioactive constituents, and microbial indicators. Naturally occurring isotopes (tritium, carbon-14, and stable isotopes of hydrogen and oxygen in water) and dissolved noble gases also were measured to help identify sources and ages of the sampled ground water. Dissolved gases, and isotopes of nitrogen gas and of dissolved nitrate also were measured in order to investigate the sources and occurrence of nitrate in the study unit. In total, nearly 400 constituents and water-quality indicators were investigated for this study.

This study did not attempt to evaluate the quality of water delivered to consumers; after withdrawal from the ground, water typically is treated, disinfected, and (or) blended with other waters to maintain acceptable water quality. Regulatory thresholds apply to treated water that is served to the consumer, not to raw ground water. However, to provide some context for the results, concentrations of constituents measured in the raw ground water were compared with regulatory and non-regulatory health-based thresholds established by the U.S. Environmental Protection Agency (USEPA) and the California Department of Public Health (CDPH) and thresholds established for aesthetic concerns (secondary maximum contaminant levels, SMCL-CA) by CDPH.

Volatile organic compounds (VOCs) were detected in more than 80 percent of USAW grid wells. Most VOCs detected were at concentrations far less than thresholds established for drinking water to protect human health; however, six wells had VOC concentrations above health-based thresholds. Twenty-four of the 85 VOCs investigated were detected in the study unit;11 were detected in more than 10 percent of the wells. The VOCs detected above health-based thresholds in at least one well were dibromochloropropane (DBCP), tetrachloroethene (PCE), trichloroethene (TCE), carbon tetrachloride, and 1,1-dichoroethene.

Pesticide compounds were detected in more than 75 percent of the grid wells. However, of the 134 different pesticide compounds investigated, 13 were detected at concentrations greater than their respective long-term method detection limits, and only 7 compounds (all herbicides or herbicide degradates) were detected in more than 10 percent of the wells. No pesticide compound was detected above its health-based threshold, although thresholds exist for fewer than half of the pesticide compounds investigated.

Samples were analyzed for a suite of 69 chemicals identified as “potential wastewater indicators.” However, data for this suite of chemicals are not presented in this report because inconsistent results for quality-control samples collected and analyzed using this analytical method suggested that the results were unreliable.

Samples were analyzed for 14 pharmaceutical compounds. Four compounds were detected in ground-water samples, but no compound was detected in more than five samples. All pharmaceutical compound concentrations were low compared to their typical prescription dosages.

Samples were analyzed for about 50 inorganic constituents. These include nutrients, major and minor ions, and trace elements, most of which occur naturally in ground water. Nitrate, a nutrient species of nitrogen, was detected at concentrations above its health-based threshold in 29 percent of the grid wells for which it was sampled. Concentrations of other forms of nitrogen detected were below health-based thresholds. Concentrations of total dissolved solids were greater than thresholds set for aesthetic concerns in nearly 40 percent of the wells for which total dissolved solids were sampled. Concentrations of chloride and sulfate were greater than such aesthetic thresholds in 3 wells and 1 well, respectively. Concentrations of all trace elements detected in samples from USAW wells were below health-based thresholds, except arsenic (above a threshold in 2 wells), boron (1 well), molybdenum (2 wells) and vanadium (2 wells). Concentrations of two additional trace elements—iron and manganese—were greater than their non-enforceable thresholds set for aesthetic concerns in 1 and 2 wells, respectively. Perchlorate, an inorganic constituent of special interest, was detected in two-thirds of the wells, and 11 wells contained perchlorate concentrations at or above its health-based threshold.

Radon-222 activities in more than half of the wells sampled for this radioactive isotope were above the proposed USEPA maximum contaminant level (MCL-US), but none were above the proposed alternative MCL-US. All other detections of radioactive constituents were below health-based thresholds except one gross-alpha measurement of 17.3 picocuries per liter (72-hour count). Total coliforms, a bacterial indicator, were detected in 1 out of 32 wells for which total coliforms were sampled.

Introduction

Ground water comprises nearly half of the water used for public supply in California (Hutson and others, 2004). To assess the quality of ground water in aquifers used for drinking-water supply and establish a program for monitoring trends in ground-water quality, the State Water Resources Control Board (SWRCB), in collaboration with the U.S. Geological Survey (USGS) and Lawrence Livermore National Laboratory (LLNL), implemented the Groundwater Ambient Monitoring and Assessment (GAMA) Program (http://www.waterboards.ca.gov/gama). The GAMA program consists of three projects: Priority Basin, conducted by the USGS (http://ca.water.usgs.gov/gama/); Voluntary Domestic Well Assessment, conducted by the SWRCB; and Special Studies, conducted by LLNL.

The SWRCB initiated the GAMA Priority Basin project in response to the Ground-Water Quality Monitoring Act of 2001 (Sections 10780-10782.3 of the California Water Code, Assembly Bill 599). AB 599 is a public mandate to assess and monitor the quality of ground water used as public supply for municipalities in California. The project is a comprehensive assessment of statewide ground-water quality designed to help better understand and identify risks to ground-water resources and to increase the availability of information about ground-water quality to the public. As part of the AB 599 process, the USGS, in collaboration with the SWRCB, developed the monitoring plan for the project (Belitz and others, 2003; State Water Resources Control Board, 2003). A key aspect of the project is inter-agency collaboration and cooperation with local water agencies and well owners. Local participation in the project is entirely voluntary.

The GAMA Priority Basin project is unique because the data collection methods include analyses that can detect an extensive number of chemical constituents at very low concentrations, analyses that are not normally available. A broader understanding of ground-water composition will be especially useful for providing an early indication of changes in water quality and for identifying the natural and human factors affecting water quality. Additionally, the GAMA Priority Basin Assessment project will analyze a suite of constituents more extensive than that required by the California Department of Public Health (CDPH). An understanding of the occurrence and distribution of these constituents is important for the management and protection of ground-water resources.

The range of hydrologic, geologic, and climatic conditions that exist in California must be considered in an assessment of ground-water quality. Belitz and others (2003) partitioned the state conceptually into 10 hydrogeologic provinces (fig. 1), each with distinctive hydrologic, geologic, and climatic characteristics, and representative regions in all 10 provinces were included in the project design. Eighty percent of California's approximately 16,000 public-supply wells are located in ground-water basins within these hydrologic provinces. These ground-water basins, defined by the California Department of Water Resources, generally consist of fairly permeable, unconsolidated deposits of alluvial or volcanic origin (California Department of Water Resources, 2003). Ground-water basins were prioritized for sampling on the basis of the number of public-supply wells in the basin, with secondary consideration given to municipal ground-water use, agricultural pumping, the number of formerly leaking underground fuel tanks, and pesticide applications within the basins (Belitz, and others, 2003).

Figure 1. Hydrogeologic provinces of California and the location of the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study unit, California.

In addition, some ground-water basins or groups of adjacent similar basins with relatively few public-supply wells were assigned high priority so that all hydrogeologic provinces would be represented in the subset of basins sampled. The 116 priority basins were grouped into 35 study units. Some areas not in the ground-water basins were included in several of the study units to represent the 20 percent of public-supply wells not located in the ground-water basins. The Upper Santa Ana Watershed GAMA study unit, hereinafter referred to as USAW, contains three ground-water basins. The largest of these 3 basins—the Upper Santa Ana Valley Groundwater Basin—contains 9 subbasins recognized by the California Department of Water Resources. The USAW study unit lies within the Transverse and Selected Peninsular Ranges hydrogeologic province (fig. 1) (Belitz, and others, 2003).

Three types of water-quality assessments are being conducted using the data collected in each study unit: (1)*Status*: assessing the current quality of the ground-water resource, (2) *Trends*: detection of changes in ground-water quality, and (3) *Understanding*: identifying the natural and human factors affecting ground-water quality (Kulongoski and Belitz, 2004). This report is one of a series of reports presenting the *status* of current water quality conditions in each study unit; previous reports in the series include Wright and others (2005), Kulongoski and others (2006), Bennett and others (2006), Kulongoski and Belitz (2007), Fram and Belitz (2007), Dawson and others (2008), Landon and Belitz (2008), and Ferrari and others (2008). Subsequent interpretive reports will address the *trends* and *understanding* aspects of the water-quality assessments.

Purpose and Scope

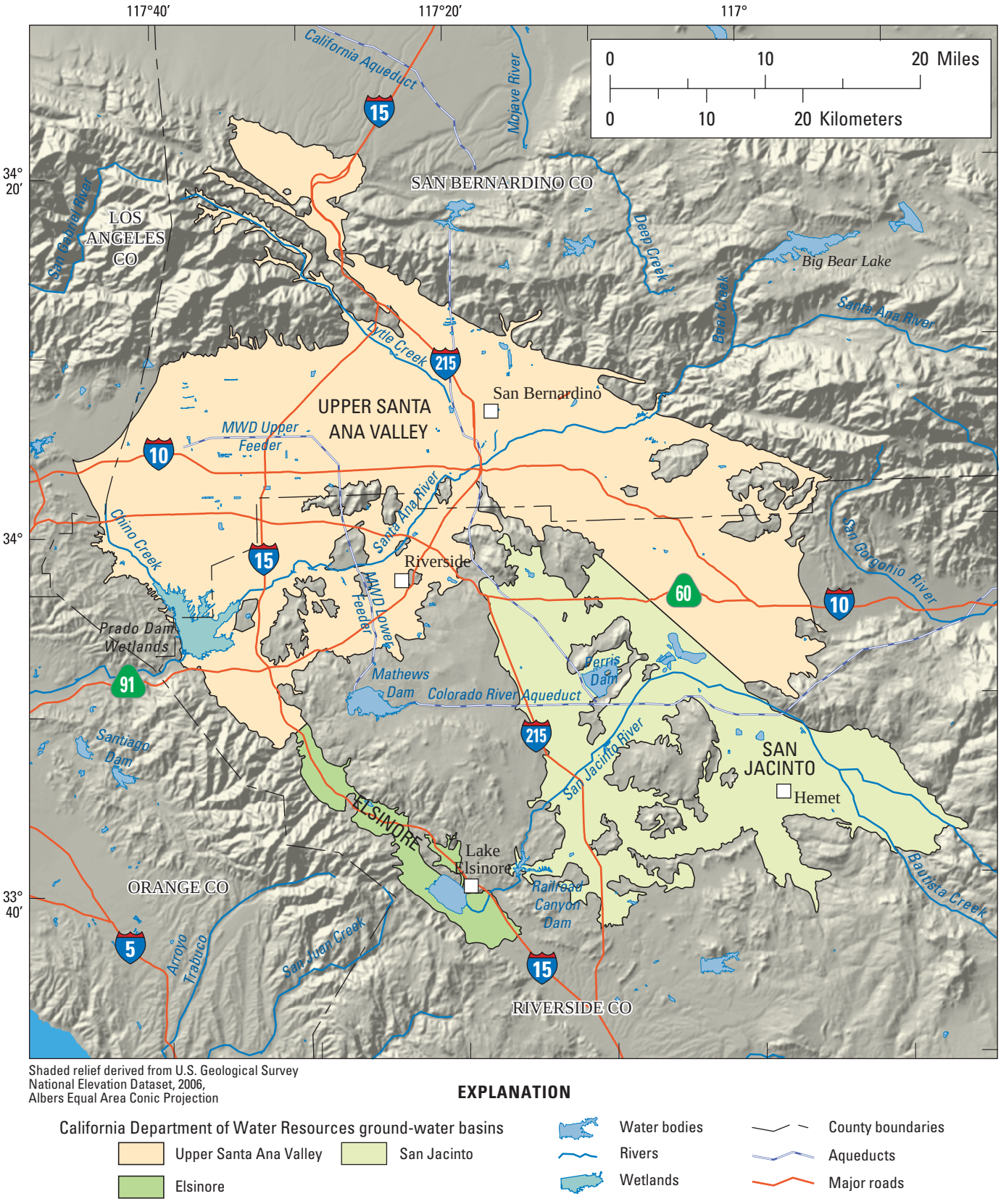
The purposes of this report are (1) to describe the study design and study methods, (2) to present the results of quality-control tests, and (3) to present the analytical results for ground-water samples collected in USAW. Ground-water samples were analyzed for organic, inorganic, and microbial constituents, water-quality indicators, and chemical tracers. The chemical and microbial data presented in this report were evaluated by comparing them to state and federal drinking water regulatory and other health-based standards that are applied to treated drinking water. Regulatory thresholds considered for this report are those established by the United States Environmental Protection Agency (USEPA) and the California Department of Public Health (CDPH). The data presented in this report are intended to characterize the quality of untreated ground-water resources within the study unit, not the treated drinking water delivered to consumers by water purveyors. Discussions of the factors that influence the distribution and occurrence of the constituents detected in ground-water samples will be the subject of subsequent publications.

Hydrogeologic Setting

The Upper Santa Ana Watershed study unit (USAW) covers approximately 1,000 square-miles in Riverside and San Bernardino Counties, California (fig. 2), and lies within the Transverse Ranges and Selected Peninsular Ranges hydrogeologic province (fig. 1). USAW includes three ground-water basins, as defined by the California Department of Water Resources (DWR) (fig. 2) (California Department of Water Resources, 2003, 2006a, 2006b): San Jacinto, Elsinore, and the Upper Santa Ana Valley. The Upper Santa Ana Valley Groundwater Basin includes nine subbasins defined by DWR (fig. 3): Bunker Hill, Cajon, Rialto-Colton, Chino, Cucamonga, Yucaipa, San Timoteo, Riverside-Arlington, and Temescal (California Department of Water Resources, 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2004g, 2006c, 2006d).

The area encompassed by USAW has also been divided into 36 Groundwater Management Zones using recently obtained hydrogeochemical data and ground-water management objectives (Wildermuth Environmental Inc., 1999; Wildermuth Environmental Inc., 2000). The Santa Ana Regional Water Quality Control Board has adopted these Management Zone delineations by amendment (California Regional Water Quality Control Board, 2004) to their Water Quality Control Plan (California Regional Water Quality Control Board, Santa Ana Region, 1995).

Topography in the USAW region varies from about 500 ft above sea level in the area around Prado Dam in Corona to over 10,000 ft in the San Bernardino Mountains near Big Bear Lake (fig. 2). Most of the valley floors are less than 2,000 ft above sea level in all three ground-water basins in the study unit. The 65 grid wells sampled in the Upper Santa Ana Valley Groundwater Basin (figs. 2 and 3) are located at altitudes between 600 and 3,700 ft. An understanding well was sampled in the mountains approximately 2.5 miles northeast of this basin at an altitude of almost 5,000 ft. The four grid wells sampled in the Elsinore Groundwater Basin are at altitudes between 1,250 and 1,300 ft. Altitudes of the 21 grid wells sampled in the San Jacinto Groundwater Basin varied between about 1,450 and 1,650 ft. The climate of the USAW region is Mediterranean, with hot, dry summers and cool, wet winters. Average annual precipitation ranges from 10 to 24 inches in the valleys and from 24 to 48 inches in the mountains.



Shaded relief derived from U.S. Geological Survey National Elevation Dataset, 2006, Albers Equal Area Conic Projection

EXPLANATION

California Department of Water Resources ground-water basins

- Upper Santa Ana Valley
- San Jacinto
- Elsinore

- Water bodies
- Rivers
- Wetlands
- County boundaries
- Aqueducts
- Major roads

Figure 2. California Department of Water Resources defined ground-water basins and major hydrologic features in the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study unit, California.

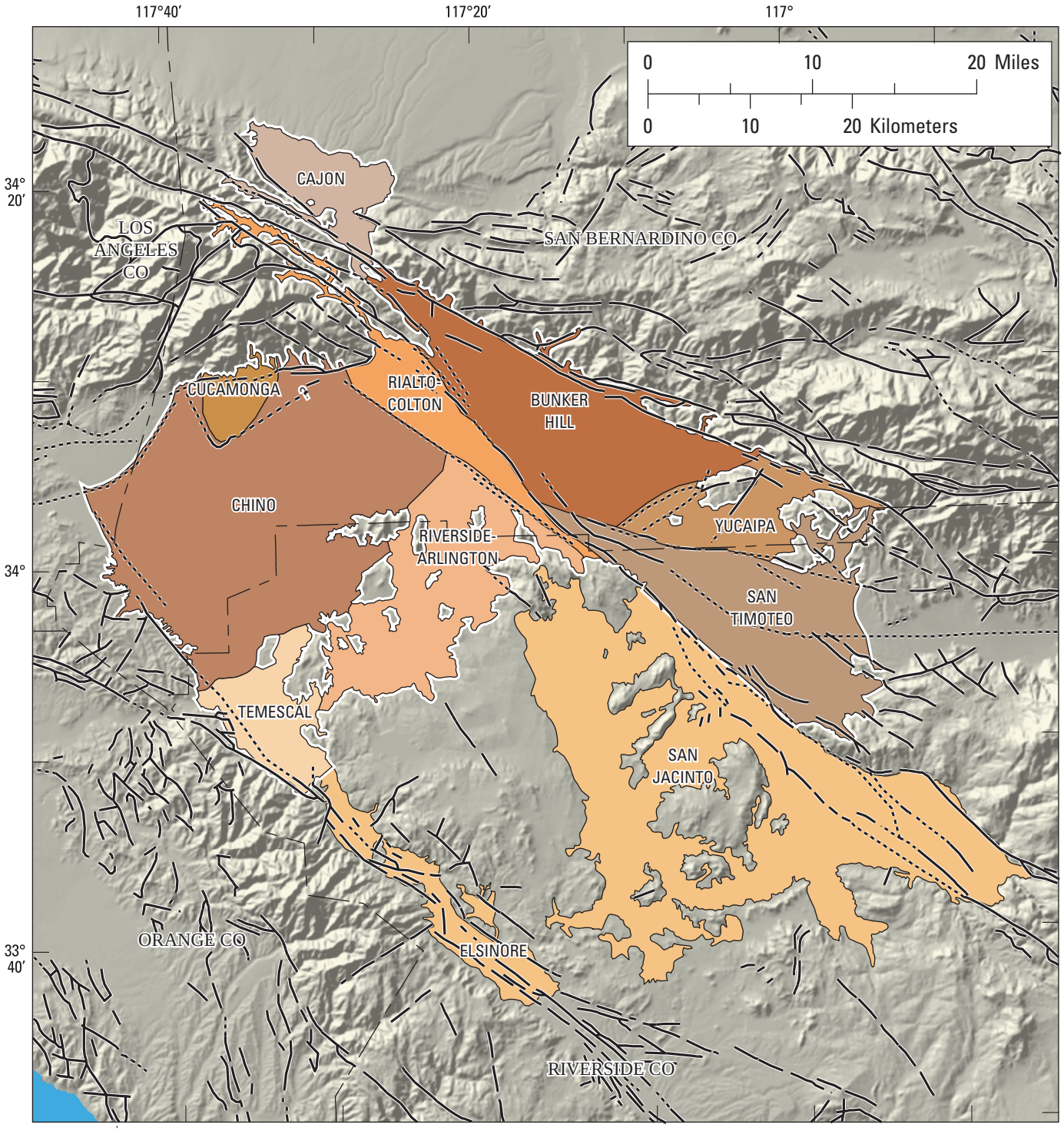


Figure 3. California Department of Water Resources defined ground-water subbasins of the Upper Santa Ana Valley ground-water basin in the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study unit, California.

Aquifers of the Upper Santa Ana Valley Groundwater Basin are generally unconfined and comprise several subbasins filled with alluvial deposits eroded from the surrounding mountains (Hamlin and others, 2005). The thickness of these deposits ranges from less than 200 ft to more than 1,000 ft (Dutcher and Garrett, 1963). Faults play an important role in the ground-water flow system here. The San Andreas Fault, which lies along the base of the San Bernardino Mountains, and other faults, which lie along the base of the San Gabriel Mountains and Chino Hills, bound the valley flow system on three sides (fig. 3) (Hamlin and others, 2002). Other faults, such as the San Jacinto Fault, divide the Upper Santa Ana Valley Groundwater Basin into its subbasins. These interior faults locally restrict ground-water flow and control the location of ground-water discharge (Izbicki and others, 1998; Woolfenden and Kadhim, 1997).

Ground-water flow in aquifers of the Elsinore Basin is also affected by several faults dividing the alluvial and lacustrine sediments. Floodplain deposits in the interior of the valley typically reach a thickness of about 200 ft, while the fine-grained lacustrine deposits in the zone of inundation of Lake Elsinore reach 800 ft in thickness (California Department of Water Resources, 1981).

Aquifers of the San Jacinto Groundwater Basin are generally unconfined and consist of a series of interconnected alluvium-filled valleys bounded by steep-sided bedrock mountains and hills (Hamlin and others, 2005). The deposits in these valleys typically are 200 to 1,000 ft thick (Eastern Municipal Water District, 2002).

Two stipulated judgments broadly adjudicated water rights in the Santa Ana Basin (upper and lower) in 1969 (*Orange County Water District* v. *City of Chino*, Superior Court No. 117628; *Western Municipal Water District of Riverside County* v. *East San Bernardino County Water District*, Superior Court No. 78426). Currently, the Santa Ana Watermaster compiles hydrologic and water-quality data in annual reports, and the Santa Ana Watershed Project Authority, a Joint Powers Authority, classified as a Special District (government agency), plans and builds facilities to protect the water quality of the Santa Ana River Watershed. In addition, the Chino Basin was separately adjudicated in 1978; the Chino Basin Watermaster was directed to establish a comprehensive basin management program that responds to declines in the quantity and quality of ground water there (Miller and others, 2007).

Methods

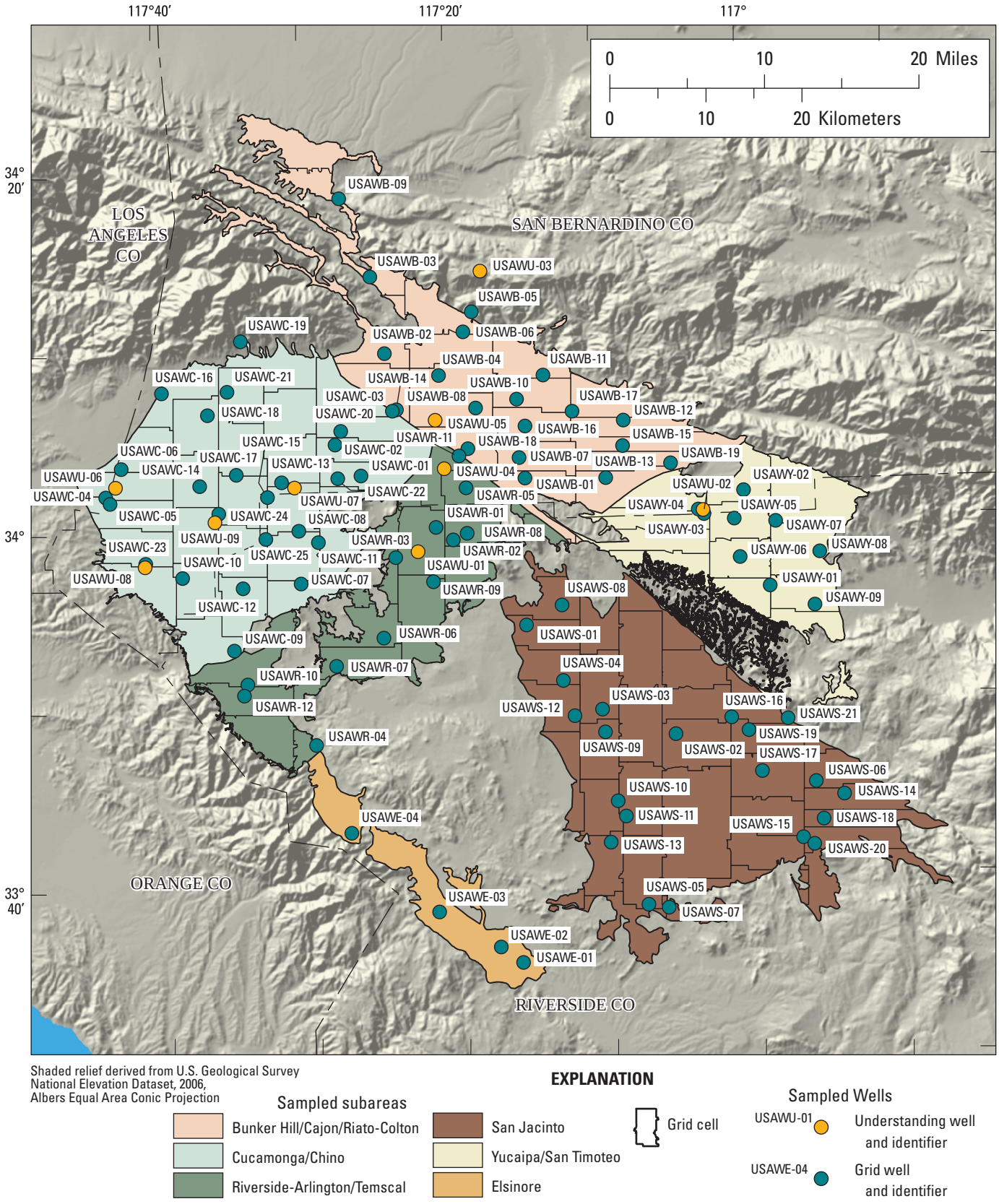
Methods used for the GAMA program were selected to achieve the following objectives: (1) design a sampling plan suitable for statistical analysis, (2) collect samples in a consistent manner, (3) analyze samples using proven and reliable laboratory methods, (4) assure the quality of the ground-water data, and (5) maintain data securely and with relevant documentation.

Study Design

The wells selected for sampling in this study reflect the combination of two well-selection strategies. Ninety wells were selected using a randomized grid-based method (Scott, 1990) in order to provide a statistically unbiased, spatially distributed assessment of the quality of ground-water resources used for public drinking-water supply. Nine additional wells were selected to increase sampling density in several areas for a better understanding of specific ground-water quality issues in the study unit.

To select an unbiased, spatially distributed network of wells, the locations of wells listed in the statewide databases maintained by the CDPH and USGS were plotted on a regional map. A grid of 107 equal-area cells (10 mi^2) was then drawn over the USAW map with the objective to select one public-supply well to sample per grid cell. For the purposes of this study, the Upper Santa Ana Valley (figs. 2 and 3) was divided into four study areas by combining the nine DWR-defined subbasins: Bunker Hill/Cajon/Rialto-Colton, Cucamonga/Chino, Riverside-Arlington/Temescal, Yucaipa/San Timoteo (fig. 4). The entire San Jacinto Basin constituted a fifth USAW study area. The relatively small (approximately 40 mi^2) Elsinore ground-water basin was not divided into cells; this sixth and final study area was sampled by picking four wells (approximately one well per 10 mi^2) spread throughout the basin to represent four "equivalent cells" (fig. 4). These four wells are treated the same as wells representing grid cells for the purpose of statistical characterization of water quality in the USAW study unit.

Ninety of the 107 grid cells were sampled in USAW. Seventeen grid cells were not sampled because some had no wells or because permission to sample was not granted. If a grid cell contained more than one public-supply well, each well was randomly assigned a number. The well having the lowest assigned number that met basic sampling criteria (for



Shaded relief derived from U.S. Geological Survey National Elevation Dataset, 2006, Albers Equal Area Conic Projection

EXPLANATION

Sampled subareas

- Bunker Hill/Cajon/Riato-Colton
- Cucamonga/Chino
- Riverside-Arlington/Temscal
- San Jacinto
- Yucaipa/San Timoteo
- Elsinore

Grid cell

Sampled Wells

- USAWU-01 — Understanding well and identifier
- USAWE-04 — Grid well and identifier

Figure 4. Distribution of study unit grid cells and the location of sampled grid wells and understanding wells in the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study unit, California.

example, sampling point prior to treatment, capability to pump for several hours, and available well-construction information) and for which permission to sample could be obtained was then sampled. If a grid cell contained no accessible public-supply wells, domestic and irrigation wells were considered. An attempt was made to select domestic and irrigation wells with depths and screened intervals similar to those in public-supply wells in the area. In this fashion, a well was selected in each cell to provide a spatially distributed, randomized monitoring network for each study area. Wells sampled as part of the randomized grid-cell network (including the four equivalent cells sampled in the Elsinore study area) are hereinafter referred to as "grid wells". Grid wells in USAW were numbered in the order they were sampled in each study area with the prefixes "USAWB" (wells in the Bunker Hill/Cajon/Rialto-Colton study area [19 grid wells sampled/out of 20 grid cells delineated]), "USAWC" (Cucamonga/Chino [25/27]), "USAWE" (Elsinore [4/4]), "USAWR" [Riverside-Arlington/Temescal (12/13)], "USAWS" [San Jacinto (21/31)], or "USAWY" [Yucaipa/San Timoteo (9/12)] (fig. 4).

In addition to the grid wells, nine "understanding" wells were sampled to attempt to answer specific questions in the study unit. Two understanding wells were sampled to fill in data gaps along flow paths in the Cucamonga-Chino study area. Three understanding wells were sampled to evaluate a conceptual flow transect that starts at the northern end of the Rialto-Colton Basin (fig. 3), progresses approximately southward until it reaches the Riverside-Arlington Basin, and then turns to the southwest across this basin. Understanding wells were assigned the prefix "USAWU" and were numbered in the order of sample collection; they were not included in the statistical characterization of water quality in USAW.

Table 1 provides the GAMA-id (alphanumeric identification number) for each well, along with the date sampled, sampling schedule, well elevation, and well-construction information. All samples but one were collected from November 27, 2006, to February 15, 2007; one was collected from well USAWC-25 on March 28, 2007. Ground-water samples were collected from 80 public-supply wells, 9 irrigation wells, 5 desalination wells, 3 monitoring wells, 1 domestic well, and a (recreation use) well used to fill ponds at a camping resort.

Well locations and identifications were verified using GPS, 1:24,000 scale USGS topographic maps, comparison with existing well information in USGS and CDPH databases, and information provided by well owners. Driller's logs for wells were obtained when available.

The wells in USAW were sampled using a tiered analytical approach. All wells were sampled for a standard set of constituents, including VOCs, pesticides and pesticide degradates, pharmaceutical compounds, potential wastewater indicators, perchlorate, stable isotopes of hydrogen and oxygen in water, dissolved noble gases, tritium, and helium isotopes. The standard set of constituents was termed the "fast" schedule (table 2). Wells on the "intermediate" schedule were sampled for all the constituents on the fast schedule, plus nutrients, major and minor ions and trace elements, standard dissolved gases, isotopes of nitrogen and oxygen in nitrate, isotopes of nitrogen in nitrogen gas, and carbon isotopes. Wells on the "slow" schedule were sampled for all the constituents on the intermediate schedule, plus dissolved organic carbon, NDMA, 1,2,3-TCP, 1,4-dioxane, tritium, the redox species of arsenic, chromium, and iron, radioactive and microbial constituents (table 2). Fast, intermediate, and slow refer to the time required to sample the well for all the analytes on the schedule.

Some of the additional wells sampled for better understanding were analyzed on a sampling schedule termed "topical". Overall, the topical sampling schedule included fewer constituents than the fast schedule, but was designed to expand the understanding of nitrate occurrence in USAW ground water The topical schedule consisted of VOCs, perchlorate, nutrients, major and minor ions and trace elements, standard dissolved gases and noble gases, isotopes of nitrogen and oxygen in nitrate, isotopes of nitrogen in nitrogen gas, carbon isotopes, and tritium/helium age dates.

In USAW, 42 of the ground-water wells were sampled on the fast schedule, 18 were sampled on the intermediate schedule, and 32 on the slow schedule. Seven wells were sampled on the topical schedule. However, analyses for dissolved organic carbon and potential wastewater indicators were added for 3 of the 7 topical samples to further investigate the occurrence of nitrate in these wells.

Sample Collection and Analysis

Ground-water samples were collected using standard and modified USGS protocols (Koterba and others, 1995; U.S. Geological Survey, variously dated) and protocols described by Weiss (1968), Shelton and others (2001), and Ball and McClesky (2003a, 2003b). The sample-collection method used for fast, intermediate, and topical sampling schedules was slightly different than that used for slow sampling and is described by Wright and others (2005). The sampling protocols ensure that a representative sample of ground water is collected at each site, and that the samples are collected and handled in a way that minimizes the potential to contaminate samples. The methods used to collect samples are described in the Appendix.

Tables 3A-L list the compounds analyzed in each constituent class. Ground-water samples were analyzed for 85 VOCs (table 3A), 135 compounds consisting of pesticides, pesticide degradates, and caffeine (tables 3B and 3C), 14 pharmaceutical compounds (table 3D), 69 potential wastewater-indicator compounds (table 3E), 4 constituents of special interest (table 3F), 5 nutrients (species of nitrogen and phosphorus), and dissolved organic carbon (table 3G), 10 major and minor ions, laboratory-determined alkalinity, silica and total dissolved solids (table 3H), 25 trace elements (table 3H), arsenic, iron, and chromium species (table 3I), stable isotopes of water, stable isotopes of nitrate and nitrogen gas, 8 radioactive constituents, including tritium and carbon-14 (table 3J), standard dissolved gases and noble gases, (table 3K), and 4 microbial constituents (table 3L). The methods used to analyze samples are listed in Appendix table A1.

Data Reporting

The methods and conventions used for reporting the data are described in the Appendix. Eighteen water-quality constituents were measured by more than one analytical method. When an analyte is measured by more than one method in the same water medium (in filtered or in unfiltered water), the results are considered as duplicated measurements of the same parameter, and a preferred analytical method is identified (listed first in the column of analytical schedules of Appendix table A2). All results available at the time that this report was prepared are presented here, including duplicated measurements of the same parameter.

Quality Assurance

The quality-assurance procedures used for this study follow the protocols described in the USGS NWQL quality-assurance plan (U.S. Geological Survey, variously dated; Maloney, 2005; Pirkey and Glodt, 1998) and the protocols used by the USGS NAWQA program (Koterba and others, 1995). Quality-control (QC) samples were collected to evaluate bias and variability of the water chemistry data that may have resulted from sample collection, processing, storage, transportation, and laboratory analysis. QC samples collected in the USAW study include source-solution blanks, field blanks, replicates, and matrix and surrogate spikes. The quality-assurance procedures are described in the Appendix.

Water-Quality Results

Ground-water samples collected in USAW were analyzed for up to 382 distinct constituents, and more than half (202) of these constituents were not detected in any of the wells (tables 3A-L). The results tables (tables 4-17) present only the constituents that were detected and list only wells at which at least one constituent was detected. For constituent classes that were analyzed at all of the grid wells, the tables include the number of wells at which each analyte was detected, the frequency at which it was detected (in relation to the number of grid wells), and the total number of constituents detected at each well. Results from the nine additional wells sampled for understanding are presented in tables 4-17, but these results were excluded from the detection frequency calculations to avoid statistically over-representing the areas where these understanding wells were located. Reported detections of constituents detected at concentrations less than their respective long-term method detection limit (LT-MDL) were also excluded from detection frequency calculations.

Table 4 includes water-quality indicators measured in the field and at the NWQL, while tables 5 through 17 present the results of ground-water analyses organized by compound classes:

- Organic Constituents
  - VOCs (table 5)
  - Pesticides, pesticide degradates, and caffeine (table 6)
  - Pharmaceutical compounds (table 7)
- Constituents of special interest (table 8)
- Inorganic constituents (and dissolved organic carbon)
  - Nutrients and dissolved organic carbon (table 9)
  - Major and minor ions, silica, and total dissolved solids (table 10)
  - Trace elements (table 11)
  - Arsenic, iron, and chromium species (table 12)
- Inorganic tracer constituents
  - Stable isotopes and tritium and carbon-14 activities (table 13)
  - Standard dissolved gases (table 14)
  - Noble gases and helium isotopes (table 15)
- Radioactive constituents (table 16)
- Microbial indicators (table 17)

Quality-Control Sample Results

Results of quality-control analyses (blanks, replicates, matrix spikes, and surrogates) were used to evaluate the bias and variability of the data for the ground-water samples. Matrix spike recoveries for a number of organic constituents were lower than the acceptable limits, which may indicate a low bias for these constituents, and they may not have been detected in some samples if they were present at very low concentrations. The quality-control results are described in the Appendix.

Comparison Thresholds

Concentrations of constituents detected in ground-water samples were compared with CDPH and USEPA drinking-water regulatory and health-based thresholds (California Department of Public Health, 2007a; U.S. Environmental Protection Agency, 2006) as a way to give context to the detected concentrations. The chemical and microbial data presented in this report are meant to characterize the quality of the untreated ground-water resources within USAW and are not intended to represent the treated drinking water delivered to consumers by water purveyors. The chemical and microbial composition of treated drinking water may differ from untreated ground water because treated drinking water may be disinfected, filtered, mixed with other waters, and exposed to the atmosphere before being delivered to consumers.

The following thresholds were used for comparisons:

- **MCL– Maximum Contaminant Level.** Legally enforceable standards that apply to public-water systems and are designed to protect public health by limiting the levels of contaminants in drinking water. MCLs established by the USEPA are the minimum standards with which states are required to comply, and individual states may choose to set more stringent standards. CDPH has established MCLs for constituents not regulated by the USEPA and has lowered the threshold concentration for a number of constituents with MCLs established by the USEPA. In this report, a threshold set by the USEPA and adopted by CDPH is labeled "MCL-US", and one set by CDPH that is more stringent than the MCL-US is labeled "MCL-CA". CDPH is notified when constituents are detected at concentrations exceeding MCL-US or MCL-CA thresholds in samples collected for the GAMA Priority Basin Assessment project.

- **AL – Action Level.** Legally enforceable standards that apply to public water systems and are designed to protect public health by limiting the levels of copper and lead in drinking water. Detections of copper or lead at concentrations above thresholds trigger mandatory water treatment to reduce the corrosiveness of water to plumbing components. The action levels established by the USEPA and CDPH are the same, thus the thresholds are labeled "AL-US" in this report.

- **TT – Treatment Technique.** Legally enforceable standards that apply to public-water systems and are designed to protect public health by limiting the levels of copper, lead, and microbial constituents in drinking water. TT requirements are applied when water delivered to consumers exceeds specified action levels. Detections of microbial constituents at concentrations above thresholds trigger additional mandatory disinfection during water treatment. The action levels established by the USEPA and CDPH are the same, thus the thresholds are labeled "TT-US" in this report.

- **SMCL – Secondary Maximum Contaminant Level.** Non-enforceable standards applied to constituents that affect the aesthetic qualities of drinking water, such as taste, odor, and color, or technical qualities of drinking water, such as scaling and staining. Both the USEPA and CDPH define SMCLs, but unlike MCLs, SMCLs established by CDPH may be less stringent than those established by USEPA. SMCLs established by CDPH (SMCL-CAs) are used in this report for all constituents that have SMCL-CA values. The SMCL-US is used for pH because no SMCL-CA has been defined.

- **NL – Notification Level.** Health-based notification levels established by CDPH for some of the constituents in drinking water that lack MCLs (NL-CA). If a constituent is detected above its NL-CA, State law requires timely notification of local governing bodies and recommends consumer notification.

- **HAL – Lifetime Health Advisory Level.** The maximum concentration of a constituent at which its presence in drinking water is not expected to cause any adverse carcinogenic effects for a lifetime of exposure. HALs are established by the USEPA (HAL-US) and are calculated assuming consumption of 2 liters of water per day over a 70-year lifetime by a 70-kilogram (154 lb) adult and that 20 percent of a person's exposure comes from drinking water.

- **RSD5 – Risk-Specific Dose.** The concentration of a constituent in drinking water corresponding to an excess estimated lifetime cancer risk of 1 in 100,000. RSD5 is an acronym for risk-specific dose at 10^{-5}. RSD5s are established by the USEPA (RSD5-US).

Concentrations of constituents in ground-water samples that had MCLs were compared to the MCL-US or MCL-CA. Constituents with SMCLs were compared with the SMCL-CA. For chloride, sulfate, specific conductance, and total dissolved solids, CDPH defines a "recommended" and an "upper" SMCL-CA; concentrations of these constituents in ground-water samples were compared with both levels. The SMCL-US for these constituents equals the recommended SMCL-CA. Detected concentrations of constituents that lack MCLs and SMCLs were compared to NL-CAs. For constituents that lack an MCL, SMCL, or NL-CA, detected concentrations were compared to the HAL-US. For constituents that lack an MCL, SMCL, NL-CA, or HAL-CA, detected concentrations were compared to the RSD5-US. This hierarchy of comparison thresholds means that for constituents that have multiple types of established thresholds, the threshold used for comparison may not have the lowest concentration. The comparison thresholds used in this report are listed in tables 3A-L for all constituents and in tables 4-17 for constituents detected in ground-water samples from USAW. Detections of constituents at concentrations greater than the selected comparison threshold are marked with asterisks in tables 4-17. Not all constituents analyzed for this study have established thresholds available.

Ground-Water-Quality Data

Results from analyses of untreated ground-water samples from USAW are presented in tables 4 through 17. A brief description of these results is given here.

Water-Quality Indicators

Field and laboratory measurements of dissolved oxygen, pH, specific conductance, alkalinity, and associated parameters are presented in table 4. Dissolved oxygen and alkalinity are used as indicators of natural processes that control water chemistry. Specific conductance is a measure of electrical conductivity of the water and is proportional to the amount of dissolved salts in the water. The pH value indicates the acidity of the water. Specific conductance measured in the field was above the recommended SMCL-CA threshold in 25 grid wells and above the upper threshold in 7 wells. pH measured in the field was above the recommended SMCL- US in 4 grid wells and 1 understanding well.

Organic Constituents

Volatile organic compounds (VOC) are in paints, solvents, fuels, fuel additives, refrigerants, fumigants, and disinfected water, and are characterized by inherent physical and chemical properties that allow them to move between water and air. VOCs persist longer in ground water than in surface water because ground water is isolated from the atmosphere. Twenty-four of the eighty-five VOCs targeted for analysis in this study were detected in samples from USAW (table 5). An additional VOC, toluene, was detected in 5 samples. However, its concentrations in field blanks were similar to the concentrations in the samples, making its presence in USAW ground water questionable. One or more VOCs were detected in more than 80 percent of USAW grid wells. Of the 24 VOCs detected in the study unit, 11 were detected "frequently" (in 10 percent or more of the grid wells): trichloromethane (chloroform), tetrachloroethene (PCE), trichloroethene (TCE), bromodichloromethane, 1,2,4-trimethylbenzene, 1,1-dichloroethene, methyl *tert*-butyl ether (MTBE), *cis*-1,2-dichloroethene, dichlorodifluoromethane (CFC-12), trichlorofluoromethane (CFC-11), and 1,1-dichloroethane.

Health-based thresholds exist for all 24 of the VOCs detected in samples from USAW, and most VOC detections were at concentrations well below these thresholds (table 5). However, five VOCs were detected at concentrations greater than their health-based threshold in at least one sample: tetrachloromethane (carbon tetrachloride), dibromochloropropane (DBCP), 1,1-dichloroethene, tetrachloroethene (PCE), and trichloroethene (TCE). At least one of these five compounds was detected at a concentration above its health-based threshold in samples from six USAW grid wells. Only two other VOCs were detected at concentrations within 10 percent of their health-based thresholds: one such detection for each of the isomers 1,1-dichloroethane and 1,2-dichloroethane.

Pesticides include herbicides, insecticides, and fungicides and are used to control weeds, insects, fungi, and other pests in agricultural, urban, and suburban settings. Thirteen of the 134 pesticide compounds targeted for analysis in this study were detected in samples from USAW at concentrations greater than their respective long-term method detection limits (LT-MDL) (table 6). These compounds appear on table 6 in the order of detection frequency (greatest to least). Four of the compounds—atrazine, 2-chloro-4-isopropylamino-6-amino-*s*-triazine, tebuthiuron, and metalaxyl—were measured by two different pesticide analytical methods. In these cases, the column of data for the preferred method appears first, and dictates the order on the table. The column of data for the non-preferred method is listed adjacent to (to the right of) the preferred-method column, regardless of the detection frequency by the non-preferred method. Atrazine and 2-chloro-4-isopropylamino-6-amino-*s*-triazine were detected at concentrations greater than their respective LT-MDLs by both methods. Tebuthiuron and metalaxyl were detected at concentrations greater than their respective LT-MDLs only by one of the two methods.

One or more pesticide compounds were detected in 68 percent of USAW grid wells. Seven pesticide compounds were detected frequently (in more than 10 percent of the grid wells). All seven of these frequently detected pesticide compounds were herbicides or herbicide degradates: atrazine, simazine, 2-chloro-4-isopropylamino-6-amino-*s*-triazine bromacil, diuron, 3,4-dicloroaniline, and 2-chloro-6-ethylamino-4-amino-*s*-triazine.

Table 6 lists an additional 13 pesticide compounds detected in USAW only at concentrations less than their respective LT-MDLs. The detection frequencies for these compounds appear as zeros on the table because the presence (or absence) of a compound below its LT-MDL cannot be reliably determined (Childress and others, 1999).

Health-based thresholds exist for 7 of the 13 pesticide compounds reliably detected in samples from USAW, and all pesticides detected were at concentrations below these thresholds. Only one pesticide detection came within 10 percent of its health-based threshold; atrazine, which has a California MCL of 1 µg/L, was detected at a concentration of 0.11 µg/L in one well (USAWR-01).

Potential wastewater indicators include chemicals used in pesticides, home maintenance, personal care, and industrial products that may have a variety of sources other than wastewater. Sixty-nine potential wastewater indicators were targeted for analysis in this study. However, inconsistent results for quality-control samples collected and analyzed using this analytical method suggested that the results were unreliable. Therefore, the data collected for this group of analytes are not presented in this report.

Pharmaceutical compounds targeted for analysis in this study include 10 prescription and over-the-counter medications, dehydronifedipine (an antianginal metabolite), cotinine (a nicotine metabolite), caffeine, and 1,7-dimethylxanthine (a caffeine metabolite) (table 3D). GAMA protocols call for censoring pharmaceutical data more rigorously than the other data because of the newness of the analytical method. Concentrations of pharmaceutical compounds that were less than their respective long-term method detection levels (LT-MDL) were considered non-detections for this study. Four pharmaceutical compounds were detected in USAW samples at concentrations greater than these censoring levels (table 7-LT-MDLs are equal to half the LRLs). These included two medications (acetaminophen and carbamazepine), caffeine, and the caffeine metabolite, 1,7-dimethylxanthine.

