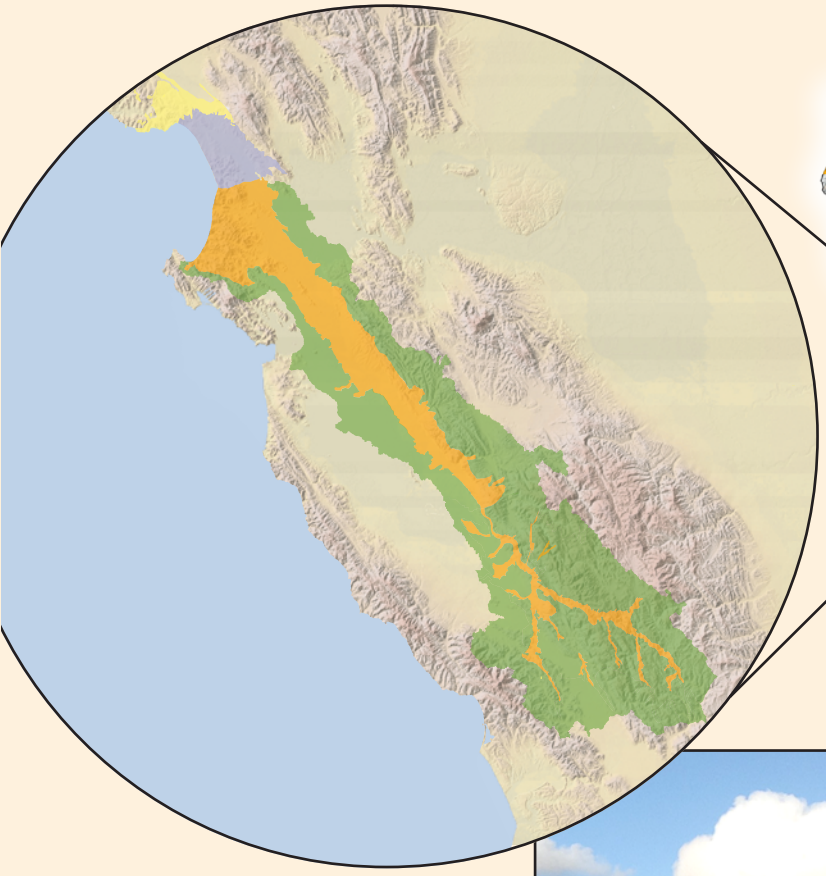
USGS
science for a changing world

CALIFORNIA
Water Boards

Prepared in cooperation with the California State Water Resources Control Board

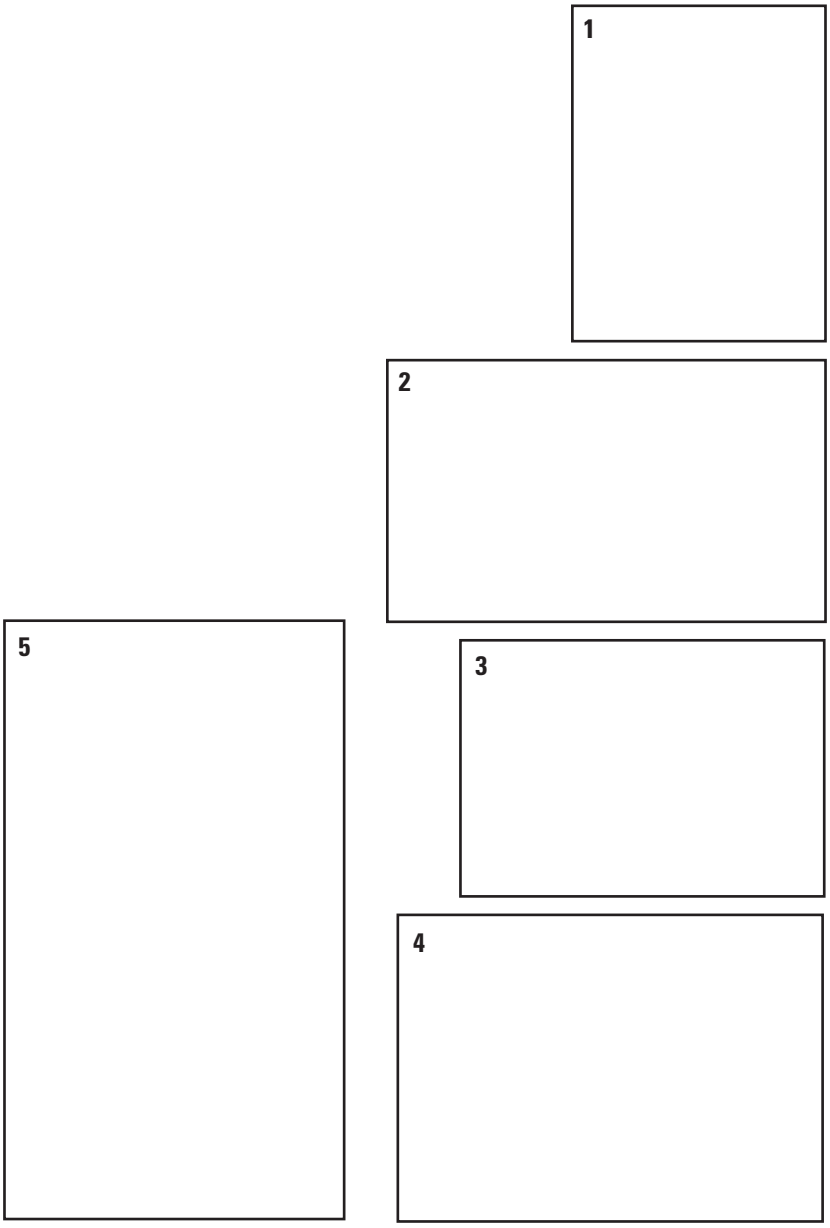
Groundwater-Quality Data in the Monterey–Salinas Shallow Aquifer Study Unit, 2013: Results from the California GAMA Program