No pharmaceutical compound was detected in more than five wells, and all of the concentrations were low. Health-based thresholds do not exist for concentrations of pharmaceuticals in drinking water. However, to reach concentrations of the two detected medications equal to dosages typically recommended or prescribed would, in all cases, require consuming more than one million liters of the sampled water. The sampled concentrations of caffeine and its metabolite were, in all cases, less than one-millionth of the concentration of caffeine in regular coffee.

Constituents of Special Interest

Perchlorate, 1,2,3-trichloropropane (1,2,3-TCP), 1,4-dioxane, and NDMA are constituents of special interest in California because they recently have been found in, or may reach, water supplies (California Department of Public Health, 2007b). These four compounds were analyzed by the Montgomery Watson-Harza Laboratory. Table 8 includes all four of these constituents, even though 1,4-dioxane was not detected in USAW ground water and both detections of NDMA were V-coded. A result is V-coded when the analyte is detected in a sample and an associated blank; thus the result is suspect and is not included in ground-water quality assessment. Perchlorate was detected in two-thirds of the grid wells, and 11 grid wells had perchlorate concentrations greater than or equal to the MCL-CA of 6 µg/L (table 8).

1,2,3-TCP is a compound that was measured by more than one analytical method. NWQL used the VOC analytical method (lab schedule 2020) to analyze all USAW samples for 1,2,3-TCP; results are described above and listed in table 5. By the VOC method, 1,2,3-TCP was not detected in any samples at a laboratory reporting level (LRL) of 0.12 µg/L. Samples from the 32 wells on the "slow" schedule were additionally analyzed for 1,2,3-TCP at the much lower LRL of 0.005 by Montgomery Watson-Harza Laboratory. By this "preferred" method, 1,2,3-TCP was detected in samples from three grid wells at concentrations far below its HAL-US (table 8). Samples from wells on the "slow" schedule were also analyzed for 1,4-dioxane and NDMA. 1,4-dioxane was not detected, and NDMA was detected in samples from two wells at concentrations less than those detected in two out of three USAW field blanks (table A3). Those detections were, therefore, not included in this ground-water quality assessment.

Dissolved organic carbon (DOC) is an additional organic analyte that was sampled in 36 USAW grid wells, and it was detected in 25 of these wells. However, DOC was also detected in two out of three blanks (table A3), resulting in the the V-coding of all but one of the USAW ground-water detections of DOC (table 9).

Inorganic Constituents

Unlike the organic constituents and the constituents of special interest, most of the inorganic constituents are naturally present in ground water, although their concentrations may be influenced by human activities.

The nutrients, nitrogen and phosphorus, and the dissolved organic carbon in ground water can affect biological activity in aquifers and in surface water bodies that receive ground-water discharge. Nitrogen may be present in the form of ammonia, nitrite, or nitrate, depending on the oxidation-reduction state of the ground water. High concentrations of nitrate can adversely affect human health, particularly the health of infants. Samples from 49 USAW grid wells were analyzed for nutrients (table 9). Samples from eight understanding wells also were analyzed for nutrients. Concentrations of nitrite plus nitrate in samples from 14 grid wells were greater than the MCL-US. A well sampled for additional understanding also had nitrite plus nitrate greater than this MCL. Concentrations of the other forms of nitrogen were less than their health-based thresholds in all samples. There is no health-based threshold for phosphorus concentrations in drinking water.

The major-ion composition, total dissolved solids (TDS) content, and levels of certain trace elements in ground water affect the aesthetic properties of water, such as taste, color, and odor, and the technical properties, such as scaling and staining. CDPH has established non-enforceable thresholds (SMCL-CAs) that are based on aesthetic and technical properties rather than health-based concerns for the major ions, such as chloride and sulfate, TDS, turbidity, and several trace elements.

Samples from 49 USAW grid wells were analyzed for major ions and trace elements. Samples from eight wells sampled for additional understanding were also analyzed for these compounds. Chloride concentrations were greater than the recommended SMCL-CA of 250 mg/L in samples from three USAW grid wells, and one of these concentrations was also above the upper SMCL-CA of 500 mg/L (table 10). The sulfate concentration was greater than the recommended SMCL-CA of 250 mg/L in the sample from one grid well. Nineteen samples from USAW grid wells contained TDS concentrations above the recommended SMCL-CA of 500 mg/L, and three of these concentrations were also above the upper SMCL-CA of 1,000 mg/L.

Iron and manganese are trace elements whose concentrations are affected by the oxidation-reduction state of the ground water. Precipitation of minerals containing iron or manganese may cause orange or black staining of surfaces. Concentrations of manganese in USAW wells were typically less than 10 µg/L (table 11). However, two grid wells had concentrations greater than the SMCL-CA of 50 µg/L. Similarly, concentrations of iron were typically less than100 µg/L, but one grid well had a concentration greater than the SMCL-CA of 300 µg/L.

USAW samples were analyzed for twenty-five different trace elements. All of these trace elements were detected at least once except for beryllium. Eighteen of the twenty-five trace elements have health-based thresholds. In addition, the major ion fluoride has a health-based threshold, All fluoride concentrations in USAW samples were below its health-based threshold, as were concentrations of all trace elements except arsenic, boron, molybdenum, and vanadium, (table 11). Samples from two grid wells and a well for additional understanding had arsenic concentrations above the MCL-US of 10 µg/L. One grid well sample contained boron above the NL-CA of 1,000 µg/L. Two grid well samples contained molybdenum above the HAL-US of 40 µg/L. One grid well, and one well for additional understanding, contained vanadium above the NL-CA of 50 µg/L.

Seven trace elements were detected in at least one USAW field blank, sometimes resulting in V-coding of the sample results for these compounds in the ground-water samples. Results in table 11 that are qualified (coded) with a "V" may have been affected by inadvertent sample contamination, and were not counted as sample detections for the ground-water quality assessment.

The relative proportions of arsenic, iron, and chromium species depend on the oxidation-reduction state of the ground water. The oxidized and reduced species have different solubilities in ground water and may have different effects on human health. The relative proportions of the oxidized and reduced species of each element also are used to help interpret the oxidation-reduction of the aquifer. The relative proportions of the other species can be calculated by finding the difference.

Samples from the 32 "slow" wells were analyzed for the oxidation-reduction species of arsenic, iron, and chromium. Concentrations of total arsenic, iron, and chromium, and concentrations of either the reduced or the oxidized species of each element are reported on table 12. Analyses of the iron detected in USAW samples indicated both oxidized and reduced species, but slightly more reduced species, Fe(II). In contrast, analyses of arsenic and chromium indicated more oxidized species, As(V) and Cr(VI), respectively, than reduced; indeed, arsenic was entirely in the oxidized form in all 18 samples in which it was detected. Concentrations of total arsenic, iron, and chromium analyzed at the USGS Trace Metal Laboratory (table 12) were generally similar to those analyzed at USGS NWQL (table 11). Minor differences could be due to the different analytical methods (Appendix table A1); concentrations reported on table 11 are considered to be more accurate.

Isotopic Tracer Constituents

Isotopic ratios, which include the ratios of stable oxygen isotopes and hydrogen isotopes in water, of stable nitrogen isotopes in dissolved nitrogen gas, and stable nitrogen isotopes and oxygen isotopes in dissolved nitrate, along with the tritium and carbon-14 activities in ground water, may be used as tracers of hydrologic processes. In USAW samples, hydrogen-2/hydrogen-1 ratios (δ^2H) ranged from -70.2 to -45.9 per mil, and oxygen-18/oxygen-16 ratios ($\delta^{18}O$) ranged from -10.17 to -5.33 per mil (table 13).

The isotopic ratios of nitrogen isotopes in dissolved nitrogen gas, and nitrogen isotopes and oxygen isotopes in dissolved nitrate (table 13) can be used to help determine the source of nitrate in ground water and to indicate which processes affect dissolved nitrate concentrations. In USAW samples, the nitrogen-15/nitrogen-14 ratios in the dissolved nitrate fraction ranged from 1 to 21 per mil, and the oxygen-18/oxygen-16 ratios ranged from 0.31 to 10.10 per mil. The nitrogen-15/nitrogen-14 ratios in the dissolved gas fraction ranged from 0.15 to 3.12 per mil.

Tritium and carbon-14 activities (table 13), and helium isotope ratios (table 15) can provide information about the ages of the ground-water. Tritium is a radioactive isotope of hydrogen that is incorporated into the water molecule. Low levels of tritium are continuously produced by cosmic-ray bombardment of water in the atmosphere, and a large amount of tritium was produced by atmospheric testing of nuclear weapons between 1952 and 1963. Thus, activities of tritium in water above background levels generally indicate that the water was recharged since the early 1950s (Izbicki, 1996). Of the inorganic tracer constituents analyzed for this study, tritium is the only one that has a health-based threshold. Although tritium was detected in 28 of the 32 USAW samples for which it was analyzed, measured tritium activities in all these samples were less than one one-thousandth of the MCL-CA (table 13).

Helium isotope ratios (table 15) can be used with tritium concentrations to estimate more exact ages for young ground water. Carbon-14 (table 13) is a radioactive isotope of carbon that is incorporated into dissolved carbonate species in water. Low levels of carbon-14 are continuously produced by cosmic-ray bombardment of nitrogen in the atmosphere. Because carbon-14 has a half-life of approximately 5,700 years, low activities of carbon-14 relative to modern values generally indicate the presence of ground water that is several thousand years old (Kalin, 2000). Carbon-14 activities in most USAW samples indicated that they contained greater than 70 percent modern carbon.

Dissolved Standard and Noble Gases

Dissolved-gas data (table 14) are used to define recharge temperatures used for age-dating, to indicate microbial processes, such as denitrification, and to trace sources of ground-water recharge. Dissolved nitrogen, argon, oxygen and carbon dioxide were detected at various concentrations in all samples analyzed for standard dissolved gases. In contrast, dissolved methane was detected in only 16 percent of the samples. Several dissolved-gas samples were compromised because the laboratory observed gas bubbles in the samples bottles prior to analysis. These compromised samples are identified in table 14. Noble-gas concentrations (table 15) can be used to help interpret ground-water recharge sources because the concentrations of the different noble gases depend on water temperature. Such interpretation is beyond the scope of this report and will be presented in a future report.

Radioactive Constituents

Radioactivity is the release of energy or energetic particles during changes in the structure of the nucleus of an atom. The source of most of the radioactivity in ground water is decay of naturally-occurring isotopes of uranium and thorium in minerals that are in the sediments or fractured rocks of the aquifer. Both uranium and thorium decay in a series of steps, eventually forming stable isotopes of lead. Radium-226, radium-228, and radon-222 are radioactive isotopes formed during the uranium and thorium decay series. In each step in the decay series, one radioactive element turns into a different radioactive element by emitting an alpha particle (helium-4 nucleus) or a beta particle (electron or positron) from its nucleus. For example, radium-226 emits an alpha particle and transforms into radon-222. Radium-228 decays to form actinium-228 by emission of a beta particle. The alpha and beta particles emitted during radioactive decay are hazardous to human health because these energetic particles may damage cells. Radiation damage to cell DNA increases the risk of cancer.

Activity is often used instead of concentration for reporting the presence of radioactive constituents. Activity of radioactive constituents in ground water is measured in units of picocuries per liter (pCi/L); one picocurie approximately equals two atoms decaying per minute. The number of atoms decaying is equal to the number of alpha or beta particles emitted.

The 32 USAW samples analyzed for radioactive constituents had activities of radium, gross alpha (except one gross-alpha measurement at 17.3 pCi/L-72-hour count) and beta emitters less than established health-based standards (table 16). In contrast, activities of radon-222 in samples from more than half of these wells were above the proposed MCL-US of 300 pCi/L, although none had activities above the proposed alternative MCL-US of 4,000 pCi/L. The alternative MCL-US will apply if the State or local water agency has an approved multimedia mitigation program to address radon in indoor air (U.S. Environmental Protection Agency, 1999a).

Microbial Indicators

Water is disinfected during drinking-water treatment to prevent diseases that may be spread by water-borne microbial constituents derived from human or animal wastes. The specific viruses and bacteria responsible for diseases generally are not measured because routine analytical methods are not available. Measurements are made of microbial constituents that are more easily analyzed and serve as indicators of human or animal waste in water. Drinking-water purveyors respond to detections of microbial indicators by applying additional disinfection agents to the water.

The thirty-two samples from the USAW "slow" wells were analyzed for microbial indicators. No samples contained the viral indicators F-specific and somatic coliphage, and none contained the bacterial indicator *Escherichia coli* (*E. coli*). However, the bacterial indicator, total coliforms (table 17), was detected once. The threshold for total coliforms is based on recurring detections; thus, the detection reported here does not constitute an exceedance of the MCL-US.

Future Work

The data presented in this report will be evaluated as part of the ongoing Priority Basin Project using statistical, qualitative, and quantitative approaches to assess the natural and human factors affecting ground-water quality. Water-quality data contained in the CDPH and USGS NWIS databases, and water-quality data available from other State and local water agencies will be compiled, evaluated, and used to complement the data presented in this report; the results of these efforts will be presented in future publications.

Summary

Ground-water quality in the approximately 1,000 square-mile Upper Santa Ana Watershed (USAW) was investigated from November 2006 through March 2007 as part of the Priority Basin Project of Groundwater Ambient Monitoring and Assessment (GAMA) Program. The project is a comprehensive assessment of statewide ground-water quality designed to identify and characterize risks to ground-water resources, and to increase the amount of information about ground-water quality available to the public. Ground-water samples were analyzed for nearly 400 constituents, including volatile organic compounds, pesticides and pesticide degradates, pharmaceutical compounds, potential wastewater-indicator compounds, nutrients, major and minor ions, trace elements, radioactivity, and microbial indicators. Naturally occurring isotopes (stable isotopes of hydrogen, oxygen, nitrogen, and carbon, and activities of tritium and carbon-14) and dissolved gases also were measured to help interpret the source and age of the sampled ground water. Quality-control samples (blanks, replicates, or samples for matrix spikes) were collected at 20 percent of the wells, and the results for these samples were used to evaluate the quality of the data derived from the ground-water samples.

This study did not attempt to evaluate the quality of water delivered to consumers; after withdrawal from the ground, water typically is treated, disinfected, and blended with other waters to maintain acceptable water quality. Regulatory thresholds apply to treated water that is served to the consumer, not to raw ground water. However, to provide some context for the results, concentrations of constituents measured in the raw ground water were compared with health-based thresholds established by the U.S. Environmental Protection Agency (USEPA) and the California Department of Public Health (CDPH).

In this study, 14 constituents were detected at concentrations higher than regulatory and non-regulatory health-based thresholds: carbon tetrachloride (tetrachloromethane), dibromochloropropane (DBCP), 1,1 dichloroethene, tetrachloroethene (PCE), trichloroethene (TCE), nitrate, arsenic, boron, molybdenum, vanadium, perchlorate, radon-222, gross-alpha, and total coliforms. These constituents were detected in 37 of the 90 grid wells and in 2 of the 9 understanding wells. However, 12 of the 37 grid wells with concentrations above health-based thresholds only had such concentrations for radon-222. Radon-222 has a proposed MCL-US of 300 pCi/L, and an alternative proposed MCL-US of 4,000 pCi/L that will apply if the State or local water agency has an approved multimedia mitigation program to address radon in indoor air (U.S. Environmental Protection Agency, 1999a). While some radon-222 activities in USAW samples exceeded the lower proposed MCL-US, no activities were as high as the upper proposed MCL-US. Seven additional constituents (total dissolved solids, chloride, sulfate, specific conductance, pH, iron, and manganese) were detected at concentrations above thresholds set for aesthetic concerns. These constituents were detected in 32 of the grid wells and 1 understanding well. Future work will evaluate the data presented in this report using statistical, qualitative, and quantitative approaches to assess the natural and human factors affecting ground-water quality.

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Table 1. Identification, sampling, and construction information for wells sampled for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo. USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. **Sampling schedule:** Sampling schedules are described in table 2. Elevation of land-surface datum (LSD) is a datum plane that is approximately at land surface at each well. The elevation of the LSD is described in feet above the North American Vertical Datum of 1988 (NAVD 88). **Abbreviations:** ft, foot; LSD, land surface datum; na, not available]

GAMA well identification number	Sampling information			Construction information (ft below LSD)		
	Date	Schedule	Elevation of LSD (ft above NAVD88)	Well depth	Top perforation	Bottom perforation
			Grid wells			
USAWB-01	11-27-06	Fast	1,075	1,067	497	1,047
USAWB-02	11-27-06	Slow	1,857	234	61	230
USAWB-03	11-28-06	Fast	2,310	199	45	175
USAWB-04	11-28-06	Slow	1,422	900	464	884
USAWB-05	11-28-06	Fast	2,042	50	21	48
USAWB-06	11-28-06	Fast	1,633	400	177	400
USAWB-07	11-29-06	Slow	1,005	654	240	462
USAWB-08	12-11-06	Slow	1,188	580	126	560
USAWB-09	12-11-06	Fast	3,075	126	52	126
USAWB-10	12-12-06	Slow	1,137	708	490	680
USAWB-11	12-13-06	Slow	1,249	606	378	569
USAWB-12	12-13-06	Fast	1,333	950	500	930
USAWB-13	12-14-06	Fast	1,313	474	150	442
USAWB-14	12-14-06	Slow	1,418	1,060	300	1,040
USAWB-15	12-14-06	Fast	1,323	1,020	600	1,000
USAWB-16	01-08-07	Intermediate	1,032	963	888	951
USAWB-17	01-10-07	Fast	1,155	421	173	415
USAWB-18	01-11-07	Intermediate	1,102	534	244	534
USAWB-19	01-11-07	Fast	1,763	na	na	na
USAWC-01	01-29-07	Intermediate	1,078	795	na	na
USAWC-02	01-29-07	Intermediate	1,173	940	na	na
USAWC-03	01-29-07	Fast	1,412	1,040	500	1,030
USAWC-04	01-30-07	Slow	859	560	317	535
USAWC-05	01-30-07	Fast	820	800	300	775
USAWC-06	01-30-07	Fast	1,008	903	472	849
USAWC-07	01-31-07	Fast	670	218	113	213
USAWC-08	01-31-07	Slow	782	370	210	370
USAWC-09	01-31-07	Fast	603	na	na	na
USAWC-10	02-01-07	Fast	625	520	290	500
USAWC-11	02-01-07	Slow	747	350	200	350
USAWC-12	02-01-07	Intermediate	634	na	na	na
USAWC-13	02-12-07	Fast	968	na	na	na
USAWC-14	02-12-07	Slow	960	1,028	415	1,007
USAWC-15	02-12-07	Fast	907	702	406	635
USAWC-16	02-13-07	Fast	1,843	491	230	460
USAWC-17	02-13-07	Slow	984	900	370	885
USAWC-18	02-13-07	Fast	1,453	764	322	702
USAWC-19	02-13-07	Fast	3,663	Spring	Spring	Spring
USAWC-20	02-14-07	Intermediate	1,248	918	na	na
USAWC-21	02-14-07	Slow	1,633	1,110	400	1,090
USAWC-22	02-14-07	Fast	1,026	na	na	na
USAWC-23	02-15-07	Slow	634	1,180	440	1,180
USAWC-24	02-15-07	Topical[1]	842	300	280	300
USAWC-25	03-28-07	Intermediate	774	435	230	430
USAWE-01	12-04-06	Slow	1,267	1,430	420	1,410
USAWE-02	12-05-06	Slow	1,247	1,720	380	1,700
USAWE-03	12-06-06	Slow	1,313	980	570	980
USAWE-04	12-07-06	Slow	1,258	740	300	730
USAWR-01	11-29-06	Fast	879	na	na	na
USAWR-02	11-29-06	Fast	822	613	284	600
USAWR-03	11-30-06	Slow	762	na	24	170

Table 1. Identification, sampling, and construction information for wells sampled for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo. USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. **Sampling schedule:** Sampling schedules are described in table 2. Elevation of land-surface datum (LSD) is a datum plane that is approximately at land surface at each well. The elevation of the LSD is described in feet above the North American Vertical Datum of 1988 (NAVD 88). **Abbreviations:** ft, foot; LSD, land surface datum; na, not available]

GAMA well identification number	Sampling information			Construction information (ft below LSD)		
	Date	Schedule	Elevation of LSD (ft above NAVD88)	Well depth	Top perforation	Bottom perforation
USAWR-04	12-12-06	Fast	799	89	28	89
USAWR-05	12-12-06	Intermediate	868	192	na	na
USAWR-06	01-09-07	Intermediate	807	190	120	180
USAWR-07	01-09-07	Intermediate	713	170	80	150
USAWR-08	01-10-07	Slow	898	402	40	380
USAWR-09	01-10-07	Intermediate	819	346	60	346
USAWR-10	01-10-07	Intermediate	643	220	108	204
USAWR-11	01-11-07	Slow	1,093	644	250	634
USAWR-12	01-29-07	Slow	733	515	200	250
USAWS-01	01-22-07	Fast	1,548	225	100	205
USAWS-02	01-22-07	Slow	1,474	518	104	518
USAWS-03	01-22-07	Fast	1,473	160	55	140
USAWS-04	01-22-07	Fast	1,496	150	50	150
USAWS-05	01-23-07	Intermediate	1,437	625	100	620
USAWS-06	01-23-07	Slow	1,533	650	200	650
USAWS-07	01-23-07	Fast	1,432	300	na	na
USAWS-08	01-24-07	Slow	1,655	428	170	420
USAWS-09	01-24-07	Fast	1,453	370	140	350
USAWS-10	01-24-07	Fast	1,420	360	90	320
USAWS-11	01-25-07	Fast	1,431	380	80	340
USAWS-12	01-25-07	Slow	1,463	760	240	740
USAWS-13	01-25-07	Fast	1,426	410	230	390
USAWS-14	02-05-07	Slow	1,595	1,550	470	1,530
USAWS-15	02-06-07	Slow	1,572	328	na	na
USAWS-16	02-06-07	Intermediate	1,450	na	na	na
USAWS-17	02-07-07	Fast	1,495	na	na	na
USAWS-18	02-07-07	Slow	1,595	714	324	714
USAWS-19	02-07-07	Fast	1,463	na	na	na
USAWS-20	02-08-07	Slow	1,567	696	300	676
USAWS-21	02-08-07	Intermediate	1,481	900	440	900
USAWY-01	11-27-06	Fast	2,496	350	300	315
USAWY-02	11-30-06	Fast	2,593	596	290	584
USAWY-03	12-13-06	Fast	2,093	600	150	576
USAWY-04	12-13-06	Intermediate	2,083	1,710	705	1,690
USAWY-05	01-08-07	Slow	2,444	585	320	585
USAWY-06	01-09-07	Slow	2,443	790	150	340
USAWY-07	01-11-07	Fast	2,881	314	164	314
USAWY-08	01-11-07	Fast	3,127	444	58	434
USAWY-09	01-24-07	Fast	2,636	946	320	694
Understanding wells						
USAWU-01	11-29-06	Topical	784	170	50	170
USAWU-02	11-30-06	Topical	2,103	1,100	390	1,100
USAWU-03	12-11-06	Fast	4,882	220	180	220
USAWU-04	01-08-07	Intermediate	1,063	540	320	520
USAWU-05	01-08-07	Topical	1,293	na	310	787
USAWU-06	01-30-07	Topical[1]	905	800	295	784
USAWU-07	02-12-07	Topical	941	980	400	980
USAWU-08	02-15-07	Intermediate	635	na	na	na
USAWU-09	02-15-07	Topical[1]	804	310	290	310

[1]Potential wastewater indicators and dissolved organic carbon were also analyzed for this well.

Table 2. Classes of chemical and microbial constituents and water-quality indicators collected for the slow, intermediate, fast, and topical well sampling schedules in the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[X indicates that analyte or analyte class was sampled for that schedule, blank cell indicates that analyte or analyte class was not sampled for that schedule. **Abbreviations:** na, samples were collected, but data are not available for this report; DO, dissolved oxygen; T, temperature; SC, specific conductance; DOC, dissolved organic carbon; VOC, volatile organic compound; NDMA; *N*-nitrosodimethylamine; TCP, trichloropropane; As, arsenic; Cr, chromium; Fe. iron; δ^2H, delta deuterium; δ^{18}O, delta oxygen-18; δ^{15}N, delta nitrogen-15; δ^{13}C, delta carbon-13; LLNL, Lawrence Livermore National Laboratory]

Analyte classes	Table reference		Sampling schedule			
	List	Results	Slow	Intermediate	Fast	Topical
Water-quality indicators						
DO, T, SC, pH	4	4	X	X	X	X
Alkalinity[1]	4	4	X	X[1]		X[1]
Turbidity	4	4	X			
Organic constituents						
DOC[2]	3G	9	X			
VOC	3A	5	X	X	X	X
Pesticides	3B, 3C	6	X	X	X	
Pharmaceuticals	3D	7	X	X	X	
Wastewater-indicators	3E	na[3]	X	X	X	
Constituents of special interest						
Perchlorate	3F	8	X	X	X	X
NDMA	3F	8	X			
1,4-Dioxane	3F	8	X			
1,2,3-TCP (low level)	3F	8	X			
Chlorofluorocarbons (low level)[4]	na	na	X			
Inorganic constituents						
Nutrients	3G	9	X	X		X
Major, minor ions, trace elements[5]	3H	10, 11	X	X		X
Species of As, Cr and Fe	3I	12	X			
Stable isotopes						
δ^2H and δ^{18}O in water	3J	13	X	X	X	X
δ^{15}N and δ^{18}O in nitrate	3J	13	X	X		X
δ^{15}N in nitrogen gas	3J	13	X	X		X
δ^{13}C and carbon-14	3J	13	X	X		X
Radioactivity and gases						
Tritium[6]	3J	13	X	na	na	na
Radium isotopes	3J	16	X			
Radon-222	3J	16	X			
Alpha and beta radiation	3J	16	X			
Dissolved gases	3K	14	X	X		X
Noble gases	3K	15	X	X	X	X
Microbial constituents						
Coliforms and coliphages	3L	17	X			

[1] Lab alkalinities only for intermediate and topical samples. Both field and lab alkalinities for Slow samples.

[2] DOC was added to 1 intermediate and 3 topical samples for 36 total analyses.

[3] Potential wastewater-indicator data are not presented in this report because of unsatisfactory quality-control data results.

[4] Low-level chlorofluorocarbon results not available for this report.

[5] Mercury analysis only done for Slow samples.

[6] Tritium by both Lawrence Livermore National Laboratory and USGS (Menlo Park) for Slow samples. Only USGS tritium data are available for this report.

Table 3A. Volatile organic compounds, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory schedule 2020.

[The five-digit U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. **CAS number:** This report contains CAS Registry Numbers®, which is a Registered Trademark of the American Chemical Society. CAS recommends verifying the CASRNs through CAS Client Services℠. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations**: CAS, Chemical Abstract Service; LRL, laboratory reporting level; HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California Department of Public Health notification level; RSD5-US, U.S. Environmental Protection Agency risk specific dose at a risk factor of 10^{-5}; D, detected; na, not available; µg/L, micrograms per liter; –, not detected; THM, trihalomethane]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold type	Threshold value (µg/L)	Detection
Acetone	Solvent	81552	67-64-1	6	na	na	–
Acrylonitrile	Organic synthesis	34215	107-13-1	0.4	RSD5-US	0.6	–
Benzene	Gasoline hydrocarbon	34030	71-43-2	0.016	MCL-CA	1	–
Bromobenzene	Solvent	81555	108-86-1	0.02	na	na	–
Bromochloromethane	Fire retardant	77297	74-97-5	0.06	HAL-US	90	–
Bromodichloromethane	Disinfection by-product (THM)	32101	75-27-4	0.04	MCL-US[1]	80	D
Bromoform (Tribromomethane)	Disinfection by-product (THM)	32104	75-25-2	0.08	MCL-US[1]	80	D
2-Butanone (MEK, Methyl ethyl ketone)	Solvent	81595	78-93-3	1.6	HAL-US	4,000	–
n-Butylbenzene	Gasoline hydrocarbon	77342	104-51-8	0.14	NL-CA	260	–
sec-Butylbenzene	Gasoline hydrocarbon	77350	135-98-8	0.04	NL-CA	260	–
tert-Butylbenzene	Gasoline hydrocarbon	77353	98-06-6	0.08	NL-CA	260	–
Carbon disulfide	Organic synthesis	77041	75-15-0	0.06	NL-CA	160	–
Carbon tetrachloride (Tetrachloromethane)	Solvent	32102	56-23-5	0.08	MCL-CA	0.5	D
Chlorobenzene	Solvent	34301	108-90-7	0.02	MCL-CA	70	–
Chloroethane	Solvent	34311	75-00-3	0.10	na	na	–
Chloroform (Trichloromethane)	Disinfection by-product (THM)	32106	67-66-3	0.08	MCL-US[1]	80	D
Chloromethane	Refrigerant/organic synthesis	34418	74-87-3	0.10	HAL-US	30	D
3-Chloro-1-propene	Organic synthesis	78109	107-05-1	0.08	na	na	–
2-Chlorotoluene	Solvent	77275	95-49-8	0.04	NL-CA	140	–
4-Chlorotoluene	Solvent	77277	106-43-4	0.04	NL-CA	140	–
Dibromochloromethane	Disinfection by-product (THM)	32105	124-48-1	0.12	MCL-US[1]	80	D
1,2-Dibromo-3-chloropropane (DBCP)	Fumigant	82625	96-12-8	0.5	MCL-US	0.2	D
1,2-Dibromoethane (EDB)	Fumigant	77651	106-93-4	0.04	MCL-US	0.05	–
Dibromomethane	Solvent	30217	74-95-3	0.04	na	na	–
1,2-Dichlorobenzene	Solvent	34536	95-50-1	0.04	MCL-CA	600	D
1,3-Dichlorobenzene	Solvent	34566	541-73-1	0.04	HAL-US	600	–
1,4-Dichlorobenzene	Fumigant	34571	106-46-7	0.04	MCL-CA	5	D
trans-1,4-Dichloro-2-butene	Organic synthesis	73547	110-57-6	0.6	na	na	–
Dichlorodifluoromethane (CFC-12)	Refrigerant	34668	75-71-8	0.14	NL-CA	1,000	D
1,1-Dichloroethane	Solvent	34496	75-34-3	0.06	MCL-CA	5	D
1,2-Dichloroethane	Solvent	32103	107-06-2	0.10	MCL-CA	0.5	D
1,1-Dichloroethene (DCE)	Organic synthesis	34501	75-35-4	0.02	MCL-CA	6	D
cis-1,2-Dichloroethene	Solvent	77093	156-59-2	0.02	MCL-CA	6	D
trans-1,2-Dichloroethene	Solvent	34546	156-60-5	0.018	MCL-CA	10	D
Dichloromethane (Methylene chloride)	Solvent	34423	75-09-2	0.04	MCL-US	5	D
1,2-Dichloropropane	Fumigant	34541	78-87-5	0.02	MCL-US	5	D
1,3-Dichloropropane	Fumigant	77173	142-28-9	0.06	na	na	–
2,2-Dichloropropane	Fumigant	77170	594-20-7	0.06	na	na	–
1,1-Dichloropropene	Organic synthesis	77168	563-58-6	0.04	na	na	–
cis-1,3-Dichloropropene	Fumigant	34704	10061-01-5	0.06	RSD5-US[2]	4	–
trans-1,3-Dichloropropene	Fumigant	34699	10061-02-6	0.10	RSD5-US[2]	4	–
Diethyl ether	Solvent	81576	60-29-7	0.08	na	na	–
Diisopropyl ether (DIPE)	Gasoline oxygenate	81577	108-20-3	0.06	na	na	–
Ethylbenzene	Gasoline hydrocarbon	34371	100-41-4	0.02	MCL-CA	300	–
Ethyl *tert*-butyl ether (ETBE)	Gasoline oxygenate	50004	637-92-3	0.04	na	na	–
Ethyl methacrylate	Organic synthesis	73570	97-63-2	0.14	na	na	–
1-Ethyl-2-methylbenzene (*o*-Ethyl toluene)	Gasoline hydrocarbon	77220	611-14-3	0.04	na	na	–

Table 3A. Volatile organic compounds, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory schedule 2020.—Continued

[The five-digit U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. **CAS number:** This report contains CAS Registry Numbers®, which is a Registered Trademark of the American Chemical Society. CAS recommends verifying the CASRNs through CAS Client Services℠. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations**: CAS, Chemical Abstract Service; LRL, laboratory reporting level; HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California Department of Public Health notification level; RSD5-US, U.S. Environmental Protection Agency risk specific dose at a risk factor of 10^{-5}; D, detected; na, not available; µg/L, micrograms per liter; –, not detected; THM, trihalomethane]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold type	Threshold value (µg/L)	Detection
Hexachlorobutadiene	Organic synthesis	39702	87-68-3	0.10	RSD5-US	9	–
Hexachloroethane	Solvent	34396	67-72-1	0.14	HAL-US	1	–
2-Hexanone (*n*-Butyl methyl ketone)	Solvent	77103	591-78-6	0.4	na	na	–
Isopropylbenzene (Cumene)	Gasoline hydrocarbon	77223	98-82-8	0.04	NL-CA	770	–
4-Isopropyl-1-methylbenzene	Gasoline hydrocarbon	77356	99-87-6	0.08	na	na	–
Methyl acrylate	Organic synthesis	49991	96-33-3	0.4	na	na	–
Methyl acrylonitrile	Organic synthesis	81593	126-98-7	0.40	na	na	–
Methyl bromide (Bromomethane)	Fumigant	34413	74-83-9	0.4	HAL-US	10	–
Methyl *tert*-butyl ether (MTBE)	Gasoline oxygenate	78032	1634-04-4	0.10	MCL-CA	13	D
Methyl iodide (Iodomethane)	Organic synthesis	77424	74-88-4	0.4	na	na	–
Methyl methacrylate	Organic synthesis	81597	80-62-6	0.20	na	na	–
4-Methyl-2-pentanone (MIBK, isobutyl methyl ketone)	Solvent	78133	108-10-1	0.2	NL-CA	120	–
Methyl tert-pentyl ether (*tert*-Amyl methyl ether, TAME)	Gasoline oxygenate	50005	994-05-8	0.04	na	na	–
Naphthalene	Gasoline hydrocarbon	34696	91-20-3	0.4	NL-CA	17	–
n-Propylbenzene	Solvent	77224	103-65-1	0.04	NL-CA	260	–
Styrene	Gasoline hydrocarbon	77128	100-42-5	0.04	MCL-US	100	–
1,1,1,2-Tetrachloroethane	Solvent	77562	630-20-6	0.04	HAL-US	70	–
1,1,2,2-Tetrachloroethane	Solvent	34516	79-34-5	0.10	MCL-CA	1	–
Tetrachloroethene (PCE)	Solvent	34475	127-18-4	0.04	MCL-US	5	D
Tetrahydrofuran	Solvent	81607	109-99-9	1.0	na	na	–
1,2,3,4-Tetramethylbenzene (Prehnitene)	Gasoline hydrocarbon	49999	488-23-3	0.14	na	na	–
1,2,3,5-Tetramethylbenzene (Isodurene)	Gasoline hydrocarbon	50000	527-53-7	0.12	na	na	–
Toluene	Gasoline hydrocarbon	34010	108-88-3	0.018	MCL-CA	150	D[3]
1,2,3-Trichlorobenzene	Organic synthesis	77613	87-61-6	0.12	na	na	–
1,2,4-Trichlorobenzene	Solvent	34551	120-82-1	0.12	MCL-CA	5	–
1,1,1-Trichloroethane (TCA)	Solvent	34506	71-55-6	0.04	MCL-CA	200	D
1,1,2-Trichloroethane	Solvent	34511	79-00-5	0.04	MCL-CA	5	–
Trichloroethene (TCE)	Solvent	39180	79-01-6	0.02	MCL-US	5	D
Trichlorofluoromethane (CFC-11)	Refrigerant	34488	75-69-4	0.08	MCL-CA	150	D
1,2,3-Trichloropropane (1,2,3-TCP)	Solvent/organic synthesis	77443	96-18-4	0.12	HAL-US	40	–
1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113)	Refrigerant	77652	76-13-1	0.04	MCL-CA	1,200	D
1,2,3-Trimethylbenzene	Gasoline hydrocarbon	77221	526-73-8	0.08	na	na	–
1,2,4-Trimethylbenzene	Gasoline hydrocarbon	77222	95-63-6	0.04	NL-CA	330	D
1,3,5-Trimethylbenzene	Organic synthesis	77226	108-67-8	0.04	NL-CA	330	–
Vinyl bromide (Bromoethene)	Fire retardant	50002	593-60-2	0.12	na	na	–
Vinyl chloride (Chloroethene)	Organic synthesis	39175	75-01-4	0.08	MCL-CA	0.5	–
m- and *p*-Xylene	Gasoline hydrocarbon	85795	108-38-3 / 106-42-3	0.08	MCL-CA[4]	1,750	–
o-Xylene	Gasoline hydrocarbon	77135	95-47-6	0.04	MCL-CA[4]	1,750	–

[1] The MCL-US, and MCL-CA thresholds for trihalomethanes are the sum of chloroform, bromoform, bromodichloromethane, and dibromochloromethane.

[2] The RSD5 threshold for 1,3-dichloropropene is the sum of its isomers (*cis* and *trans*).

[3] Toluene detections were at approximately the same concentrations as detections in blank samples. Detections in ground-water samples could be entirely attributed to unintended sample contamination.

[4] The MCL-CA threshold for xylenes is the sum of the *m*, *p*, and *o* isomers.

Table 3B. Pesticides and pesticide degradates, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory schedule 2033.

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Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold type	Threshold value (µg/L)	Detection
Acetochlor	Herbicide	49260	34256-82-1	0.006	na	na	–
Alachlor	Herbicide	46342	15972-60-8	0.005	MCL-US	2	–
Atrazine	Herbicide	39632	1912-24-9	0.007	MCL-CA	1	D
Azinphos-methyl	Insecticide	82686	86-50-0	0.08	na	na	–
Azinphos-methyl-oxon	Degradate	61635	961-22-8	0.042	na	na	–[1]
Benfluralin	Herbicide	82673	1861-40-1	0.01	na	na	–[1]
Carbaryl	Insecticide	82680	63-25-2	0.06	RSD5-US	400	–
Carbofuran	Insecticide	82674	1563-66-2	0.02	MCL-CA	18	–
2-Chloro-2,6-diethylacetanilide	Degradate	61618	6967-29-9	0.0065	na	na	–
4-Chloro-2-methylphenol	Degradate	61633	1570-64-5	0.005	na	na	–[1]
Chlorpyrifos	Insecticide	38933	2921-88-2	0.005	HAL-US	20	–
Chlorpyrifos, oxygen analog	Degradate	61636	5598-15-2	0.0562	na	na	–[1]
Cyanazine	Herbicide	04041	21725-46-2	0.018	HAL-US	1	–
Cyfluthrin	Insecticide	61585	68359-37-5	0.053	na	na	–[1]
λ-Cyhalothrin	Insecticide	61595	91465-08-6	0.014	na	na	–[1]
Cypermethrin	Insecticide	61586	52315-07-8	0.046	na	na	–[1]
DCPA (Dacthal)	Herbicide	82682	1861-32-1	0.003	HAL-US	70	D
Deethylatrazine (2-Chloro-4-isopropylamino-6-amino-*s*-triazine)	Degradate	04040	6190-65-4	0.014	na	na	D[1]
Desulfinylfipronil	Degradate	62170	na	0.012	na	na	–[2]
Desulfinylfipronil amide	Degradate	62169	na	0.029	na	na	–[2]
Diazinon	Insecticide	39572	333-41-5	0.005	HAL-US	0.6	–
Diazinon oxon	Degradate	61638	962-59-3	0.006	na	na	–
3,4-Dichloroaniline	Degradate	61625	95-76-1	0.0045	na	na	D
3,5-Dichloroaniline	Degradate	61627	626-43-7	0.012	na	na	–
Dichlorvos	Insecticide	38775	62-73-7	0.013	na	na	–[1]
Dicrotophos	Insecticide	38454	141-66-2	0.0843	na	na	–[1]
Dieldrin	Insecticide	39381	60-57-1	0.009	RSD5-US	0.02	–
2,6-Diethylaniline	Degradate	82660	579-66-8	0.006	na	na	–
Dimethoate	Insecticide	82662	60-51-5	0.0061	na	na	–[1]
Disulfoton	Insecticide	82677	298-04-4	0.02	HAL-US	0.7	–[1]
Disulfoton sulfone	Degradate	61640	2497-06-5	0.014	na	na	–
α-Endosulfan	Insecticide	34362	959-98-8	0.011	na	na	–
Endosulfan sulfate	Degradate	61590	1031-07-8	0.022	na	na	–
EPTC	Herbicide	82668	759-94-4	0.002	na	na	–
Ethion	Insecticide	82346	563-12-2	0.016	na	na	–
Ethion monoxon	Degradate	61644	17356-42-2	0.021	na	na	–
Ethoprophos	Herbicide	82672	13194-48-4	0.012	na	na	–
2-Ethyl-6-methylaniline	Degradate	61620	24549-06-2	0.01	na	na	–
Fenamiphos	Insecticide	61591	22224-92-6	0.029	HAL-US	0.7	–
Fenamiphos sulfone	Degradate	61645	31972-44-8	0.053	na	na	–[1]
Fenamiphos sulfoxide	Degradate	61646	31972-43-7	0.04	na	na	–[1]
Fipronil	Insecticide	62166	120068-37-3	0.016	na	na	–[2]
Fipronil sulfide	Degradate	62167	120067-83-6	0.013	na	na	–[2]

Table 3B. Pesticides and pesticide degradates, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory schedule 2033.—Continued

[The five-digit U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. **CAS number:** This report contains CAS Registry Numbers®, which is a Registered Trademark of the American Chemical Society. CAS recommends verifying the CASRNs through CAS Client Services℠ . **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists.**Abbreviations**: CAS, Chemical Abstract Service; LRL, laboratory reporting level; HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; RSD5-US, U.S. Environmental Protection Agency risk specific dose at a risk factor of 10^{-5}; D, detected; na, not available; µg/L, micrograms per liter; –, not detected; LT-MDL, long-term method detection limit]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold type	Threshold value (µg/L)	Detection
Fipronil sulfone	Degradate	62168	120068-36-2	0.024	na	na	–[1]
Fonofos	Insecticide	04095	944-22-9	0.006	HAL-US	10	–
Hexazinone	Herbicide	04025	51235-04-2	0.026	HAL-US	400	–[1]
Iprodione	Fungicide	61593	36734-19-7	0.026	na	na	–
Isofenphos	Insecticide	61594	25311-71-1	0.011	na	na	–
Malaoxon	Degradate	61652	1634-78-2	0.039	na	na	–
Malathion	Insecticide	39532	121-75-5	0.027	HAL-US	100	–
Metalaxyl	Fungicide	61596	57837-19-1	0.0069	na	na	D
Methidathion	Insecticide	61598	950-37-8	0.0087	na	na	–
Metolachlor	Herbicide	39415	51218-45-2	0.010	HAL-US	700	–[2]
Metribuzin	Herbicide	82630	21087-64-9	0.012	HAL-US	70	–
Molinate	Herbicide	82671	2212-67-1	0.003	MCL-CA	20	–
Myclobutanil	Fungicide	61599	88671-89-0	0.033	na	na	–
1-Naphthol	Degradate	49295	90-15-3	0.0882	na	na	–[1]
Oxyfluorfen	Herbicide	61600	42874-03-3	0.017	na	na	–[1]
Paraoxon-methyl	Degradate	61664	950-35-6	0.019	na	na	–[1]
Parathion-methyl	Insecticide	82667	298-00-0	0.008	HAL-US	1	–
Pendimethalin	Herbicide	82683	40487-42-1	0.02	na	na	D
cis-Permethrin	Insecticide	82687	54774-45-7	0.01	na	na	–[1]
Phorate	Insecticide	82664	298-02-2	0.02	na	na	–
Phorate oxygen analog	Degradate	61666	2600-69-3	0.027	na	na	–
Phosmet	Insecticide	61601	732-11-6	0.0079	na	na	–[1]
Phosmet oxon	Degradate	61668	3735-33-9	0.0511	na	na	–[1]
Prometon	Herbicide	04037	1610-18-0	0.01	HAL-US	100	D
Prometryn	Herbicide	04036	7287-19-6	0.0059	na	na	–
Pronamide	Herbicide	82676	23950-58-5	0.004	na	na	–
Propanil	Herbicide	82679	709-98-8	0.011	na	na	–
Propargite	Insecticide	82685	2312-35-8	0.02	na	na	–[1]
cis-Propiconazole	Fungicide	79846	60207-90-1	0.013	na	na	–[1]
trans-Propiconazole	Fungicide	79847	60207-90-1	0.034	na	na	–[1]
Simazine	Herbicide	04035	122-34-9	0.006	MCL-US	4	D
Tebuconazole	Fungicide	62852	107534-96-3	0.0136	na	na	–[1]
Tebuthiuron	Herbicide	82670	34014-18-1	0.016	HAL-US	500	D
Tefluthrin	Insecticide	61606	79538-32-2	0.0033	na	na	–[1]
Terbufos	Insecticide	82675	13071-79-9	0.012	HAL-US	0.4	–
Terbufos oxygen analog sulfone	Degradate	61674	56070-15-6	0.045	na	na	–[1]
Terbuthylazine	Herbicide	04022	5915-41-3	0.0083	na	na	–
Thiobencarb	Herbicide	82681	28249-77-6	0.01	MCL-CA	70	–
Tribufos	Herbicide	61610	78-48-8	0.035	na	na	–[1]
Trifluralin	Herbicide	82661	1582-09-8	0.009	HAL-US	10	–[1]

[1] The median matrix-spike recovery was less than 70 percent. Low recoveries may indicate that the compound would not have been detected in some samples if it was present at very low concentrations.

[2] Detected at less than the LT-MDL in at least one sample.

Table 3C. Polar pesticides and pesticide degradates, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory schedule 2060.

[The five-digit U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. **CAS number:** This report contains CAS Registry Numbers®, which is a Registered Trademark of the American Chemical Society. CAS recommends verifying the CASRNs through CAS Client Services℠ . **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations**: LRL, laboratory reporting level; CAS, Chemical Abstract Service; HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; RSD5-US, U.S. Environmental Protection Agency risk specific dose at a risk factor of 10^{-5}; D, detected; na, not available; µg/L, micrograms per liter; –, not detected; LT-MDL, long-term method detection limit]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold type	Threshold value (µg/L)	Detection
Acifluorfen	Herbicide	49315	50594-66-6	0.06	na	na	–[1]
Aldicarb	Insecticide	49312	116-06-3	0.04	MCL-US	3	–[1]
Aldicarb sulfone	Degradate	49313	1646-88-4	0.08	MCL-US	3	–[1]
Aldicarb sulfoxide	Degradate	49314	1646-87-3	0.04	MCL-US	4	–
Atrazine	Herbicide	39632	1912-24-9	0.04	MCL-CA	1	D
Bendiocarb	Insecticide	50299	22781-23-3	0.04	na	na	–
Benomyl	Fungicide	50300	17804-35-2	0.02	na	na	–
Bensulfuron-methyl	Herbicide	61693	83055-99-6	0.06	na	na	–
Bentazon	Herbicide	38711	25057-89-0	0.02	MCL-CA	18	–[1]
Bromacil	Herbicide	04029	314-40-9	0.04	HAL-US	70	D
Bromoxynil	Herbicide	49311	1689-84-5	0.12	na	na	–[1,2]
Caffeine	Stimulant	50305	58-08-2	0.04	na	na	–
Carbaryl	Herbicide	49310	63-25-2	0.02	RSD5-US	400	–
Carbofuran	Herbicide	49309	1563-66-2	0.06	MCL-CA	18	–
Chloramben methyl ester	Herbicide	61188	7286-84-2	0.1	na	na	–
Chlorimuron-ethyl	Herbicide	50306	90982-32-4	0.08	na	na	–
2-Chloro-4-isopropylamino-6-amino-*s*-triazine (Deethylatrazine, CIAT)	Degradate	04040	6190-65-4	0.02	na	na	D[1]
2-Choro-6-ethylamino-4-amino-*s*-triazine (Deisopropylatrazine, CEAT)	Degradate	04038	1007-28-9	0.08	na	na	D[1]
3-(4-Chlorophenyl)-1-methyl urea	Degradate	61692	5352-88-5	0.06	na	na	–[1,2]
Clopyralid	Herbicide	49305	1702-17-6	0.06	na	na	–
Cycloate	Herbicide	04031	1134-23-2	0.06	na	na	–
2,4-D (2,4-Dichlorophenoxyacetic acid)	Herbicide	39732	94-75-7	0.04	MCL-US	70	–
2,4-D methyl ester (2,4-Dichlorophenoxyacetic acid methyl ester)	Herbicide	50470	1928-38-7	0.2	na	na	–
2,4-DB (4-(2,4-Dichlorophenoxy) butyric acid)	Herbicide	38746	94-82-6	0.02	na	na	–[1]
DCPA (Dacthal) monoacid	Degradate	49304	887-54-7	0.02	na	na	–
Dicamba	Herbicide	38442	1918-00-9	0.08	HAL-US	4000	–[1]
Dichlorprop	Herbicide	49302	120-36-5	0.04	na	na	–
Dinoseb	Herbicide	49301	88-85-7	0.04	MCL-CA	7	–[1,2]
Diphenamid	Herbicide	04033	957-51-7	0.04	HAL-US	200	–[2]
Diuron	Herbicide	49300	330-54-1	0.04	RSD5-US	20	D
Fenuron	Herbicide	49297	101-42-8	0.04	na	na	–
Flumetsulam	Herbicide	61694	98967-40-9	0.06	na	na	–
Fluometuron	Herbicide	38811	2164-17-2	0.04	HAL-US	90	–
2-Hydroxy-4-isopropylamino-6-ethylamino-*s*-triazine (Hydroxyatrazine)	Degradate	50355	2163-68-0	0.08	na	na	–[2]
3-Hydroxy carbofuran	Degradate	49308	16655-82-6	0.02	na	na	–
Imazaquin	Herbicide	50356	81335-37-7	0.04	na	na	–
Imazethapyr	Herbicide	50407	81335-77-5	0.04	na	na	–[2]

Table 3C. Polar pesticides and pesticide degradates, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory schedule 2060.—Continued

[The five-digit U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. **CAS number:** This report contains CAS Registry Numbers®, which is a Registered Trademark of the American Chemical Society. CAS recommends verifying the CASRNs through CAS Client Services℠ . **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations**: LRL, laboratory reporting level; CAS, Chemical Abstract Service; HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; RSD5-US, U.S. Environmental Protection Agency risk specific dose at a risk factor of 10^{-5}; D, detected; na, not available; µg/L, micrograms per liter; –, not detected; LT-MDL, long-term method detection limit]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold type	Threshold value (µg/L)	Detection
Imidacloprid	Insecticide	61695	138261-41-3	0.06	na	na	–[2]
Linuron	Herbicide	38478	330-55-2	0.04	na	na	–
MCPA (2-Methyl-4-chlorophenoxyacetic acid)	Herbicide	38482	94-74-6	0.06	HAL-US	30	–[1]
MCPB (4-(2-Methyl-4-chlorophenoxy) butyric acid)	Herbicide	38487	94-81-5	0.2	na	na	–[1]
Metalaxyl	Fungicide	50359	57837-19-1	0.04	na	na	–
Methiocarb	Insecticide	38501	2032-65-7	0.04	na	na	–
Methomyl	Insecticide	49296	16752-77-5	0.06	HAL-US	200	–
Metsulfuron methyl	Herbicide	61697	74223-64-6	0.14	na	na	–
Neburon	Herbicide	49294	555-37-3	0.02	na	na	–
Nicosulfuron	Herbicide	50364	111991-09-4	0.1	na	na	–
Norflurazon	Herbicide	49293	27314-13-2	0.04	na	na	D
Oryzalin	Herbicide	49292	19044-88-3	0.04	na	na	–
Oxamyl	Insecticide	38866	23135-22-0	0.04	MCL-CA	50	–
Picloram	Herbicide	49291	1918-02-1	0.12	MCL-US	500	–[1]
Propham	Herbicide	49236	122-42-9	0.06	HAL-US	100	–
Propiconazole	Fungicide	50471	60207-90-1	0.06	na	na	–
Propoxur (Baygon)	Insecticide	38538	114-26-1	0.04	HAL-US	3	–
Siduron	Herbicide	38548	1982-49-6	0.04	na	na	–[2]
Sulfometuron methyl	Herbicide	50337	74222-97-2	0.06	na	na	–
Tebuthiuron	Herbicide	82670	34014-18-1	0.016	HAL-US	500	–[2]
Terbacil	Herbicide	04032	5902-51-2	0.04	HAL-US	90	–
Triclopyr	Herbicide	49235	55335-06-3	0.04	na	na	–

[1] The median matrix-spike recovery was less than 70 percent. Low recoveries may indicate that the compound would not have been detected in some samples if it was present at very low concentrations.

[2] Detected at less than the LT-MDL in at least one sample.

Table 3D. Pharmaceutical compounds, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory schedule 2080.

[The five-digit U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. **CAS number:** This report contains CAS Registry Numbers®, which is a Registered Trademark of the American Chemical Society. CAS recommends verifying the CASRNs through CAS Client Services℠. **Abbreviations**: CAS, Chemical Abstract Service; IRL, interim reporting level; D, detected; na, not available; µg/L, micrograms per liter; –, not detected]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold type	Threshold value (µg/L)	Detection
Acetaminophen	Analgesic	62000	103-90-2	0.025	na	na	D[1]
Caffeine	Stimulant	50305	58-08-2	0.015	na	na	D
Carbamazepine	Anticonvulsant; analgesic; mood stabilizer	62793	298-46-4	0.030	na	na	D
Codeine	Opiod narcotic	62003	76-57-3	0.020	na	na	–
Cotinine	Nicotine metabolite	62005	486-56-6	0.030	na	na	–
Dehydronifedipine	Antianginal metabolite	62004	67035-22-7	0.020	na	na	–
Diltiazem	Antianginal; antihypertensive	62008	42399-41-7	0.040	na	na	–[1]
1,7-Dimethylxanthine	Caffeine metabolite	62030	611-59-6	0.020	na	na	D
Diphenhydramine	Antihistamine	62796	58-73-1	0.050	na	na	–[1]
Salbutamol (albuterol)	Anti-inflammatory; bronchodilator	62020	18559-94-9	0.015	na	na	–
Sulfamethoxazole	Antibacterial, antiprotozoal	62021	723-46-6	0.10	na	na	–[1]
Thiabendazole	Anthelmintic	62801	148-79-8	0.10	na	na	–
Trimethoprim	Antibacterial	62023	738-70-5	0.040	na	na	–
Warfarin	Anticoagulant	62024	81-81-2	0.020	na	na	–[1]

[1] The median matrix-spike recovery was less than 70 percent. Low recoveries may indicate that the compound would not have been detected in some samples if it was present at very low concentrations.

Table 3E. Wastewater-indicator compounds, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory schedule 4433.

[The five-digit U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. NOTE: Results for this group of compounds are not presented in this report because results from quality-control samples suggest that these data are unreliable. **CAS number:** This report contains CAS Registry Numbers®, which is a Registered Trademark of the American Chemical Society. CAS recommends verifying the CASRNs through CAS Client Services℠. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations**: CAS, Chemical Abstract Service; LRL, laboratory reporting level; HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California Department of Public Health notification level; RSD5-US, U.S. Environmental Protection Agency risk specific dose at a risk factor of 10^{-5}; D, detected; na, not available; µg/L, micrograms per liter]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold type	Threshold value (µg/L)
Acetophenone	Fragrance, flavor additive	62811	98-86-2	0.2	na	na
Acetyl hexamethyl tetrahydronaphthalene (AHTN)	Musk fragrance	62812	21145-77-7	0.2	na	na
Anthracene	Wood preservative, combustion product	34220	120-12-7	0.2	na	na
Anthraquinone	Dye/textiles, seed treatment	62813	84-65-1	0.2	na	na
Atrazine	Herbicide	39630	1912-24-9	0.2	MCL-CA	1
Benzo[a]pyrene	Combustion product	34247	50-32-8	0.2	MCL-US	0.2
Benzophenone	Fixative for perfumes and soaps	62814	119-61-9	0.2	na	na
Bisphenol A	Polycarbonate resins, flame retardant	62816	80-05-7	0.4	na	na
Bis(2-ethylhexyl)phthalate	Plasticizer, softener	39100	117-81-7	2	MCL-US	6
Bromacil	Herbicide	30234	314-40-9	0.2	HAL-US	70
Bromoform (tribromomethane)	Disinfection by-product	32104	75-25-2	0.2	MCL-US	80
3-*tert*-Butyl-4-hydroxy anisole (BHA)	Antioxidant, general preservative	61702	25013-16-5	0.2	na	na
Caffeine	Beverages	81436	58-08-2	0.2	na	na
Camphor	Flavor, odorant, ointments	62817	76-22-2	0.2	na	na
Carbaryl	Insecticide	39750	63-25-2	0.2	RSD5-US	400
Carbazole	Insecticide	77571	86-74-8	0.2	na	na
Chlorpyrifos	Insecticide	38932	2921-88-2	0.2	HAL-US	20
Cholesterol	Fecal indicator, plant sterol	62818	57-88-5	0.8	na	na
3-*beta*-Coprostanol	Carnivore fecal indicator	62806	360-68-9	0.8	na	na
Cotinine	Primary nicotine metabolite	61945	486-56-6	0.8	na	na
para-Cresol	Wood preservative	77146	106-44-5	0.2	na	na
4-Cumylphenol	Nonionic detergent metabolite	62808	599-64-4	0.2	na	na
Diazinon	Insecticide	39570	333-41-5	0.2	HAL-US	1
N,*N*-diethyl-*m*-toluamide (DEET)	Insecticide	61947	134-62-3	0.2	na	na
1,4-Dichlorobenzene	Moth repellant, fumigant, deodorant	34571	106-46-7	0.2	MCL-CA	5
3,4- Dichlorophenyl isocyanate	Intermediate for the synthesis of organic compounds	63145	102-36-3	2	na	na
Dichlorvos	Insecticide	30218	62-73-7	0.2	na	na
Diethyl phthalate	Wood stains and varnishes, plasticizer, softener	34336	84-66-2	0.2	na	na
2,6-Dimethylnaphthalene	Diesel/kerosene	62805	581-42-0	0.2	na	na
4-Nonylphenol diethoxylates	Nonionic detergent metabolite	61703	na	3.2	na	na
4-Octylphenol diethoxylates	Nonionic detergent metabolite	61705	na	0.32	na	na
Nonylphenol, monoethoxylates (total)	Nonionic detergent metabolite	61704	na	2	na	na
4-Octylphenol monoethoxylates	Nonionic detergent metabolite	61706	na	1	na	na
Fluoranthene	Component of coal tar and asphalt	34376	206-44-0	0.2	na	na
Hexahydrohexamethylcyclo-pentabenzopyran (HHCB)	Musk fragrance	62823	1222-05-5	0.2	na	na

Table 3E. Wastewater-indicator compounds, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory schedule 4433.—Continued

[The five-digit U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. NOTE: Results for this group of compounds are not presented in this report because results from quality-control samples suggest that these data are unreliable. **CAS number:** This report contains CAS Registry Numbers®, which is a Registered Trademark of the American Chemical Society. CAS recommends verifying the CASRNs through CAS Client Services℠. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations**: CAS, Chemical Abstract Service; LRL, laboratory reporting level; HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California Department of Public Health notification level; RSD5-US, U.S. Environmental Protection Agency risk specific dose at a risk factor of 10^{-5}; D, detected; na, not available; µg/L, micrograms per liter]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold type	Threshold value (µg/L)
Indole	Pesticide ingredient	62824	120-72-9	0.2	na	na
Isoborneol	Fragrance in perfumery	62825	124-76-5	0.2	na	na
Isophorone	Solvent	34408	78-59-1	0.2	HAL-US	100
Isopropylbenzene	Fuels, paint thinner	77223	98-82-8	0.2	NL-CA	770
Isoquinoline	Flavors and fragrances	62826	119-65-3	0.2	na	na
d-Limonene	Fungicide, solvent	62819	5989-27-5	0.2	na	na
Menthol	Cigarettes, cough drops, liniment	62827	89-78-1	0.2	na	na
Metalaxyl	Herbicide, fungicide	04254	57837-19-1	0.2	na	na
3-Methyl-1(H)-indole (Skatole)	Fragrance, stench in feces	62807	83-34-1	0.2	na	na
5-Methyl-1H-benzotriazole	Antioxidant in antifreeze and deicers	61944	136-85-6	1.6	na	na
1-Methylnaphthalene	Gasoline, diesel fuel, or crude oil	81696	90-12-0	0.2	na	na
2-Methylnaphthalene	Gasoline, diesel fuel, or crude oil	30194	91-57-6	0.2	na	na
Methyl salicylate	Liniment, UV-absorbing lotion	62828	119-36-8	0.2	na	na
Metolachlor	Herbicide	82612	51218-45-2	0.2	HAL-US	700
Naphthalene	Fumigant, moth repellent, gasoline	34696	91-20-3	0.2	NL-CA	17
para-Nonylphenol (total)	Nonionic detergent metabolite	62829	84852-15-3	1.6	na	na
4-*n*-Octylphenol	Nonionic detergent metabolite	62809	1806-26-4	0.2	na	na
4-*tert*-Octylphenol	Nonionic detergent metabolite	62810	140-66-9	0.2	na	na
Pentachlorophenol	Fumigant, moth repellent, gasoline	39032	87-86-5	0.8	MCL-US	1
Phenanthrene	Manufactured explosives	34461	85-01-8	0.2	na	na
Phenol	Disinfectant, organic synthesis	34694	108-95-2	0.2	HAL-US	2,000
Prometon	Herbicide	39056	1610-18-0	0.2	HAL-US	100
Pyrene	Component of coal tar and asphalt	34469	129-00-0	0.2	na	na
beta-Sitosterol	Plant sterol	62815	83-46-5	0.8	na	na
beta-Stigmastanol	Plant sterol	61948	19466-47-8	0.8	na	na
2,2',4,4'- Tetrabromodiphenyl ether	Brominated flame retardant	63147	5436-43-1	0.2	na	na
Tetrachloroethylene (PCE)	Solvent, degreaser	34475	127-18-4	0.4	MCL-US	5
Tributyl phosphate	Antifoaming agent, flame retardant	62832	126-73-8	0.2	na	na
Triclosan	Disinfectant, antimicrobial	61708	3380-34-5	0.2	na	na
Triethyl citrate (ethyl citrate)	Cosmetics, pharmaceuticals	62833	77-93-0	0.2	na	na
Triphenyl phosphate	Plasticizer	62834	115-86-6	0.2	na	na
Tris(2-butoxyethyl)phosphate	Flame retardant	62830	78-51-3	0.2	na	na
Tris(2-chloroethyl)phosphate	Plasticizer, flame retardant	62831	115-96-8	0.2	na	na
Tris(dichlorisopropyl)phosphate	Flame retardant	61707	13674-87-8	0.2	na	na

Table 3F. Constituents of special interest, primary uses or sources, comparative thresholds, and reporting information for the Montgomery Watson-Harza Laboratory.

[The five-digit U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. **CAS number:** This report contains CAS Registry Numbers®, which is a Registered Trademark of the American Chemical Society. CAS recommends verifying the CASRNs through CAS Client Services℠. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations**: CAS, Chemical Abstract Service; MRL, minimum reporting level; MCL-CA, California Department of Public Health maximum contaminant level; NL-CA, California notification level; D, detected; µg/L, micrograms per liter; –, not detected]

Constituent	Primary use or source	USGS parameter code	CAS number	MRL (µg/L)	Threshold type	Threshold value (µg/L)	Detection
Perchlorate	Rocket fuel, fireworks, flares	61209	14797-73-0	0.5	MCL-CA	6	D
1,4-Dioxane	Industrial solvent, solvent stabilizer	81582	123-91-1	2.0	NL-CA	3	–[1]
1,2,3-Trichloropropane (TCP)	Industrial solvent, organic synthesis	77443	96-18-4	0.005	HAL-US	40	D
N-Nitrosodimethylamine (NDMA)	Rocket fuel, plasticizer, disinfection by-product	64176	62-75-9	0.002	NL-CA	0.010	D[2]

[1] The median matrix-spike recovery was less than 70 percent. Low recoveries may indicate that the compound would not have been detected in some samples if it was present at very low concentrations.

[2] NDMA was detected at a concentration below the concentration detected in a blank sample. Detections in ground-water samples could be attributed to unintended sample contamination.

Table 3G. Nutrients and dissolved organic carbon, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory schedule 2755 and lab code 2612.

[The five-digit U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. **CAS number:** This report contains CAS Registry Numbers®, which is a Registered Trademark of the American Chemical Society. CAS recommends verifying the CASRNs through CAS Client Services℠. **Threshold value:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations**: CAS, Chemical Abstract Service; HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory Level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; D, detected; na, not available; mg/L, milligrams per liter]

Constituent	USGS parameter code	CAS number	LRL (mg/L)	Threshold type	Threshold value (mg/L)	Detection
Ammonia	00608	7664-41-7	0.02	HAL-US	[1]30	D
Nitrite (as nitrogen)	00613	14797-65-0	0.002	MCL-US	1	D
Nitrite plus nitrate (as nitrogen)	00631	12797-55-8 plus 14797-65-0	0.060	MCL-US	10	D
Total nitrogen (ammonia, nitrite, nitrate, organic nitrogen)	62854	17778-88-0	0.06	na	na	D
Phosphorus, phosphate, orthophosphate (as phosphorus)	00671	14265-44-2	0.006	na	na	D
Dissolved organic carbon (DOC)	00681	na	0.4	na	na	D

[1] Threshold for ammonia is as ammonia; results are listed as nitrogen.

Table 3H. Major and minor ions, silica, total dissolved solids, and trace elements, comparative thresholds, and reporting information for the USGS National Water Quality Laboratory schedule 1948.

[The five-digit U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. **CAS number:** This report contains CAS Registry Numbers®, which is a Registered Trademark of the American Chemical Society. CAS recommends verifying the CASRNs through CAS Client Services℠. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists **Abbreviations**: CAS, Chemical Abstract Service; AL-US, U.S. Environmental Protection Agency action level; HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California Department of Public Health notification level; SMCL-CA, California Department of Public Health secondary maximum contaminant level; SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level; D, detected; na, not available; mg/L, milligrams per liter; µg/L, micrograms per liter; –, not detected]

Constituent	USGS parameter code	CAS number	LRL	Threshold type	Threshold value	Detection
Major and minor ions, silica, and total dissolved solids (mg/L)						
Bromide	71870	24959-67-9	0.02	na	na	D
Calcium	00915	7440-70-2	0.02	na	na	D
Chloride	00940	16887-00-6	0.12	SMCL-CA	[1] 250 (500)	D
Fluoride	00950	16984-48-8	0.10	MCL-CA	2	D
Iodide	78165	7553-56-2	0.002	na	na	D
Magnesium	00925	7439-95-4	0.014	na	na	D
Potassium	00935	7440-09-7	0.04	na	na	D
Silica (as SiO_2)	00955	7631-86-9	0.018	na	na	D
Sodium	00930	7440-23-5	0.20	na	na	D
Sulfate	00945	14808-79-8	0.18	SMCL-CA	[1] 250 (500)	D
Residue on evaporation (total dissolved solids, TDS)	70300	na	10	SMCL-US	[1] 500 (1,000)	D
Trace elements (µg/L)						
Aluminum	01106	7429-90-5	1.6	MCL-CA	1,000	D
Antimony	01095	7440-36-0	0.06	MCL-US	6	D
Arsenic	01000	7440-38-2	0.12	MCL-US	10	D
Barium	01005	7440-39-3	0.08	MCL-CA	1,000	D
Beryllium	01010	7440-41-7	0.06	MCL-US	4	–
Boron	01020	7440-42-8	8	NL-CA	1,000	D
Cadmium	01025	7440-43-9	0.04	MCL-US	5	D
Chromium	01030	7440-47-3	0.12	MCL-CA	50	D
Cobalt	01035	7440-48-4	0.04	na	na	D
Copper	01040	7440-50-8	0.4	AL-US	1,300	D
Iron	01046	7439-89-6	6	SMCL-CA	300	D
Lead	01049	7439-92-1	0.12	AL-US	15	D
Lithium	01130	7439-93-2	0.6	na	na	D
Manganese	01056	7439-96-5	0.2	SMCL-CA	50	D
Mercury	71890	7439-97-6	0.01	MCL-US	2	D
Molybdenum	01060	7439-98-7	0.12	HAL-US	40	D
Nickel	01065	7440-02-0	0.06	MCL-CA	100	D
Selenium	01145	7782-49-2	0.08	MCL-US	50	D
Silver	01075	7440-22-4	0.1	SMCL-CA	100	D
Strontium	01080	7440-24-6	0.4	HAL-US	4,000	D
Thallium	01057	7440-28-0	0.04	MCL-US	2	D
Tungsten	01155	7440-33-7	0.06	na	na	D
Uranium	22703	7440-61-1	0.04	MCL-US	30	D
Vanadium	01085	7440-62-2	0.1	NL-CA	50	D
Zinc	01090	7440-66-6	0.6	SMCL-US	5,000	D

[1] The recommended SMCL-CA thresholds for chloride, sulfate, and TDS are listed with the upper SMCL-CA thresholds in parentheses.

Table 3I. Arsenic, chromium, and iron species, comparative thresholds, and reporting information for the U.S. Geological Survey Trace Metal Laboratory, Boulder, Colorado.

[The five-digit U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. **CAS number:** This report contains CAS Registry Numbers®, which is a Registered Trademark of the American Chemical Society. CAS recommends verifying the CASRNs through CAS Client Services℠. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations**: CAS, Chemical Abstract Service; MDL, method detection limit; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; SMCL-CA, California Department of Public Health secondary maximum contaminant level; na, not available; µg/L, micrograms per liter; D, detected; –, not detected]

Constituent (valence state)	USGS parameter code	CAS number	MDL (µg/L)	Threshold type	Threshold value (µg/L)	Detection
Arsenic(III)	99034	22569-72-8	1	na	na	–
Arsenic (total)	01000	7440-38-2	0.5	MCL-US	10	D
Chromium(VI)	01032	18540-29-9	1	na	na	D
Chromium (total)	01030	7440-47-3	1	MCL-CA	50	D
Iron(II)	01047	7439-89-6	2	na	na	D
Iron (total)	01046	7439-89-6	2	SMCL-CA	300	D

Table 3J. Isotopic and radioactive constituents, comparative thresholds, and reporting information for laboratories.

[The five-digit U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. **CAS number:** This report contains CAS Registry Numbers®, which is a Registered Trademark of the American Chemical Society. CAS recommends verifying the CASRNs through CAS Client Services℠. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations**: CAS, Chemical Abstract Service; Laboratory entity codes are listed in the footnotes. Stable isotope ratios are reported in the standard delta notation (δ), the ratio of a heavier isotope to more common lighter isotope of that element, relative to a standard reference material. MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MRL, minimum reporting level; MU, method uncertainty; na, not available; pCi/L, picocuries per liter; per mil, per thousand; CSU, combined standard uncertainty; CV, critical value; SSMDC, sample specific minimum detectable concentration; σ, sigma (standard deviation); D, detected]

Constituent	USGS parameter code	CAS number	Reporting level type	Reporting level or uncertainty type	Threshold type	Threshold value	Reporting units	Detection
[1]Radon-222	82303	14859-67-7	SSMDC	2 σ CSU and CV	Proposed MCL-US[2]	300, 4,000	pCi/L	D
Tritium[3,4]	07000	10028-17-8	MRL	1	MCL-CA	20,000	pCi/L	D
δ^{2}H of water[5]	82082	na	MU	2	na	na	per mil	D
δ^{18}O of water[5]	82085	na	MU	0.20	na	na	per mil	D
δ^{15}N of nitrate[5]	82690	na	MU	na	na	na	per mil	D
δ^{18}O of nitrate[5]	63041	na	MU	na	na	na	per mil	D
δ^{15}N of nitrogen gas[5]	82698	na	MU	na	na	na	per mil	D
Gross-alpha radioactivity, 72-hour and 30-day counts[6]	62636, 62639	12587-46-1	SSMDC	2 σ CSU and CV	MCL-US	15	pCi/L	D
Gross-beta radioactivity, 72-hour and 30-day counts[6]	62642, 62645	12587-47-2	SSMDC	2 σ CSU and CV	MCL-US	4	pCi/L	D
[6]Radium-226	09511	13982-63-3	SSMDC	2 σ CSU and CV	MCL-US[9]	5	pCi/L	D
[6]Radium-228	81366	15262-20-1	SSMDC	2 σ CSU and CV	MCL-US[9]	5	pCi/L	D
δ^{13}C of dissolved carbonates[7]	82081	na	1 σ	0.05	na	na	per mil	D
[8]Carbon-14	49933	14762-75-5	1 σ	0.0015	na	na	percent modern	D

[1] USGS National Water Quality Laboratory

[2] Two MCL-US thresholds have been proposed, 300 pCi/L and 4,000 pCi/L.

[3] USGS Stable Isotope and Tritium Laboratory, Menlo Park, California

[4] Lawrence Livermore National Laboratory—tritium data from this laboratory not available for this report

[5] USGS Stable Isotope Laboratory, Reston, Virginia

[6] Eberline Analytical Services (contract laboratory)

[7] University of Waterloo (contract laboratory)

[8] University of Arizona, Accelerator Mass Spectrometry Laboratory (contract laboratory)

[9] The MCL-US threshold for radium is the sum of radium-226 and radium-228

Table 3K. Dissolved and noble gases, comparative thresholds, and reporting information for dissolved gases analyzed by the U.S. Geological Survey Chlorofluorocarbon Laboratory (CFC) and the Lawrence Livermore National Laboratory (LLNL).

[The five-digit U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. **CAS number:** This report contains CAS Registry Numbers®, which is a Registered Trademark of the American Chemical Society. CAS recommends verifying the CASRNs through CAS Client Services℠. **Abbreviations**: CAS, Chemical Abstract Service. The laboratory entity code for the Lawrence Livermore National Laboratory in the USGS National Water Information System (NWIS) is CA-LLNL. MU, method uncertainty; na, not available; mg/L, milligrams per liter; cm^3 STP/g, cubic centimeters of gas at standard temperature and pressure per gram of water; pCi/L, picocuries per liter; D, detected]

Constituent	USGS parameter code	CAS number	MU (percent)	Reporting units	Threshold type	Threshold value	Detection
Standard dissolved gases[1]							
Methane	76994	74-82-8	na	mg/L	na	na	D
Carbon dioxide	00405	124-39-9	na	mg/L	na	na	D
Nitrogen	00597	7727-37-9	na	mg/L	na	na	D
Oxygen	62971	7782-44-7	na	mg/L	na	na	D
Argon	82043	7440-37-1	na	mg/L	na	na	D
Noble gases[2]							
Argon	na	7440-37-1	2	cm^3STP/g	na	na	D
Helium-3 / Helium-4 ratio	na	na / 7440-59-7	0.75	atom ratio	na	na	D
Helium-4	na	7440-59-7	2	cm^3STP/g	na	na	D
Krypton	na	7439-90-9	2	cm^3STP/g	na	na	D
Neon	na	7440-01-09	2	cm^3STP/g	na	na	D
Xenon	na	7440-63-3	2	cm^3STP/g	na	na	D

[1]Analyzed by the U.S. Geological Survey Reston Chlorofluorocarbon Laboratory.

[2]Analyzed by the Lawrence Livermore National Laboratory.

Table 3L. Microbial constituents, comparison thresholds, and reporting information for the U.S. Geological Survey Ohio Microbiology Laboratory parameter codes 90901, 90900, 99335 and 99332.

[The five-digit U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations**: MDL, method detection limit; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; TT-US, U.S. Environmental Protection Agency treatment technique - a required process intended to reduce the level of contamination in drinking water; na, not available; mL, milliliters; D, detected; –, not detected]

Constituent	USGS parameter code	Primary source	MDL	Threshold type	Threshold value	Detection
Escherichia coli [1]	90901	Sewage and animal waste indicator / intestinal tracts of humans and animals	1 colony / 100 mL	TT-US	Zero	–
Total coliform - including fecal coliform and *E. coli*[1]	90900	Water-quality indicator / soil, water and intestinal tracts of animals	1 colony / 100 mL	MCL-US	5 percent of samples positive per month	D
F-specific coliphage[2]	99335	Viral indicator / intestinal tracts of warm-blooded animals	na	TT-US	99.99 percent killed/ inactivated	–
Somatic coliphage[2]	99332	Viral indicator / fecal contaminated waters	na	TT-US	99.99 percent killed/ inactivated	–

[1] Analyzed in the field.

[2] Analyzed by the U.S. Geological Survey Ohio Microbiology Laboratory (laboratory entity code USGSOHML).

Table 4. Water-quality indicators in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five digit number below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. **Abbreviations:** SMCL-CA, California Department of Public Health secondary maximum contaminant level; SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level; C, Celsius; mg/L, milligrams per liter; nc, sample not collected; na, not available; NTU, nephelometric turbidity unit; µS/cm, microsiemens per centimeter; $CaCO_3$, calcium carbonate; –, not detected]

GAMA well identification number	Turbidity, field (NTU) (63676)	Dissolved oxygen, field (mg/L) (00300)	Water temperature, field (degrees C) (00010)	pH, lab (standard units) (00403)	pH, field (standard units) (00400)	Specific conductance, lab (µS/cm at 25°C) (90095)	Specific conductance, field (µS/cm at 25°C) (00095)	Alkalinity, lab (mg/L as $CaCO_3$) (29801)	Alkalinity, field (mg/L as $CaCO_3$) (29802)	Bicarbonate, field (mg/L) (63786)	Carbonate, field (mg/L) (63788)
Threshold type	SMCL-CA	na	na	SMCL-US	SMCL-US	SMCL-CA[1]	SMCL-CA[1]	na	na	na	na
Threshold level	5	na	na	6.5 - 8.5	6.5 - 8.5	900 (1,600)	900 (1,600)	na	na	na	na
					Grid wells						
USAWB-01	nc	1.2	24.5	nc	8.0	nc	525	nc	nc	nc	nc
USAWB-02	0.2	8.0	15.0	7.7	7.3	313	314	137	132	160	–
USAWB-03	nc	4.7	16.5	nc	7.4	nc	660	nc	nc	nc	nc
USAWB-04	0.3	10.0	18.5	8.1	7.9	312	299	120	124	150	–
USAWB-05	nc	9.8	16.5	nc	7.3	nc	437	nc	nc	nc	nc
USAWB-06	nc	8.1	20.0	nc	7.4	nc	485	nc	nc	nc	nc
USAWB-07	0.3	5.5	19.5	7.8	7.7	517	513	141	147	178	–
USAWB-08	0.2	8.8	18.5	7.5	7.4	593	577	190	224	272	–
USAWB-09	nc	20.2	17.5	nc	7.2	nc	723	nc	nc	nc	nc
USAWB-10	0.3	9.6	19.0	7.6	7.6	622	618	204	193	234	–
USAWB-11	0.4	8.1	21.5	7.4	7.3	674	663	154	147	178	–
USAWB-12	nc	nc	19.0	nc	7.3	nc	353	nc	nc	nc	nc
USAWB-13	nc	nc	22.5	nc	7.6	nc	647	nc	nc	nc	nc
USAWB-14	0.4	11.0	19.5	7.8	7.4	367	365	168	157	189	–
USAWB-15	nc	nc	17.5	nc	7.6	nc	382	nc	nc	nc	nc
USAWB-16	nc	4.0	22.0	7.7	7.8	342	339	112	nc	nc	nc
USAWB-17	nc	7.9	18.0	nc	7.2	nc	355	nc	nc	nc	nc
USAWB-18	nc	11.1	20.0	7.6	7.7	402	405	148	nc	nc	nc
USAWB-19	nc	7.7	17.5	nc	nc	nc	480	nc	nc	nc	nc
USAWC-01	nc	7.8	22.5	7.8	8.0	397	394	138	nc	nc	nc
USAWC-02	nc	7.7	22.0	7.8	8.0	368	360	162	nc	nc	nc
USAWC-03	nc	9.1	19.5	nc	7.9	nc	346	nc	nc	nc	nc
USAWC-04	0.1	9.1	19.5	7.6	7.5	776	760	205	198	240	–
USAWC-05	nc	10.6	19.5	nc	7.6	nc	543	nc	nc	nc	nc
USAWC-06	nc	7.8	17.5	nc	7.8	nc	454	nc	nc	nc	nc
USAWC-07	nc	0.7	21.0	nc	7.5	nc	*944	nc	nc	nc	nc
USAWC-08	0.1	8.1	21.5	7.7	7.7	580	569	147	144	175	–
USAWC-09	nc	–	24.5	nc	*8.6	nc	*925	nc	nc	nc	nc
USAWC-10	nc	10.6	26.0	nc	8.2	nc	420	nc	nc	nc	nc

Table 4. Water-quality indicators in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.–Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five digit number below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. **Abbreviations:** SMCL-CA, California Department of Public Health secondary maximum contaminant level; SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level; C, Celsius; mg/L, milligrams per liter; nc, sample not collected; na, not available; NTU, nephelometric turbidity unit; µS/cm, microsiemens per centimeter; $CaCO_3$, calcium carbonate; –, not detected]

GAMA well identification number	Turbidity, field (NTU) (63676)	Dissolved oxygen, field (mg/L) (00300)	Water temperature, field (degrees C) (00010)	pH, lab (standard units) (00403)	pH, field (standard units) (00400)	Specific conductance, lab (µS/cm at 25°C) (90095)	Specific conductance, field (µS/cm at 25°C) (00095)	Alkalinity, lab (mg/L as $CaCO_3$) (29801)	Alkalinity, field (mg/L as $CaCO_3$) (29802)	Bicarbonate, field (mg/L) (63786)	Carbonate, field (mg/L) (63788)
Threshold type	SMCL-CA	na	na	SMCL-US	SMCL-US	SMCL-CA[1]	SMCL-CA[1]	na	na	na	na
Threshold level	5	na	na	6.5 - 8.5	6.5 - 8.5	900 (1,600)	900 (1,600)	na	na	na	na
Grid wells–Continued											
USAWC-11	0.2	6.2	22.5	7.6	7.4	876	872	235	230	279	–
USAWC-12	nc	4.7	20.5	7.4	7.5	*1,130	*1,120	289	nc	nc	nc
USAWC-13	nc	6.5	21.5	nc	7.4	nc	470	nc	nc	nc	nc
USAWC-14	0.2	7.7	20.5	7.8	7.5	404	402	149	144	174	–
USAWC-15	nc	5.8	21.0	nc	nc	nc	522	nc	nc	nc	nc
USAWC-16	nc	8.2	16.0	nc	7.5	nc	473	nc	nc	nc	nc
USAWC-17	0.2	9.6	20.5	7.9	7.7	382	394	165	157	190	–
USAWC-18	nc	7.9	20.5	nc	7.7	nc	407	nc	nc	nc	nc
USAWC-19	nc	7.0	14.0	nc	7.2	nc	297	nc	nc	nc	nc
USAWC-20	nc	7.8	21.5	7.6	7.8	381	376	166	nc	nc	nc
USAWC-21	0.2	10.1	21.0	7.6	7.5	427	433	146	141	172	–
USAWC-22	nc	7.6	22.0	nc	7.6	nc	387	nc	nc	nc	nc
USAWC-23	0.2	8.8	20.0	7.5	7.7	475	474	150	143	174	–
USAWC-24	nc	2.2	21.0	7.8	7.9	303	301	110	nc	nc	nc
USAWC-25	nc	5.7	20.0	7.5	7.4	792	785	169	nc	nc	nc
USAWE-01	0.3	5.6	23.5	8.0	8.0	*910	887	114	108	132	–
USAWE-02	0.8	0.3	26.5	*9.0	*9.2	867	876	82	107	119	6
USAWE-03	0.3	1.2	21.5	7.5	7.4	771	767	146	171	208	–
USAWE-04	0.5	8.8	19.0	7.1	7.1	823	811	134	129	157	–
USAWR-01	nc	7.4	20.0	nc	7.4	nc	578	nc	nc	nc	nc
USAWR-02	nc	6.9	21.0	nc	7.6	nc	473	nc	nc	nc	nc
USAWR-03	0.2	6.1	20.5	7.5	7.3	*1,040	*1,040	286	273	332	–
USAWR-04	nc	6.6	20.5	nc	7.1	nc	*1,340	nc	nc	nc	nc
USAWR-05	nc	2.0	22.0	nc	7.1	nc	729	207	nc	nc	nc
USAWR-06	nc	5.8	23.5	7.4	nc	*1,490	*1,500	336	nc	nc	nc
USAWR-07	nc	3.6	21.5	7.3	7.2	**1,690	**1,680	364	nc	nc	nc

Table 4. Water-quality indicators in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.–Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five digit number below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. **Abbreviations:** SMCL-CA, California Department of Public Health secondary maximum contaminant level; SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level; C, Celsius; mg/L, milligrams per liter; nc, sample not collected; na, not available; NTU, nephelometric turbidity unit; µS/cm, microsiemens per centimeter; $CaCO_3$, calcium carbonate; –, not detected]

GAMA well identification number	Turbidity, field (NTU) (63676)	Dissolved oxygen, field (mg/L) (00300)	Water temperature, field (degrees C) (00010)	pH, lab (standard units) (00403)	pH, field (standard units) (00400)	Specific conductance, lab (µS/cm at 25°C) (90095)	Specific conductance, field (µS/cm at 25°C) (00095)	Alkalinity, lab (mg/L as $CaCO_3$) (29801)	Alkalinity, field (mg/L as $CaCO_3$) (29802)	Bicarbonate, field (mg/L) (63786)	Carbonate, field (mg/L) (63788)
Threshold type	SMCL-CA	na	na	SMCL-US	SMCL-US	SMCL-CA[1]	SMCL-CA[1]	na	na	na	na
Threshold level	5	na	na	6.5 - 8.5	6.5 - 8.5	900 (1,600)	900 (1,600)	na	na	na	na
Grid wells–Continued											
USAWR-08	0.2	0.2	20.5	7.0	7.1	*930	*922	261	249	302	–
USAWR-09	nc	6.6	22.0	7.5	7.2	*1,100	*1,110	273	nc	nc	nc
USAWR-10	nc	2.1	23.5	7.5	7.2	*1,250	*1,260	225	nc	nc	nc
USAWR-11	0.3	10.8	19.0	7.7	7.8	406	410	155	125	152	–
USAWR-12	0.2	7.9	21.5	7.2	7.3	*1,160	*1,150	244	236	287	–
USAWS-01	nc	7.9	21.0	nc	6.9	nc	794	nc	nc	nc	nc
USAWS-02	0.2	6.4	22.5	7.6	7.7	**2,070	**2,030	127	121	147	–
USAWS-03	nc	6.1	22.0	nc	7.6	nc	767	nc	nc	nc	nc
USAWS-04	nc	3.8	22.5	nc	7.0	nc	*1,590	nc	nc	nc	nc
USAWS-05	nc	9.3	20.5	7.3	6.9	**1,730	**1,660	178	nc	nc	nc
USAWS-06	0.3	0.2	20.0	7.5	7.4	414	403	186	195	237	–
USAWS-07	nc	6.3	21.0	nc	6.6	nc	**5,220	nc	nc	nc	nc
USAWS-08	0.2	9.6	23.5	6.2	6.8	828	831	75	69.1	84	–
USAWS-09	nc	7.5	22.0	nc	7.5	nc	823	nc	nc	nc	nc
USAWS-10	nc	7.5	21.0	nc	7.7	nc	**4,830	nc	nc	nc	nc
USAWS-11	nc	6.6	23.0	nc	7.2	nc	**2,410	nc	nc	nc	nc
USAWS-12	0.2	10.5	22.0	7.4	7.1	*1,230	*1,220	115	106	129	–
USAWS-13	nc	7.0	22.5	nc	7.0	nc	**3,060	nc	nc	nc	nc
USAWS-14	0.2	–	21.5	8.1	8.1	396	394	138	132	159	1
USAWS-15	0.2	0.8	23.5	7.0	7.5	*1,050	*1,060	94	123	150	–
USAWS-16	nc	0.6	23.5	7.8	8.2	*947	*944	95	nc	nc	nc
USAWS-17	nc	3.2	22.5	nc	7.9	nc	*1,580	nc	nc	nc	nc
USAWS-18	0.3	2.5	26.5	7.5	7.5	*1,210	*1,220	105	130	158	–
USAWS-19	nc	–	23.0	nc	*9.3	nc	*907	nc	nc	nc	nc
USAWS-20	0.2	4.7	25.5	7.6	7.5	899	*906	126	124	150	–
USAWS-21	nc	–	24.0	7.8	*8.7	504	501	191	nc	nc	nc
USAWY-01	nc	8.5	18.5	nc	7.6	nc	395	nc	nc	nc	nc

Table 4. Water-quality indicators in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.–Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five digit number below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. **Abbreviations:** SMCL-CA, California Department of Public Health secondary maximum contaminant level; SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level; C, Celsius; mg/L, milligrams per liter; nc, sample not collected; na, not available; NTU, nephelometric turbidity unit; µS/cm, microsiemens per centimeter; $CaCO_3$, calcium carbonate; –, not detected]

GAMA well identification number	Turbidity, field (NTU) (63676)	Dissolved oxygen, field (mg/L) (00300)	Water temperature, field (degrees C) (00010)	pH, lab (standard units) (00403)	pH, field (standard units) (00400)	Specific conductance, lab (µS/cm at 25°C) (90095)	Specific conductance, field (µS/cm at 25°C) (00095)	Alkalinity, lab (mg/L as $CaCO_3$) (29801)	Alkalinity, field (mg/L as $CaCO_3$) (29802)	Bicarbonate, field (mg/L) (63786)	Carbonate, field (mg/L) (63788)
Threshold type	SMCL-CA	na	na	SMCL-US	SMCL-US	SMCL-CA[1]	SMCL-CA[1]	na	na	na	na
Threshold level	5	na	na	6.5 - 8.5	6.5 - 8.5	900 (1,600)	900 (1,600)	na	na	na	na
Grid wells–Continued											
USAWY-02	nc	6.7	17.5	nc	7.5	nc	413	nc	nc	nc	nc
USAWY-03	nc	nc	20.0	nc	7.7	nc	435	nc	nc	nc	nc
USAWY-04	nc	nc	21.5	7.8	7.7	430	437	173	nc	nc	nc
USAWY-05	0.2	6.2	22.0	7.9	7.7	508	511	157	154	187	–
USAWY-06	0.3	8.8	21.0	7.6	7.7	611	600	206	197	239	–
USAWY-07	nc	6.5	16.5	nc	7.0	nc	615	nc	nc	nc	nc
USAWY-08	nc	4.8	16.0	nc	nc	nc	539	nc	nc	nc	nc
USAWY-09	nc	10.2	19.0	nc	8.0	nc	366	nc	nc	nc	nc
Understanding wells											
USAWU-01	nc	0.8	21.0	7.5	7.4	772	760	214	nc	nc	nc
USAWU-02	nc	4.8	19.5	7.7	7.6	488	479	194	nc	nc	nc
USAWU-03	nc	5.0	9.5	nc	nc	nc	261	nc	nc	nc	nc
USAWU-04	nc	7.5	20.0	7.8	7.7	464	456	165	nc	nc	nc
USAWU-05	nc	8.5	18.5	7.7	7.5	514	511	167	nc	nc	nc
USAWU-06	nc	9.4	18.0	7.5	7.5	530	521	141	nc	nc	nc
USAWU-07	nc	7.9	22.5	7.6	nc	449	454	161	nc	nc	nc
USAWU-08	nc	0.3	26.0	*9.2	*9.2	249	251	83	nc	nc	nc
USAWU-09	nc	6.7	19.0	7.3	7.2	789	793	222	nc	nc	nc

[1] The SMCL-CA for specific conductance has recommended and upper threshold values. The upper value is shown in parentheses.

* Value exceeds threshold.

** Value exceeds upper threshold.

Table 5. Volatile organic compounds (VOCs) detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. All analytes are listed in table 3A. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; NL-CA, California Department of Public Health notification level; E, estimated value; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Disinfection by-product (THM)				Refrigerant			Refrigerant/ organic synthesis	Organic synthesis	Gasoline		
	Chloroform (trichloro-methane) (µg/L) (32106)	Bromodi-chloro methane (µg/L) (32101)	Bromoform (Tribromo-methane) (µg/L) (32104)	Dibromo-chloro-methane (µg/L) (32105)	Dichloro-difluoro-methane (CFC-112) (µg/L) (34668)	Trichloro-fluorome-thane (CFC-111) (µg/L) (34488)	1,1,2-Trichloro-1,2,2-trifluoro-ethane (CFC-113) (µg/L) (77652)	Chloro-methane (µg/L) (34418)	1,1-Dichloro-ethene (µg/L) (34501)	1,2,4-Trimethyl-benzene (µg/L) (77222)	Methyl tert-butyl ether (µg/L) (78032)	Toluene (µg/L) (34010)
[LRL]	0.04	0.04	0.08	0.12	0.14	0.08	0.04	0.1	0.02	0.04	0.1	0.02
Threshold type	MCL-US	MCL-US	MCL-US	MCL-US	NL-CA	MCL-CA	MCL-CA	HAL-US	MCL-CA	NL-CA	MCL-CA	MCL-CA
Threshold level	80[1]	80[1]	80[1]	80[1]	1,000	150	1,200	30	6	330	13	150
Grid wells												
USAWB-02	0.50	E 0.09	–	–	–	–	–	–	–	E 0.03	–	–
USAWB-03	E 0.03	–	–	–	–	–	–	–	–	–	–	–
USAWB-05	E 0.02	–	–	–	–	–	–	–	–	–	–	–
USAWB-06	0.10	–	–	–	–	–	–	–	–	–	0.2	–
USAWB-07	0.24	0.36	0.43	0.6	E 0.12	–	–	–	–	–	–	–
USAWB-08	0.82	–	–	–	–	2.16	10.8	–	–	E 0.02	0.1	–
USAWB-10	E 0.05	–	–	–	E 0.29	–	–	–	–	–	–	–
USAWB-11	0.11	–	–	–	–	–	–	–	–	E 0.05	–	–
USAWB-12	–	–	–	–	–	–	–	–	–	–	–	–
USAWB-13	0.18	–	–	–	–	–	–	–	0.13	–	–	–
USAWB-14	E 0.07	–	–	–	E 1.49	0.35	–	–	–	–	–	–
USAWB-16	–	–	–	–	–	–	–	–	–	E 0.02	–	–
USAWB-17	E 0.02	–	–	–	E 0.07	0.78	–	–	–	–	0.6	–
USAWB-18	E 0.02	–	–	–	–	–	–	–	–	E 0.09	–	–
USAWB-19	0.32	E 0.04	–	–	–	–	–	–	–	–	–	–
USAWC-01	E 0.03	–	–	–	–	–	–	–	–	–	–	–
USAWC-02	0.17	0.29	0.51	0.5	–	–	–	–	–	–	–	–
USAWC-03	E 0.03	–	–	–	E 0.11	–	–	–	–	–	–	–
USAWC-04	0.43	0.37	1.21	0.5	–	–	–	–	* 6.80	–	0.2	–
USAWC-05	E 0.05	–	–	–	–	–	–	–	0.15	–	–	V 0.01
USAWC-06	0.49	0.38	0.99	0.5	–	–	–	–	E 0.03	–	0.1	–
USAWC-07	–	–	–	–	–	–	–	–	–	–	E 0.1	–
USAWC-08	E 0.08	–	–	–	–	–	–	–	0.26	–	–	–

Table 5. Volatile organic compounds (VOCs) detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. All analytes are listed in table 3A. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; NL-CA, California Department of Public Health notification level; E, estimated value; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Disinfection by-product (THM)				Refrigerant			Refrigerant/ organic synthesis	Organic synthesis	Gasoline		
	Chloroform (trichloro-methane) (µg/L) (32106)	Bromodi-chloro methane (µg/L) (32101)	Bromoform (Tribromo-methane) (µg/L) (32104)	Dibromo-chloro-methane (µg/L) (32105)	Dichloro-difluoro-methane (CFC-112) (µg/L) (34668)	Trichloro-fluorome-thane (CFC-111) (µg/L) (34488)	1,1,2-Trichloro-1,2,2-trifluoro-ethane (CFC-113) (µg/L) (77652)	Chloro-methane (µg/L) (34418)	1,1-Dichloro-ethene (µg/L) (34501)	1,2,4-Trimethyl-benzene (µg/L) (77222)	Methyl tert-butyl ether (µg/L) (78032)	Toluene (µg/L) (34010)
[LRL]	0.04	0.04	0.08	0.12	0.14	0.08	0.04	0.1	0.02	0.04	0.1	0.02
Threshold type	MCL-US	MCL-US	MCL-US	MCL-US	NL-CA	MCL-CA	MCL-CA	HAL-US	MCL-CA	NL-CA	MCL-CA	MCL-CA
Threshold level	80[1]	80[1]	80[1]	80[1]	1,000	150	1,200	30	6	330	13	150
Grid wells—Continued												
USAWC-09	–	–	–	–	–	–	–	–	–	–	E 0.1	–
USAWC-10	E[2] 0.01	–	–	–	–	–	–	–	–	–	–	–
USAWC-11	–	–	–	–	E 0.64	–	–	–	E 0.04	–	–	V 0.01
USAWC-12	E 0.06	–	–	–	–	–	–	–	–	–	–	–
USAWC-13	E 0.03	–	–	–	–	–	–	–	–	–	–	–
USAWC-14	E 0.02	–	–	–	–	–	–	–	–	–	–	–
USAWC-15	E 0.03	–	–	–	–	–	–	–	–	–	–	–
USAWC-16	0.26	–	–	–	–	–	–	–	–	–	–	–
USAWC-17	0.93	E 0.04	–	–	–	–	–	–	–	–	–	–
USAWC-18	E 0.04	–	–	–	–	–	–	–	–	–	–	–
USAWC-21	E 0.03	–	–	–	–	–	–	–	–	–	–	–
USAWC-22	E 0.04	–	–	–	–	–	–	–	–	–	–	–
USAWC-23	0.29	–	0.26	–	–	–	–	–	–	–	–	V 0.02
USAWC-24	2.49	0.40	–	–	–	–	–	–	–	–	–	–
USAWC-25	5.13	0.26	–	–	–	–	–	–	2.34	–	–	V 0.01
USAWE-01	E 0.08	E 0.07	–	–	–	–	–	–	–	–	–	–
USAWE-02	–	–	–	–	–	–	–	–	–	E 0.07	–	–
USAWE-03	E 0.06	–	–	–	–	0.52	–	–	–	E 0.03	–	–
USAWE-04	E 0.03	–	–	–	–	–	–	–	–	E 0.04	–	–
USAWR-01	E 0.03	–	–	–	E 0.07	–	–	–	–	–	0.1	–
USAWR-02	E 0.02	–	–	–	–	–	–	–	–	–	–	–

Table 5. Volatile organic compounds (VOCs) detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. All analytes are listed in table 3A. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; NL-CA, California Department of Public Health notification level; E, estimated value; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Disinfection by-product (THM)				Refrigerant			Refrigerant/ organic synthesis	Organic synthesis	Gasoline		
	Chloroform (trichloro-methane) (µg/L) (32106)	Bromodi-chloro methane (µg/L) (32101)	Bromoform (Tribromo-methane) (µg/L) (32104)	Dibromo-chloro-methane (µg/L) (32105)	Dichloro-difluoro-methane (CFC-112) (µg/L) (34668)	Trichloro-fluorome-thane (CFC-111) (µg/L) (34488)	1,1,2-Trichloro-1,2,2-trifluoro-ethane (CFC-113) (µg/L) (77652)	Chloro-methane (µg/L) (34418)	1,1-Dichloro-ethene (µg/L) (34501)	1,2,4-Trimethyl-benzene (µg/L) (77222)	Methyl tert-butyl ether (µg/L) (78032)	Toluene (µg/L) (34010)
[LRL]	0.04	0.04	0.08	0.12	0.14	0.08	0.04	0.1	0.02	0.04	0.1	0.02
Threshold type	MCL-US	MCL-US	MCL-US	MCL-US	NL-CA	MCL-CA	MCL-CA	HAL-US	MCL-CA	NL-CA	MCL-CA	MCL-CA
Threshold level	80[1]	80[1]	80[1]	80[1]	1,000	150	1,200	30	6	330	13	150
Grid wells—Continued												
USAWR-03	0.11	–	–	–	–	0.22	–	–	–	E 0.04	–	–
USAWR-04	0.43	–	–	–	–	–	–	–	–	–	–	–
USAWR-05	E 0.04	–	–	–	–	–	–	–	–	–	–	–
USAWR-06	E 0.07	–	–	–	–	–	–	–	–	–	–	–
USAWR-07	0.10	–	–	–	–	0.19	E 0.12	–	–	E[2] 0.01	–	–
USAWR-08	0.53	–	–	–	E 0.07	0.12	–	E[2] 0.01	E 0.03	E 0.04	E 0.1	–
USAWR-09	1.06	E 0.03	–	–	E 0.47	E 0.04	E 0.45	–	1.83	–	–	–
USAWR-10	E 0.06	–	–	–	–	–	–	–	–	–	–	–
USAWR-11	E 0.04	–	–	–	–	–	–	–	–	E[2] 0.01	–	–
USAWR-12	0.16	–	–	–	–	–	–	–	–	0.34	–	–
USAWS-01	0.20	E 0.04	–	–	–	–	–	–	–	–	–	–
USAWS-02	E 0.07	–	–	–	–	–	–	–	–	E 0.08	–	–
USAWS-04	3.67	E 0.06	–	–	E 1.58	0.15	–	–	–	–	–	–
USAWS-05	0.14	E 0.04	–	–	–	–	–	–	–	–	–	–
USAWS-06	–	–	–	–	–	–	–	–	–	E 0.05	–	–
USAWS-07	0.15	–	–	–	–	–	–	–	–	–	–	–
USAWS-08	0.22	–	–	–	–	–	–	–	E 0.03	0.36	–	–
USAWS-09	E 0.02	–	–	–	–	–	–	–	–	–	–	–
USAWS-10	1.76	0.51	–	–	–	0.17	–	–	–	–	–	–
USAWS-11	1.10	0.10	–	–	–	–	–	–	–	–	–	–

Table 5. Volatile organic compounds (VOCs) detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. All analytes are listed in table 3A. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; NL-CA, California Department of Public Health notification level; E, estimated value; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Disinfection by-product (THM)				Refrigerant			Refrigerant/ organic synthesis	Organic synthesis	Gasoline		
	Chloroform (trichloro-methane) (µg/L) (32106)	Bromodi-chloro methane (µg/L) (32101)	Bromoform (Tribromo-methane) (µg/L) (32104)	Dibromo-chloro-methane (µg/L) (32105)	Dichloro-difluoro-methane (CFC-112) (µg/L) (34668)	Trichloro-fluorome-thane (CFC-111) (µg/L) (34488)	1,1,2-Trichloro-1,2,2-trifluoro-ethane (CFC-113) (µg/L) (77652)	Chloro-methane (µg/L) (34418)	1,1-Dichloro-ethene (µg/L) (34501)	1,2,4-Trimethyl-benzene (µg/L) (77222)	Methyl tert-butyl ether (µg/L) (78032)	Toluene (µg/L) (34010)
[LRL]	0.04	0.04	0.08	0.12	0.14	0.08	0.04	0.1	0.02	0.04	0.1	0.02
Threshold type	MCL-US	MCL-US	MCL-US	MCL-US	NL-CA	MCL-CA	MCL-CA	HAL-US	MCL-CA	NL-CA	MCL-CA	MCL-CA
Threshold level	80[1]	80[1]	80[1]	80[1]	1,000	150	1,200	30	6	330	13	150
Grid wells—Continued												
USAWS-12	0.11	–	–	–	–	–	–	–	–	–	–	–
USAWS-13	0.10	–	–	–	–	–	–	–	–	–	–	–
USAWS-17	–	–	–	–	–	–	–	–	–	–	–	–
USAWS-18	E 0.02	–	–	–	–	–	–	–	–	–	–	V 0.02
USAWS-20	–	–	–	–	–	–	–	–	–	–	–	–
USAWY-01	–	–	–	–	–	–	–	–	–	–	0.5	–
USAWY-02	0.53	E 0.03	–	–	–	–	–	–	–	–	–	–
USAWY-04	–	–	–	–	–	–	–	–	–	–	–	–
USAWY-05	0.16	–	–	–	–	–	–	–	–	E 0.02	–	–
USAWY-06	–	–	–	–	–	–	–	–	–	E 0.13	–	–
USAWY-07	E 0.04	–	–	–	–	–	6.03	–	2.79	–	–	–
USAWY-08	0.26	E 0.06	–	–	–	–	–	–	–	–	–	
Number of detections	63	18	5	4	10	10	4	0	11	16	10	0
Detection frequency (percent)	70	20	6	4	11	11	4	0	12	18	11	0

Table 5. Volatile organic compounds (VOCs) detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. All analytes are listed in table 3A. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; NL-CA, California Department of Public Health notification level; E, estimated value; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Disinfection by-product (THM)				Refrigerant			Refrigerant/ organic synthesis	Organic synthesis	Gasoline		
	Chloroform (trichloro-methane) (µg/L) (32106)	Bromodi-chloro methane (µg/L) (32101)	Bromoform (Tribromo-methane) (µg/L) (32104)	Dibromo-chloro-methane (µg/L) (32105)	Dichloro-difluoro-methane (CFC-112) (µg/L) (34668)	Trichloro-fluorome-thane (CFC-111) (µg/L) (34488)	1,1,2-Trichloro-1,2,2-trifluoro-ethane (CFC-113) (µg/L) (77652)	Chloro-methane (µg/L) (34418)	1,1-Dichloro-ethene (µg/L) (34501)	1,2,4-Trimethyl-benzene (µg/L) (77222)	Methyl tert-butyl ether (µg/L) (78032)	Toluene (µg/L) (34010)
[LRL]	0.04	0.04	0.08	0.12	0.14	0.08	0.04	0.1	0.02	0.04	0.1	0.02
Threshold type	MCL-US	MCL-US	MCL-US	MCL-US	NL-CA	MCL-CA	MCL-CA	HAL-US	MCL-CA	NL-CA	MCL-CA	MCL-CA
Threshold level	80[1]	80[1]	80[1]	80[1]	1,000	150	1,200	30	6	330	13	150
Understanding wells												
USAWU-01	E[2] 0.01	–	–	–	–	–	–	–	–	–	0.1	–
USAWU-03	–	–	–	–	–	–	–	–	–	E 0.04	–	–
USAWU-04	E 0.03	–	–	–	–	–	–	–	–	–	–	–
USAWU-05	0.13	–	–	–	–	–	–	–	–	–	–	–
USAWU-06	0.15	E 0.06	0.12	–	–	–	–	–	–	–	0.1	–
USAWU-07	E 0.03	–	–	–	–	–	–	–	E 0.06	–	–	–
USAWU-08	E 0.03	–	–	–	–	–	–	–	–	–	–	–
USAWU-09	0.37	E 0.07	–	–	–	–	–	–	–	–	0.1	–

Table 5. Volatile organic compounds (VOCs) detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. All analytes are listed in table 3A. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; NL-CA, California Department of Public Health notification level; E, estimated value; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Fumigant			Solvent										VOC detections per well
	1,2-Dichloropropane (µg/L) (34541)	1,2-Dibromo-3-chloropropane (DBCP) (µg/L) (82625)	1,4-Dichlorobenzene (µg/L) (34571)	Tetrachloroethene (µg/L) (34475)	Trichloroethene (µg/L) (39180)	*cis*-1,2-Dichloroethene (µg/L) (77093)	1,1-Dichloroethane (µg/L) (34496)	Dichloromethane (µg/L) (34423)	1,1,1-Trichloroethane (µg/L) (34506)	Carbon tetrachloride (tetrachloromethane) (µg/L) (32102)	1,2-Dichlorobenzene (µg/L) (34536)	1,2-Dichloroethane (µg/L) (32103)	*trans*-1,2-Dichloroethene (µg/L) (34546)	
[LRL]	0.02	0.5	0.04	0.04	0.02	0.02	0.06	0.04	0.04	0.08	0.04	0.1	0.018	
Threshold type	MCL-US	MCL-US	MCL-CA	MCL-US	MCL-US	MCL-CA	MCL-CA	MCL-US	MCL-US	MCL-CA	MCL-US	MCL-CA	MCL-CA	
Threshold level	5	0.2	5	5	5	6	5	5	200	0.5	600	0.5	10	
Grid wells—Continued														
USAWB-02	–	–	–	–	–	–	–	–	–	–	–	–	–	3
USAWB-03	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWB-05	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWB-06	–	–	–	E 0.02	–	–	–	–	–	–	–	–	–	3
USAWB-07	–	–	–	0.22	0.14	E 0.04	–	–	–	–	–	–	–	8
USAWB-08	–	–	–	0.14	–	–	–	–	E 0.03	E 0.06	–	–	–	8
USAWB-10	–	–	–	0.44	E 0.06	–	–	–	–	–	–	–	–	4
USAWB-11	–	–	–	E 0.03	–	–	–	–	–	–	–	–	–	3
USAWB-12	–	–	–	E 0.03	–	–	–	–	–	–	–	–	–	1
USAWB-13	–	E* 0.4	–	E 0.09	0.78	–	–	–	–	–	–	–	–	5
USAWB-14	–	–	–	2.99	0.21	0.29	E 0.05	E 0.06	–	–	–	–	E 0.01	9
USAWB-16	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWB-17	–	–	–	0.34	–	–	–	–	–	–	–	–	–	5
USAWB-18	–	–	–	–	–	–	–	–	–	–	–	–	–	2
USAWB-19	–	–	–	E 0.02	–	–	–	–	–	–	–	–	–	3
USAWC-01	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWC-02	–	–	–	–	–	–	–	–	–	–	–	–	–	4
USAWC-03	–	–	–	0.26	–	–	–	–	–	–	–	–	–	3
USAWC-04	–	–	–	* 12.4	* 12.4	E 0.01	E 0.06	E 0.02	E 0.06	E[2] 0.02	–	0.14	–	13
USAWC-05	–	–	–	1.25	0.45	–	–	–	–	–	–	–	–	5
USAWC-06	–	–	–	E 0.1	E 0.06	–	–	–	–	–	–	–	–	8
USAWC-07	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWC-08	–	–	–	E 0.04	E 0.08	–	E[2] 0.02	–	–	–	–	–	–	4

Table 5. Volatile organic compounds (VOCs) detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. All analytes are listed in table 3A. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; NL-CA, California Department of Public Health notification level; E, estimated value; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Fumigant			Solvent										VOC detections per well
	1,2-Dichloropropane (µg/L) (34541)	1,2-Dibromo-3-chloropropane (DBCP) (µg/L) (82625)	1,4-Dichlorobenzene (µg/L) (34571)	Tetrachloroethene (µg/L) (34475)	Trichloroethene (µg/L) (39180)	*cis*-1,2-Dichloroethene (µg/L) (77093)	1,1-Dichloroethane (µg/L) (34496)	Dichloromethane (µg/L) (34423)	1,1,1-Trichloroethane (µg/L) (34506)	Carbon tetrachloride (tetrachloromethane) (µg/L) (32102)	1,2-Dichlorobenzene (µg/L) (34536)	1,2-Dichloroethane (µg/L) (32103)	*trans*-1,2-Dichloroethene (µg/L) (34546)	
[LRL]	0.02	0.5	0.04	0.04	0.02	0.02	0.06	0.04	0.04	0.08	0.04	0.1	0.018	
Threshold type	MCL-US	MCL-US	MCL-CA	MCL-US	MCL-US	MCL-CA	MCL-CA	MCL-US	MCL-US	MCL-CA	MCL-US	MCL-CA	MCL-CA	
Threshold level	5	0.2	5	5	5	6	5	5	200	0.5	600	0.5	10	
Grid wells—Continued														
USAWC-09	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWC-10	–	–	–	–	–	–	–	–	–	–	–	–	–	0
USAWC-11	–	–	–	0.15	–	–	–	–	–	–	–	–	–	4
USAWC-12	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWC-13	–	–	–	–	E 0.03	–	–	E 0.02	–	–	–	–	–	3
USAWC-14	–	–	–	–	0.25	–	–	–	–	–	–	–	–	2
USAWC-15	–	–	–	–	–	–	–	E[2] 0.01	–	–	–	–	–	1
USAWC-16	–	–	–	E 0.02	–	–	–	–	–	–	–	–	–	2
USAWC-17	–	–	–	–	–	–	–	–	–	–	–	–	–	2
USAWC-18	–	E* 0.3	–	E 0.02	–	–	–	–	–	–	–	–	–	3
USAWC-21	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWC-22	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWC-23	–	–	–	–	–	–	–	–	–	–	–	–	–	3
USAWC-24	–	–	–	–	–	–	–	–	–	–	–	–	–	2
USAWC-25	–	–	0.02	E 0.06	0.25	E 0.03	0.20	–	–	–	–	–	–	9
USAWE-01	–	–	–	–	–	–	–	–	–	–	–	–	–	2
USAWE-02	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWE-03	–	–	–	–	–	–	–	–	–	–	–	–	–	3
USAWE-04	–	–	–	–	–	–	–	–	–	–	–	–	–	2
USAWR-01	E 0.09	–	–	0.27	E 0.03	–	–	–	–	–	–	–	–	6
USAWR-02	0.13	* 0.5	–	E 0.04	E 0.03	–	–	–	–	–	–	–	–	5

Table 5. Volatile organic compounds (VOCs) detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. All analytes are listed in table 3A. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; NL-CA, California Department of Public Health notification level; E, estimated value; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Fumigant			Solvent										VOC detections per well
	1,2-Dichloropropane (µg/L) (34541)	1,2-Dibromo-3-chloropropane (DBCP) (µg/L) (82625)	1,4-Dichlorobenzene (µg/L) (34571)	Tetrachloroethene (µg/L) (34475)	Trichloroethene (µg/L) (39180)	*cis*-1,2-Dichloroethene (µg/L) (77093)	1,1-Dichloroethane (µg/L) (34496)	Dichloromethane (µg/L) (34423)	1,1,1-Trichloroethane (µg/L) (34506)	Carbon tetrachloride (tetrachloromethane) (µg/L) (32102)	1,2-Dichlorobenzene (µg/L) (34536)	1,2-Dichloroethane (µg/L) (32103)	*trans*-1,2-Dichloroethene (µg/L) (34546)	
[LRL]	0.02	0.5	0.04	0.04	0.02	0.02	0.06	0.04	0.04	0.08	0.04	0.1	0.018	
Threshold type	MCL-US	MCL-US	MCL-CA	MCL-US	MCL-US	MCL-CA	MCL-CA	MCL-US	MCL-US	MCL-CA	MCL-US	MCL-CA	MCL-CA	
Threshold level	5	0.2	5	5	5	6	5	5	200	0.5	600	0.5	10	
Grid wells—Continued														
USAWR-03	–	–	–	0.10	–	–	–	–	–	–	–	–	–	4
USAWR-04	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWR-05	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWR-06	–	–	–	E 0.03	–	–	–	–	–	–	–	–	–	2
USAWR-07	–	–	–	0.32	–	–	–	–	–	–	–	–	–	4
USAWR-08	–	–	–	0.50	E 0.07	E 0.02	0.10	–	–	–	–	–	–	10
USAWR-09	0.15	* 0.5	–	* 5.37	21.70	E 0.09	E 0.05	–	–	E[2] 0.03	E 0.02	–	–	13
USAWR-10	–	–	–	E 0.07	3.16	E 0.04	–	–	E 0.02	–	–	–	–	5
USAWR-11	–	–	–	0.25	E 0.09	–	–	–	–	–	–	–	–	3
USAWR-12	–	–	–	–	–	–	–	–	–	–	–	–	–	2
USAWS-01	–	–	–	E 0.04	E 0.02	–	E 0.04	–	–	–	–	–	–	5
USAWS-02	0.10	–	–	–	–	–	–	–	–	–	–	–	–	3
USAWS-04	–	–	–	* 10.7	3.67	0.31	0.58	–	–	* 0.91	–	–	–	9
USAWS-05	–	–	–	–	–	–	–	–	–	–	–	–	–	2
USAWS-06	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWS-07	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWS-08	–	–	–	3.93	0.17	–	–	–	–	E 0.04	–	–	–	6
USAWS-09	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWS-10	–	–	–	–	–	–	–	–	–	–	–	–	–	3
USAWS-11	–	–	–	–	–	–	–	–	–	–	–	–	–	2

Table 5. Volatile organic compounds (VOCs) detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. All analytes are listed in table 3A. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; NL-CA, California Department of Public Health notification level; E, estimated value; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Fumigant			Solvent										VOC detections per well
	1,2-Dichloropropane (µg/L) (34541)	1,2-Dibromo-3-chloropropane (DBCP) (µg/L) (82625)	1,4-Dichlorobenzene (µg/L) (34571)	Tetrachloroethene (µg/L) (34475)	Trichloroethene (µg/L) (39180)	*cis*-1,2-Dichloroethene (µg/L) (77093)	1,1-Dichloroethane (µg/L) (34496)	Dichloromethane (µg/L) (34423)	1,1,1-Trichloroethane (µg/L) (34506)	Carbon tetrachloride (tetrachloromethane) (µg/L) (32102)	1,2-Dichlorobenzene (µg/L) (34536)	1,2-Dichloroethane (µg/L) (32103)	*trans*-1,2-Dichloroethene (µg/L) (34546)	
[LRL]	0.02	0.5	0.04	0.04	0.02	0.02	0.06	0.04	0.04	0.08	0.04	0.1	0.018	
Threshold type	MCL-US	MCL-US	MCL-CA	MCL-US	MCL-US	MCL-CA	MCL-CA	MCL-US	MCL-US	MCL-CA	MCL-US	MCL-CA	MCL-CA	
Threshold level	5	0.2	5	5	5	6	5	5	200	0.5	600	0.5	10	
Grid wells—Continued														
USAWS-12	–	–	–	–	1.57	–	–	–	–	–	–	–	–	2
USAWS-13	–	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWS-17	–	–	–	E 0.04	–	–	–	–	–	–	–	–	–	1
USAWS-18	–	–	–	–	–	–	–	–	–	–	–	–	–	2
USAWS-20	0.13	–	–	–	–	–	–	–	–	–	–	–	–	1
USAWY-01	–	–	–	0.21	–	–	–	–	–	–	–	–	–	2
USAWY-02	–	–	–	0.36	E 0.09	E 0.02	–	–	–	–	–	–	–	5
USAWY-04	–	–	–	E[2] 0.01	–	–	–	–	–	–	–	–	–	0
USAWY-05	–	–	E 0.02	E 0.24	0.16	E 0.07	E 0.05	E 0.06	–	–	E 0.05	–	–	9
USAWY-06	–	–	–	E 0.03	–	–	–	–	–	–	E 0.03	–	–	3
USAWY-07	–	–	–	E 0.02	–	–	–	–	4.60	–	–	–	–	5
USAWY-08	–	–	–	E 0.04	–	–	–	–	–	–	–	–	–	3
Number of detections	5	4	2	38	23	10	8	4	4	3	3	1	1	[3]257
Detection frequency (percent)	6	4	2	42	26	11	9	4	4	3	3	1	1	[4]82

Table 5. Volatile organic compounds (VOCs) detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. All analytes are listed in table 3A. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; NL-CA, California Department of Public Health notification level; E, estimated value; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Fumigant			Solvent										VOC detections per well
	1,2-Dichloropropane (µg/L) (34541)	1,2-Dibromo-3-chloropropane (DBCP) (µg/L) (82625)	1,4-Dichlorobenzene (µg/L) (34571)	Tetrachloroethene (µg/L) (34475)	Trichloroethene (µg/L) (39180)	*cis*-1,2-Dichloroethene (µg/L) (77093)	1,1-Dichloroethane (µg/L) (34496)	Dichloromethane (µg/L) (34423)	1,1,1-Trichloroethane (µg/L) (34506)	Carbon tetrachloride (tetrachloromethane) (µg/L) (32102)	1,2-Dichlorobenzene (µg/L) (34536)	1,2-Dichloroethane (µg/L) (32103)	*trans*-1,2-Dichloroethene (µg/L) (34546)	
[LRL]	0.02	0.5	0.04	0.04	0.02	0.02	0.06	0.04	0.04	0.08	0.04	0.1	0.018	
Threshold type	MCL-US	MCL-US	MCL-CA	MCL-US	MCL-US	MCL-CA	MCL-CA	MCL-US	MCL-US	MCL-CA	MCL-US	MCL-CA	MCL-CA	
Threshold level	5	0.2	5	5	5	6	5	5	200	0.5	600	0.5	10	
Understanding wells														
USAWU-01	–	–	–	E0.02	–	–	–	–	–	–	–	–	–	2
USAWU-03	–	–	–	E0.08	–	–	–	–	–	–	–	–	–	2
USAWU-04	–	–	–	2.51	E0.09	E0.04	–	–	–	–	–	–	–	4
USAWU-05	–	–	–	–	E0.10	–	–	–	–	–	–	–	–	2
USAWU-06	–	–	–	0.42	1.36	–	–	–	–	–	–	–	–	6
USAWU-07	–	–	–	E0.05	–	–	–	–	–	–	–	–	–	3
USAWU-08	–	–	–	0.18	–	–	–	–	–	–	–	–	–	2
USAWU-09	–	–	–	0.11	–	–	–	–	–	–	–	–	–	4

[1]The MCL-US threshold for trihalomethanes is the sum of chloroform, bromoform, bromodichloromethane, and dibromochloromethane.

[2]The detected concentration was less than the LT-MDL for this compound and, therefore, is not included in statistical summaries.

[3]Total number of VOC detections in grid wells.

[4]Frequency of detection of at least one VOC in the grid wells. Detected concentrations less than the LT-MDL (approximately half the LRL) and detections with V remark codes are not included.

*Value above threshold level.

Table 6. Pesticides and pesticide degradates detected in samples analyzed using schedules 2033 and 2060 collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; E, estimated value; V, analyte was detected in a sample and an associated blank thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Atrazine[1], (µg/L) (39632)	Atrazine, (µg/L)	Simazine, (µg/L) (04035)	2-Chloro-4-isopropy-lamino-6-amino-*s*-triazine[1] (µg/L) (04040)	2-Chloro-4-isopropy-lamino-6-amino-*s*-triazine (µg/L)	Bromacil (µg/L) (04029)	Diuron (µg/L) (49300)	3,4-Dichloro-aniline (µg/L) (61625)
Laboratory Schedule	2033	2060	2033	2033	2060	2060	2060	2033
[LRL]	0.007	0.04	0.006	0.014	0.02	0.04	0.04	0.0045
Threshold type[3]	MCL-CA	MCL-CA	MCL-US	na	na	HAL-US	HAL-US	na
Threshold level	1	1	4	na	na	70	10	na
				Grid wells				
USAWB-01	0.009	E[4] 0.007	0.016	E[4] 0.007	E[4] 0.006	–	–	–
USAWB-02	–	–	E 0.005	–	–	E 0.08	–	–
USAWB-03	0.008	E[4] 0.005	E 0.007	E 0.012	E 0.012	–	–	–
USAWB-05	–	–	E 0.005	–	–	–	–	–
USAWB-06	–	–	E 0.005	E[4] 0.005	–	–	–	–
USAWB-08	E 0.004	–	–	E 0.017	0.022	–	–	–
USAWB-09	0.034	0.041	0.014	E 0.032	0.036	–	E 0.028	–
USAWB-10	E 0.005	–	–	E 0.008	E 0.012	–	–	–
USAWB-11	E 0.007	E[4] 0.005	0.028	E[4] 0.006	E[4] 0.007	–	E 0.02	–
USAWB-12	E 0.004	–	E 0.006	E[4] 0.005	–	E[4] 0.01	–	–
USAWB-13	0.011	E[4] 0.01	0.137	E 0.009	E[4] 0.003	E 0.22	E 0.188	E 0.014
USAWB-14	–	–	–	–	–	–	–	–
USAWB-15	E 0.004	–	0.016	–	–	E 0.03	E[4] 0.017	–
USAWB-16	–	–	–	–	–	–	–	–
USAWB-17	0.015	E[4] 0.010	0.124	E 0.011	E[4] 0.008	–	E[4] 0.015	–
USAWB-18	E 0.004	–	–	E[4] 0.005	E[4] 0.001	E[4] 0.01	–	–
USAWB-19	E 0.005	E[4] 0.001	0.137	E[4] 0.005	–	0.08	–	E 0.007
USAWC-01	E 0.006	E[4] 0.001	–	E[4] 0.006	E[4] 0.003	–	–	–
USAWC-04	0.009	E[4] 0.004	–	E 0.013	E 0.011	–	E[4] 0.001	–
USAWC-05	E 0.005	–	–	E[4] 0.007	E[4] 0.004	–	–	–
USAWC-06	0.033	E 0.033	0.030	E 0.011	0.028	–	E[4] 0.005	–
USAWC-07	0.012	E[4] 0.007	0.066	E[4] 0.007	–	–	E[4] 0.002	–
USAWC-08	0.020	E[4] 0.017	E 0.007	E 0.022	0.028	E[4] 0.01	E 0.031	E 0.004
USAWC-09	E 0.005	–	0.013	E[4] 0.006	E[4] 0.002	–	–	E 0.008
USAWC-11	0.012	E[4] 0.008	E 0.006	E 0.010	E 0.017	–	E[4] 0.005	–
USAWC-12	E 0.006	E[4] 0.002	–	E 0.010	E[4] 0.005	–	–	–
USAWC-14	E 0.007	E[4] 0.003	E 0.005	E 0.010	E 0.012	–	–	–
USAWC-16	E 0.005	E[4] 0.008	–	E[4] 0.007	E[4] 0.004	E 0.03	E[4] 0.001	–
USAWC-17	E 0.008	E[4] 0.003	0.024	E[4] 0.006	E[4] 0.003	–	–	–
USAWC-18	–	–	–	–	–	–	–	–
USAWC-21	–	–	–	–	–	E[4] 0.01	–	–
USAWC-22	–	–	–	–	–	E[4] 0.01	–	–
USAWC-23	E 0.005	–	–	E[4] 0.006	E[4] 0.004	–	–	–
USAWE-01	0.008	E[4] 0.005	0.018	E 0.009	E[4] 0.005	–	–	–
USAWE-02	E 0.005	–	0.011	–	–	–	–	–
USAWE-03	–	–	–	–	–	E[4] 0.01	–	–
USAWE-04	E 0.005	–	0.021	E[4] 0.007	–	0.51	–	–

Table 6. Pesticides and pesticide degradates detected in samples analyzed using schedules 2033 and 2060 collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; E, estimated value; V, analyte was detected in a sample and an associated blank thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Atrazine[1], (µg/L) (39632)	Atrazine, (µg/L)	Simazine, (µg/L) (04035)	2-Chloro-4-isopropylamino-6-amino-*s*-triazine[1] (µg/L) (04040)	2-Chloro-4-isopropylamino-6-amino-*s*-triazine (µg/L)	Bromacil (µg/L) (04029)	Diuron (µg/L) (49300)	3,4-Dichloroaniline (µg/L) (61625)
Laboratory Schedule	2033	2060	2033	2033	2060	2060	2060	2033
[LRL]	0.007	0.04	0.006	0.014	0.02	0.04	0.04	0.0045
Threshold type[3]	MCL-CA	MCL-CA	MCL-US	na	na	HAL-US	HAL-US	na
Threshold level	1	1	4	na	na	70	10	na
Grid wells—Continued								
USAWR-01	0.110	0.102	0.028	E 0.051	0.055	E 0.02	–	–
USAWR-02	E 0.007	E[4] 0.004	0.010	E[4] 0.007	E[4] 0.003	E 0.09	–	–
USAWR-03	0.010	E[4] 0.010	0.008	E 0.014	E 0.012	–	–	–
USAWR-05	0.023	E[4] 0.023	0.008	E 0.047	0.052	–	–	–
USAWR-06	E 0.007	E[4] 0.004	0.139	E 0.015	E[4] 0.010	E 1.99	E 0.185	E 0.015
USAWR-07	E 0.007	E[4] 0.003	0.070	E 0.020	E 0.012	E 0.37	E 0.139	–
USAWR-08	0.034	E 0.025	0.132	E 0.032	E 0.032	E 0.04	E 0.041	E 0.009
USAWR-09	0.033	E 0.024	0.078	E 0.024	E 0.021	E 0.12	E 0.043	–
USAWR-10	E 0.006	E[4] 0.001	0.055	–	–	–	–	–
USAWR-11	0.010	E[4] 0.004	E 0.006	E 0.011	E[4] 0.010	–	–	–
USAWS-01	0.014	E[4] 0.011	–	E 0.016	0.023	–	–	–
USAWS-02	E 0.005	E[4] 0.001	E 0.005	E[4] 0.007	E[4] 0.007	–	–	–
USAWS-03	E 0.004	–	0.027	E[4] 0.007	E[4] 0.005	–	–	–
USAWS-04	0.078	0.071	E 0.006	E 0.032	0.039	0.13	E[4] 0.002	–
USAWS-05	0.019	E[4] 0.019	–	E 0.015	0.021	–	–	–
USAWS-07	E 0.006	E[4] 0.002	–	E 0.008	E[4] 0.003	–	–	–
USAWS-08	0.008	E[4] 0.005	E 0.006	E[4] 0.007	E[4] 0.007	E 0.03	E[4] 0.018	–
USAWS-09	0.021	E[4] 0.017	0.028	E 0.011	E[4] 0.009	E 0.03	–	–
USAWS-10	0.072	E 0.070	0.026	E 0.024	0.032	0.06	0.229	E 0.018
USAWS-11	0.012	E[4] 0.008	0.058	E 0.011	E[4] 0.007	E 0.04	0.044	E 0.011
USAWS-12	0.010	E[4] 0.006	E 0.006	E 0.009	E[4] 0.004	E[4] 0.01	E[4] 0.011	E 0.006
USAWS-13	E 0.006	E[4] 0.002	E 0.005	E[4] 0.007	–	–	–	–
USAWS-17	E 0.007	E[4] 0.003	–	E[4] 0.005	E[4] 0.001	–	–	–
USAWS-19	–	–	V 0.006	–	–	–	–	–
USAWS-20	–	–	E 0.004	–	–	–	–	–
USAWY-01	E 0.004	–	0.027	E[4] 0.006	E[4] 0.003	–	–	–
USAWY-02	E 0.004	–	0.011	E[4] 0.006	–	–	0.145	E 0.009
USAWY-05	E 0.004	E[4] 0.007	E 0.004	–	–	E[4] 0.01	–	–
USAWY-06	0.022	E[4] 0.014	0.008	E 0.016	E 0.015	E[4] 0.01	–	–
USAWY-07	–	–	0.008	–	–	–	–	–
USAWY-08	E 0.004	–	E 0.004	E[4] 0.004	–	–	–	–
Number of detections	56	8	48	30	20	17	11	10
Detection frequency (percent)	62	9	53	33	22	19	12	11
Understanding well								
USAWU-04	0.010	E[4] 0.006	E 0.004	E 0.013	E 0.016	E 0.04	–	–

Table 6. Pesticides and pesticide degradates detected in samples analyzed using schedules 2033 and 2060 collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; E, estimated value; V, analyte was detected in a sample and an associated blank thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	2-Chloro-6-ethylamino-4-amino-*s*-triazine (µg/L) (04038)	Prometon (µg/L) (04037)	Tebuthiuron[1] (µg/L) (82670)	Tebuthiuron (µg/L)	Metalaxyl[1] (µg/L) (61596)	Metalaxyl (µg/L) (50359)	Norflurazon (µg/L) (49293)	DCPA (µg/L) (82682)
Laboratory Schedule	2060	2033	2033	2060	2033	2060	2060	2033
[LRL]	0.08	0.01	0.016	0.04	0.0069	0.04	0.04	0.003
Threshold type[3]	na	HAL-US	HAL-US	HAL-US	na	na	na	HAL-US
Threshold level	na	100	500	500	na	na	na	70
				Grid wells—Continued				
USAWB-01	–							
USAWB-02	–	–	–	–	–	–	–	–
USAWB-03	–	–	–	–	–	–	–	–
USAWB-05	–	–	–	–	–	–	–	–
USAWB-06	–	–	E0.01	E[4]0.015	–	–	–	–
USAWB-08	–	–	–	–	–	–	–	–
USAWB-09	E[4]0.03	–	–	–	–	–	–	–
USAWB-10	–	–	–	–	–	–	–	–
USAWB-11	E[4]0.03	–	–	–	–	–	–	–
USAWB-12	E[4]0.03	–	–	–	–	–	–	–
USAWB-13	0.21	–	–	–	–	–	–	–
USAWB-14	–	–	–	–	–	–	–	–
USAWB-15	E0.04	–	–	–	–	–	–	–
USAWB-16	–	–	–	–	–	–	–	–
USAWB-17	E0.06	–	–	E[4]0.004	–	–	–	–
USAWB-18	–	–	–	–	–	–	–	–
USAWB-19	0.11	–	E0.01	E[4]0.006	–	–	E[4]0.002	–
USAWC-01	–	–	–	–	–	–	–	–
USAWC-04	–	–	–	–	–	–	–	–
USAWC-05	–	–	–	–	–	–	–	–
USAWC-06	E[4]0.03	–	–	E[4]0.001	–	–	–	–
USAWC-07	E[4]0.02	E0.01	–	E[4]0.001	–	–	–	–
USAWC-08	–	–	–	–	–	–	–	–
USAWC-09	E[4]0.01	E0.01	–	E[4]0.001	–	–	–	–
USAWC-11	–	–	–	–	–	–	–	–
USAWC-12	–	–	–	E[4]0.001	–	–	–	–
USAWC-14	–	–	–	–	–	–	–	–
USAWC-16	–	–	–	–	–	–	–	–
USAWC-17	–	–	–	–	–	–	–	–
USAWC-18	–	–	–	–	–	–	–	–
USAWC-21	–	–	–	–	–	–	–	–
USAWC-22	–	–	–	–	–	–	–	–
USAWC-23	–	–	–	–	–	–	–	–
USAWE-01	–	–	–	–	–	–	–	–
USAWE-02	–	–	–	–	–	–	–	–
USAWE-03	–	–	–	–	–	–	–	–
USAWE-04	0.10	–	–	–	E 0.005	–	–	–

Table 6. Pesticides and pesticide degradates detected in samples analyzed using schedules 2033 and 2060 collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; E, estimated value; V, analyte was detected in a sample and an associated blank thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	2-Chloro-6-ethylamino-4-amino-*s*-triazine (µg/L) (04038)	Prometon (µg/L) (04037)	Tebuthiuron[1] (µg/L) (82670)	Tebuthiuron (µg/L)	Metalaxyl[1] (µg/L) (61596)	Metalaxyl (µg/L) (50359)	Norflurazon (µg/L) (49293)	DCPA (µg/L) (82682)
Laboratory Schedule	2060	2033	2033	2060	2033	2060	2060	2033
[LRL]	0.08	0.01	0.016	0.04	0.0069	0.04	0.04	0.003
Threshold type[3]	na	HAL-US	HAL-US	HAL-US	na	na	na	HAL-US
Threshold level	na	100	500	500	na	na	na	70
Grid wells—Continued								
USAWR-01	–	0.02	E 0.01	E[4] 0.013	–	–	–	–
USAWR-02	–	–	–	–	–	–	–	–
USAWR-03	–	–	–	–	–	–	–	–
USAWR-05	–	E 0.01	–	–	–	–	–	–
USAWR-06	0.41	E 0.01	–	–	E 0.006	–	–	–
USAWR-07	0.72	0.01	0.02	E[4] 0.012	–	–	–	–
USAWR-08	E 0.05	–	–	E[4] 0.001	–	–	–	–
USAWR-09	0.12	–	–	–	–	–	–	–
USAWR-10	E[4] 0.01	–	–	E[4] 0.002	–	–	–	–
USAWR-11	–	–	–	–	–	–	–	–
USAWS-01	–	–	–	–	–	–	–	–
USAWS-02	–	–	–	–	–	–	–	–
USAWS-03	–	–	–	–	–	–	–	–
USAWS-04	–	–	–	–	–	–	–	–
USAWS-05	–	–	–	–	–	–	–	–
USAWS-07	–	–	–	–	–	–	–	–
USAWS-08	–	–	–	–	–	–	–	–
USAWS-09	–	–	–	–	–	–	–	–
USAWS-10	–	–	–	–	–	–	–	–
USAWS-11	E[4] 0.03	0.01	–	E[4] 0.001	–	–	–	–
USAWS-12	–	–	–	–	–	–	–	E 0.004
USAWS-13	–	–	–	–	–	–	–	–
USAWS-17	–	–	–	–	–	–	–	–
USAWS-19	–	–	–	E[4] 0.001	–	–	–	–
USAWS-20	–	–	–	–	–	–	–	–
USAWY-01	0.10	–	–	–	–	–	–	–
USAWY-02	–	–	–	–	–	–	E 0.02	–
USAWY-05	E[4] 0.01	–	–	–	–	–	–	–
USAWY-06	–	–	–	–	–	–	–	–
USAWY-07	–	–	–	–	–	–	–	–
USAWY-08	–	–	–	–	–	–	–	–
Number of detections	10	7	4	0	2	0	1	1
Detection frequency (percent)	11	8	4	0	2	0	1	1
Understanding well								
USAWU-04	E[4] 0.01	–	–	–	–	–	–	–

Table 6. Pesticides and pesticide degradates detected in samples analyzed using schedules 2033 and 2060 collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; E, estimated value; V, analyte was detected in a sample and an associated blank thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Pendimethalin (µg/L) (82683)	Diphenamid (µg/L) (04033)	Siduron (µg/L) (38548)	Desulfinyl fipronil (µg/L) (62170)	2-Hydroxy-4-isopropylamino-6-ethylamino-*s*-triazine (µg/L) (50355)	Dinoseb (µg/L) (49301)	3-(4-Chlorophenyl)-1 methyl urea (µg/L) (61692)	Bromoxynil (µg/L) (49311)
Laboratory Schedule	2033	2060	2060	2033	2060	2060	2060	2060
[LRL]	0.02	0.04	0.04	0.012	0.08	0.04	0.06	0.12
Threshold type[3]	na	HAL-US	na	na	na	MCL-CA	na	na
Threshold level	na	200	na	na	na	7	na	na
Grid wells—Continued								
USAWB-01		–	–					
USAWB-02	–	–	–	–	–	–	–	–
USAWB-03	–	–	–	–	E[4] 0.008	–	–	–
USAWB-05	–	–	–	–	–	–	–	–
USAWB-06	–	–	–	–	–	–	–	–
USAWB-08	–	–	–	–	–	–	–	–
USAWB-09	–	–	–	–	–	–	–	–
USAWB-10	–	–	–	–	–	–	–	–
USAWB-11	–	–	–	–	–	–	E[4] 0.010	–
USAWB-12	–	–	–	–	–	–	–	–
USAWB-13	–	–	E[4] 0.01	–	–	E[4] 0.010	–	–
USAWB-14	–	–	E[4] 0.01	–	–	–	–	–
USAWB-15	–	–	E[4] 0.01	–	–	E[4] 0.004	–	–
USAWB-16	–	–	E[4] 0.01	–	–	–	–	–
USAWB-17	0.039	–	E[4] 0.01	–	–	–	–	–
USAWB-18	–	E[4] 0.0100	–	–	–	–	–	–
USAWB-19	–	–	–	–	–	–	–	–
USAWC-01	–	E[4] 0.0005	–	–	–	–	–	–
USAWC-04	–	E[4] 0.0006	–	–	–	–	–	–
USAWC-05	–	–	–	–	–	–	–	–
USAWC-06	–	E[4] 0.0001	–	–	–	–	–	–
USAWC-07	–	E[4] 0.0100	–	–	–	–	E[4] 0.003	–
USAWC-08	–	E[4] 0.0001	–	–	–	–	–	–
USAWC-09	–	–	–	–	–	–	–	–
USAWC-11	–	–	–	–	–	–	–	–
USAWC-12	–	–	–	–	–	–	–	–
USAWC-14	–	–	–	–	–	–	–	–
USAWC-16	–	–	–	–	–	–	–	–
USAWC-17	–	–	–	–	–	–	–	–
USAWC-18	–	E[4] 0.0040	–	–	–	–	–	–
USAWC-21	–	–	–	–	–	–	–	–
USAWC-22	–	–	–	–	–	–	–	–
USAWC-23	–	–	–	–	–	–	–	–
USAWE-01	–	–	–	–	–	–	–	–
USAWE-02	–	–	–	–	–	–	–	–
USAWE-03	–	–	–	–	–	–	–	–
USAWE-04	–	–	–	–	–	–	–	–

Table 6. Pesticides and pesticide degradates detected in samples analyzed using schedules 2033 and 2060 collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; E, estimated value; V, analyte was detected in a sample and an associated blank thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Pendimethalin (µg/L) (82683)	Diphenamid (µg/L) (04033)	Siduron (µg/L) (38548)	Desulfinyl fipronil (µg/L) (62170)	2-Hydroxy-4-isopropylamino-6-ethylamino-*s*-triazine (µg/L) (50355)	Dinoseb (µg/L) (49301)	3-(4-Chlorophenyl)-1 methyl urea (µg/L) (61692)	Bromoxynil (µg/L) (49311)
Laboratory Schedule	2033	2060	2060	2033	2060	2060	2060	2060
[LRL]	0.02	0.04	0.04	0.012	0.08	0.04	0.06	0.12
Threshold type[3]	na	HAL-US	na	na	na	MCL-CA	na	na
Threshold level	na	200	na	na	na	7	na	na
Grid wells—Continued								
USAWR-01	–	–	–	–	E[4] 0.005	–	–	–
USAWR-02	–	–	–	–	–	–	–	–
USAWR-03	–	–	–	–	–	–	–	–
USAWR-05	–	–	–	–	–	–	–	–
USAWR-06	–	–	E[4] 0.005	–	–	–	–	–
USAWR-07	–	–	E[4] 0.010	–	–	–	–	–
USAWR-08	–	E[4] 0.0010	E[4] 0.010	–	–	–	–	–
USAWR-09	–	–	E[4] 0.010	–	–	–	–	–
USAWR-10	–	–	E[4] 0.005	E[4] 0.003	–	–	–	–
USAWR-11	–	E[4] 0.0030	–	–	–	–	–	–
USAWS-01	–	–	–	–	–	–	–	–
USAWS-02	–	–	–	–	–	–	–	–
USAWS-03	–	–	–	–	–	–	–	–
USAWS-04	–	–	–	–	–	–	–	–
USAWS-05	–	–	–	E[4] 0.003	–	–	–	–
USAWS-07	–	–	–	–	–	–	–	–
USAWS-08	–	–	–	–	–	–	–	–
USAWS-09	–	E[4] 0.0020	–	–	–	–	–	–
USAWS-10	–	–	–	–	–	–	–	–
USAWS-11	–	–	–	–	–	–	–	–
USAWS-12	–	E[4] 0.0002	–	–	–	–	–	–
USAWS-13	–	–	–	–	–	–	–	–
USAWS-17	–	–	–	–	–	–	–	–
USAWS-19	–	–	–	–	–	–	–	E[4] 0.001
USAWS-20	–	–	–	–	–	–	–	–
USAWY-01	–	–	–	–	–	–	–	–
USAWY-02	–	–	–	–	–	–	–	–
USAWY-05	–	E[4] 0.0010	E[4] 0.005	–	–	–	–	–
USAWY-06	–	–	E[4] 0.004	–	–	–	–	–
USAWY-07	–	–	–	E[4] 0.003	–	–	–	–
USAWY-08	–	–	–	–	–	–	–	–
Number of detections	1	0	0	0	0	0	0	0
Detection frequency (percent)	1	0	0	0	0	0	0	0
Understanding well—Continued								
USAWU-04	–	E[4] 0.0005	E[4] 0.01	–	–	–	–	–

Table 6. Pesticides and pesticide degradates detected in samples analyzed using schedules 2033 and 2060 collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; E, estimated value; V, analyte was detected in a sample and an associated blank thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Desulfinyl-fipronil amide (µg/L) (62169)	Fipronil sulfide (µg/L) (62167)	Fipronil (µg/L) (62166)	Imazethapyr (µg/L) (50407)	Imidacloprid (µg/L) (61695)	Metolachlor (µg/L) (39415)	Pesticide detections per well[2]
Laboratory Schedule	2033	2033	2033	2060	2060	2033	
[LRL]	0.029	0.013	0.016	0.04	0.06	0.01	
Threshold type[3]	na	na	na	na	na	HAL-US	
Threshold level	na	na	na	na	na	700	
Grid wells—Continued							
USAWB-01						–	2
USAWB-02	–	–	–	–	–	–	2
USAWB-03	–	–	–	–	–	–	3
USAWB-05	–	–	–	–	–	–	1
USAWB-06	–	–	–	–	–	–	2
USAWB-08	–	–	–	–	–	–	2
USAWB-09	–	–	–	–	–	–	4
USAWB-10	–	–	–	–	–	–	2
USAWB-11	–	–	–	–	–	–	3
USAWB-12	–	–	–	–	–	–	2
USAWB-13	–	–	–	–	–	–	7
USAWB-14	–	–	–	–	–	–	0
USAWB-15	–	–	–	–	–	–	4
USAWB-16	–	–	–	–	–	–	0
USAWB-17	–	–	–	–	–	–	5
USAWB-18	–	–	–	–	–	–	1
USAWB-19	–	–	–	–	E[4] 0.005	–	6
USAWC-01	–	–	–	–	–	–	1
USAWC-04	–	–	–	–	–	–	2
USAWC-05	–	–	–	–	–	–	1
USAWC-06	–	–	–	–	–	–	3
USAWC-07	–	–	–	–	–	–	3
USAWC-08	–	–	–	–	–	–	5
USAWC-09	–	–	–	–	–	–	4
USAWC-11	–	–	–	–	–	–	3
USAWC-12	–	–	–	–	–	–	2
USAWC-14	–	–	–	–	–	–	3
USAWC-16	–	–	–	–	–	–	2
USAWC-17	–	–	–	–	–	–	2
USAWC-18	–	–	–	–	–	–	0
USAWC-21	–	–	–	–	–	–	0
USAWC-22	–	–	–	–	–	–	0
USAWC-23	–	–	–	–	–	–	1
USAWE-01	–	–	–	–	–	–	3
USAWE-02	–	–	–	–	–	–	2
USAWE-03	–	–	–	–	–	–	0
USAWE-04	–	–	–	–	–	–	5

Table 6. Pesticides and pesticide degradates detected in samples analyzed using schedules 2033 and 2060 collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 99 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the 90 grid wells. **Abbreviations:** LRL, laboratory reporting level; LT-MDL, long-term method detection limit; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level; E, estimated value; V, analyte was detected in a sample and an associated blank thus data are not included in ground-water quality assessment; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Desulfinyl-fipronil amide (µg/L) (62169)	Fipronil sulfide (µg/L) (62167)	Fipronil (µg/L) (62166)	Imazethapyr (µg/L) (50407)	Imidacloprid (µg/L) (61695)	Metolachlor (µg/L) (39415)	Pesticide detections per well[2]
Laboratory Schedule	2033	2033	2033	2060	2060	2033	
[LRL]	0.029	0.013	0.016	0.04	0.06	0.01	
Threshold type[3]	na	na	na	na	na	HAL-US	
Threshold level	na	na	na	na	na	700	
Grid wells—Continued							
USAWR-01	–	–	–	–	–	–	6
USAWR-02	–	–	–	–	–	–	3
USAWR-03	–	–	–	–	–	–	3
USAWR-05	–	–	–	–	–	–	4
USAWR-06	–	–	–	–	–	–	9
USAWR-07	–	–	–	–	–	–	8
USAWR-08	–	–	–	–	–	–	7
USAWR-09	–	–	–	–	–	–	6
USAWR-10	E[4] 0.006	E[4] 0.005	E[4] 0.006	–	–	–	2
USAWR-11	–	–	–	–	–	–	3
USAWS-01	–	–	–	–	–	–	2
USAWS-02	–	–	–	–	–	–	2
USAWS-03	–	–	–	–	–	–	2
USAWS-04	–	–	–	–	–	–	4
USAWS-05	–	–	–	–	–	E[4] 0.004	2
USAWS-07	–	–	–	–	–	–	2
USAWS-08	–	–	–	–	–	–	3
USAWS-09	–	–	–	–	–	–	4
USAWS-10	–	–	–	E[4] 0.010	–	–	6
USAWS-11	–	–	–	–	–	–	7
USAWS-12	–	–	–	–	–	–	5
USAWS-13	–	–	–	–	–	–	2
USAWS-17	–	–	–	–	–	–	1
USAWS-19	–	–	–	–	–	–	0
USAWS-20	–	–	–	–	–	–	1
USAWY-01	–	–	–	–	–	–	3
USAWY-02	–	–	–	–	–	–	5
USAWY-05	–	–	–	–	–	–	2
USAWY-06	–	–	–	–	–	–	3
USAWY-07	–	–	–	–	–	–	1
USAWY-08	–	–	–	–	–	–	2
Number of detections	0	0	0	0	0	0	[5]198
Detection frequency (percent)	0	0	0	0	0	0	[6]68
Understanding well—Continued							
USAWU-04	–	–	–	–	–	–	4

[1]Preferred analytical method (for compounds analyzed by more than one method).

[2]Duplicated detections of parameter codes 39632 and 04040 are counted only once.

[3]Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists.

[4]The detected concentration was less than the LT-MDL for this compound and, therefore, is not included in statistical summaries.

[5]Total number of pesticide detections in grid wells.

[6]Frequency of detection of at least one pesticide in the grid wells. Detected concentrations that are less than the LT-MDL (approximately half the LRL) and detections with V remark codes are not included.

Table 7. Pharmaceutical compounds detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[**GAMA well identification No.:** USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from 92 wells were analyzed, but only samples with detections are listed. Analytes are listed in order of decreasing detection frequency in the grid wells. **Caffeine:** Not detected by the preferred filtered Laboratory Schedule 2060 (parameter code 50305 removed from this table). **Detections per well:** Because of the newness of this analytical method compared with the other methods used in this study, an extra level of quality-control assessment was applied to the pharmaceutical data. More rigorous censoring was applied to this group of constituents so that only detected concentrations greater than one-half the LRL are reported in this table. **Abbreviations:** LRL, laboratory reporting level; E, estimated value; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Carbamazepine (µg/L) (62793)	Acetaminophen (µg/L) (62000)	Caffeine (µg/L)	1,7-Dimethylxanthine (µg/L) (62030)	Detections per well
LRL	[0.030]	[0.025]	[0.015]	[0.020]	
Threshold level	na	na	na	na	
Typical dose	1,000,000	500,000	100,000	na	
Grid wells					
USAWC-07	0.043	–	–	–	1
USAWC-09	0.043	–	–	–	1
USAWR-07	–	0.079	0.085	E 0.015	3
USAWR-08	0.032	0.024	–	–	2
USAWR-10	0.222	–	–	–	1
USAWS-11	0.051	–	–	–	1
USAWS-19	–	E 0.015	E 0.011	–	2
USAWY-07			E 0.013		1
Number of detections	5	3	3	1	[1]12
Detection frequency (percent)	6	3	3	1	[2]8
Understanding wells					
USAWU-04	–	0.116	E 0.168	E 0.014	3

[1] Total number of pharmaceutical detections in grid wells.

[2] Frequency of detection of at least one pharmaceutical in the grid wells.

Table 8. Constituents of special interest (perchlorate, *N*-nitrosodimethylamine [NDMA], and 1,2,3-trichloropropane [1,2,3-TCP], and 1,4-dioxane) detected in samples collected in the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Analyses done by the Mongomery Watson-Harza laboratory (laboratory entity code CA-MWHL). Samples from all 99 wells were analyzed for perchlorate, samples from the 32 slow wells were sampled for NDMA, 1,2,3-TCP, and 1,4-Dioxane. **Abbreviations**: MRL, method reporting level; MCL-CA; California Department of Public Health maximum contaminant level; HAL-US, U.S. Environmental Protection Agency health advisory level; NL-CA, California Department of Public Health notification level; µg/L, microgram per liter; nc, sample not collected; –, not detected; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment]

GAMA well identification number	Perchlorate (µg/L) (61209)	*N*-Nitrosodimethylamine (NDMA) (µg/L) (64176)	1,2,3-Trichloropropane (1,2,3-TCP) (µg/L) (77443)	1,4-Dioxane (81582)
Threshold type[1]	MCL-CA	NL-CA	HAL-US	NL-CA
Threshold level	6	0.01	40	3
MRL	[0.5]	[0.002]	[0.005]	[2]
		Grid wells		
USAWB-01	1.2	nc	nc	nc
USAWB-02	–	–	–	–
USAWB-03	–	nc	nc	nc
USAWB-04	–	–	–	–
USAWB-05	–	nc	nc	nc
USAWB-06	–	nc	nc	nc
USAWB-07	3.5	V 0.003	–	–
USAWB-08	0.78	–	–	–
USAWB-09	0.79	nc	nc	nc
USAWB-10	0.67	–	–	–
USAWB-11	3.6	–	–	–
USAWB-12	1.8	nc	nc	nc
USAWB-13	* 11	nc	nc	nc
USAWB-14	–	–	–	–
USAWB-15	3.4	nc	nc	nc
USAWB-16	2.8	nc	nc	nc
USAWB-17	0.63	nc	nc	nc
USAWB-18	5.2	nc	nc	nc
USAWB-19	–	nc	nc	nc
USAWC-01	3.3	nc	nc	nc
USAWC-02	1.9	nc	nc	nc
USAWC-03	0.66	nc	nc	nc
USAWC-04	* 8.9	V 0.003	–	–
USAWC-05	* 9.3	nc	nc	nc
USAWC-06	0.86	nc	nc	nc
USAWC-07	–	nc	nc	nc
USAWC-08	2.5	–	–	–
USAWC-09	–	nc	nc	nc
USAWC-10	–	nc	nc	nc
USAWC-11	2.6	–	–	–
USAWC-12	1.1	nc	nc	nc
USAWC-13	1.0	nc	nc	nc
USAWC-14	2.7	–	–	–
USAWC-15	1.8	nc	nc	nc
USAWC-16	–	nc	nc	nc
USAWC-17	1.3	–	–	–

Table 8. Constituents of special interest (perchlorate, *N*-nitrosodimethylamine [NDMA], and 1,2,3-trichloropropane [1,2,3-TCP], and 1,4-dioxane) detected in samples collected in the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Analyses done by the Mongomery Watson-Harza laboratory (laboratory entity code CA-MWHL). Samples from all 99 wells were analyzed for perchlorate, samples from the 32 slow wells were sampled for NDMA, 1,2,3-TCP, and 1,4-Dioxane. **Abbreviations**: MRL, method reporting level; MCL-CA; California Department of Public Health maximum contaminant level; HAL-US, U.S. Environmental Protection Agency health advisory level; NL-CA, California Department of Public Health notification level; µg/L, microgram per liter; nc, sample not collected; –, not detected; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment]

GAMA well identification number	Perchlorate (µg/L) (61209)	*N*-Nitrosodimethylamine (NDMA) (µg/L) (64176)	1,2,3-trichloropropane (1,2,3-TCP) (µg/L) (77443)	1,4-dioxane (81582)
Threshold type[1]	MCL-CA	NL-CA	HAL-US	NL-CA
Threshold level	6	0.01	40	3
MRL	[0.5]	[0.002]	[0.005]	[2]
		Grid wells—Continued		
USAWC-18	3.4	nc	nc	nc
USAWC-19	–	nc	nc	nc
USAWC-20	0.98	nc	nc	nc
USAWC-21	1.3	–	–	–
USAWC-22	2.0	nc	nc	nc
USAWC-23	2.0	nc	0.069	nc
USAWC-24	–	nc	nc	nc
USAWC-25	2.8	nc	nc	nc
USAWE-01	–	–	–	–
USAWE-02	–	–	–	–
USAWE-03	–	–	–	–
USAWE-04	–	–	–	–
USAWR-01	*10	nc	nc	na
USAWR-02	4.7	nc	nc	na
USAWR-03	*10	–	–	–
USAWR-04	2.9	nc	nc	nc
USAWR-05	4.4	nc	nc	nc
USAWR-06	*8.0	nc	nc	nc
USAWR-07	*7.9	nc	nc	nc
USAWR-08	2.6	–	–	–
USAWR-09	*10	nc	nc	nc
USAWR-10	1.6	nc	nc	nc
USAWR-11	5.0	–	–	–
USAWR-12	*8.8	–	–	–
USAWS-01	3.1	nc	nc	nc
USAWS-02	2.8	–	0.120	–
USAWS-03	0.69	nc	nc	nc
USAWS-04	*7.1	nc	nc	nc
USAWS-05	1.9	nc	nc	nc
USAWS-06	–	–	–	–
USAWS-07	–	nc	nc	nc
USAWS-08	*6.0	–	–	–
USAWS-09	2.0	nc	nc	nc
USAWS-10	–	nc	nc	nc
USAWS-11	1.5	nc	nc	nc

Table 8. Constituents of special interest (perchlorate, *N*-nitrosodimethylamine [NDMA], and 1,2,3-trichloropropane [1,2,3-TCP], and 1,4-dioxane) detected in samples collected in the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Analyses done by the Mongomery Watson-Harza laboratory (laboratory entity code CA-MWHL). Samples from all 99 wells were analyzed for perchlorate, samples from the 32 slow wells were sampled for NDMA, 1,2,3-TCP, and 1,4-Dioxane. **Abbreviations**: MRL, method reporting level; MCL-CA; California Department of Public Health maximum contaminant level; HAL-US, U.S. Environmental Protection Agency health advisory level; NL-CA, California Department of Public Health notification level; µg/L, microgram per liter; nc, sample not collected; –, not detected; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment]

GAMA well identification number	Perchlorate (µg/L) (61209)	*N*-Nitrosodimethylamine (NDMA) (µg/L) (64176)	1,2,3-trichloropropane (1,2,3-TCP) (µg/L) (77443)	1,4-dioxane (81582)
Threshold type[1]	MCL-CA	NL-CA	HAL-US	NL-CA
Threshold level	6	0.01	40	3
MRL	[0.5]	[0.002]	[0.005]	[2]
		Grid wells—Continued		
USAWS-12	2.1	–	–	–
USAWS-13	2.1	nc	nc	nc
USAWS-14	–	–	–	–
USAWS-15	–	–	–	–
USAWS-16	–	nc	nc	nc
USAWS-17	0.81	nc	nc	nc
USAWS-18	1.3	–	–	–
USAWS-19	–	nc	nc	nc
USAWS-20	2.3	–	0.076	–
USAWS-21	–	nc	nc	nc
USAWY-01	–	nc	nc	nc
USAWY-02	–	nc	nc	nc
USAWY-03	–	nc	nc	nc
USAWY-04	–	nc	nc	nc
USAWY-05	1.8	–	–	–
USAWY-06	1.8	–	–	–
USAWY-07	0.6	nc	nc	nc
USAWY-08	0.58	nc	nc	nc
USAWY-09	–	nc	nc	nc
Number of wells with detections	60	0	3	0
Detection frequency (percent)	67	0	9	0
		Understanding wells		
USAWU-01	1.1	nc	nc	nc
USAWU-02	–	nc	nc	nc
USAWU-03	–	nc	nc	nc
USAWU-04	4.8	nc	nc	nc
USAWU-05	3	nc	nc	nc
USAWU-06	5.6	nc	nc	nc
USAWU-07	4.1	nc	nc	nc
USAWU-08	–	nc	nc	nc
USAWU-09	1.9	nc	nc	nc

* Indicates value above threshold level

[1] Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists.

Table 9. Nutrients and dissolved organic carbon detected in samples collected for the Upper Santa Ana Watershed Ground-Water Ambient Monitoring and Assessment (GAMA) Program, California, November 2006–February 2007.

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Forty-nine grid wells were sampled for nutrients. Eight understanding wells were sampled for nutrients. Thirty-four grid wells were sampled for dissolved organic carbon. Two understanding wells were sampled for dissolved organic carbon. **Abbreviations**: HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; E, estimated value; LRL, laboratory reporting level; mg/L, milligram per liter; na, not available; nc, sample not collected; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; –, not detected]

GAMA well identification number	Nutrients					
	Ammonia, as nitrogen (mg/L) (00608)	Nitrite plus nitrate, as nitrogen (mg/L) (00631)	Nitrite, as nitrogen (mg/L) (00613)	Total nitrogen (nitrate + nitrite + ammonia + organic -nitrogen) as nitrogen (mg/L) (62854)	Orthophosphate, as phosphorous (mg/L) (00671)	Dissolved organic carbon (DOC) (mg/L) (00681)
Threshold type	HAL-US	MCL-US	MCL-US	na	na	na
Threshold level	[1] 30	[2] 10	1	na	na	na
[LRL]	[0.01]	[0.06]	[0.002]	[0.06]	[0.006]	[0.33]
			Grid wells			
USAWB-02	–	1.11	–	1.15	0.012	V 0.3
USAWB-04	–	2.73	–	2.82	0.018	V 0.2
USAWB-07	–	4.86	–	4.91	0.017	V 0.3
USAWB-08	–	* 10.5	–	[3] 10.3	0.014	V 0.2
USAWB-10	–	5.50	–	5.66	0.022	V 0.4
USAWB-11	–	7.51	–	7.87	0.038	V 0.3
USAWB-14	–	2.27	–	[3] 2.21	0.028	V 0.3
USAWB-16	–	1.57	–	[3] 1.56	0.019	nc
USAWB-18	–	5.97	–	6.11	0.035	nc
USAWC-01	–	5.44	–	5.50	0.018	nc
USAWC-02	–	2.95	–	[3] 2.86	0.039	nc
USAWC-04	–	* 15.1	–	15.2	0.020	V 0.3
USAWC-08	–	* 11.5	–	12.5	0.016	–
USAWC-11	–	5.37	–	5.55	0.046	–
USAWC-12	–	* 34.8	–	37.8	0.047	nc
USAWC-14	–	6.39	–	[3] 6.26	0.034	–
USAWC-17	–	2.36	–	2.37	0.037	V 0.2
USAWC-20	–	4.05	–	[3] 4.03	0.037	nc
USAWC-21	–	5.88	–	5.94	0.043	–
USAWC-23	–	8.38	–	8.82	0.015	V 0.3
USAWC-24	–	1.34	E 0.001	1.36	0.060	V 0.6
USAWC-25	–	* 13.9	–	14.6	0.033	nc
USAWE-01	E 0.010	1.39	0.007	1.40	0.012	V 0.2
USAWE-02	0.025	0.14	0.008	0.20	0.027	V 1.3
USAWE-03	–	4.53	0.039	4.53	0.049	V 0.2
USAWE-04	–	4.34	–	4.46	0.026	V 0.6

Table 9. Nutrients and dissolved organic carbon detected in samples collected for the Upper Santa Ana Watershed Ground-Water Ambient Monitoring and Assessment (GAMA) Program, California, November 2006–February 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Forty-nine grid wells were sampled for nutrients. Eight understanding wells were sampled for nutrients. Thirty-four grid wells were sampled for dissolved organic carbon. Two understanding wells were sampled for dissolved organic carbon. **Abbreviations**: HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; E, estimated value; LRL, laboratory reporting level; mg/L, milligram per liter; na, not available; nc, sample not collected; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; –, not detected]

GAMA well identification number	Nutrients					
	Ammonia, as nitrogen (mg/L) (00608)	Nitrite plus nitrate, as nitrogen (mg/L) (00631)	Nitrite, as nitrogen (mg/L) (00613)	Total nitrogen (nitrate + nitrite + ammonia + organic -nitrogen) as nitrogen (mg/L) (62854)	Orthophosphate, as phosphorous (mg/L) (00671)	Dissolved organic carbon (DOC) (mg/L) (00681)
Threshold type	HAL-US	MCL-US	MCL-US	na	na	na
Threshold level	[1] 30	[2] 10	1	na	na	na
[LRL]	[0.01]	[0.06]	[0.002]	[0.06]	[0.006]	[0.33]
			Grid wells—Continued			
USAWR-03	–	*12.9	E 0.002	13.4	0.030	V 0.5
USAWR-05	–	*10.4	–	11.5	0.062	nc
USAWR-06	–	*19.0	–	20.1	0.036	nc
USAWR-07	–	*17.9	–	18.9	0.045	V 1.2
USAWR-08	–	9.19	–	10.2	0.017	V 0.4
USAWR-09	–	*16.2	–	17.6	0.028	nc
USAWR-10	–	3.88	–	3.97	0.057	nc
USAWR-11	–	5.63	–	6.04	0.025	–
USAWR-12	–	*17.5	0.003	17.7	0.020	–
USAWS-02	–	*11.0	–	11.9	0.035	–
USAWS-05	E 0.010	6.56	–	6.88	0.059	nc
USAWS-06	1.95	–	–	2.20	0.511	2.1
USAWS-08	–	*13.7	–	14.1	0.075	–
USAWS-12	–	5.38	E 0.001	[3] 5.13	0.029	–
USAWS-14	0.051	0.19	0.005	0.26	0.048	V 0.4
USAWS-15	–	3.40	E 0.002	3.41	0.013	–
USAWS-16	–	0.59	E 0.002	0.64	0.010	nc
USAWS-18	–	*14.6	0.010	14.8	0.011	V 0.7
USAWS-20	–	7.04	–	7.08	0.035	V 0.3
USAWS-21	1.10	–	–	1.25	0.060	nc
USAWY-04	–	1.45	–	1.55	0.013	nc
USAWY-05	–	5.64	–	5.89	0.026	V 0.3
USAWY-06	–	7.38	–	8.18	0.024	V 0.4

Table 9. Nutrients and dissolved organic carbon detected in samples collected for the Upper Santa Ana Watershed Ground-Water Ambient Monitoring and Assessment (GAMA) Program, California, November 2006–February 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Forty-nine grid wells were sampled for nutrients. Eight understanding wells were sampled for nutrients. Thirty-four grid wells were sampled for dissolved organic carbon. Two understanding wells were sampled for dissolved organic carbon. **Abbreviations**: HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; E, estimated value; LRL, laboratory reporting level; mg/L, milligram per liter; na, not available; nc, sample not collected; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; –, not detected]

GAMA well identification number	Nutrients					
	Ammonia, as nitrogen (mg/L) (00608)	Nitrite plus nitrate, as nitrogen (mg/L) (00631)	Nitrite, as nitrogen (mg/L) (00613)	Total nitrogen (nitrate + nitrite + ammonia + organic -nitrogen) as nitrogen (mg/L) (62854)	Orthophosphate, as phosphorous (mg/L) (00671)	Dissolved organic carbon (DOC) (mg/L) (00681)
Threshold type	HAL-US	MCL-US	MCL-US	na	na	na
Threshold level	[1] 30	[2] 10	1	na	na	na
[LRL]	[0.01]	[0.06]	[0.002]	[0.06]	[0.006]	[0.33]
Understanding wells						
USAWU-01	–	4.86	E 0.001	5.04	0.019	nc
USAWU-02	–	4.35	–	[3] 4.33	0.015	nc
USAWU-04	–	7.24	–	7.67	0.026	nc
USAWU-05	–	8.59	–	9.28	0.019	nc
USAWU-06	–	8.62	–	9.36	0.017	–
USAWU-07	–	7.07	–	7.29	0.029	nc
USAWU-08	–	1.22	0.056	1.26	0.032	nc
USAWU-09	–	* 21.8	–	22.7	0.037	V 0.4

[1] Threshold for ammonia is as ammonia, results are listed as nitrogen.

[2] Threshold for nitrate alone, the predominant species in this summed parameter.

[3] Total nitrogen in these samples is less than the sum of the nitrogen analytes, but falls within the U.S. Geological Survey National Water Quality Laboratory acceptance criterion of a 10 percent relative percent difference.

* Value exceeds threshold.

Table 10. Major and minor ions, silica, and total dissolved solids detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Forty-nine grid wells and eight understanding wells were sampled for these parameters. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Bicarbonate** and **carbonate** concentrations were calculated from the laboratory measured alkalinity and pH values using the advanced speciation method (http://or.water.usgs.gov/alk/methods.html). See table 4 for the results of the preferred method (samples for which field alkalinity measurements were made). **Abbreviations**: LRL, laboratory reporting level; MCL-CA; California Department of Public Health maximum contaminant level; SMCL-CA; California Department of Public Health secondary maximum contaminant level; E, estimated value; mg/L, milligram per liter; na, not available; –, not detected]

GAMA well identification number	Calcium (mg/L) (00915)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Bicarbonate (mg/L) (29805)	Carbonate (mg/L) (29808)	Bromide (mg/L) (71870)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)	Iodide (mg/L) (71865)	Sulfate (mg/L) (00945)	Silica (mg/L) (00955)	Total dissolved solids (TDS) (mg/L) (70300)
Threshold type	na	na	na	na	na	na	na	SMCL-CA[1]	MCL-CA	na	SMCL-CA[1]	na	SMCL-CA[1]
Threshold level	na	na	na	na	na	na	na	250 (500)	2	na	250 (500)	na	500 (1000)
[LRL]	[0.02]	[0.014]	[0.04]	[0.2]	[1]	[0.1]	[0.02]	[0.12]	[0.1]	[0.002]	[0.18]	[0.018]	[10]
						Grid wells							
USAWB-02	47.0	7.04	2.26	8.47	166	–	–	2.95	0.40	–	21.3	18.0	194
USAWB-04	42.7	3.66	1.68	14.4	145	–	0.03	3.82	0.31	–	16.9	21.0	184
USAWB-07	66.5	7.70	3.39	33.7	171	–	E 0.02	18.9	0.55	–	74.2	22.7	335
USAWB-08	79.9	12.9	3.54	15.7	231	–	0.07	14.6	0.42	–	53.0	19.0	375
USAWB-10	86.8	16.4	3.84	19.0	248	–	0.10	27.6	0.36	–	61.7	24.3	378
USAWB-11	49.2	12.5	1.94	72.0	187	–	0.10	27.9	1.55	–	116	34.6	438
USAWB-14	55.2	6.59	1.89	12.3	204	–	0.02	4.65	0.29	–	17.2	24.0	244
USAWB-16	31.7	3.32	2.78	32.6	136	–	0.03	9.73	0.58	–	38.2	21.8	216
USAWB-18	51.3	8.97	2.11	14.2	180	–	0.04	7.29	0.31	–	30.5	24.9	263
USAWC-01	51.1	4.29	1.93	18.3	167	–	0.06	15.5	0.18	–	16.6	23.8	248
USAWC-02	46.7	6.70	1.77	18.1	196	–	0.02	7.29	0.26	–	8.38	27.3	226
USAWC-04	112	19.6	2.35	16.8	249	–	0.12	36.1	0.32	–	85.4	25.3	486
USAWC-08	70.6	8.16	2.42	27.7	178	–	0.18	46.7	0.17	E 0.001	26.8	23.2	369
USAWC-11	91.4	12.8	3.65	60.3	286	–	0.22	90.7	0.24	0.003	60.4	33.1	*536
USAWC-12	124	27.0	2.39	51.0	352	–	0.21	84.4	0.15	0.042	42.2	32.4	*686
USAWC-14	46.8	12.4	1.62	19.2	181	–	0.05	11.3	0.38	–	18.7	33.2	259
USAWC-17	47.2	9.09	1.99	19.7	200	–	0.03	8.61	0.22	–	13.7	31.5	244
USAWC-20	54.1	7.29	1.78	17.6	202	–	0.04	8.33	0.23	–	9.53	28.5	246
USAWC-21	46.3	13.6	1.76	21.3	177	–	0.03	8.22	0.38	–	41.5	45.9	291
USAWC-23	57.5	12.4	2.05	17.5	182	–	0.13	18.8	0.27	–	34.6	21.8	295
USAWC-24	30.0	6.65	1.29	22.1	133	–	0.03	15.7	0.37	0.002	17.9	30.2	198
USAWC-25	96.4	20.0	2.32	29.9	206	–	0.26	74.0	0.16	0.024	67.6	32.9	499

Table 10. Major and minor ions, silica, and total dissolved solids detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Forty-nine grid wells and eight understanding wells were sampled for these parameters. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Bicarbonate** and **carbonate** concentrations were calculated from the laboratory measured alkalinity and pH values using the advanced speciation method (http://or.water.usgs.gov/alk/methods.html). See table 4 for the results of the preferred method (samples for which field alkalinity measurements were made). **Abbreviations**: LRL, laboratory reporting level; MCL-CA; California Department of Public Health maximum contaminant level; SMCL-CA; California Department of Public Health secondary maximum contaminant level; E, estimated value; mg/L, milligram per liter; na, not available; –, not detected]

GAMA well identification number	Calcium (mg/L) (00915)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Bicarbonate (mg/L) (29805)	Carbonate (mg/L) (29808)	Bromide (mg/L) (71870)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)	Iodide (mg/L) (71865)	Sulfate (mg/L) (00945)	Silica (mg/L) (00955)	Total dissolved solids (TDS) (mg/L) (70300)
Threshold type	na	na	na	na	na	na	na	SMCL-CA[1]	MCL-CA	na	SMCL-CA[1]	na	SMCL-CA[1]
Threshold level	na	na	na	na	na	na	na	250 (500)	2	na	250 (500)	na	500 (1000)
[LRL]	[0.02]	[0.014]	[0.04]	[0.2]	[1]	[0.1]	[0.02]	[0.12]	[0.1]	[0.002]	[0.18]	[0.018]	[10]
Grid wells—Continued													
USAWE-01	42.7	7.40	2.34	118	138	–	0.47	154	0.23	0.014	77.5	13.4	500
USAWE-02	13.3	0.426	0.81	162	91	4.2	0.54	160	0.53	0.115	81.4	11.6	481
USAWE-03	84.9	14.8	2.16	58.1	178	–	0.16	38.4	0.19	0.004	167	29.0	*529
USAWE-04	80.7	18.1	2.15	56.1	163	–	0.21	83.5	0.33	E 0.002	136	32.1	*519
USAWR-03	101	35.7	3.58	66.1	348	–	0.2	83.2	0.44	0.006	97.8	47.4	*663
USAWR-05	92.1	14.8	8.55	32.2	252	–	0.17	30.5	0.43	0.005	80.7	23.5	458
USAWR-06	120	42.5	3.90	133	409	–	0.39	139	0.3	0.009	180	38.9	*972
USAWR-07	141	59.1	3.81	137	443	–	0.46	169	0.39	0.014	232	46.2	**1,120
USAWR-08	105	18.0	4.45	57.8	318	–	0.18	64.7	0.57	0.005	101	23.6	*600
USAWR-09	116	22.7	4.37	73.7	332	–	0.39	109	0.64	0.003	78.2	24.2	*660
USAWR-10	97.2	23.2	3.51	128	274	–	0.26	146	0.41	0.010	189	29.0	*804
USAWR-11	56.0	6.58	2.33	13.1	188	–	0.04	7.61	0.30	–	23.7	22.5	259
USAWR-12	133	36.0	2.04	48.0	297	–	0.27	92.0	0.29	–	164	28.4	*709
USAWS-02	161	45.2	7.37	149	154	–	1.22	**539	0.31	0.012	41.2	23.9	**1,160
USAWS-05	140	40.9	5.31	140	217	–	0.76	*303	0.42	0.006	196	46.0	**1,030
USAWS-06	39.7	4.23	3.54	39.2	226	–	0.09	16.8	0.47	0.009	3.93	32.5	261
USAWS-08	60.1	20.6	3.20	56.2	92	–	0.63	159	0.44	E 0.002	22.9	57.7	*513
USAWS-12	89.2	23.3	3.23	104	140	–	0.9	*267	0.51	0.006	44.2	39.5	*735
USAWS-14	39.5	3.20	3.23	40.5	166	1.0	0.06	13.2	0.45	0.009	43.1	17.5	233
USAWS-15	94.9	19.8	7.17	85.4	115	–	0.42	129	0.56	–	188	23.5	*646
USAWS-16	29.2	5.00	4.36	153	115	–	0.39	130	1.11	0.037	152	16.1	*565
USAWS-18	117	23.2	8.13	88.5	128	–	0.52	110	0.47	–	*260	21.9	*754
USAWS-20	76.4	15.7	5.68	87.6	153	–	0.37	116	0.28	E 0.001	119	34.1	*522
USAWS-21	50.0	2.34	2.20	61.5	232	–	0.09	17.4	0.39	0.011	43.8	24.3	320

Table 10. Major and minor ions, silica, and total dissolved solids detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Forty-nine grid wells and eight understanding wells were sampled for these parameters. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Bicarbonate** and **carbonate** concentrations were calculated from the laboratory measured alkalinity and pH values using the advanced speciation method (http://or.water.usgs.gov/alk/methods.html). See table 4 for the results of the preferred method (samples for which field alkalinity measurements were made). **Abbreviations**: LRL, laboratory reporting level; MCL-CA; California Department of Public Health maximum contaminant level; SMCL-CA; California Department of Public Health secondary maximum contaminant level; E, estimated value; mg/L, milligram per liter; na, not available; –, not detected]

GAMA well identification number	Calcium (mg/L) (00915)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Bicarbonate (mg/L) (29805)	Carbonate (mg/L) (29808)	Bromide (mg/L) (71870)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)	Iodide (mg/L) (71865)	Sulfate (mg/L) (00945)	Silica (mg/L) (00955)	Total dissolved solids (TDS) (mg/L) (70300)
Threshold type	na	na	na	na	na	na	na	SMCL-CA[1]	MCL-CA	na	SMCL-CA[1]	na	SMCL-CA[1]
Threshold level	na	na	na	na	na	na	na	250 (500)	2	na	250 (500)	na	500 (1000)
[LRL]	[0.02]	[0.014]	[0.04]	[0.2]	[1]	[0.1]	[0.02]	[0.12]	[0.1]	[0.002]	[0.18]	[0.018]	[10]
Grid wells—Continued													
USAWY-04	49.2	8.45	2.22	29.5	210	–	0.05	10.2	0.59	E 0.001	33.4	23.6	259
USAWY-05	43.9	8.00	2.20	47.4	190	–	0.07	19.2	1.02	–	51.0	24.9	326
USAWY-06	53.6	21.7	2.00	42.1	250	–	0.18	41.9	0.57	E 0.001	20.9	24.6	366
Understanding wells													
USAWU-01	83.6	13.5	3.85	60.8	214	–	0.12	57.2	0.43	0.009	79.2	23.3	477
USAWU-02	67.2	12.6	1.85	20.0	194	–	0.06	10.0	0.54	–	33.1	23.9	303
USAWU-04	67.2	7.29	2.36	13.7	165	–	0.06	10.5	0.28	–	32.8	22.5	288
USAWU-05	79.3	9.56	2.86	12.8	167	–	0.09	8.98	0.28	–	52.8	22.2	331
USAWU-06	68.9	12.4	1.82	11.2	200	–	0.14	34.6	0.28	–	38.3	23.7	327
USAWU-07	56.7	6.52	1.97	25.1	161	–	0.07	16.4	0.23	E 0.002	20.7	28.2	298
USAWU-08	3.05	0.053	0.46	49.7	83	6.4	0.03	6.97	0.70	0.004	25.1	16.2	164
USAWU-09	98.8	25.2	1.74	24.1	222	–	0.13	43.8	0.32	0.002	44.2	31.8	482

* Value above recommended threshold level.

** Value above upper threshold level.

[1]The SMCL-CA for chloride, sulfate, and total dissolved solids have recommended and upper threshold values. The upper value is shown in parentheses.

Table 11. Trace elements detected in ground-water samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Forty-nine grid wells and eight understanding wells were sampled for these parameters. **Abbreviations:** LRL, laboratory reporting level; MCL-CA; California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; AL-US, U.S. Environmental Protection Agency action level; NL-CA, California Department of Public Health notification level; SMCL-CA; California Department of Public Health secondary maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; E, estimated value; µg/L, micrograms per liter; nc, sample not collected; na, not available; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; –, not detected]

GAMA well identification number	Aluminum (µg/L) (01106)	Antimony (µg/L) (01095)	Arsenic (µg/L) (01000)	Barium (µg/L) (01005)	Boron (µg/L) (01020)	Cadmium (µg/L) (01025)	Chromium (µg/L) (01030)	Cobalt (µg/L) (01035)	Copper (µg/L) (01040)	Iron (µg/L) (01046)	Lead (µg/L) (01049)	Lithium (µg/L) (01130)
Threshold type[1]	MCL-CA	MCL-US	MCL-US	MCL-CA	NL-CA	MCL-US	MCL-CA	na	AL-US	SMCL-CA	AL-US	na
Threshold level	1000	6	10	1000	1000	5	50	na	1300	300	15	na
[LRL]	[1.6]	[0.06]	[0.12]	[0.08]	[8]	[0.04]	[0.12]	[0.04]	[0.4]	[6]	[0.12]	[0.6]
						Grid wells						
USAWB-02	–	–	1.6	18	17	–	0.31	–	E 0.27	–	E 0.09	3.6
USAWB-04	1.6	0.07	9.4	13	14	–	0.88	–	4.2	–	0.52	3.2
USAWB-07	E 3.0	–	2.2	34	122	–	3.0	–	6.1	–	0.39	5.9
USAWB-08	E 1.2	–	1.6	58	33	–	1.2	–	1.6	–	0.40	3.8
USAWB-10	E 1.0	–	1.4	59	61	E 0.02	1.6	–	3.7	–	3.0	3.3
USAWB-11	E 0.9	–	0.66	24	559	E 0.02	1.7	–	1.8	E 5	0.83	10
USAWB-14	E 1.4	E 0.03	1.0	27	13	–	1.3	–	1.3	–	E 0.11	1.7
USAWB-16	E 1.2	–	3.8	17	28	–	4.8	–	V 1.4	E 4	V 0.31	4.5
USAWB-18	E 0.9	E 0.03	2.4	24	11	–	1.8	–	V 1.5	–	V 0.21	1.6
USAWC-01	E 1.0	–	0.70	38	12	–	4.1	–	V 1.3	–	V 0.68	2.5
USAWC-02	E 1.1	–	0.82	35	15	–	2.5	–	V 1.9	–	V 0.56	2.1
USAWC-04	2.7	E 0.05	0.41	54	24	–	9.1	E 0.03	2.3	–	0.77	E 0.5
USAWC-08	–	–	0.95	59	17	–	4.8	0.08	1.5	–	0.91	3.6
USAWC-11	2.3	–	3.2	195	143	E 0.02	1.8	E 0.02	1.6	–	0.23	9.8
USAWC-12	–	–	0.62	244	50	–	3.4	0.15	V 0.64	–	V 0.34	2.2
USAWC-14	2.5	E 0.05	1.8	47	28	–	3.3	–	0.61	–	0.22	E 0.5
USAWC-17	E 1.4	E 0.03	1.4	97	E 7	–	3.9	–	1.8	–	0.30	E 0.5
USAWC-20	E 0.8	–	0.61	35	16	0.12	2.4	–	V 1.6	–	V 0.59	1.4
USAWC-21	–	–	0.28	86	26	E 0.02	4.2	E 0.02	0.73	E 3	0.22	E 0.5
USAWC-23	–	–	1.7	76	16	–	9.5	–	1.2	E 3	0.34	0.7
USAWC-24	3.5	–	2.9	33	68	0.15	0.59	0.04	V 0.35	8	V 0.33	E 0.3
USAWC-25	2.5	–	0.47	157	E 7	–	7.0	0.35	V 1.5	–	V 0.14	2.6

Table 11. Trace elements detected in ground-water samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Forty-nine grid wells and eight understanding wells were sampled for these parameters. **Abbreviations:** LRL, laboratory reporting level; MCL-CA; California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; AL-US, U.S. Environmental Protection Agency action level; NL-CA, California Department of Public Health notification level; SMCL-CA; California Department of Public Health secondary maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; E, estimated value; µg/L, micrograms per liter; nc, sample not collected; na, not available; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; –, not detected]

GAMA well identification number	Aluminum (µg/L) (01106)	Antimony (µg/L) (01095)	Arsenic (µg/L) (01000)	Barium (µg/L) (01005)	Boron (µg/L) (01020)	Cadmium (µg/L) (01025)	Chromium (µg/L) (01030)	Cobalt (µg/L) (01035)	Copper (µg/L) (01040)	Iron (µg/L) (01046)	Lead (µg/L) (01049)	Lithium (µg/L) (01130)
Threshold type[1]	MCL-CA	MCL-US	MCL-US	MCL-CA	NL-CA	MCL-US	MCL-CA	na	AL-US	SMCL-CA	AL-US	na
Threshold level	1000	6	10	1000	1000	5	50	na	1300	300	15	na
[LRL]	[1.6]	[0.06]	[0.12]	[0.08]	[8]	[0.04]	[0.12]	[0.04]	[0.4]	[6]	[0.12]	[0.6]
						Grid wells—Continued						
USAWE-01	4.1	–	2.8	135	78	–	0.19	–	0.69	10	–	6.1
USAWE-02	23.3	0.08	*19	48	113	0.07	E0.10	0.12	0.93	–	0.12	2.9
USAWE-03	2.1	0.27	5.5	24	29	0.11	E0.11	E0.02	0.92	–	0.67	13
USAWE-04	E1.2	E0.04	0.49	120	55	0.07	0.29	E0.02	4.0	E6	1.1	27
USAWR-03	–	E0.03	1.1	126	106	E0.02	2.8	0.14	4.0	–	0.33	10
USAWR-05	E0.9	0.09	3.3	62	109	–	2.6	0.14	2.2	–	1.1	4.1
USAWR-06	–	E0.03	1.4	50	282	E0.02	2.5	0.11	4.3	18	5.0	16
USAWR-07	–	E0.03	1.4	55	323	–	2.8	0.13	18	–	V0.66	20
USAWR-08	3.2	E0.03	0.99	75	195	–	0.73	0.21	1.1	E3	0.44	7.7
USAWR-09	–	E0.03	0.55	115	106	E0.02	2.5	0.10	V1.1	–	1.0	6.9
USAWR-10	–	0.11	2.1	83	444	0.12	0.16	7.4	2.8	E3	1.5	6.8
USAWR-11	189	E0.03	1.1	27	22	–	1.9	–	2.2	–	0.48	1.3
USAWR-12	E0.8	0.07	1.1	36	45	E0.02	0.31	0.20	4.7	11	0.64	2.1
USAWS-02	E1.1	E0.03	0.68	443	574	0.04	1.1	E0.03	0.5	E10	0.43	2.2
USAWS-05	E1.2	–	1.2	56	55	0.04	0.61	E0.02	3.7	34	V0.26	17
USAWS-06	–	–	0.71	156	32	–	E0.06	E0.03	–	*441	E0.07	1.6
USAWS-08	–	–	0.63	124	34	E0.02	1.2	E0.02	4.4	10	0.74	25
USAWS-12	E1.0	–	1.6	214	544	–	1.3	E0.02	3.4	E4	0.72	11
USAWS-14	8.1	–	1.4	98	36	–	E0.06	–	E0.28	E5	E0.10	5.1
USAWS-15	E1.4	–	0.18	30	67	0.04	5.0	E0.02	0.82	31	0.46	11
USAWS-16	E13.3	–	1.4	38	*1,460	E0.02	0.15	–	V0.61	E5	–	30
USAWS-18	E0.8	–	0.26	31	91	–	3.0	E0.03	0.99	26	0.48	22
USAWS-20	E1.1	–	0.24	54	158	E0.02	2.7	–	1.9	8	0.58	5.8
USAWS-21	4.4	–	*13	97	40	–	–	E0.03	–	82	–	5.1

Table 11. Trace elements detected in ground-water samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Forty-nine grid wells and eight understanding wells were sampled for these parameters. **Abbreviations:** LRL, laboratory reporting level; MCL-CA; California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; AL-US, U.S. Environmental Protection Agency action level; NL-CA, California Department of Public Health notification level; SMCL-CA; California Department of Public Health secondary maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; E, estimated value; µg/L, micrograms per liter; nc, sample not collected; na, not available; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; –, not detected]

GAMA well identification number	Aluminum (µg/L) (01106)	Antimony (µg/L) (01095)	Arsenic (µg/L) (01000)	Barium (µg/L) (01005)	Boron (µg/L) (01020)	Cadmium (µg/L) (01025)	Chromium (µg/L) (01030)	Cobalt (µg/L) (01035)	Copper (µg/L) (01040)	Iron (µg/L) (01046)	Lead (µg/L) (01049)	Lithium (µg/L) (01130)
Threshold type[1]	MCL-CA	MCL-US	MCL-US	MCL-CA	NL-CA	MCL-US	MCL-CA	na	AL-US	SMCL-CA	AL-US	na
Threshold level	1000	6	10	1000	1000	5	50	na	1300	300	15	na
[LRL]	[1.6]	[0.06]	[0.12]	[0.08]	[8]	[0.04]	[0.12]	[0.04]	[0.4]	[6]	[0.12]	[0.6]
Grid wells—Continued												
USAWY-04	E1.1	–	E0.07	17	16	E0.02	6.9	–	V1.6	–	2.76	–
USAWY-05	E1.1	–	0.14	24	34	E0.02	4.0	–	1.6	E5	0.58	–
USAWY-06	E0.9	–	0.20	57	23	–	7.4	–	1.4	–	0.37	1.2
Understanding wells												
USAWU-01	E1.6	E0.03	1.2	61	227	E0.02	0.91	1.5	6.7	–	1.2	3.3
USAWU-02	E1.1	–	–	20	15	–	7.2	–	3.0	–	V0.61	–
USAWU-04	E1.1	E0.03	1.6	35	21	–	2.7	–	V0.23	8	V0.11	1.6
USAWU-05	8.7	E0.03	0.73	36	14	–	2.1	–	3.6	8	V0.52	1
USAWU-06	–	E0.05	0.63	42	21	–	9.9	–	V1.4	–	V0.27	E0.5
USAWU-07	E1.3	–	0.57	62	32	–	3.9	0.08	V0.89	–	V0.29	2.2
USAWU-08	10.8	0.13	*96	17	56	–	0.68	–	V0.23	7	V0.1	1.5
USAWU-09	2.5	–	0.82	90	21	0.23	7.7	E0.02	5.7	–	3.3	E0.4

Table 11. Trace elements detected in ground-water samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Forty-nine grid wells and eight understanding wells were sampled for these parameters. **Abbreviations:** LRL, laboratory reporting level; MCL-CA; California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; AL-US, U.S. Environmental Protection Agency action level; NL-CA, California Department of Public Health notification level; SMCL-CA; California Department of Public Health secondary maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; E, estimated value; µg/L, micrograms per liter; nc, sample not collected; na, not available; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; –, not detected]

GAMA well identification number	Manganese (µg/L) (01056)	Mercury (µg/L) (71890)	Molybdenum (µg/L) (01060)	Nickel (µg/L) (01065)	Selenium (µg/L) (01145)	Silver (µg/L) (01075)	Strontium (µg/L) (01080)	Thallium (µg/L) (01057)	Tungsten (µg/L) (01155)	Uranium (µg/L) (22703)	Vanadium (µg/L) (01085)	Zinc (µg/L) (01090)
Threshold type[1]	SMCL-CA	MCL-US	HAL-US	MCL-CA	MCL-US	SMCL-CA	HAL-US	MCL-US	na	MCL-US	NL-CA	SMCL-CA
Threshold level	50	2	40	100	50	100	4000	2	na	30	50	5000
[LRL]	[0.2]	[0.01]	[0.12]	[0.06]	[0.08]	[0.1]	[0.4]	[0.04]	[0.06]	[0.04]	[0.04]	[0.6]
						Grid wells						
USAWB-02	–	–	3.1	0.06	0.18	–	248	–	4.8	3.10	2.1	V 0.62
USAWB-04	–	–	2.1	0.11	0.26	–	259	–	47.9	2.07	6.1	7.0
USAWB-07	–	–	4.1	0.23	0.27	–	319	–	1.1	7.32	6.5	8.7
USAWB-08	–	–	2.4	0.29	0.35	–	479	–	E 0.05	4.99	3.1	4.9
USAWB-10	0.3	–	2.8	2.0	0.43	–	378	–	1.4	3.99	3.5	38.4
USAWB-11	0.3	–	7.7	0.09	0.25	–	297	–	0.27	5.28	5.6	3.6
USAWB-14	–	–	3.7	0.07	0.34	–	298	–	0.42	3.93	7.0	1.8
USAWB-16	0.2	nc	6.0	E 0.05	0.25	–	148	–	0.95	1.18	6.9	V 2.9
USAWB-18	E 0.1	nc	4.4	E 0.05	0.32	–	315	–	0.58	3.90	6.4	V 3.5
USAWC-01	–	nc	3.0	0.13	0.65	–	337	–	0.26	2.99	6.6	4.8
USAWC-02	E 0.1	nc	5.0	E 0.05	0.56	–	252	–	0.35	1.59	8.8	V 3.4
USAWC-04	E 0.1	E 0.005	3.0	0.08	1.2	–	486	–	0.11	4.97	4.2	4.8
USAWC-08	–	0.052	3.0	0.07	1.2	–	553	–	0.35	3.49	8.2	3.5
USAWC-11	2	–	6.3	0.12	1.4	–	581	–	0.39	12.6	17	5.8
USAWC-12	10	nc	1.4	0.16	0.47	–	1,050	–	0.15	8.16	12	V 1.1
USAWC-14	E 0.1	–	6.5	E 0.03	0.87	–	278	–	0.36	1.63	7.7	V 0.34
USAWC-17	–	–	4.2	E 0.04	0.51	–	357	–	0.25	0.96	17	3.2
USAWC-20	–	nc	4.7	E 0.05	0.59	–	261	–	3.2	1.41	9.7	V 2.7
USAWC-21	0.5	–	12	0.11	0.98	E 0.1	216	–	0.66	0.26	36	1.4
USAWC-23	–	–	2.9	0.09	3.0	–	365	–	3.1	1.42	6.6	4.1
USAWC-24	2.4	nc	8.4	0.90	–	–	216	–	6.2	0.37	11	V 2.9
USAWC-25	E 0.1	nc	2.5	0.23	0.84	–	710	–	0.14	2.29	9.9	4.4

Table 11. Trace elements detected in ground-water samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Forty-nine grid wells and eight understanding wells were sampled for these parameters. **Abbreviations:** LRL, laboratory reporting level; MCL-CA; California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; AL-US, U.S. Environmental Protection Agency action level; NL-CA, California Department of Public Health notification level; SMCL-CA; California Department of Public Health secondary maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; E, estimated value; µg/L, micrograms per liter; nc, sample not collected; na, not available; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; –, not detected]

GAMA well identification number	Manganese (µg/L) (01056)	Mercury (µg/L) (71890)	Molybdenum (µg/L) (01060)	Nickel (µg/L) (01065)	Selenium (µg/L) (01145)	Silver (µg/L) (01075)	Strontium (µg/L) (01080)	Thallium (µg/L) (01057)	Tungsten (µg/L) (01155)	Uranium (µg/L) (22703)	Vanadium (µg/L) (01085)	Zinc (µg/L) (01090)
Threshold type[1]	SMCL-CA	MCL-US	HAL-US	MCL-CA	MCL-US	SMCL-CA	HAL-US	MCL-US	na	MCL-US	NL-CA	SMCL-CA
Threshold level	50	2	40	100	50	100	4000	2	na	30	50	5000
[LRL]	[0.2]	[0.01]	[0.12]	[0.06]	[0.08]	[0.1]	[0.4]	[0.04]	[0.06]	[0.04]	[0.04]	[0.6]
Grid wells—Continued												
USAWE-01	0.4	–	7.9	0.07	1.8	–	573	–	6.6	2.46	20	3.0
USAWE-02	3.8	–	*44	0.08	1.3	E0.1	135	–	37	0.46	*110	0.92
USAWE-03	28	–	*52	0.13	16	–	369	–	3.5	4.29	10	3.3
USAWE-04	0.5	–	20	1.3	1.3	–	246	E0.02	0.49	12.3	1.6	4.7
USAWR-03	–	–	7.2	0.36	1.7	–	460	–	0.07	11.8	33	14
USAWR-05	0.6	nc	7.0	0.51	2.0	–	582	–	0.34	8.46	6.6	12
USAWR-06	0.2	nc	4.5	0.44	0.95	–	686	–	0.81	16.2	34	21
USAWR-07	–	nc	4.6	0.66	1.5	–	911	–	1.1	16.1	28	24
USAWR-08	E0.1	–	3.2	1.6	0.52	–	713	–	0.42	22.8	4.5	2.1
USAWR-09	–	nc	3.7	0.20	1.1	–	823	–	0.43	19.2	7.4	V3.1
USAWR-10	0.2	nc	6.6	5.5	1.1	–	636	–	0.36	2.18	6.0	5.5
USAWR-11	0.2	–	3.3	0.87	0.41	–	316	–	0.34	4.76	4.3	3.1
USAWR-12	0.8	E0.007	2.9	0.42	5.1	–	788	–	0.34	0.95	2.8	10
USAWS-02	0.4	–	8.8	0.06	2.5	E0.1	832	–	E0.03	2.72	27	1.8
USAWS-05	1.7	nc	13	0.24	4.2	E0.1	741	–	E0.05	2.42	9.0	6.8
USAWS-06	*275	–	4.8	E0.05	–	–	247	–	0.79	E0.03	0.29	1.0
USAWS-08	1.1	–	3.1	0.10	1.8	–	325	–	–	0.70	12	8.5
USAWS-12	E0.2	–	11	0.12	1.7	–	548	–	1.6	4.32	23	6.6
USAWS-14	32	–	14	E0.05	0.28	–	297	–	3.1	2.26	9.5	2.1
USAWS-15	1.5	–	25	0.10	5.3	–	390	–	0.26	4.83	8.8	3.1
USAWS-16	1.6	nc	16	0.06	0.79	–	290	–	5.5	1.44	17	47
USAWS-18	5.2	–	14	0.14	25	–	620	–	0.19	6.24	7.9	3.4
USAWS-20	0.4	–	9.2	0.15	2.9	–	458	–	E0.03	2.84	8.5	7.1
USAWS-21	*115	nc	8.6	0.18	E0.06	–	325	–	7.3	0.15	0.1	V0.8

Table 11. Trace elements detected in ground-water samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Forty-nine grid wells and eight understanding wells were sampled for these parameters. **Abbreviations:** LRL, laboratory reporting level; MCL-CA; California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; AL-US, U.S. Environmental Protection Agency action level; NL-CA, California Department of Public Health notification level; SMCL-CA; California Department of Public Health secondary maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; E, estimated value; µg/L, micrograms per liter; nc, sample not collected; na, not available; V, analyte was detected in a sample and an associated blank, thus data are not included in ground-water quality assessment; –, not detected]

GAMA well identification number	Manganese (µg/L) (01056)	Mercury (µg/L) (71890)	Molybdenum (µg/L) (01060)	Nickel (µg/L) (01065)	Selenium (µg/L) (01145)	Silver (µg/L) (01075)	Strontium (µg/L) (01080)	Thallium (µg/L) (01057)	Tungsten (µg/L) (01155)	Uranium (µg/L) (22703)	Vanadium (µg/L) (01085)	Zinc (µg/L) (01090)
Threshold type[1]	SMCL-CA	MCL-US	HAL-US	MCL-CA	MCL-US	SMCL-CA	HAL-US	MCL-US	na	MCL-US	NL-CA	SMCL-CA
Threshold level	50	2	40	100	50	100	4000	2	na	30	50	5000
[LRL]	[0.2]	[0.01]	[0.12]	[0.06]	[0.08]	[0.1]	[0.4]	[0.04]	[0.06]	[0.04]	[0.04]	[0.6]
Grid wells—Continued												
USAWY-04	–	nc	6.8	E0.03	0.54	–	249	–	0.3	1.42	5.4	7.6
USAWY-05	0.2	–	5.1	E0.04	0.51	–	240	–	1.9	0.92	7.6	2.6
USAWY-06	E0.1	–	2.1	0.08	0.62	–	301	–	–	1.39	12	2.8
Understanding wells												
USAWU-01	42	nc	5.4	1.9	0.44	–	508	–	0.27	8.24	3.8	14
USAWU-02	–	nc	4.8	E0.04	0.63	–	244	–	E0.05	2.28	3.6	V3.8
USAWU-04	–	nc	3.1	E0.05	0.49	–	370	–	0.37	7	5	–
USAWU-05	0.2	nc	2.8	0.07	0.52	–	458	–	0.21	6.72	3.3	6.5
USAWU-06	–	nc	2.4	0.07	0.45	–	329	–	0.16	2.13	4	V3.4
USAWU-07	–	nc	5.0	0.08	0.80	E0.1	342	–	3.2	1.93	10.3	V2.1
USAWU-08	1.9	nc	7.8	0.10	0.94	–	45.8	–	6.2	0.31	*68.2	V1.1
USAWU-09	–	nc	2.9	0.52	0.33	–	594	–	2.5	5.69	6.8	9.6

* Value above threshold level.

[1] Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists.

Table 12. Species of inorganic arsenic, iron, and chromium detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) Program, California, November 2006–February 2007.

[Data in this table were analyzed at the U.S. Geological Survey Trace Metals Laboratory using research methods and are not stored in the USGS' NWIS database. Only samples from the 32 Slow wells were analyzed for the reduced and oxidized species of iron, arsenic and chromium. **Iron, arsenic, and chromium:** Compare result here to preferred method of analysis for this element, which is the result for this element found on table 11. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. **Abbreviations**: USAWB, USAWC, USAWE, USAWR, USAWS, or USAWY Upper Santa Ana Watershed study unit grid well; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA, California Department of Public Health maximum contaminant level; SMCL-CA, California Department of Public Health secondary maximum contaminant level; MDL, method detection limit; na, not available; µg/L, microgram per liter; –, not detected]

GAMA well identification number	Iron (µg/L)	Iron(II) (µg/L)	Arsenic (µg/L)	Arsenic(III) (µg/L)	Chromium (µg/L)	Chromium(VI) (µg/L)
Threshold type [1]	SMCL-CA	na	MCL-US	na	MCL-CA	na
Threshold level	300	na	10	na	50	na
[MDL]	[2]	[2]	[0.5]	[1]	[1]	[1]
			Grid wells			
USAWB-02	3	3	1.3	–	–	–
USAWB-04	4	3	6.6	–	–	–
USAWB-07	4	3	1.9	–	2	2
USAWB-08	4	3	–	–	–	–
USAWB-10	6	3	1.1	–	–	–
USAWB-11	8	5	0.56	–	1	–
USAWB-14	4	3	0.72	–	–	–
USAWC-04	–	–	0.9	–	11	9
USAWC-08	–	–	0.6	–	5	4
USAWC-11	–	–	1.9	–	2	1
USAWC-14	–	–	0.7	–	2	1
USAWC-17	–	–	0.9	–	3	2
USAWC-21	3	–	–	–	4	4
USAWC-23	2	–	0.9	–	11	11
USAWE-01	11	4	2	–	–	–
USAWE-02	4	4	*15	–	–	–
USAWE-03	5	3	4.1	–	–	–
USAWE-04	6	4	–	–	–	–
USAWR-03	4	3	1.1	–	2	2
USAWR-08	3	3	–	–	–	–
USAWR-11	–	–	–	–	2	2
USAWR-12	9	3	–	–	–	–
USAWS-02	9	4	–	–	–	2
USAWS-06	*455	453	–	–	–	–
USAWS-08	9	6	–	–	–	–
USAWS-12	3	3	0.5	–	1	1
USAWS-14	4	4	–	–	–	–
USAWS-15	29	10	–	–	5	3
USAWS-18	24	7	0.9	–	3	2
USAWS-20	5	3	–	–	2	2
USAWY-05	6	2	–	–	3	3
USAWY-06	–	–	–	–	7	6
Number of detections	25	23	18	0	17	17
Detection frequency (percent)	78	72	56	0	53	53

* Value is above threshold.

Table 13. Results for analyses of stable isotope ratios, carbon-14, and tritium activities in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study unit, California, November 2006–February 2007.

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Laboratory entity codes are listed in the footnotes. Samples from all 99 wells were analyzed for stable isotopes of water; samples from 57 wells were analyzed for isotopes of nitrate, nitrogen gas, and carbon; samples from the 32 slow wells were analyzed for tritium. Stable isotope ratios are reported in the standard delta notation (δ), the ratio of a heavier isotope to a more common lighter isotope of that element, relative to a standard reference material. **Abbreviations:** MCL-CA, California Department of Public Health maximum contaminant level; na, not available; nc, sample not collected; pCi/L, picocurie per liter; per mil, per thousand; –, not detected; <, less than]

GAMA well identification number	$\delta^{2}H$ in water (per mil) (82082)[1]	$\delta^{18}O$ in water (per mil) (82085)[1]	$\delta^{15}N$ in nitrate (per mil) (82690)[1]	$\delta^{18}O$ in nitrate (per mil) (63041)[1]	$\delta^{15}N$ in nitrogen gas (per mil) (82698)[1]	Tritium (pCi/L) (07000)[2]	$\delta^{13}C$ of dissolved inorganic carbon (per mil) (82081)[3]	^{14}C (percent modern) (49933)[4]
Threshold type[5]	na	na	na	na	na	MCL-CA	na	na
Threshold level	na	na	na	na	na	20,000	na	na
Understanding wells								
USAWB-01	-58.7	-8.46	nc	nc	nc	nc	nc	nc
USAWB-02	-65.0	-9.78	1.99	4.48	0.65	10.9	-12.44	95.4
USAWB-03	-61.3	-9.23	nc	nc	nc	nc	nc	nc
USAWB-04	-56.7	-8.73	1.08	8.45	0.84	9.3	-13.36	88.4
USAWB-05	-57.2	-8.50	nc	nc	nc	nc	nc	nc
USAWB-06	-50.0	-7.74	nc	nc	nc	nc	nc	nc
USAWB-07	-60.5	-8.96	6.57	3.85	0.62	4.2	-12.78	84.7
USAWB-08	-52.8	-8.08	5.44	3.35	0.66	8.6	-12.94	95.4
USAWB-09	-65.7	-9.69	nc	nc	nc	nc	nc	nc
USAWB-10	-51.6	-7.70	3.75	3.85	0.63	8.6	-13.35	98.2
USAWB-11	-52.2	-7.82	6.12	3.45	0.62	5.1	-15.19	94.6
USAWB-12	-62.5	-9.18	nc	nc	nc	nc	nc	nc
USAWB-13	-67.3	-9.60	nc	nc	nc	nc	nc	nc
USAWB-14	-56.3	-8.68	2.39	8.00	0.62	5.4	-13.75	84.8
USAWB-15	-68.3	-10.01	nc	nc	nc	nc	nc	nc
USAWB-16	-64.2	-9.43	5.76	3.46	0.45	nc	-11.44	75.7
USAWB-17	-57.5	-8.62	nc	nc	nc	nc	nc	nc
USAWB-18	-59.9	-9.11	5.30	3.53	0.58	nc	-12.90	83.7
USAWB-19	-70.2	-10.17	nc	nc	nc	nc	nc	nc
USAWC-01	-56.2	-8.46	5.19	1.35	0.68	nc	-12.71	82.1
USAWC-02	-51.7	-7.96	4.60	2.30	0.88	nc	-13.57	79.8
USAWC-03	-54.5	-8.52	nc	nc	nc	nc	nc	nc
USAWC-04	-55.8	-8.53	6.58	3.50	0.47	4.8	-13.50	87.5
USAWC-05	-57.6	-8.68	nc	nc	nc	nc	nc	nc
USAWC-06	-63.1	-8.85	nc	nc	nc	nc	nc	nc
USAWC-07	-56.7	-8.13	nc	nc	nc	nc	nc	nc
USAWC-08	-53.1	-7.84	7.36	1.27	0.72	1.3	-13.63	85.2
USAWC-09	-55.6	-7.96	nc	nc	nc	nc	nc	nc
USAWC-10	-52.8	-8.10	nc	nc	nc	nc	nc	nc
USAWC-11	-51.4	-7.21	8.26	3.51	0.42	2.2	-13.26	98.6
USAWC-12	-46.2	-7.28	12.40	4.46	0.53	nc	-14.87	108
USAWC-13	-48.0	-7.47	nc	nc	nc	nc	nc	nc
USAWC-14	-50.9	-7.93	4.64	1.87	0.68	1.0	-13.61	86.3
USAWC-15	-48.4	-7.44	nc	nc	nc	nc	nc	nc
USAWC-16	-61.2	-9.25	nc	nc	nc	nc	nc	nc
USAWC-17	-52.0	-8.14	4.23	2.00	0.61	3.2	-13.17	88.2

Table 13. Results for analyses of stable isotope ratios, carbon-14, and tritium activities in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study unit, California, November 2006 - February 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Laboratory entity codes are listed in the footnotes. Samples from all 99 wells were analyzed for stable isotopes of water; samples from 57 wells were analyzed for isotopes of nitrate, nitrogen gas, and carbon; samples from the 32 slow wells were analyzed for tritium. Stable isotope ratios are reported in the standard delta notation (δ), the ratio of a heavier isotope to a more common lighter isotope of that element, relative to a standard reference material. **Abbreviations**: MCL-CA, California Department of Public Health maximum contaminant level; na, not available; nc, sample not collected; pCi/L, picocurie per liter; per mil, per thousand; –, not detected; <, less than]

GAMA well identification number	δ^2H in water (per mil) (82082)[1]	δ^{18}O in water (per mil) (82085)[1]	δ^{15}N in nitrate (per mil) (82690)[1]	δ^{18}O in nitrate (per mil) (63041)[1]	δ^{15}N in nitrogen gas (per mil) (82698)[1]	Tritium (pCi/L) (07000)[2]	δ^{13}C of dissolved inorganic carbon (per mil) (82081)[3]	^{14}C (percent modern) (49933)[4]
Threshold type[5]	na	na	na	na	na	MCL-CA	na	na
Threshold level	na	na	na	na	na	20,000	na	na
				Understanding wells—Continued				
USAWC-18	-52.1	-8.00	nc	nc	nc	nc	nc	nc
USAWC-19	-60.4	-9.32	nc	nc	nc	nc	nc	nc
USAWC-20	-50.7	-7.49	3.16	3.00	0.77	nc	-13.32	79.9
USAWC-21	-54.4	-8.12	6.67	3.41	0.58	1.3	-14.34	85.9
USAWC-22	-57.8	-8.36	nc	nc	nc	nc	nc	nc
USAWC-23	-62.8	-9.00	6.56	1.96	0.63	–	-10.99	85.8
USAWC-24	-48.3	-6.92	12.58	4.32	0.73	nc	-17.56	94.8
USAWC-25	-46.5	-6.64	8.13	0.57	0.69	nc	-14.61	80.0
USAWE-01	-47.9	-6.60	10.94	7.71	0.15	8.0	-12.46	70.1
USAWE-02	-51.8	-7.36	21.01	10.10	0.78	1.9	na	na
USAWE-03	-47.5	-7.15	8.12	5.36	0.39	5.4	-16.44	84.0
USAWE-04	-45.9	-6.49	5.06	6.80	0.45	8.6	-10.00	101
USAWR-01	-56.2	-8.47	nc	nc	nc	nc	nc	nc
USAWR-02	-57.6	-8.70	nc	nc	nc	nc	nc	nc
USAWR-03	-54.8	-7.99	7.59	3.64	0.62	3.2	-13.52	97.6
USAWR-04	-52.1	-7.37	nc	nc	nc	nc	nc	nc
USAWR-05	-57.0	-8.50	11.14	6.57	0.23	nc	-14.59	91.6
USAWR-06	-59.1	-8.24	7.36	3.62	0.54	nc	-14.55	106
USAWR-07	-60.7	-8.35	9.14	4.60	0.49	nc	-14.79	103
USAWR-08	-56.4	-8.30	11.74	4.40	1.04	6.7	-13.62	105
USAWR-09	-58.1	-8.40	7.85	3.92	0.55	nc	-14.07	96.1
USAWR-10	-60.3	-7.90	8.41	5.01	3.12	nc	-13.64	91.5
USAWR-11	-57.1	-8.54	4.50	3.80	0.80	2.2	-13.21	82.9
USAWR-12	-48.9	-7.11	6.95	3.67	0.74	4.5	-13.30	82.2
USAWS-01	-51.8	-7.19	nc	nc	nc	nc	nc	nc
USAWS-02	-53.1	-7.38	4.94	2.54	0.64	2.2	-14.60	83.5
USAWS-03	-47.9	-5.33	nc	nc	nc	nc	nc	nc
USAWS-04	-55.5	-7.64	nc	nc	nc	nc	nc	nc
USAWS-05	-47.0	-6.35	5.30	3.51	0.46	nc	-11.89	81.3
USAWS-06	-61.6	-9.18	nc[6]	nc[6]	0.89	–	-9.18	52.7
USAWS-07	-51.8	-7.28	nc	nc	nc	nc	nc	nc
USAWS-08	-52.5	-7.45	5.64	2.49	0.35	3.2	-14.62	96.3
USAWS-09	-54.4	-6.82	nc	nc	nc	nc	nc	nc
USAWS-10	-58.8	-8.18	nc	nc	nc	nc	nc	nc
USAWS-11	-55.1	-7.60	nc	nc	nc	nc	nc	nc
USAWS-12	-57.0	-8.11	9.01	2.49	na	2.9	na	na

Table 13. Results for analyses of stable isotope ratios, carbon-14, and tritium activities in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study unit, California, November 2006 - February 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Laboratory entity codes are listed in the footnotes. Samples from all 99 wells were analyzed for stable isotopes of water; samples from 57 wells were analyzed for isotopes of nitrate, nitrogen gas, and carbon; samples from the 32 slow wells were analyzed for tritium. Stable isotope ratios are reported in the standard delta notation (δ), the ratio of a heavier isotope to a more common lighter isotope of that element, relative to a standard reference material. **Abbreviations**: MCL-CA, California Department of Public Health maximum contaminant level; na, not available; nc, sample not collected; pCi/L, picocurie per liter; per mil, per thousand; –, not detected; <, less than]

GAMA well identification number	δ^2H in water (per mil) (82082)[1]	$\delta^{18}O$ in water (per mil) (82085)[1]	$\delta^{15}N$ in nitrate (per mil) (82690)[1]	$\delta^{18}O$ in nitrate (per mil) (63041)[1]	$\delta^{15}N$ in nitrogen gas (per mil) (82698)[1]	Tritium (pCi/L) (07000)[2]	$\delta^{13}C$ of dissolved inorganic carbon (per mil) (82081)[3]	^{14}C (percent modern) (49933)[4]
Threshold type[5]	na	na	na	na	na	MCL-CA	na	na
Threshold level	na	na	na	na	na	20,000	na	na
Grid wells—Continued								
USAWS-13	-53.1	-7.32	nc	nc	nc	nc	nc	nc
USAWS-14	-61.8	-9.13	11.36	9.32	0.57	1.3	-12.62	61.8
USAWS-15	-53.2	-7.76	5.67	4.21	0.67	–	-11.92	74.3
USAWS-16	-57.3	-8.20	13.07	8.27	1.17	nc	-15.52	37.5
USAWS-17	-52.5	-7.54	nc	nc	nc	nc	nc	nc
USAWS-18	-56.5	-8.27	5.80	1.38	0.65	–	-12.77	73.6
USAWS-19	-57.5	-8.40	nc	nc	nc	nc	nc	nc
USAWS-20	-54.2	-7.78	5.93	2.28	0.83	1.9	-12.71	86.8
USAWS-21	-58.9	-8.85	nc6	nc6	0.70	nc	-13.70	45.0
USAWY-01	-58.8	-8.54	nc	nc	nc	nc	nc	nc
USAWY-02	-62.2	-9.26	nc	nc	nc	nc	nc	nc
USAWY-03	-59.5	-8.87	nc	nc	nc	nc	nc	nc
USAWY-04	-57.9	-8.59	4	2.21	0.61	nc	-12.90	71.1
USAWY-05	-58.5	-8.60	6.54	0.40	0.80	1.0	-13.63	75.1
USAWY-06	-53.4	-7.86	4.11	3.16	0.74	3.2	-14.23	90.1
USAWY-07	-56.3	-8.39	nc	nc	nc	nc	nc	nc
USAWY-08	-60.5	-8.89	nc	nc	nc	nc	nc	nc
USAWY-09	-59.4	-8.76	nc	nc	nc	nc	nc	nc
Understanding wells								
USAWU-01	-56.8	-8.44	20.02	9.60	1.77	nc	-13.03	97.1
USAWU-02	-59.2	-8.74	6.18	2.27	0.74	nc	na	na
USAWU-03	-56.0	-8.77	nc	nc	nc	nc	nc	nc
USAWU-04	-57.0	-8.59	5.10	3.38	0.70	nc	-12.87	84.8
USAWU-05	-54.4	-8.16	4.74	3.48	0.46	nc	-13.27	82.1
USAWU-06	-58.1	-8.40	6.25	2.45	0.67	nc	-13.11	72.2
USAWU-07	-52.8	-7.94	6.20	1.90	0.78	nc	-13.73	80.7
USAWU-08	-64.3	-9.39	7.06	3.34	0.53	nc	-14.37	19.1
USAWU-09	-49.5	-7.26	7.97	0.31	0.93	nc	-16.75	114

[1] USGS Stable Isotope Laboratory, Reston, Virginia (USGSSIVA).

[2] USGS Stable Isotope and Tritium Laboratory, Menlo Park, California (USGSH3CA).

[3] University of Waterloo (contract laboratory) (CAN-UWIL).

[4] University of Arizona, Accelerator Mass Spectrometry Laboratory (contract laboratory) (AZ-UAMSL).

[5] Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists.

[6] Sample was collected to determine stable isotope ratios of nitrogen and oxygen in nitrate, but it was not submitted because nitrate was not detected.

Table 14. Dissolved gases detected in ground-water samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) Program, California, November 2006–February 2007.

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding.The five digit number below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. **Dissolved oxygen:** compare result here to preferred method of analysis for dissolved oxygen in table 4. **Abbreviations**: mg/L, milligrams per liter; µg/L, microgram per liter; na, not available, –, not detected]

GAMA well identification number	Dissolved nitrogen (mg/L) 00597)	Dissolved argon (mg/L) (82043)	Dissolved oxygen (mg/L) (62971)	Dissolved carbon dioxide (mg/L) (00405)	Dissolved methane (µg/L) (76994)
Threshold type	na	na	na	na	na
[LRL]	0.001	0.003	0.002	0.04	0.001
			Grid wells		
USAWB-02	17.7	0.614	4.1	13	–
[1]USAWB-04	38.9	1.05	10.2	5.7	–
[1]USAWB-07	31.1	0.908	7.3	7.0	–
USAWB-08	24.3	0.732	9.5	14	–
[1]USAWB-10	32.6	0.952	9.3	14	–
USAWB-11	25.6	0.777	5.5	20	–
[1]USAWB-14	29.7	0.884	12.3	7.0	–
USAWB-16	30.3	0.878	5.4	3.4	–
[1]USAWB-18	30.6	0.884	10.2	8.0	–
USAWC-01	22.6	0.708	7.8	6.7	–
USAWC-02	20.7	0.651	8.3	7.2	–
[1]USAWC-04	29.6	0.831	11.6	11	–
USAWC-08	20.2	0.642	8.7	6.1	–
[1]USAWC-11	41.5	1.04	8.4	21	–
USAWC-12	20.1	0.648	3.5	43	–
USAWC-14	20.5	0.665	6.6	12	–
[1]USAWC-17	29.1	0.890	10.7	8.3	–
USAWC-20	21.3	0.679	7.7	8.9	–
[1]USAWC-21	46.3	1.22	13.4	13	–
USAWC-23	23.8	0.754	7.8	6.9	–
USAWC-24	25.7	0.772	1.2	5.7	2.89
USAWC-25	17.9	0.612	6.3	13	–
[1]USAWE-01	58.1	1.36	12.7	6.7	–
USAWE-02	25.2	0.778	0.2	0.1	4.17
[2]USAWE-03	24.4	0.733	0.2	16	–
[1]USAWE-04	36.2	1.01	8.9	31	–
USAWR-03	16.9	0.594	3.1	36	–
USAWR-05	17.2	0.551	0.2	30	–
USAWR-06	15.7	0.548	2.6	29	–
USAWR-07	17.1	0.577	2.1	41	–
USAWR-08	23.7	0.664	1.5	28	–
USAWR-09	17.7	0.593	3.9	31	–
USAWR-10	18.8	0.536	0.2	28	0.824
[2]USAWR-11	25.3	0.797	11.4	5.1	–
USAWR-12	17.6	0.586	5.5	26	–
USAWS-02	24.2	0.728	6.7	5.5	–
[1]USAWS-05	40.1	0.992	12.3	64	1.31
USAWS-06	22.7	0.729	0.1	15	4,950

Table 14. Dissolved gases detected in ground-water samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) Program, California, November 2006–February 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding.The five digit number below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. **Dissolved oxygen:** compare result here to preferred method of analysis for dissolved oxygen in table 4. **Abbreviations**: mg/L, milligrams per liter; µg/L, microgram per liter; na, not available, –, not detected]

GAMA well identification number	Dissolved nitrogen (mg/L) 00597)	Dissolved argon (mg/L) (82043)	Dissolved oxygen (mg/L) (62971)	Dissolved carbon dioxide (mg/L) (00405)	Dissolved methane (µg/L) (76994)
Threshold type	na	na	na	na	na
[LRL]	0.001	0.003	0.002	0.04	0.001
			Grid wells—Continued		
[1]USAWS-08	34.2	0.977	11.2	24	–
USAWS-12	na	na	na	na	na
USAWS-14	29.3	0.849	0.3	2.1	6.44
USAWS-15	17.1	0.600	0.4	7.1	–
USAWS-16	23.2	0.684	0.4	1.1	32.3
USAWS-18	17.9	0.605	2.3	8.5	–
USAWS-20	19.2	0.625	4.1	10	–
USAWS-21	26.9	0.807	0.2	3.3	732
USAWY-04	18.9	0.632	0.8	9.1	–
USAWY-05	18.2	0.606	4.5	8.0	–
[1]USAWY-06	34.1	0.916	10.3	10	–
			Understanding wells		
USAWU-01	19.8	0.576	0.2	22	–
USAWU-02	18.9	0.637	1.7	12	–
USAWU-04	23.7	0.747	6.9	8.4	–
[1]USAWU-05	32.4	0.918	10.2	11	–
USAWU-06	23.5	0.741	10.6	6.8	–
USAWU-07	21.0	0.666	7.7	9.0	–
USAWU-08	30.4	0.871	0.2	0.08	8.74
USAWU-09	19.3	0.673	4.8	21	–

[1] Dissolved gas sample was compromised. A bubble was observed in sample bottle.

[2] Uncompromised replicate analysis used in place of first analysis. A bubble was observed in sample bottle analyzed first.

Table 15. Results for analyses of noble gases detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[**GAMA well identification No**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. **Abbreviations**: na, not available; cm^3 STP/g, cubic centimeters at standard temperature and pressure per gram of water]

GAMA well identification number	Collection date	Noble gas analysis date	Helium-3/ Helium-4 (atom ratio) (61040)	Helium-4 (85561)	Neon (61046)	Argon (85563)	Krypton (85565)	Xenon (85567)
				(cm^3 STP/g)				
			x 10^{-6}	x 10^{-7}	x 10^{-7}	x 10^{-4}	x 10^{-8}	x 10^{-8}
Grid wells								
USAWB-01	11-27-06	11-29-07	1.21	4.13	2.42	3.41	7.48	1.02
USAWB-02	11-27-06	12-02-07	1.26	0.55	1.99	3.10	6.92	0.97
USAWB-03	11-28-06	12-02-07	1.04	1.07	3.01	3.43	7.42	0.97
USAWB-04	11-28-06	12-02-07	1.42	2.61	10.72	8.20	13.80	1.48
USAWB-05	11-28-06	03-13-08	1.36	0.64	2.67	3.92	8.17	1.10
USAWB-06	11-28-06	12-02-07	1.17	1.11	3.51	4.11	8.17	1.01
USAWB-07	11-29-06	12-03-07	0.67	21.67	3.71	4.44	8.98	1.11
USAWB-08	12-11-06	12-04-07	1.37	0.77	3.13	3.73	7.00	0.87
USAWB-09	12-11-06	12-04-07	1.29	0.61	2.54	4.25	8.56	1.11
USAWB-10	12-12-06	12-07-07	1.26	1.15	3.94	4.62	9.10	1.09
USAWB-11	12-13-06	12-05-07	0.71	6.07	3.25	3.91	7.70	0.97
USAWB-12	12-13-06	01-11-08	1.48	2.19	9.44	7.62	12.47	1.43
USAWB-13	12-14-06	12-05-07	1.32	1.98	3.15	3.98	8.06	1.03
USAWB-14	12-14-06	12-05-07	1.43	0.94	3.74	4.47	8.63	1.11
USAWB-15	12-14-06	01-11-08	1.49	3.83	15.66	8.72	16.55	1.65
USAWB-16	01-08-07	09-09-07	0.69	12.91	3.81	4.48	8.84	1.14
USAWB-17	01-10-07	09-10-07	1.45	0.10	4.66	4.67	8.89	1.15
USAWB-18	01-11-07	09-11-07	1.38	0.97	3.88	4.37	8.84	1.09
USAWB-19	01-11-07	09-11-07	1.46	1.03	4.05	4.33	8.64	1.08
USAWC-01	01-29-07	10-08-07	1.30	0.77	2.93	3.66	7.64	1.00
USAWC-02	01-29-07	10-08-07	0.91	1.14	2.64	3.41	7.22	0.91
USAWC-03	01-29-07	10-08-07	1.42	1.65	6.46	5.84	10.67	1.23
USAWC-04	01-30-07	10-08-07	1.37	1.07	4.35	4.27	8.43	1.04
USAWC-05	01-30-07	12-07-07	1.36	0.97	3.94	4.33	8.35	1.05
USAWC-06	01-30-07	10-12-07	1.48	0.60	2.50	3.67	7.97	1.06
USAWC-07	01-31-07	09-07-07	0.21	5.84	1.82	2.96	6.57	0.90
USAWC-08	01-31-07	09-07-07	0.68	1.46	2.45	3.40	7.22	0.91
USAWC-09	01-31-07	09-07-07	0.10	44.81	2.23	3.21	7.00	0.93
USAWC-10	02-01-07	10-12-07	0.57	18.05	8.63	7.25	11.86	1.37
USAWC-11	02-01-07	10-12-07	0.32	10.46	6.14	5.22	9.23	1.10
USAWC-12	02-01-07	10-12-07	1.02	0.87	2.47	3.41	7.10	0.92
USAWC-13	02-12-07	10-16-07	0.79	1.39	2.59	3.45	7.22	0.94
USAWC-14	02-12-07	10-16-07	1.31	0.97	3.63	3.88	7.68	1.01
USAWC-15	02-12-07	10-16-07	1.25	0.64	2.43	3.25	6.88	0.93
USAWC-16	02-13-07	10-17-07	1.41	2.04	8.51	6.28	10.59	1.24
USAWC-17	02-13-07	10-17-07	1.39	0.94	3.69	4.35	8.45	1.12
USAWC-18	02-13-07	12-08-07	1.39	1.90	7.18	5.69	9.98	1.14
USAWC-19	02-13-07	10-18-07	1.37	0.40	1.73	2.92	6.92	0.97
USAWC-20	02-14-07	10-18-07	0.86	1.23	2.57	3.38	7.16	0.91

Table 15. Results for analyses of noble gases detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. **Abbreviations**: na, not available; cm^3 STP/g, cubic centimeters at standard temperature and pressure per gram of water]

GAMA well identification number	Collection date	Noble gas analysis date	Helium-3/ Helium-4 (atom ratio) (61040)	Helium-4 (85561)	Neon (61046)	Argon (85563)	Krypton (85565)	Xenon (85567)
				(cm^3 STP/g)				
			x 10^{-6}	x 10^{-7}	x 10^{-7}	x 10^{-4}	x 10^{-8}	x 10^{-8}
Grid wells—Continued								
USAWC-21	02-14-07	10-23-07	1.39	3.80	17.76	8.41	16.58	1.62
USAWC-22	02-14-07	10-18-07	1.36	0.67	2.85	3.49	7.39	0.95
USAWC-23	02-15-07	10-18-07	1.38	1.14	4.37	4.50	8.93	1.14
USAWC-24	02-15-07	10-22-07	1.40	0.77	3.22	3.99	8.21	1.01
USAWC-25	03-28-07	03-12-08	1.58	0.52	2.17	3.07	6.62	0.89
USAWE-01	12-04-07	01-11-08	1.17	4.97	12.45	8.30	14.05	1.42
USAWE-02	12-05-07	12-03-07	0.56	1.94	2.84	4.10	8.74	1.12
USAWE-03	12-06-07	12-04-07	0.88	2.20	4.38	4.56	8.80	1.07
USAWE-04	12-07-07	12-04-07	1.13	1.59	5.11	5.29	10.07	1.17
USAWR-01	11-29-06	12-07-07	1.41	0.58	2.36	3.30	7.05	0.93
USAWR-02	11-29-06	12-03-07	1.27	0.95	3.36	3.95	7.83	1.05
USAWR-03	11-30-06	01-11-08	1.41	0.46	1.91	2.92	6.39	0.86
USAWR-04	12-12-06	12-04-07	1.41	0.49	2.03	3.04	6.55	0.89
USAWR-05	12-12-06	12-05-07	1.38	0.49	2.01	2.85	6.05	0.81
USAWR-06	01-08-07	09-09-07	0.40	1.35	2.10	3.21	7.14	1.00
USAWR-07	01-08-07	09-10-07	0.77	0.08	2.08	3.07	6.72	0.91
USAWR-08	01-10-07	09-10-07	1.46	0.06	2.96	3.64	7.27	1.00
USAWR-09	01-10-07	09-10-07	1.10	0.01	2.23	3.14	6.74	0.87
USAWR-10	01-10-07	10-01-07	0.99	0.66	2.29	2.91	6.08	0.78
USAWR-11	01-11-07	10-01-07	1.39	1.64	6.50	5.70	10.10	1.15
USAWR-12	01-29-07	10-08-07	1.46	0.55	3.00	3.17	6.75	0.93
USAWS-01	01-22-07	09-11-07	1.31	1.11	4.19	5.05	9.82	1.11
USAWS-02	01-22-07	09-11-07	0.47	33.14	3.72	4.16	7.99	0.99
USAWS-03	01-22-07	10-03-07	1.43	2.36	9.64	8.20	13.60	1.49
USAWS-04	01-22-07	10-03-07	1.26	2.26	7.85	6.45	10.84	1.18
USAWS-05	01-23-07	01-11-08	2.78	3.39	8.72	6.71	10.85	1.20
USAWS-06	01-23-07	10-03-07	1.13	0.95	3.00	8.16	7.51	1.18
USAWS-07	01-23-07	10-04-07	2.92	11.65	8.12	5.90	9.73	1.11
USAWS-08	01-24-07	10-04-07	1.38	1.73	6.25	5.99	10.21	1.16
USAWS-09	01-24-07	na	na	na	na	na	na	na
USAWS-10	01-24-07	12-05-07	0.53	5.88	5.02	6.29	12.28	1.39
USAWS-11	01-25-07	12-06-07	2.44	13.83	4.73	5.26	10.19	1.15
USAWS-12	01-25-07	01-10-08	0.43	9.43	6.45	7.15	12.50	1.44
USAWS-13	01-25-07	10-15-07	2.41	12.08	6.45	5.98	10.36	1.20
USAWS-14	02-05-07	10-12-07	1.19	1.01	3.40	4.28	8.60	1.12
USAWS-15	02-06-07	10-13-07	0.57	4.49	2.01	3.18	7.05	0.93
USAWS-16	02-06-07	12-07-07	0.53	54.98	2.40	3.53	7.74	1.03
USAWS-17	02-07-07	10-13-07	1.20	15.41	2.20	3.18	6.72	0.88
USAWS-18	02-07-07	10-15-07	0.56	2.44	2.10	3.18	6.88	0.92

Table 15. Results for analyses of noble gases detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[**GAMA well identification No.**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo; USAWU, Upper Santa Ana Watershed study unit well sampled for additional understanding. The five-digit number below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. **Abbreviations**: na, not available; cm^3 STP/g , cubic centimeters at standard temperature and pressure per gram of water]

GAMA well identification number	Collection date	Noble gas analysis date	Helium-3/ Helium-4 (atom ratio) (61040)	Helium-4 (85561)	Neon (61046)	Argon (85563)	Krypton (85565)	Xenon (85567)
				(cm^3 STP/g)				
			x 10^{-6}	x 10^{-7}	x 10^{-7}	x 10^{-4}	x 10^{-8}	x 10^{-8}
Grid wells—Continued								
USAWS-19	02-07-07	10-15-07	0.61	34.64	2.57	3.66	7.68	1.03
USAWS-20	02-08-07	10-15-07	0.47	33.46	3.91	4.19	7.94	1.03
USAWS-21	02-08-07	10-15-07	0.89	1.28	3.08	4.29	8.46	1.14
USAWY-01	11-27-06	12-02-07	1.36	0.43	1.95	3.00	6.70	0.90
USAWY-02	11-30-06	03-30-07	1.40	0.95	3.74	4.13	7.90	1.04
USAWY-03	12-13-06	12-05-07	1.05	1.30	2.73	3.56	7.36	0.98
USAWY-04	12-13-06	12-05-07	1.29	0.60	2.38	3.32	7.11	0.96
USAWY-05	01-08-07	12-05-07	0.96	2.36	2.22	3.11	6.70	0.90
USAWY-06	01-09-07	09-09-07	1.37	1.49	6.20	5.55	9.74	1.12
USAWY-07	01-11-07	10-01-07	1.17	0.82	2.07	3.17	6.95	0.93
USAWY-08	01-11-07	10-02-07	1.08	1.65	2.28	3.42	7.51	1.02
USAWY-09	01-24-07	01-10-08	1.38	7.06	29.95	9.35	26.00	2.37
Understanding wells								
USAWU-01	11-29-06	12-03-07	0.94	0.85	1.97	2.91	6.45	0.86
USAWU-02	11-30-06	03-30-07	1.15	0.78	2.21	3.28	7.12	0.96
USAWU-03	12-11-06	12-04-07	1.36	0.49	2.16	3.55	8.28	1.10
USAWU-04	01-08-07	09-09-07	1.39	0.73	2.96	3.86	8.13	1.07
USAWU-05	01-08-07	10-03-07	1.39	1.23	4.61	4.86	9.28	1.12
USAWU-06	01-30-07	10-12-07	1.43	0.75	2.92	3.83	8.06	1.07
USAWU-07	02-12-07	10-16-07	0.85	1.35	3.05	3.41	6.94	0.93
USAWU-08	02-15-07	10-23-07	0.57	6.93	5.56	4.96	9.33	1.21
USAWU-09	02-15-07	10-30-07	1.39	0.53	2.46	3.50	7.56	1.07

Table 16. Radioactive constituents in ground-water samples collected for the Upper Santa Ana Watershed Ground-Water Ambient Monitoring and Assessment (GAMA) Program, California, November 2006–February 2007.

[**GAMA well identification No**: USAW, Upper Santa Ana Watershed study unit. Study area grid wells: USAWB, Bunker Hill/Cajon/Rialto-Colton; USAWC, Cucamonga/Chino; USAWE, Elsinore; USAWR, Riverside-Arlington/Temescal; USAWS, San Jacinto; USAWY, Yucaipa/San Timoteo. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. The data reported in this table has been screened using the reporting algorithm described in the Appendix under "Data Reporting". The screened data are not stored in NWIS; raw data for these constituents are stored in NWIS under the parameter codes listed in the table. Samples from the 32 slow wells were analyzed. **Abbreviations**: MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; E, estimated value; V, analyte detected in sample and an associated blank thus data are not included in ground-water quality assessment; pCi/L, picocuries per liter; <, less than sample-specific critical level]

GAMA well identification number	Radium-226 (pCi/L) (09511)	Radium-228 (pCi/L) (81366)	Radon-222 (pCi/L) (82303)	Gross-alpha radioactivity, 72-hour count (pCi/L) (62636)	Gross-alpha radioactivity, 30-day count (pCi/L) (62639)	Gross-beta radioactivity, 72-hour count (pCi/L) (62642)	Gross-beta radioactivity, 30-day count (pCi/L) (62645)
Threshold type[1]	MCL-US	MCL-US	Proposed MCL-US	MCL-US	MCL-US	MCL-CA	MCL-CA
Threshold value	[2] 5	[2] 5	[3] 300 (4,000)	15	15	50	50
USAWB-02	V 0.029	< 0.5	* 750	< 3.8	< 2.8	E 2.1	E 3.3
USAWB-04	V 0.017	< 0.5	* 550	3.7	E 1.8	E 1.4	2.4
USAWB-07	0.060	V 0.3	* 380	9.4	E 4.5	4.1	5.9
USAWB-08	0.090	< 0.5	* 330	E 1.4	E 1.8	E 2.7	E 5.4
USAWB-10	E 0.059	E 0.4	* 430	E 2.3	E 3.3	E 1.8	5.4
USAWB-11	0.077	< 0.4	* 1,000	E 5.3	E 5.3	E 2.0	3.2
USAWB-14	E 0.039	< 0.5	260	3.9	< 3.9	1.8	E 2.7
USAWC-04	E 0.037	< 0.5	290	E 1.2	< 3.7	E 1.2	E 3.3
USAWC-08	V 0.031	< 0.5	170	E 2.3	< 2.9	E 2.4	2.9
USAWC-11	0.088	V 0.3	* 500	11.2	E 8.9	4.1	7.4
USAWC-14	V 0.015	< 0.4	* 380	E 1.0	< 4.6	E 1.9	E 1.6
USAWC-17	E 0.036	< 0.4	210	< 1.8	< 4.8	E 1.4	< 4.5
USAWC-21	V 0.018	< 0.5	130	< 1.8	< 2.5	E 1.5	< 2.4
USAWC-23	E 0.044	< 0.4	* 360	E 1.5	< 2.3	2.6	2.4
USAWE-01	0.064	E 0.4	240	E 6.8	< 4.1	E 1.3	E 2.7
USAWE-02	E 0.051	< 0.4	200	E 1.5	< 5.0	< 2.3	E 1.4
USAWE-03	E 0.039	< 0.4	* 1,400	E 3.2	E 2.2	< 2.1	4.6
USAWE-04	0.207	E 0.4	* 2,200	14.0	E 9.4	3.4	6.9
USAWR-03	0.088	V 0.2	* 580	8.7	4.7	4.5	6.6
USAWR-08	0.107	< 0.5	* 310	* 17.3	12.5	E 3.8	10.5
USAWR-11	0.109	< 0.5	* 580	E 4.1	E 2.8	E 2.9	E 3.3
USAWR-12	0.067	< 0.5	* 520	< 6.1	< 5.0	E 2.3	E 1.8
USAWS-02	0.072	< 0.5	220	< 11.0	< 8.5	6.8	8.1
USAWS-06	0.087	0.6	210	E 1.6	< 2.0	4.4	3.5
USAWS-08	0.278	V 0.3	* 1,400	< 3.5	< 4.1	E 3.5	E 2.9
USAWS-12	0.260	0.6	* 940	E 7.7	< 6.6	3.8	4.8
USAWS-14	E 0.057	V 0.2	230	E 2.2	< 3.3	E 2.6	E 3.2
USAWS-15	E 0.043	< 0.5	160	< 5.3	< 4.5	7.2	7.0
USAWS-18	E 0.067	< 0.5	170	< 6.3	< 6.3	8.4	9.8
USAWS-20	V 0.019	< 0.5	* 350	E 1.6	< 7.9	4.3	E 5.7
USAWY-05	V 0.021	< 0.5	200	< 2.1	< 2.0	E 2.3	3.1
USAWY-06	E 0.037	< 0.5	210	E 0.9	< 2.6	E 2.1	E 2.1

* Value exceeds threshold level (lower threshold level for radon is lower).

[1] Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists.

[2] The MCL-US threshold for radium is the sum of radium-226 and radium-228.

[3] Two MCLs have been proposed for Radon-222. The proposed alternative MCL is in parentheses.

Table 17. Microbial indicators detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from the 32 slow wells were analyzed, but only the one sample with a detection is listed. **Abbreviations**: USAWR, Upper Santa Ana Watershed study unit grid well; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; mL, milliliter]

GAMA well identification number	Total coliform (colonies/100 mL) (90900)
Threshold type[1]	MCL-US
Threshold value	5 percent of samples per month
USAWR-03	45

[1] Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists.

Appendix

This appendix includes discussions of the methods used to collect and analyze ground-water samples and report the data for USAW. These methods were selected to obtain representative samples of the ground water from each well and to minimize contamination of the samples or bias in the data. Procedures used to collect and assess quality-control data, and the results of the quality-control assessments are also discussed.

Sample Collection and Analysis

Sample Collection

Ground-water samples were collected using standard and modified USGS protocols (Koterba and others, 1995; U.S. Geological Survey, variously dated), and protocols described by Weiss (1968), Shelton and others (2001), Ball and McClesky (2003a,b), and Wright and others (2005). Before sampling, each well was pumped continuously in order to purge at least three casing-volumes of water from the well (U.S. Geological Survey, variously dated). Samples were collected using Teflon tubing with brass and stainless-steel fittings attached to a sampling point on the well discharge pipe as close to the well as possible. The sampling point was always located upstream of any well-head treatment system or water storage tank. If a chlorinating system was attached to the well, the chlorinator was shut off before purging and sampling the well in order to clear all chlorine out of the system. Samples collected using the fast, topical, and intermediate schedules were collected at the well head through a foot-long length of Teflon tubing (Wright and others, 2005). These samples were collected inside an enclosed chamber when environmental conditions dictated (for example, windy conditions or obvious sources of contamination observed nearby). Samples collected using the slow schedule were collected inside an enclosed chamber located inside a mobile laboratory and connected to the well head by a 10 to 50 foot length of the Teflon tubing (Lane and others, 2003). All fittings and lengths of tubing were cleaned between samples (Wilde, 2004).

For the field measurements, ground water was pumped through a flow-through chamber fitted with a multi-probe meter that simultaneously measured dissolved oxygen, temperature, pH, turbidity, and specific conductance. Field measurements were made in accordance with protocols in the USGS National Field Manual (Wilde and Radtke, 2005; Wilde, 2006; Lewis, 2006; Radtke and others, 2005; Wilde and others, 2006). All sensors on the multi-probe meter were calibrated daily. Measured temperature, dissolved oxygen, pH, and specific conductance values were recorded at 5-minute intervals for at least 30 minutes, and after these values remained stable for 20 minutes, samples to be analyzed in the laboratory were collected. Field measurements and instrument calibrations were recorded by hand on field record sheets and electronically in PCFF-GAMA, a software package designed by the USGS with support from the GAMA program. Analytical service requests and chain of custody documentation also were managed by PCFF-GAMA. Information from PCFF-GAMA was uploaded directly into NWIS at the end of each week that samples were collected.

For analyses requiring filtered water, ground water was diverted through a 0.45-µm pore size vented capsule filter, a disk filter, or a 0.7-µm pore size baked glass-fiber filter depending on the protocol for the analysis (U.S. Geological Survey, variously dated; Wilde and others, 2004). Before samples were collected, polyethylene sample bottles were pre-rinsed using native water three times. Samples requiring acidification were acidified to a pH of 2 or less with the appropriate acids using ampoules of certified, traceable concentrated acids obtained from the USGS National Water Quality Laboratory (NWQL).

Temperature-sensitive samples were stored on ice before being shipped daily to the various laboratories. The non-temperature sensitive samples to be analyzed for tritium, noble gases, chromium speciation and stable isotopes were shipped monthly, while samples to be analyzed for volatile organic compounds, pesticides, pharmaceuticals, potential wastewater indicator constituents, compounds of special interest, dissolved organic carbon, nutrients, major, minor, and trace elements, standard dissolved gases, radium isotopes, gross alpha and beta radioactivity, and radon-222 were shipped daily. Samples to be analyzed for dissolved gases were shipped at the end of each sampling week. Samples for nitrogen and oxygen isotopes of nitrate were frozen at the end of each sampling week and shipped monthly.

Detailed sampling protocols for individual analyses and groups of analytes are described by Koterba and others (1995) and in the USGS National Field Manual (U.S. Geological Survey, variously dated; Wilde and others, 2004) and the references for analytical methods listed in table A1; only brief descriptions are given here. Volatile organic compounds (VOC) samples were collected in 40-mL sample vials that were purged with three vial volumes of sample water before bottom filling to eliminate atmospheric contamination. Six normal (6 N) hydrochloric acid (HCl) was added as a preservative to all the VOC samples except the additional 1,2,3-TCP samples collected to obtain a lower detection limit for this VOC. Perchlorate samples were collected in 125-mL polyethylene bottles. Tritium samples were collected by bottom filling two 1-L polyethylene bottles with unfiltered ground water, after first overfilling the bottle with three volumes of water. Stable isotopes of hydrogen and oxygen in water were collected in 60-mL clear glass bottles filled with unfiltered water, sealed with a conical cap, and secured by electrical tape to prevent leakage and evaporation.

Samples to be analyzed for pesticides and pesticide degradation products, potential wastewater-indicator constituents, pharmaceutical compounds, 1,4-dioxane, and *N*-nitrosodimethylamine (NDMA) samples were collected in 1-L baked amber glass bottles. Pesticide and pharmaceutical samples were filtered with a 0.7-µm pore-size glass-fiber filter, whereas the NDMA samples were filtered at the Montgomery Watson-Harza laboratory before analysis. Potential wastewater-indicator samples were unfiltered.

Ground-water samples to be analyzed for major and minor ions, trace elements, alkalinity (laboratory), and total dissolved solids analyses were processed by filling one 250-mL polyethylene bottle with raw groundwater, and one 500-mL and one 250-mL polyethylene bottles with filtered ground water (Wilde and others, 2004). The filter used was a 0.45-µm pore-size disposable Whatman capsule filter. The 250-mL filtered sample was then preserved with 7.5 N nitric acid. Mercury samples were collected by filtering ground water into 250-mL glass bottles and preserving them with 6 N hydrochloric acid. Arsenic and iron speciation samples were filtered into 250-mL polyethylene bottles that were covered with tape to prevent light exposure, and preserved with 6 N Hydrochloric acid. The nutrient sample was filtered into a 125-mL brown polyethylene bottle. The sample for isotopes of nitrogen and oxygen in nitrate was filtered into a second 125-mL brown polyethylene bottle. Radium isotopes, and gross alpha and beta radiation samples were filtered into 1-L polyethylene bottles and acidified with 7.5 N nitric acid. Carbon isotope samples were filtered and bottom-filled into two 500-mL glass bottles that were first overfilled with three bottle volumes of ground water. These samples had no headspace and were sealed with a conical cap to avoid atmospheric contamination. The sample to be analyzed for field alkalinity titration was collected by filtering ground water into a 500-mL polyethylene bottle.

Samples to be analyzed for DOC, oxidation-reduction species of chromium, radon-222, dissolved standard and noble gases, and microbial constituents were collected from the hose bib at the well head, regardless of the sampling schedule (fast, intermediate or slow). DOC was collected after rinsing the sampling equipment with organic blank water (Wilde and others, 2004). Using a 50-mL syringe and a 0.45-µm disk filter, the ground water sample then was filtered into a 125-mL baked glass bottle and preserved with 4.5 N sulfuric acid. The chromium speciation sample was collected using a 10-mL syringe with an attached 0.45-µm disk filter. After the syringe was thoroughly rinsed and filled with ground water, 4 mL were forced through the disk filter; the next 2 mL of the ground water was slowly filtered into a small centrifuge vial for analysis of total chromium. Hexavalent chromium, Cr(VI), was then collected by attaching a small cation exchange column to the syringe filter, and after conditioning the column with a 2-mL of sample water, 2 mL were collected in a second centrifuge vial. Both vials were preserved with 10 µL of 7.5 N nitric acid (Ball and McClesky, 2003a,b).

To collect samples to be analyzed for radon-222, a stainless-steel and Teflon valve assembly was attached to the sampling port at the well head (Wilde and others, 2004). The valve was partially closed to create back pressure, and a 10-mL sample was collected through a Teflon septum on the value assembly using a glass syringe affixed with a stainless-steel needle. The sample was then injected into a 25-mL vial partially filled with scintillation mixture (mineral oil) and shaken. The vial was then placed in a cardboard tube in order to shield it from light during shipping.

Samples collected for the determination of standard dissolved gases (and subsequent determination of nitrogen gas isotopes) were collected by bottom-filling a 150-mL sample bottle immersed in a water-filled beaker. Air was excluded from the sample by sealing the bottle under water with a rubber stopper pierced with a perforated needle. As the stopper was inserted residual air was voided through the perforated needle. Noble gases were collected in 3/8-in copper tubes using reinforced nylon tubing connected to the hose bib at the wellhead. Ground water was flushed through the tubing to dislodge bubbles before flow was restricted with a back pressure valve. Clamps on either side of the copper tube were then tightened, trapping a sample of ground water for analyses of noble gases (Weiss, 1968).

Samples to be analyzed for microbial constituents also were collected at the well head following protocols described by Myers (2004) and Bushon (2003). Before samples were collected, the sampling port was sterilized using isopropyl alcohol, and ground water was run through the sampling port for at least 3 minutes to remove any traces of the sterilizing agent. Two sterilized 250-mL bottles were then filled with ground water to be analyzed for coliform (total and *Escherichia coliform* determinations), and one sterilized 3-liter carboy was filled to be analyzed for coliphage (F specific and somatic coliphage determinations).

Sample Analysis

Ten laboratories performed chemical and microbial analyses for this study (see table A1), although most of the analyses were performed at the NWQL or by laboratories contracted by the NWQL. The NWQL maintains a rigorous quality-assurance program (Maloney, 2005; Pirkey and Glodt, 1998). Laboratory quality control samples—method blanks, continuing calibration verification standards, standard reference samples, reagent spikes, external certified reference materials, and external blind proficiency samples—are analyzed regularly. Method detection limits are continuously tested and laboratory reporting levels updated accordingly. NWQL maintains National Environmental Laboratory Accreditation Program (NELAP) and other certifications (http://nwql.usgs.gov/Public/lab_cert.shtml). In addition, the Branch of Quality Systems within the USGS Office of Water Quality independently oversees quality assurance at the NWQL and laboratories contracted by the NWQL. The Branch

of Quality Systems also runs a national field quality assurance program that includes testing all USGS field personal annually for proficiency in making field water-quality measurements (http://bqs.usgs.gov/nfqa/). Results for analyses made at the NWQL or by laboratories contracted by the NWQL are uploaded directly into NWIS by the NWQL.

Turbidity, field alkalinity, total coliforms, and *Escherichia coliform* (*E. coli*) were measured in the mobile laboratory at the well site. Turbidity was measured in the field with a calibrated turbidity meter. Total coliforms and *Escherichia coliform* (*E. coli*) plates were prepared using sterilized equipment and reagents (Myers, 2004). Plates were counted under an ultraviolet light, following a 22–24 hour incubation time. Alkalinity and the concentrations of bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) in filtered samples were measured by Gran's titration method (Gran, 1952; Rounds, 2006; Stumm and Morgan, 1996).

Concentrations of HCO_3^- and CO_3^{2-} were also calculated using the laboratory alkalinity and pH measurements. Calculations were made using the advanced speciation method (http://or.water.usgs.gov/alk/methods.html) with $\rho K_1 = 6.35$, $\rho K_2 = 10.33$, and $\rho K_W = 14$.

Data Reporting

The following section details the reporting conventions of the USGS National Water Quality Laboratory (NWQL) and how these reporting conventions were established. It also describes details of the procedure that GAMA uses to screen radiochemical data. Finally, reporting conventions for constituents that are determined by multiple analytical methods are described.

Laboratory Reporting Conventions

The USGS NWQL uses the laboratory reporting level (LRL) as a threshold for reporting analytical results. The LRL is set to minimize the reporting of false negatives (not detecting a compound when it is actually in a sample at a concentration greater than or equal to the LRL) to less than 1 percent (Childress, and others, 1999). The LRL is usually set at two-times the long-term method detection level (LT-MDL). The LT-MDL is derived from the standard deviation of at least 24 MDL determinations made over an extended period of time. LT-MDLs are continually monitored and updated. The method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the concentration is greater than zero (at MDL there is less than 1 percent chance of a false positive) (U.S. Environmental Protection Agency, 2002a). The USGS NWQL updates LRL values regularly and the values listed in this report were in effect during the period ground-water samples from the USAW study unit were analyzed (November 2006 to March 2007).

Some compound concentrations in this study are reported using minimum reporting levels or method uncertainties. The minimum reporting level is the smallest measurable concentration of a constituent that may be reliably reported using a given analytical method (Timme, 1995). The method uncertainty generally indicates the precision of a particular analytical measurement; it gives a range of values in which the true value will be found.

Concentrations between the LRL and the LT-MDL are reported as estimated concentrations (designated with an "E" before the values in the tables and text). For information-rich methods, concentrations below the LRL have a high certainty of detection, but the precise concentration is uncertain. Information-rich methods are those that use gas chromatography or high-performance liquid chromatography (HPLC) with mass spectrometry detection (to analyze for VOCs, gasoline oxygenates and degradates, pesticides, pharmaceuticals, potential wastewater-indicators). Compounds are identified by the presence of characteristic fragmentation patterns in their mass spectra in addition to being quantified by measurement of peak areas at their associated chromatographic retention times. E-values also may result from detections outside the range of calibration standards, for detections that did not meet all laboratory quality-control criteria, and for samples that were diluted before being analyzed (Childress and others, 1999).

Detections that may have resulted from inadvertent sample contamination are reported with a "V" before the values in the tables. The potential for sample contamination was assessed using results from field, source-solution, and laboratory blanks.

The reporting levels for radiochemical constituents (gross-alpha radioactivity, gross-beta radioactivity, radium-226, and radium-228) in picocuries per liter (pCi/L) were based on a sample-specific minimum detectable concentration (SSMDC), a sample-specific critical value, and the combined standard uncertainty (CSU) (U.S. Environmental Protection Agency, 2004; Bennett and others, 2006). A result above the critical value represents a greater-than-95-percent certainty that the result is greater than zero (significantly different from the instrument's background response to a blank sample), and a result above the SSMDC represents a greater-than-95-percent certainty that the result is greater than the critical value. Using these reporting level elements, three unique cases were possible when screening the raw analytical data. If the analytical result was less than the critical value (case 1), the analyte was considered not detected, and the concentration was reported as less than the SSMDC. If the analytical result was greater than the critical value, the ratio of the CSU to the analytical result was calculated as a percent (percent relative CSU). For those samples with percent relative CSU greater than 20 percent (case 2), concentrations were reported as estimated values (designated by an "E" preceding the value). For those samples with percent relative CSU less than 20 percent (case 3), concentrations were reported with no qualifiers.

Scenario	Critical value (pCi/L)	SSMDC (pCi/L)	Combined standard uncertainty (pCi/L)	Relative CSU (percent)	Result (pCi/L)	
					Raw	Reported
Case 1 - Result less than critical value	1.4	3.2	±1.2	133	0.9	<3.2
Case 2 – Relative combined standard uncertainty greater than 20 percent	0.5	1.4	±0.6	32	2.0	E2.0
Case 3 – Relative combined standard uncertainty less than 20 percent	0.4	1.1	±0.5	14	3.2	3.2

Stable isotopic compositions of oxygen, hydrogen, and carbon are reported as relative isotope ratios in units of per mil using the standard delta notation (Coplen and others, 2002):

$$\delta^{i}\mathrm{E} = \left[\frac{R_{\mathrm{sample}}}{R_{\mathrm{reference}}} - 1\right] \bullet 1{,}000 \text{ per mil}, \quad (1)$$

where

^{i}E is the heavier isotope of the element (^{18}O for oxygen, ^{13}C for carbon, or ^{2}H for hydrogen),

R_{sample} is the ratio of the abundance of the heavier isotope of the element (^{18}O, ^{13}C, or ^{2}H) to the lighter isotope of the element (^{16}O,^{12}C, or ^{1}H) in the sample and,

$R_{\mathrm{reference}}$ is the ratio of the abundance of the heavier isotope of the element to the lighter isotope of the element in the reference material hydrogen.

The reference material for oxygen and hydrogen is Vienna Standard Mean Ocean Water (VSMOW), which is assigned δ^{18}O and δ^{2}H values of 0 per mil. The reference material for carbon is Vienna Peedee Belemnite (VPDB), which is assigned a δ^{13}C value of 0 per mil. Positive values indicate enrichment of the heavier isotope and negative values indicate depletion of the heavier isotope, compared to the ratios in the reference material.

Constituents on Multiple Analytical Schedules

Results for 18 constituents targeted in the USAW study were determined by more than one analytical schedule or more than one laboratory (table A2). All results, including these multiple or "duplicate" analyses are included in this report. The data tables that include the 18 constituents with duplicate results identify the preferred methods and provide direction for locating duplicate results for the constituents in other tables. Preferred methods were selected based on procedures recommended by the NWQL. Methods having full approval are preferred over those having provisional approval, and approved methods are favored over research methods. The most precise method (the one that has lower LRLs for the overlapping constituents) is preferred, and certain analytical technologies are preferred over others (for example gas chromatography over liquid chromatography).

Duplicate results were usually in substantial agreement for these constituents. In particular, comparisons between field and laboratory determinations of pH, specific conductance, and alkalinity indicated that field calibration and measurement techniques were reliable and that laboratory results agreed with (were similar to) the corresponding sample sent from the field. Dissolved argon results measured by the Reston Chlorofluorocarbon Laboratory (table 14) are in good agreement with results from Lawrence Livermore National Laboratory (table 15) when the Lawrence Livermore results are converted to mg/L.

The duplicate results for two compounds in particular merit note: caffeine and tebuthiuron. Caffeine, detected four times by the pharmaceutical schedule 2080, was not detected in any sample by the preferred method of analysis, schedule 2060. Two of the four concentrations detected were greater than the schedule 2060 LRL, and two detections were accompanied by detections of 1,7-dimethylxanthine, a caffeine degradate. Tebuthiuron was detected more frequently and at lower concentrations by the non-preferred method schedule 2060 than by the preferred method of analysis schedule 2033. However, all of the schedule 2060 detections of tebuthiuron were at concentrations less than the LT-MDL for this compound and were therefore not included in detection frequency calculations.

Quality-Assurance Methods

The quality-assurance methods used for this study follow protocols described in the USGS National Field Manual (U.S. Geological Survey, variously dated), protocols used by the USGS NAWQA program (Koterba and others, 1995), and the NWQL quality-assurance plan (Maloney, 2005). Quality-control (QC) samples were collected concurrently with approximately 21 percent of the samples in the USAW study to assess the bias and variability of water-quality data potentially possibly introduced during sample collection, processing, storage, transportation, and laboratory analysis, as well as intrinsic variability within the ground water itself. Four types of QC samples were collected and analyzed: blanks, field replicates, laboratory surrogates, and laboratory matrix spikes.

Blanks

Blank samples (blanks) were collected using water (Nitrogen-Purged Universal blank water) certified by the NWQL to contain less than the LRL or MRL of the analytes investigated in the study. Two types of blanks were collected: source-solution and field blanks. Source-solution blanks were collected to verify that the blank water used for the field blanks was free of analytes. Field and source solution blanks were collected at 8 percent of the wells sampled to determine if equipment or procedures used in the field or laboratory had introduced contamination. Field blanks were analyzed for VOCs, pesticides, potential wastewater indicators, pharmaceuticals, constituents of special interest, nutrients, dissolved organic carbon, major and minor ions, trace elements, radioactive constituents. Suitable blank water is not available for tritium, coliphage, or noble gases; thus field blanks were not collected for these constituents. Filter and procedure blanks were performed with each sample plating of samples for *E. coli* and total coliforms: none were detected during this study.

Source-solution blanks were collected at the sampling site by pouring blank water directly into sample containers that were preserved, stored, shipped, and analyzed in the same manner as the ground-water samples. Blank water used for field blanks was either pumped or poured through the sampling equipment (fittings and tubing) used to collect ground water, then processed and transported using the same protocols as those used for the ground-water samples.

If a constituent was detected in a field blank, the associated source-solution blank results were examined for similar constituent detections. If the field blank and the source-solution blank contained the constituent, the source solution water was interpreted as the origin of the contamination in the blanks, and the field blank detections using the same blank water were disregarded. Source-solution blanks were only performed for VOCs, pharmaceuticals, perchlorate, NDMA, 1,4-Dioxane, and 1,2,3-TCP. If a field blank detection could not be attributed to the source solution, the ground-water samples collected before and after the blank were evaluated. If the ground-water samples collected before or after the contaminated field blank were not contaminated, then carry-over contamination was ruled out. If the concentration of an analyte detected in a field blank plus one-half the LRL for that analyte (one-half the sample-specific method detection concentration in the case of radium) was greater than the concentration measured in a ground-water sample collected immediately before or after the blank sample, the ground-water value was V-coded (table A3). These results have a 'V' preceding the value in results tables (4–17), and are excluded from the summary statistics. If a compound was detected in multiple field blanks and the detections could not be attributed to the source-solution water, any ground-water sample in which the compound in question was detected was evaluated for possible contamination.

Replicates

Sequential replicate samples were collected to assess variability that may result from processing and analyzing inorganic and organic constituents. Relative standard deviation (RSD) of the measured values was used in determining the variability between replicate pairs for each compound (tables A4A–B). The RSD is defined as 100 times the standard deviation divided by the mean concentration for each replicate pair of samples. If a constituent was not detected in one replicate and its concentration was estimated to be below the LRL or MRL in the other replicate, the RSD was set to zero because the values are analytically identical. If one value for a sample pair was reported as a non-detection and the other value was greater than the LRL or MRL, the non-detection value was set equal to one-quarter of the LRL and the RSD was calculated (Hamlin and others, 2002). Values of RSD less than 20 percent are considered acceptable in this study. High RSD values for a compound may indicate analytical uncertainty at low concentrations, particularly for concentrations within an order of magnitude of LT-MDL or MDL. Sequential replicate samples were collected at 8 percent of the wells sampled.

Matrix Spikes

Adding a known concentration of a constituent (”spike”) to a replicate environmental sample enables the analyzing laboratory to determine the effect of the matrix, in this case ground water, on the analytical technique used to measure the constituent. The known compounds added to matrix spikes are the same as those being analyzed using the method. This enables matrix interferences to be analyzed with each compound. Matrix spikes were added at the laboratory that analyzed the samples. Compounds with low recoveries are of concern if environmental concentrations are close to the MCLs; a concentration below an MCL could falsely indicate that the standard was not exceeded. Conversely, compounds with high recoveries are of concern if the environmental concentrations exceed MCLs: a high recovery could falsely indicate a concentration above the MCL.

Acceptable ranges for matrix-spike recoveries are based on the acceptable ranges established for laboratory “set” spike recoveries. Laboratory set spikes are aliquots of laboratory blank water to which the same spike solution as that used for the matrix spikes has been added. One set spike is analyzed with each set of samples. Acceptable ranges for set spike recoveries are 70 to 130 percent for NWQL schedules 2020 and 4433 (Connor and others, 1998; Zaugg and others, 2002), 60 to 120 percent for NWQL schedules 2033 and 2060 (Sandstrom and others, 2001; Furlong and others, 2001), and 60 to 130 percent for schedule 2080 (Kolpin and others, 2002). We used these ranges to define 70 to 130 percent as the acceptable range for matrix-spike recoveries for organic compounds in this study.

Matrix spikes were added to samples to be analyzed for VOCs, pesticide compounds, pharmaceutical compounds, potential wastewater-indicator constituents, NDMA, 1,4-Dioxane, 1,2,3-TCP, radium isotopes, and gross alpha and beta radiation because the analytical methods used for these constituents may be susceptible to matrix interferences. Replicate samples to which matrix spikes were to be added were collected at 7 percent of the wells sampled, although not all analyte classes listed above were added to samples from every well (tables A5A-G).

Surrogates

Surrogate compounds are added to environmental samples in the laboratory before analysis in order to evaluate the recovery of similar constituents. Surrogate compounds were added to all ground-water and quality-control samples that were analyzed for VOCs, pesticide compounds, pharmaceutical compounds, potential wastewater-indicator compounds, NDMA,1,4,-Dioxane, and 1,2,3-TCP (table A6). Most of the surrogate compounds are deuterated analogs of compounds being analyzed. For example, the surrogate toluene-d8 used for the VOC analytical method has the same chemical structure as toluene, except that the eight hydrogen-1 atoms on the molecule have been replaced by deuterium (hydrogen-2). Toluene-d8 and toluene behave very similarly during the analytical procedure, but the small mass difference between the two causes slightly different chromatographic retention times; thus using a toluene-d8 surrogate does not interfere with the analysis of toluene (Grob, 1995). Only 0.015 percent of hydrogen atoms are deuterium (Firestone and others, 1996); thus deuterated compounds like toluene-d8 do not occur naturally and are not found in environmental samples. Surrogates are used to identify general problems that may arise during sample analysis that could affect the analysis results for all compounds in that sample. Potential problems include matrix interferences (such as high levels of dissolved organic carbon) that produce a positive bias, and incomplete laboratory recovery (possibly caused by improperly maintaining and calibrating analytical equipment) that produces a negative bias. A 70 to 130 percent recovery of surrogates is generally considered acceptable; values outside this range indicate possible problems with processing and analyzing samples (table A6) (Connor and others, 1998; Sandstrom and others, 2001).

Quality-Control Results

Detections of Constituents in Field Blanks

Field blanks were collected at eight wells sampled in USAW. Three of the field blanks were collected at wells sampled using the “slow” analytical schedule and using equipment dedicated to this type of sampling. The other five field blanks were collected at “fast”, “intermediate”, or “topical” wells using a different equipment set-up. Table A3 presents a summary of detections in field blanks. The table summarizes results separately for blanks collected using the “slow” analytical schedule and those collected using the “fast”, “intermediate”, or “topical” schedule.

All eight field blanks were analyzed for VOCs, and five VOCs were detected in the blanks. However, since three of these compounds were not detected in ground-water samples, their occurrence in field blanks was of no consequence. 1,2,4-trimethylbenzene was detected in 19 ground-water samples and in a single field blank at a concentration similar to its concentrations in many of the ground-water samples. However, since this compound was not detected in the ground-water samples collected using the same equipment set-up immediately before and after it was detected in the field blank, no ground-water detections of 1,2,4-trimethylbenzene were V-coded. Detections of toluene in field blanks collected at wells using both types of sampling equipment and at concentrations similar to those detected in ground-water samples resulted in the censoring of all (5) USAW ground-water detections of toluene.

Seven USAW field blanks were analyzed for pesticides. The pesticides atrazine and simazine were detected in one field blank collected on a "fast" analytical schedule on February 8, 2007 (table A3). The estimated concentration of atrazine detected in this blank was 0.005 µg/L, and the estimated concentration of simazine detected was 0.004 µg/L. Neither atrazine nor simazine were detected in the ground-water sample collected after the field blank. Atrazine was not detected in the ground-water sample collected immediately before the field blank, but simazine was detected at a concentration of 0.006 µg/L. However, this simazine detection was V-coded because the concentration in the blank plus half the simazine LRL is greater than 0.006 µg/L. No other pesticide detections were V-coded.

Seven USAW field blanks were analyzed for potential wastewater indicator compounds. Eighteen potential wastewater indicator compounds were detected in the blank collected February 8, 2007. The NWQL subsequently determined that this blank was among 60 samples nationwide that were inadvertently cross-contaminated as a result of a change in method procedure. An additional wastewater indicator in a blank was *d*-limonene detected at an estimated concentration of 0.03 µg/L in a blank collected November 28, 2006, using a "fast" equipment set-up. These issues formed part of the basis for the decision to omit the results for this analytical method from this report.

Five USAW field blanks were analyzed for nutrients, major and minor ions, and trace elements. The only nutrient species that was detected in a field blank was total nitrogen, detected in one field blank at a concentration of 0.14 mg/L (table A3). However, no ground-water samples were V-coded for total dissolved nitrogen because the resulting level to require a V-code (0.14 mg/L plus one-half the LRL of 0.03 mg/L) was far below any of the concentrations detected in ground-water samples. Similarly, calcium was the only major ion detected in a USAW field blank, present at an estimated concentration of 0.013 mg/L in one blank. Since the lowest concentration of calcium in any of the ground-water samples was 3 mg/L, no calcium results were V-coded. Single blank detections of two trace elements—barium and chromium—were also too small to result in censoring ground-water results. Mercury, detected one time in a field blank, was not detected in the associated ground-water sample. Therefore, the isolated detection did not result in V-coding any ground-water mercury results.

However, multiple blank detections of three trace elements—copper, lead, and zinc—collectively resulted in censoring 45 ground-water results. A single detection of aluminum in the February 8, 2007, blank collected with a "fast" equipment set-up was probably the result of field conditions. The field crew noted, as well as documented with photographs, an elaborate combination of metal fittings necessary to connect the field blank pump to the sampling line. Therefore, it would be inappropriate to censor detections of aluminum in ground-water samples collected before and after this blank. The ground-water sample associated with the field blank had an aluminum concentration of 4.4 µg/L, which is greater than the censoring level that would result from the 1.6-µg/L concentration detected in the blank. Note that the USGS Branch of Quality Systems determined that aluminum and lead had positive analytical biases (of 9 and 14 percent, respectively) during the time that USAW samples were analyzed at the NWQL.

Field blanks were collected at three of the thirty-two sites sampled for iron, arsenic, and chromium speciation analysis by the USGS Trace Metal Laboratory (TML). The concentration of arsenic in one field blank was 2.5 µg/L, and the concentrations of iron in two field blanks were 4 µg/L and 3 µg/L. Iron and arsenic detected in ground water by TML (table A3) were not V-coded because these results were used only to determine the relative proportions of the oxidation-reduction species of these metals in the samples. The preferred methods of analyses for these metals were those used by NWQL (table 11).

NDMA was detected in two of the three field blanks for which it was analyzed (table A3), and the concentrations in the field blanks were greater than those of the two ground-water samples in which it was detected. Therefore, both of these ground-water detections of NDMA were V-coded.

DOC was detected in two of the three field blanks for which it was analyzed at concentrations similar to those detected in ground-water samples. While all three field blanks analyzed for DOC were collected at slow wells, the collection procedure and equipment used to process samples for this analyte are the same at all wells. As a result, all but one of the 25 DOC detections in USAW ground-water samples were V-coded.

Two field blanks were collected to be analyzed for radioactive constituents. Radium-226 and radium-228 were detected in both blanks. The greatest concentration of radium-226 detected in a field blank was estimated to be 0.019 pCi/L. The greatest such concentration of radium-228 was estimated to be 0.08 pCi/L. Since radium was detected in both blanks, censoring levels for these analytes were obtained derived by adding the maximum blank concentrations to one-half the sample-specific method detection concentration determined for the ground-water detections; a censoring strategy analogous to that used for analytes with fixed LRLs. This resulted in censoring 7 ground-water detections of radium-226 and 5 ground-water detections of radium-228.

No compounds were detected in field blanks for the following analytes or groups: pharmaceutical compounds (7 field blanks), perchlorate (8 field blanks), 1,2,3-TCP (3 field blanks), and 1,4-dioxane (3 field blanks).

Variability in Replicate Samples

Tables A4A,B summarize the results of replicate analyses of constituents detected in ground-water samples collected in the USAW study. More than 1,000 replicate analyses were evaluated for constituents detected in at least one ground-water sample. Concentrations or activities in the environmental and replicate samples are given in tables A4A,B for all replicate analyses with RSD values greater than 20 percent. Most replicate analyses yielded RSD values less than 20 percent. Constituents in replicate samples whose analyses yielded RSD values greater than 20 percent include the VOC 1,2,4-trimethylbenzene; the potential wastewater indicators caffeine, 3,4-Dichlorophenyl isocyanate, phenol, and tetrachloroethene (PCE); the trace elements copper, nickel and zinc (table A4A); dissolved oxygen measured by the Reston Chlorofluorocarbon laboratory; four noble gases; and four radioactive constituents (table A4B). One of these, 3,4-Dichlorophenyl isocyanate, is recognized by the NWQL as a highly variable compound in the potential wastewater indicator laboratory schedule. With one exception each for 1,2,4-trimethylbenzene, copper, and zinc replicate analyses, the magnitudes of the concentrations of the replicate sample pairs with RSD values greater than 20 percent were all within a factor of five of the LRLs for the respective analytes. At these low concentrations, small deviations in measured values result in large RSDs. No data were qualified as a result of variability in replicate analyses.

Matrix-Spike Recoveries

Tables A5A–G summarize matrix-spike recoveries for the USAW study. Adding a spike or known concentration of a constituent to an environmental sample enables the analyzing laboratory to determine the effect of the matrix, in this case ground water, on the analytical technique used to measure the constituent. Seven ground-water samples were spiked with VOCs to calculate matrix-spike recoveries (table A5A). Seventy-nine of the eighty-five VOC spike compounds consistently had recoveries within the acceptable range of 70 and 130 percent. Three VOC spike compounds—3-chloro-1-propene, methyl bromide, and vinyl chloride—had at least one matrix spike recovery greater than 130 percent. Despite this indication of positive analytical bias, none of these three compounds were detected in ground-water samples. Three VOC spike compounds—carbon disulfide, dichlorodifluoromethane, and trichlorofluoromethane—had at least one matrix-spike recovery less than 70 percent, and the first two of these compounds were not detected in ground-water samples. [NOTE – low recoveries may indicate that the compound might not have been detected in some samples if it was present at very low concentrations].

In contrast to the generally-acceptable matrix spike recoveries observed for the VOCs, about half of the pesticide and pesticide degradate spike compounds had at least one matrix spike recovery outside the acceptable range (tables A5B and A5C). Only six of these were on the high side of the range with recoveries greater than 130 percent on at least one occasion, and only two of those six (bromacil by lab schedule 2060 analysis and tebuthiuron by lab schedule 2033 analysis) were detected in USAW ground-water samples. Low spike recoveries for many pesticide compounds potentially represent a more serious problem than do high spike recoveries. Most (121) of the 134 pesticide compounds targeted for analysis in this study for were not detected in USAW ground-water samples at or above concentrations equal to or greater than their respective long-term method detection limits (LT-MDLs). Sixty-six of the 121 compounds that were not detected in any ground-water sample had at least one matrix spike recovery less than 70 percent, and forty-one of these compounds had median matrix spike recoveries of less than 70 percent. [NOTE – low recoveries may indicate that the compound might not have been detected in some samples if it was present at very low concentrations].

There also tended to be low matrix spike recoveries for the six samples spiked with potential wastewater indicator compounds (table A5D). All but one (Bisphenol A) of these compounds had at least one matrix spike recovery less than 70 percent, and most of these compounds had median matrix spike recoveries of less than 70 percent. [NOTE – low recoveries may indicate that the compound might not have been detected in some samples if it was present at very low concentrations].

Six ground-water samples were spiked with pharmaceutical compounds. Five of the fourteen pharmaceutical compounds recovered within the acceptable range of 70 to 130 percent in all six tests, but nine compounds recovered less than 70 percent for at least one of the six tests (table A5E). Two compounds, diltiazem and sulfamethoxazole, had low recoveries for all six spiked samples and were not detected in any USAW ground-water samples. [NOTE – low recoveries may indicate that the compound might not have been detected in some samples if it was present at very low concentrations].

Two ground-water samples were spiked with NDMA and 1,2,3-TCP. Spike recoveries for these two compounds were within the acceptable range of 70 to 130 percent (table A5F). However, the single ground-water sample that was spiked with1,4-dioxane had a recovery slightly below the acceptable range (69 percent). [NOTE – low recoveries may indicate that the compound might not have been detected in some samples if it was present at very low concentrations].

One ground-water sample was spiked with radium-226 and 228. Two ground-water samples were spiked with gross alpha and gross beta radioactivity. Spike recoveries for these radioactive constituents were within the acceptable range of 70 to 130 percent (table A5G). No data were qualified as a result of the observed matrix spike recoveries.

Surrogate Compound Recoveries

Surrogate compounds were added to environmental samples in the laboratory and analyzed to evaluate the recovery of similar constituents. Table A6 lists in columns the surrogate, analytical schedule for which it was applied, the number of analyses for both blank and ground-water samples, the number of surrogate recoveries below 70 percent, and the number of surrogate recoveries above 130 percent for the blank and non-blank samples. Blank and non-blank samples were considered separately to assess whether the matrices in non-blank samples affect surrogate recoveries. No systematic differences between surrogate recoveries in blank and ground-water samples were observed. While 79 percent of the surrogate recoveries for VOCs, 86 percent of the surrogate recoveries for pesticides, and 98 percent of the surrogate recoveries for pharmaceuticals were in the acceptable range of 70 to 130 percent, only a little more than half of the surrogate recoveries for potential wastewater-indicator constituent analyses were in the acceptable range. Poor surrogate recoveries for the potential wastewater-indicators should not be surprising, given the generally low recoveries of matrix spikes for this analyte group. About three-fourths of the surrogate recoveries for the constituents of special interest—1,4-dioxane, NDMA, and 1,2,3-trichloropropane—were in the acceptable range. No data were qualified as a result of the observed surrogate recoveries.

Internal Laboratory Quality-Control Samples for Pharmaceutical Compounds

The protocols for analyzing pharmaceutical compounds (NWQL schedule 2080) have been used for routine sample analysis since October 2005, but because of the newness of the method compared with the other methods of analysis used in this study, an extra level of quality-control assessment was applied to the pharmaceutical data. More rigorous censoring was applied to this group of constituents so that only detected concentrations greater than one-half the LRL are reported in table 7. Also, in addition to the results for field blanks, matrix spike recoveries, surrogate recoveries, and replicate variability, results for internal laboratory quality control samples that were analyzed with USAW ground-water samples were compiled and examined. Samples were analyzed in the order received by the NWQL in sets that included approximately ten samples. The 92 ground-water samples, 6 matrix spikes, 7 replicates, 5 source solution blanks, and 7 field blanks were analyzed in 20 different laboratory sets. Each set also included a set blank and a set spike. Purified water (de-ionized, carbon-filtered, and disinfected by ultraviolet radiation) was used for the set blanks and the matrix water for the set spikes (Kolpin and others, 2002).

At least one pharmaceutical compound was detected in half of the twenty set blanks. Nine of the 14 pharmaceutical compounds were detected in set blanks, and the most frequently detected compound in these set blanks was cotinine, which was detected in 8 set blanks (table A7A). However, cotinine was not detected in USAW ground-water samples. The rest of the discussion on set blank results will be limited to pharmaceutical compounds that were detected in at least one USAW ground-water sample at a concentration greater than its censoring level following GAMA censoring protocols specific to this group of analytes. One of the four such pharmaceuticals, 1,7-dimethylxanthine (a caffeine metabolite), was not detected in the set blanks. Acetaminophen, caffeine, and carbamazepine were detected in 2, 4, and 1 of the 20 set blanks, respectively. However, in each case, the concentration in the set blank was less than one-tenth the concentration detected in the associated ground-water sample; thus no pharmaceutical data were V-coded as a result of detections in set blanks.

Recoveries of spike constituents in the set spike samples were similar to those in the ground-water matrix spike samples. Seven of the 14 pharmaceutical compounds in the 20 set spikes recovered within the acceptable range of 70 to 130 percent. Of the remaining 7 compounds, 3 had median recoveries within the acceptable range. Median recoveries for diltiazem, diphenhydramine, sulfamethoxazole, and warfarin were below the acceptable range. [NOTE – low recoveries may indicate that the compound might not have been detected in some samples if it was present at very low concentrations].

Table A1. Methods used to measure organic, inorganic, and microbial constituents analyzed by the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL) and contract laboratories.

[**Abbreviations:** MI agar, supplemented nutrient agar in which coliforms (total and *Escherichia*) produce distinctly different fluorescence under ultraviolet lighting; UV, ultraviolet; VOCs, volatile organic compounds]

Analyte	Analytical method	Laboratory and analytical schedule	Citation(s)
		Water-quality indicators	
Field parameters	Calibrated field meters and test kits	USGS field measurement	U.S. Geological Survey, variously dated
Alkalinity, field	Gran titration with advanced speciation	USGS field measurement	Gran, 1952; Stumm and Morgan, 1996; Rounds, 2006
		Organic constituents	
VOCs	Purge and trap capillary gas chromatography/mass spectrometry	NWQL, schedule 2020	Connor and others, 1998
Pesticides and degradates	Solid-phase extraction and gas chromatography/mass spectrometry	NWQL, schedule 2033	Zaugg and others, 1995; Lindley and others, 1996; Madsen and others, 2003; Sandstrom and others, 2001
Polar pesticides and degradates	High-performance liquid chromatography/mass spectrometry	NWQL, schedule 2060	Furlong and others, 2001
Pharmaceuticals	Solid-phase extraction and HPLC/mass spectrometry	NWQL, schedule 2080	Kolpin and others, 2002
Wastewater-indicators	Solid-phase extraction and gas chromatography/mass spectrometry	NWQL, schedule 4433	Zaugg and others, 2002
Dissolved organic carbon	UV-promoted persulfate oxidation and infrared spectrometry	NWQL, lab code 2612	Brenton and Arnett, 1993
		Constituents of special interest	
Perchlorate	Chromatography and mass spectrometry	Montgomery Watson-Harza Laboratory	Hautman and others, 1999
N-Nitrosodimethylamine (NDMA)	Chromatography and mass spectrometry	Montgomery Watson-Harza Laboratory	U.S. Environmental Protection Agency, 1996; U.S. Environmental Protection Agency, 1999b
1,4-Dioxane	Gas chromatography/mass spectrometry	Montgomery Watson-Harza Laboratory	U.S. Environmental Protection Agency, 1996
1,2,3-Trichloropropane	Gas chromatography/electron capture detector	Montgomery Watson-Harza Laboratory	U.S. Environmental Protection Agency, 1995
		Inorganic constituents	
Nutrients	Alkaline persulfate digestion, Kjedahl digestion	NWQL, schedule 2755	Fishman, 1993; Patton and Kryskalla, 2003
Major and minor ions, trace elements and nutrients	Atomic absorption spectrometry, colorimetry, ion-exchange chromatography, inductively-coupled plasma atomic emission spectrometry and mass spectrometry	NWQL, schedule 1948	Fishman and Friedman, 1989; Fishman, 1993; Faires, 1993; McLain, 1993; Garbarino, 1999; Garbarino and Damrau, 2001; American Public Health Association, 1998; Garbarino and others, 2006
Alkalinity, laboratory	Fixed endpoint titration	NWQL Schedule 1948	Fishman and Friedman, 1989
Chromium, arsenic and iron speciation	Various techniques of ultraviolet visible (UV-VIS) spectrophotometry and atomic absorbance spectroscopy	USGS Trace Metal Laboratory, Boulder, Colorado	Stookey, 1970; To and others, 1998; Ball and McCleskey, 2003a and 2003b; McCleskey and others, 2003

Table A1. Methods used to measure organic, inorganic, and microbial constituents analyzed by the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL) and contract laboratories.—Continued

[**Abbreviations:** MI agar, supplemented nutrient agar in which coliforms (total and *Escherichia*) produce distinctly different fluorescence under ultraviolet lighting; UV, ultraviolet; VOCs, volatile organic compounds]

Analyte	Analytical method	Laboratory and analytical schedule	Citation(s)
		Stable isotopes	
Stable isotopes of hydrogen and oxygen in water	Gaseous hydrogen and carbon dioxide-water equilibration and stable-isotope mass spectrometry	USGS Stable Isotope Laboratory, Reston, Virginia	Epstein and Mayeda, 1953; Coplen and others, 1991; Coplen, 1994
Stable isotopes of nitrogen and oxygen in nitrate	Bacterial conversion of nitrate to nitrous oxide and mass spectrometry	USGS Stable Isotope Laboratory, Reston, Virginia, lab code 2900	Sigman and others, 2001; Casciotti and others, 2002
Stable isotopes of nitrogen in nitrogen gas	Gas chromatography and continuous-flow isotope-ratio mass spectrometry on low-pressure headspace (same samples as major dissolved gases)	USGS Stable Isotope Laboratory, Reston, Virginia (research lab)	Modified from Revesz and others, 1999; Tobias and others, 2007
Carbon isotopes in carbonaceous material	Accelerator mass spectrometry	University of Waterloo, Environmental Isotope Lab; University of Arizona Accelerator Mass Spectrometry Laboratory	Donahue and others, 1990; Jull and others, 2004
		Radioactivity and gases	
Tritium	Electrolytic enrichment-liquid scintillation	USGS Stable Isotope and Tritium Laboratory, Menlo Park, California	Thatcher and others, 1977
Tritium and noble gases	Helium-3 in-growth and mass spectrometry	Lawrence Livermore National Laboratory	Moran and others, 2002; Eaton and others, 2004
Standard dissolved gases	Gas chromatography/thermal conductivity detector and flame ionization detector	Reston Chlorofluorocarbon Laboratory	Busenberg and others, 2001
Radon-222	Liquid scintillation counting	NWQL, schedule 1369	American Society for Testing and Materials, 1998
Radium 226/228	Alpha activity counting	Eberline Analytical Services, NWQL method 1262	U.S. Environmental Protection Agency, 1980 (USEPA methods 903 and 904)
Gross alpha and beta radioactivity	Alpha and beta activity counting	Eberline Analytical Services, NWQL method 1792	U.S. Environmental Protection Agency, 1980 (USEPA method 900.0)
		Microbial constituents	
F-specific and somatic coliphage	Single-agar layer (SAL) and two-step enrichment methods	USGS Ohio Water Microbiology Laboratory	U.S. Environmental Protection Agency, 2001
Total and *Escherichia* coliform	Membrane filter technique with "MI agar"	USGS field measurement	U.S. Environmental Protection Agency, 2002b

Table A2. Analytical schedules for constituents appearing on multiple schedules used to analyze samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[Preferred analytical schedules are the most precise and accurate of the methods used to analyze the compound in question. LLNL, Lawrence Livermore National Laboratory; MWH, Montgomery Watson-Harza Laboratory; TML, U.S. Geological Survey Trace Metal Laboratory; CFC, U.S. Geological Survey Chlorofluorocarbon Laboratory; VOC, volatile organic compound]

Constituent	Primary constituent classification	Analytical schedules—preferred listed first (parameter code)	Result tables
Results are reported for all analytical schedules that detect the constituent			
Alkalinity	Water-quality indicator	Field (29802), 1948 (29801)	4
Argon	dissolved gas	LLNL (85563), CFC (82043)	[1]15, 14
Arsenic, total	Trace element	1948 (01000), TML (01000)	11, 12
Atrazine	Pesticide	2033 (39632), 2060 (39632)	6
Bicarbonate	Major ion	Field (63786), 1948 (na[2])	4, 10
Caffeine	Pharmaceutical	[3]2060 (50305), 2080 (50305)	[4]6, 7
Carbaryl	Pesticide	[3]2033 (82680), [3]2060 (49310)	[4]6
Carbofuran	Pesticide	[3]2033 (82674), [3]2060 (49309)	[4]6
Carbonate	Major ion	Field (63786), 1948 (na[2])	4, 10
2-Chloro-4-isopropylamino-6-amino-*s*-triazine {Deethylatrazine}	Degradate	2033 (04040), 2060 (04040)	6
Chromium, total	Trace element	1948 (01030), TML (01030)	11, 12
Iron, total	Trace element	1948 (01046), TML (01046)	11, 12
Metalaxyl	Pesticide	2033 (61596), [3]2060 (50359)	6
Oxygen, dissolved	dissolved gas	Field (00300), CFC (62971)	4, 14
pH	Water-quality indicator	Field (00400), 1948 (00403)	4
Specific conductance	Water-quality indicator	Field (00095), 1948 (90095)	4
Tebuthiuron	Pesticide	2033 (82670), 2060 (82670)	6
1,2,3-Trichloropropane (1,2,3-TCP)	VOC	MWH (77443), [3]2020 (77443)	8, [4]5

[1] Results for argon by LLNL in their units can be converted to milligrams per liter by multiplying the value by 1,784 based on the density of argon gas at standard temperature and pressure.

[2] Bicarbonate and carbonate concentrations (non-preferred method) were calculated from the laboratory measured alkalinity and pH values using the advanced speciation method (http://or.water.usgs.gov/alk/methods.html).

[3] Not detected in Upper Santa Ana Watershed samples by this analytical schedule.

[4] Constituent does not appear on this table because the constituent was not detected by the analytical schedule(s) for which results are reported by this table.

Table A3. Constituents detected in field blanks collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[**Abbreviations:** E, estimated value; pCi/L, picocuries per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; –, not detected; NWQL, USGS National Water Quality Laboratory]

Constituent	Slow schedule			Fast, intermediate, and topical schedules		
	Number of field blank detections/ analyses	Maximum concentration detected in field blanks	Number of ground-water detections censored	Number of field blank detections/ analyses	Maximum concentration detected in field blanks	Number of ground-water detections censored
Organic constituents						
Dissolved organic carbon (mg/L)	2/3	1.4	21	0/0	–	[1]3
N-Nitrosodimethylamine (NDMA) (µg/L)	2/3	0.015	2(all)	0/0	–	0
Volatile organic compounds (µg/L) [unfiltered]						
1,2,4-Trimethylbenzene	1/3	E 0.035	0	0/5	–	0
Acetone	1/3	E 4.0	0	0/5	–	0
2-Butanone (MEK, Methyl ethyl ketone)	1/3	13	0	0/5	–	0
m- and *p*-Xylene	1/3	E 0.020	0	0/5	–	0
Toluene	1/3	E 0.010	1(all)	2/5	E 0.020	4(all)
Pesticides (µg/L) [filtered]						
Atrazine	0/3	–	0	1/4	E 0.005	0
Simazine	0/3	–	0	1/4	E 0.004	1
Potential wastewater indicators (µg/L) [unfiltered][2]						
d-Limonene	0/3	–	0	1/4	E 0.030	1
Inorganic constituents						
Calcium (mg/L)	0/3	–	0	1/2	E 0.013	0
Total nitrogen (mg/L)	0/3	–	0	1/2	0.14	0
Trace elements (µg/L)						
Aluminum	0/3	–	0	1/2	E 1.2	0
Barium	0/3	–	0	1/2	E 0.040	0
Chromium	0/3	–	0	1/2	E 0.10	0
Copper	0/3	–	0	2/2	1.8	15
Lead	0/3	–	0	2/2	0.7	16
Mercury	1/3	E 0.0094	0	0/0	–	0
Zinc	1/3	0.34	2	2/2	3.55	14
Arsenic (TML)[3]	1/3	2.5	0	0/0	–	0
Iron (TML)[3]	2/3	4	0	0/0	–	0
Radioactive constituents(pCi/L)						
Radium-226	2/2	E 0.019	7	0/0	–	0
Radium-228	2/2	E 0.080	5	0/0	–	0

[1] Equipment and sampling method identical for all DOC sampling. Blanks collected at slow wells are equally applicable to fast, intermediate and topical wells.

[2] An additional 18 potential wastewater indicators were detected in a blank that was subsequently determined to have been cross-contaminated at the NWQL.

[3] Analyses made by U.S. Geological Survey Trace Metal Laboratory.

Table A4A. Quality-control summary of replicate analyses of organic and inorganic compounds detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2008.

[**Abbreviations:** RSD, relative standard deviation in percent; np, no pairs with RSDs greater than 20 percent; µg/L, micrograms per liter; mg/L, milligrams per liter; E, estimated; V, reported but not used in summary statistics; <, less than; –, not detected]

Constituent	Number of RSDs greater than 20 percent/ number of replicate pairs	Maximum RSD (percent)	Median of RSDs greater than zero (percent)	Concentrations for replicates with RSD greater than 20 percent (environmental, replicate) (µg/L)
Organic constituents				
Volatile organic compounds from schedule 2020 (µg/L)				
1,2,4-Trimethylbenzene	1/8	119	61	(E 0.05, 0.59)
All other VOCs	0/8	18	2	np
Pesticide and pharmaceutical compounds from schedules 2033, 2060 and 2080 (µg/L)				
Pesticide compounds	0/7	16	3	np
Pharmaceutical compounds	0/7	3	3	np
Potential wastewater indicators from schedule 4433 (µg/L)				
Caffeine	1/7	84	84	(E 0.09, E 0.02)
3,4-Dichlorophenyl isocyanate	1/7	25	25	(E 0.33, E 0.23)
Phenol	1/7	89	89	(E 0.099, 0.023)
Tetrachloroethene	1/7	104	104	(E 0.09, E 0.01)
All other potential wastewater indicators	0/7	–	–	np
Dissolved organic carbon	0/4	1	< 1	np
Inorganic constituents				
Major ions, total dissolved solids, and silica (mg/L)	0/4	7	< 1	np
Trace elements (µg/L)				
Copper	1/4	21	3	(V 1.64, 2.52)
Nickel	1/4	33	9	(E 0.03, 0.06)
Zinc	1/4	20	3	(7.64, 11.44)
All other trace elements	0/4	14	< 1	np
USGS Trace Metals Laboratory (µg/L)				
Iron, total	0/3	6	2	np
Iron(II)	0/3	2	0	np
Arsenic, total	0/3	13	0	np
Arsenic(III)	0/3	–	–	np
Chromium, total	0/3	–	–	np
Chromium(VI)	0/3	–	–	np
Nutrients (mg/L)	0/4	4	< 1	np

Table A4B. Quality-control summary for replicate analyses of constituents of special interest, stable isotopes, dissolved gases, noble gases, and radioactive constituents detected in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2008.

[**Abbreviations:** RSD, relative standard deviation in percent; np, no pairs with RSDs greater than 20 percent; µg/L, micrograms per liter; per mil, per thousand; mg/L, milligrams per liter; cm^3 STP/g, cubic centimeters of gas at standard temperature and pressure per gram of water; pCi/L, picocuries per liter; <, less than; –, not detected]

Constituent	Number of RSDs greater than 20 percent/number of replicate pairs	Maximum RSD (percent)	Median of RSDs greater than zero (percent)	Concentrations for replicates with RSD greater than 20 percent (environmental, replicate) (µg/L)
Constituents of special interest (µg/L)				
Perchlorate	0/8	5	0	np
1,2,3-Trichloropropane	0/3	<1	<1	np
Stable isotopes of water, dissolved nitrate, and dissolved nitrogen gas (per mil)				
δ^2H	0/8	1	<1	np
$\delta^{18}O$	0/8	<1	<1	np
N^{15}/N^{14} in nitrate	0/3	2	2	np
O^{18}/O^{16} in nitrate	0/3	8	5	np
N^{15}/N^{14} in nitrogen gas	4/54	35	5	(0.30, 0.49), (0.19, 0.27), (0.54, 0.39), (0.65, 0.89)
Dissolved gases (mg/L)				
Dissolved Nitrogen	0/3	1	<1	np
Dissolved Argon	0/3	<1	<1	np
Dissolved Oxygen	1/3	27	11	(4.09, 5.99)
Dissolved Carbon dioxide	0/3	6	<1	np
Dissolved Methane	0/3	2	<1	np
Noble gases (cm^3 STP/g)				
Helium-3/Helium-4	0/6	2	1	np
Helium-4	1/6	58	<1	$(4.97 \times 10^{-7}, 1.20 \times 10^{-6})$
Argon	0/6	3	<1	np
Krypton	1/6	42	2	$(1.40 \times 10^{-7}, 2.59 \times 10^{-7})$
Neon	1/6	61	<1	$(1.24 \times 10^{-6}, 3.11 \times 10^{-6})$
Xenon	1/6	34	<1	$(1.24 \times 10^{-8}, 2.32 \times 10^{-8})$
Radioactive constituents				
Radium-226 (pCi/L)	1/2	26	21	(0.087, 0.060)
Radium-228 (pCi/L)	1/2	28	19	(0.611, E 0.408)
Alpha radioactivity, 72-hour count (pCi/L)	0/2	13	9	np
Alpha radioactivity, 30-day count (pCi/L)	0/2	–	–	np
Beta radioactivity, 72-hour count (pCi/L)	1/2	53	28	(E 1.35, E 2.96)
Beta radioactivity, 30-day count (pCi/L)	1/2	20	12	(E 2.7, E 3.6)
Radon-222 (pCi/L)	0/2	5	<1	np
Tritium (pCi/L)	0/3	2	0	np
$\delta^{13}C$ (per mil)	0/3	2	<1	np
Carbon-14 (percent modern)	0/3	<1	<1	np

Table A5A. Quality-control summary of matrix-spike recoveries of volatile organic compounds (VOCs) in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[Acceptable recovery range is between 70 and 130 percent]

Constituent	Number of spike samples	Recovery (percent)		
		Minimum	Maximum	Median
Acetone	7	99	110	105
Acrylonitrile	7	98	110	103
Benzene	7	95	109	100
Bromobenzene	7	87	109	103
Bromochloromethane	7	104	115	109
Bromodichloromethane[1]	7	97	114	107
Bromoform (tribromomethane)[1]	7	98	110	101
2-Butanone (ethyl methyl ketone)	7	92	106	100
Butylbenzene (*n*-Butylbenzene)	7	80	97	91
sec-Butylbenzene	7	91	115	99
tert-Butylbenzene	7	102	120	108
Carbon disulfide	7	68	90	75
Carbon tetrachloride (tetrachloromethane)[1]	7	97	116	106
Chlorobenzene	7	83	108	100
Chloroethane	7	94	117	101
Chloroform (trichloromethane)[1]	7	89	119	113
Chloromethane[1]	7	90	122	116
3-Chloro-1-propene	7	110	136	116
2-Chlorotoluene	7	87	111	103
4-Chlorotoluene	7	87	115	103
Dibromochloromethane[1]	7	95	107	103
1,2-Dibromo-3-chloropropane (DBCP)[1]	7	90	108	104
1,2-Dibromoethane (EDB)	7	95	109	103
Dibromomethane	7	92	115	109
1,2-Dichlorobenzene (*o*-dichlorobenzene)[1]	7	88	109	106
1,3-Dichlorobenzene	7	89	113	105
1,4-Dichlorobenzene (*p*-dichlorobenzene)[1]	7	90	111	101
trans-1,4-Dichloro-2-butene	7	90	101	97
Dichlorodifluoromethane (CFC-12)[1]	7	64	104	81
1,1-Dichloroethane[1]	7	102	116	109
1,2-Dichloroethane[1]	7	99	116	109
1,1-Dichloroethylene (DCE)[1]	7	81	104	93
cis-1,2-Dichloroethylene[1]	7	91	111	101
trans-1,2-Dichloroethylene[1]	7	96	117	104
Dichloromethane (methylene chloride)[1]	7	90	106	103
1,2-Dichloropropane[1]	7	87	105	100
1,3-Dichloropropane	7	92	110	106
2,2-Dichloropropane	7	81	89	84
1,1-Dichloropropene	7	85	109	96
cis-1,3-Dichloropropene	7	74	94	90
trans-1,3-Dichloropropene	7	84	96	93
Diethyl ether	7	80	107	100
Diisopropyl ether	7	84	104	98
Ethylbenzene	7	83	111	103
Ethyl *tert*-butyl ether (ETBE, *tert*-butyl ethyl ether)	7	75	100	93
Ethyl methacrylate	7	71	96	92
o-Ethyl toluene (2-Ethyltoluene)	7	83	106	96
Hexachlorobutadiene	7	74	92	81
Hexachloroethane	7	96	107	102
2-Hexanone (*n*-Butyl methyl ketone)	7	95	109	107
Isopropylbenzene (cumene)	7	89	119	106
4-Isopropyl-1-methylbenzene (*p*-isopropyltoluene)	7	88	110	99
Methyl acrylate (Methyl-2-propenoate)	7	93	104	99
Methyl acrylonitrile	7	104	115	106

Table A5A. Quality-control summary of matrix-spike recoveries of volatile organic compounds (VOCs) in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[Acceptable recovery range is between 70 and 130 percent]

Constituent	Number of spike samples	Recovery (percent)		
		Minimum	Maximum	Median
Methyl bromide (bromomethane)	7	107	141	133
Methyl *tert*-butyl ether (MTBE)[1]	7	75	100	96
Methyl iodide (iodomethane)	7	94	127	121
Methyl methacrylate	7	70	100	93
4-Methyl-2-pentanone (MIBK, isobutyl methyl ketone)	7	87	102	98
Methyl *tert*-pentyl ether	7	81	100	98
Naphthalene	7	80	110	102
n-Propylbenzene	7	87	115	99
Styrene	7	85	106	99
1,1,1,2-Tetrachloroethane	7	93	111	107
1,1,2,2-Tetrachloroethane	7	93	109	103
Tetrachloroethene (PCE)[1]	7	89	113	100
Tetrahydrofuran	7	90	118	109
1,2,3,4-Tetramethylbenzene	7	77	110	103
1,2,3,5-Tetramethylbenzene (isodurene)	7	85	113	108
Toluene[2]	7	90	108	101
1,2,3-Trichlorobenzene	7	85	113	105
1,2,4-Trichlorobenzene	7	77	106	95
1,1,1-Trichloroethane (TCA)[1]	7	96	115	111
1,1,2-Trichloroethane	7	96	113	106
Trichloroethene (TCE)[1]	7	81	105	100
Trichlorofluoromethane (CFC-11)[1]	7	68	123	108
1,2,3-Trichloropropane (1,2,3-TCP)	7	96	111	103
1,1,2-Trichlorotrifluoroethane (CFC-113)[1]	7	71	96	82
1,2,3-Trimethylbenzene	7	95	108	105
1,2,4-Trimethylbenzene[1]	7	94	119	105
1,3,5-Trimethylbenzene	7	94	115	101
Vinyl bromide (Bromoethene)	7	106	128	115
Vinyl chloride	7	94	138	112
m- and *p*-Xylene	7	96	115	104
o-Xylene	7	81	106	99

[1] Constituents detected in ground-water samples.

[2] Detections of toluene in ground-water samples could be entirely attributed to contamination.

Table A5B. Quality-control summary of matrix-spike recoveries of polar pesticides and pesticide degradates (lab analytical schedule 2060) in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[Acceptable recovery range is between 70 and 130 percent]

Constituent	Number of spike samples	Recovery (percent)		
		Minimum	Maximum	Median
Acifluorfen	6	31	85	67
Aldicarb	6	24	76	55
Aldicarb sulfone	6	29	79	48
Aldicarb sulfoxide	6	88	116	98
Atrazine[1]	6	82	102	93
Bendiocarb	6	67	102	79
Benomyl	6	63	86	75
Bensulfuron-methyl	6	94	121	108
Bentazon	6	48	75	61
Bromacil[1]	6	72	142	107
Bromoxynil[1]	6	32	55	44
Caffeine	6	68	106	89
Carbaryl	6	82	105	91
Carbofuran	6	79	93	90
Chloramben methyl ester	6	76	113	88
Chlorimuron-ethyl	6	76	109	91
2-Chloro-4-isopropylamino-6-amino-*s*-triazine (Deethylatrazine, CIAT)[1]	6	43	82	66
2-Choro-6-ethylamino-4-amino-*s*-triazine (Deisopropylatrazine, CEAT)[1]	6	56	87	77
3-(4-Chlorophenyl)-1-methyl urea[1]	6	47	84	68
Clopyralid	6	32	72	54
Cycloate	6	64	98	79
2,4-D (2,4-Dichlorophenoxyacetic acid)	6	64	90	77
2,4-D methyl ester (2,4-Dichlorophenoxyacetic acid methyl ester)	6	77	102	81
2,4-DB (4-(2,4-Dichlorophenoxy)butyric acid)	6	36	58	54
DCPA (Dacthal) monoacid	6	56	87	75
Dicamba	6	44	72	57
Dichlorprop	6	60	87	73
Dinoseb[1]	6	36	72	56
Diphenamid[1]	6	84	102	90
Diuron[1]	6	84	98	89
Fenuron	6	76	105	87
Flumetsulam	6	52	128	110
Fluometuron	6	84	105	94
2-Hydroxy-4-isopropylamino-6-ethylamino-*s*-triazine (Hydroxyatrazine)[1]	6	84	103	97
3-Hydroxy carbofuran	6	70	113	88
Imazaquin	6	79	109	92
Imazethapyr[1]	6	78	117	93
Imidacloprid	6	51	123	100
Linuron	6	80	94	89
MCPA (2-Methyl-4-chlorophenoxyacetic acid)	6	52	76	69
MCPB (4-(2-Methyl-4-chlorophenoxy) butyric acid)	6	36	58	50
Metalaxyl	6	89	109	90
Methiocarb	6	78	97	89
Methomyl	6	90	110	97
Metsulfuron methyl	6	28	124	70
Neburon	6	84	109	90
Nicosulfuron	6	76	225	134
Norflurazon[1]	6	87	109	97
Oryzalin	6	71	98	82

Table A5B. Quality-control summary of matrix-spike recoveries of polar pesticides and pesticide degradates (lab analytical schedule 2060) in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[Acceptable recovery range is between 70 and 130 percent]

Constituent	Number of spike samples	Recovery (percent)		
		Minimum	Maximum	Median
Oxamyl	6	72	121	89
Picloram	6	54	729	62
Propham	6	86	112	95
Propiconazole	6	76	113	94
Propoxur (Baygon)	6	88	103	93
Siduron[1]	6	88	107	94
Sulfometuron methyl	6	84	121	106
Tebuthiuron[1]	6	85	129	103
Terbacil	6	71	125	97
Triclopyr	6	56	92	81

[1] Constituents detected in ground-water samples.

Table A5C. Quality-control summary of matrix-spike recoveries of pesticides and pesticide degradates (lab analytical schedule 2033) in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[Acceptable recovery range is between 70 and 130 percent]

Constituent	Number of spike samples	Recovery (percent)		
		Minimum	Maximum	Median
Acetochlor	6	86	112	98
Alachlor	6	94	108	99
Atrazine[1]	6	93	103	97
Azinphos-methyl	6	80	118	87
Azinphos-methyl-oxon	6	38	73	57
Benfluralin	6	47	71	56
Carbaryl	6	95	127	113
Carbofuran	6	88	100	95
2-Chloro-2,6-diethylacetanilide	6	87	101	93
4-Chloro-2-methylphenol	6	58	73	64
Chlorpyrifos	6	82	97	89
Chlorpyrofos, oxygen analog	6	10	55	22
Cyanazine	6	78	106	95
Cyfluthrin	6	35	61	37
λ-Cyhalothrin	6	25	45	27
Cypermethrin	6	34	65	38
DCPA (Dacthal)[1]	6	91	107	97
Deethylatrazine (2-Chloro-4-isopropylamino-6-amino-*s*-triazine)[1]	6	41	52	47
Desulfinylfipronil[1]	6	76	103	87
Desulfinylfipronil amide[1]	6	55	109	77
Diazinon	6	88	97	94
Diazon oxon	6	57	100	75
3,4-Dichloroaniline[1]	6	72	85	78
3,5-Dichloroaniline	6	76	91	86
Dichlorvos	6	10	27	17
Dicrotophos	6	28	39	35
Dieldrin	6	84	120	99
2,6-Diethylaniline	6	89	96	93
Dimethoate	6	26	41	35
Disulfoton	6	44	82	64
Disulfoton sulfone	6	72	109	96
α-Endosulfan	6	76	87	80
Endosulfan sulfate	6	71	92	84
EPTC	6	84	95	93
Ethion	6	61	91	72
Ethion monoxon	6	58	109	87
Ethoprop	6	77	130	108
2-Ethyl-6-methylaniline	6	84	95	91
Fenamiphos	6	52	127	75
Fenamiphos sulfone	6	47	95	61
Fenamiphos sulfoxide	6	34	43	37
Fipronil[1]	6	63	118	82
Fipronil sulfide[1]	6	65	95	76
Fipronil sulfone	6	51	81	61
Fonofos	6	81	96	87
Hexazinone	6	54	84	65
Iprodione	6	67	78	74
Isofenphos	6	83	118	98
Malaoxon	6	65	103	88
Malathion	6	88	106	96
Metalaxyl[1]	6	93	101	96
Methidathion	6	75	105	93
Metolachlor[1]	6	97	110	105

Table A5C. Quality-control summary of matrix-spike recoveries of pesticides and pesticide degradates (lab analytical schedule 2033) in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[Acceptable recovery range is between 70 and 130 percent]

Constituent	Number of spike samples	Recovery (percent)		
		Minimum	Maximum	Median
Metribuzin	6	70	85	79
Molinate	6	87	102	96
Myclobutanil	6	76	104	88
1-Naphthol	6	14	36	20
Oxyfluorfen	6	42	56	48
Paraoxon-methyl	6	32	54	43
Parathion-methyl	6	62	93	80
Pendimethalin[1]	6	59	120	77
cis-Permethrin	6	37	71	43
Phorate	6	57	80	70
Phorate oxygen analog	6	49	127	86
Phosmet	6	12	22	17
Phosmet oxon	6	9	18	11
Prometon[1]	6	84	100	90
Prometryn	6	87	112	102
Pronamide	6	90	102	93
Propanil	6	87	134	101
Propargite	6	59	82	66
cis-Propiconazole	6	20	26	23
trans-Propiconazole	6	57	82	67
Simazine[1]	6	86	110	95
Tebuconazole	6	48	69	57
Tebuthiuron[1]	6	74	145	95
Tefluthrin	6	25	47	29
Terbufos	6	74	135	90
Terbufos oxygen analog sulfone	6	51	91	66
Terbuthylazine	6	95	108	98
Thiobencarb	6	107	120	118
Tribufos	6	41	80	55
Trifluralin	6	52	77	61

[1] Constituents detected in ground-water samples.

Table A5D. Quality-control summary of matrix-spike recoveries of pharmaceutical compounds in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[Acceptable recovery range is between 70 and 130 percent]

Constituent	Number of spike samples	Recovery (percent)		
		Minimum	Maximum	Median
Acetaminophen[1]	6	55	113	64
Caffeine[1]	6	78	108	80
Carbamazepine[1]	6	70	115	85
Codeine	6	81	107	92
Cotinine	6	80	94	89
Dehydronifedipine	6	47	92	72
Diltiazem	6	3	54	15
1,7-Dimethylxanthine[1]	6	62	95	74
Diphenhydramine	6	29	65	55
Salbutamol (albuterol)	6	60	129	77
Sulfamethoxazole	6	17	62	52
Thiabendazole	6	16	80	72
Trimethoprim	6	85	106	94
Warfarin	6	19	62	44

[1] Constituents detected in ground-water samples.

Table A5E. Quality-control summary of matrix-spike recoveries of wastewater indicator compounds in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[Acceptable recovery range is between 70 and 130 percent]

Constituent	Number of spike samples	Recovery (percent)		
		Minimum	Maximum	Median
Acetophenone	6	56	83	64
Acetyl hexamethyl tetrahydronaphthalene (AHTN)	6	63	85	75
Anthracene	6	58	76	63
Anthraquinone	6	49	86	64
Atrazine	6	62	78	74
Benzo[a]pyrene	6	51	68	57
Benzophenone	6	51	81	66
Bisphenol A	6	71	98	75
bis(2-Ethylhexyl) phthalate	6	0	379	83
Bromacil	6	54	77	67
Bromoform (tribromomethane)	6	49	65	58
3-*tert*-Butyl-4-hydroxy anisole (BHA)	6	28	57	38
Caffeine	6	60	74	68
Camphor	6	60	79	66
Carbaryl	6	47	89	66
Carbazole	6	67	78	71
Chlorpyrifos	6	61	76	67
Cholesterol	6	36	64	47
3-*beta*-Coprostanol	6	40	73	55
Cotinine	6	24	44	33
para-Cresol	6	54	76	65
4-Cumylphenol	6	63	73	68
N,N-diethyl-*m*-toluamide (DEET)	6	54	82	68
1,4-Dichlorobenzene	6	37	68	49
3,4- Dichlorophenyl isocyanate	6	39	233	90
Dichlorvos	6	45	76	56
Diethyl phthalate	6	63	84	73
2,6-Dimethylnaphthalene	6	57	74	65
Diazinon	6	55	62	62
4-Nonylphenol diethoxylates	6	58	90	68
4-Octylphenol diethoxylates	6	52	95	62
Nonylphenol, monoethoxylates (total)	6	62	85	71
4-Octylphenol monoethoxylates	6	46	70	56
Fluoranthene	6	67	86	75
Hexahydrohexamethylcyclopentabenzopyran (HHCB)	6	64	85	71
Indole	6	50	68	60
Isoborneol	6	57	76	65
Isophorone	6	54	77	60
Isopropylbenzene	6	18	58	32
Isoquinoline	6	5	59	51
d-Limonene	6	7	44	21
Menthol	6	53	84	69
Metalaxyl	6	64	80	67
3-Methyl-1(H)-indole (Skatole)	6	57	77	67
5-Methyl-1H-benzotriazole	6	43	79	56
1-Methylnaphthalene	6	60	73	66
2-Methylnaphthalene	6	55	71	65
Methyl salicylate	6	65	89	72
Metolachlor	6	59	79	68
Naphthalene	6	62	71	67
para-Nonylphenol (total)	6	68	87	74
4-*n*-Octylphenol	6	51	75	65
4-*tert*-Octylphenol	6	66	83	73

Table A5E. Quality-control summary of matrix-spike recoveries of wastewater indicator compounds in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.—Continued

[Acceptable recovery range is between 70 and 130 percent]

Constituent	Number of spike samples	Recovery (percent)		
		Minimum	Maximum	Median
Pentachlorophenol	6	52	100	74
Phenanthrene	6	64	78	68
Phenol	6	55	80	62
Prometon	6	52	75	61
Pyrene	6	65	80	71
beta-Sitosterol	3	59	66	61
beta-Stigmastanol	4	53	68	61
2,2',4,4'- Tetrabromodiphenyl ether	1	9	9	9
Tetrachloroethylene (PCE)	6	11	45	20
Tributyl phosphate	6	50	76	61
Triclosan	6	61	98	71
Triethyl citrate (ethyl citrate)	6	57	81	65
Triphenyl phosphate	6	57	82	65
Tris(2-butoxyethyl)phosphate	6	51	88	56
Tris(2-chloroethyl)phosphate	6	61	76	66
Tris(dichlorisopropyl)phosphate	6	56	84	66

Table A5F. Quality-control summary of matrix-spike recoveries of 1,4-Dioxane, 1,2,3-Trichloropropane, and *N*-Nitrosodimethylamine in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[Acceptable recovery range is between 70 and 130 percent]

Constituent	Number of spike samples	Recovery (percent)		
		Minimum	Maximum	Median
1,4-Dioxane	1	69	69	69
1,2,3-Trichloropropane (TCP)[1]	2	90	95	93
N-Nitrosodimethylamine (NDMA)[2]	2	98	99	99

[1] Constituent detected in ground-water samples.

[2] The constituent detected in one ground-water sample could be attributed to contamination.

Table A5G. Quality-control summary of matrix-spike recoveries of radioactive constituents in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[Acceptable recovery range is between 70 and 130 percent. All constituents were detected in ground-water samples]

Constituent	Number of spike samples	Recovery (percent)		
		Minimum recovery (percent)	Maximum recovery (percent)	Median recovery (percent)
Gross-alpha radioactivity, 72 hr count	2	84	92	88
Gross-alpha radioactivity, 30 day count	2	90	114	102
Gross-beta radioactivity, 72 hr count	2	93	101	97
Gross-beta radioactivity, 30 day count	2	91	93	92
Radium-226	1	96	96	96
Radium-228	1	106	106	106

Table A6. Quality-control summary for surrogate recoveries of volatile organic compounds, pesticides and pesticide degradates, pharmaceutical compounds, wastewater-indicator compounds, and constituents of special interest in samples collected for the Upper Santa Ana Watershed Groundwater Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[MWH, Montgomery Watson-Harza Laboratory (special interest constituents); VOC, volatile organic compound; 1,2,3-TCP, 1,2,3-trichloropropane; NDMA, *N*-nitrosodimethylamine]

Surrogate	Analytical schedule	Constituent or constituent class analyzed	Number of blank analyses	Median recovery in blanks (percent)	Number of surrogate recoveries		Number of sample analyses	Median recovery in samples (percent)	Number of surrogate recoveries	
					Below 70 percent in blanks	Above 130 percent in blanks			Below 70 percent in samples	Above 130 percent in samples
1-Bromo-4-fluorobenzene	2020	VOC	8	75	0	0	99	73	22	0
1,2-Dichloroethane-d4	2020	VOC	8	120	0	2	99	128	0	43
Toluene-d8	2020	VOC	8	96	0	0	99	96	0	0
Diazinon-d10	2033	Pesticide	7	103	0	0	92	102	5	0
alpha-HCH-d6	2033	Pesticide	7	92	0	0	92	90	0	0
Barban	2060	Polar pesticide	6	86	0	0	92	86	3	0
Caffeine-^{13}C	2060	Polar pesticide	6	108	0	1	92	94	12	2
2,4,5-T	2060	Polar pesticide	6	74	1	0	92	70	45	0
Ethyl nicotinate-d4	2080	Pharmaceutical	7	93	0	0	92	90	0	0
Carbamazepine-d10	2080	Pharmaceutical	7	100	0	0	92	103	0	4
Bisphenol A-d3	4433	Potential wastewater-indicator	7	43	5	0	95	73	44	0
Caffeine-^{13}C	4433	Potential wastewater-indicator	7	62	5	0	95	78	31	0
Decafluorobiphenyl	4433	Potential wastewater-indicator	7	53	7	0	95	61	79	0
Fluoranthene-d10	4433	Potential wastewater-indicator	7	91	2	0	95	90	7	0
Toluene-d8	MWH	1,2,3-TCP	3	101	0	0	32	101	0	0
NDMA-d6	MWH	NDMA	3	95	1	0	32	92	3	0
Nitrobenzene-d5	MWH	1,4-Dioxane	3	78	0	0	32	76	5	0
Terphenyl-d14	MWH	1,4-Dioxane	3	63	2	0	32	56	25	0

Table A7A. Quality-control summary for laboratory "set blanks" for pharmaceutical compounds corresponding to analyses of samples collected for the Upper Santa Ana Watershed Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[µg/L, micrograms per liter; E, estimated value]

Constituent	Number of detections in 20 set blank analyses	Maximum concentration detected in set blank samples (µg/L)	Minimum concentration detected in ground-water samples (µg/L)	Number of ground-water samples censored
Acetaminophen[1]	2	E 0.002	E 0.015	0
Albuterol	1	E 0.0002	Not detected	0
Caffeine[1]	4	E 0.004	E 0.011	0
Carbamazepine[1]	1	E 0.0003	0.032	0
Codeine	0			
Cotinine	8	E 0.017	Not detected	0
Dehydronifedipine	1	E 0.0004	Not detected	0
Diltiazem	0			
1,7-dimethylxanthine[1]	0			
Diphenhydramine	1	E 0.0005	Not detected	0
Sulfamethoxazole	0			
Thiabendazole	1	E 0.0003	Not detected	0
Trimethoprim	1	E 0.0003	Not detected	0
Warfarin	0			

[1] Constituents detected in ground-water samples.

Table A7B. Quality-control summary for laboratory "set spikes" for pharmaceutical compounds corresponding to analyses of samples collected for the Upper Santa Ana Watershed Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, November 2006 to March 2007.

[Acceptable recovery range is between 70 and 130 percent]

Constituent	Number of set spike samples	Recovery (percent)		
		Minimum	Maximum	Median
Acetaminophen[1]	20	72	143	99
Albuterol	20	76	126	104
Caffeine[1]	20	85	135	103
Carbamazapine[1]	20	63	120	96
Codeine	20	67	100	85
Cotinine	20	87	114	96
Dehydronifedipine	20	49	98	70
Diltiazem	20	1	51	12
1,7-dimethylxanthine[1]	20	77	133	108
Diphenhydramine	20	49	79	57
Sulfamethoxazole	20	47	105	67
Thiabendazole	20	75	109	91
Trimethoprim	20	73	112	100
Warfarin	20	10	55	24

[1] Constituents detected in ground-water samples.

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