Data Series 987

U.S. Department of the Interior
U.S. Geological Survey

Cover photographs



Cover. **1.** Well near Santa Cruz, California. (Photograph taken by Christine Lawrence, U.S. Geological Survey.)

2. Field near Pajaro, California. (Photograph taken by George L. Bennett, U.S. Geological Survey.)

3. Salinas Valley, California. (Photograph taken by George L. Bennett, U.S. Geological Survey.)

4. Well near Santa Margarita, California. (Photograph taken by Dara A. Goldrath, U.S. Geological Survey.)

5. Salinas Valley, California. (Photograph taken by George L. Bennett, U.S. Geological Survey.)

Groundwater-Quality Data in the Monterey–Salinas Shallow Aquifer Study Unit, 2013: Results from the California GAMA Program

By Dara A. Goldrath, Justin T. Kulongoski, and Tracy A. Davis

Prepared in cooperation with the California State Water Resources Control Board

Data Series 987

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
SALLY JEWELL, Secretary

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

U.S. Geological Survey, Reston, Virginia: 2016

For more information on the USGS—the Federal source for science about the Earth, its natural and living resources, natural hazards, and the environment—visit http://www.usgs.gov or call 1–888–ASK–USGS.

For an overview of USGS information products, including maps, imagery, and publications, visit http://www.usgs.gov/pubprod/.

Suggested citation:
Goldrath, D.A., Kulongoski, J.T., and Davis, T.A., 2015, Groundwater-quality data in the Monterey–Salinas shallow aquifer study unit, 2013: Results from the California GAMA Program: U.S. Geological Survey Data Series 987, 138 p., http://dx.doi.org/10.3133/ds987.

ISSN 2327-638X (online)

Contents

Figures

Tables

Tables—Continued

Tables—Continued

Tables—Continued

Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
quart (qt)	0.95	liter (L)
ounce, avoirdupois (oz)	28.35	gram (g)
pound, avoirdupois (lb)	0.4536	kilogram (kg)

SI to Inch/foot/mile

Multiply	By	To obtain
centimeter (cm)	0.3937	inch (in.)
meter (m)	3.28	foot (ft)
kilometer (km)	0.6214	mile (mi)
square kilometer (km^2)	0.3861	square mile (mi^2)
liter (L)	1.0567	quart (qt)
gram (g)	0.03527	ounce, avoirdupois (oz)
kilogram (kg)	2.205	pound, avoirdupois (lb)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as °F = (1.8 × °C) + 32.

Supplemental Information

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 in either milligrams per liter (mg/L) or micrograms per liter (µg/L). Milligrams per liter is equivalent to parts per million (ppm), and micrograms per liter is equivalent to parts per billion (ppb).

Activities for radioactive constituents in water are given in picocuries per liter (pCi/L).

Delta notation ($\delta^i E$) represents the ratio of a heavier isotope of an element (δ) to the more common lighter isotope of that element, relative to a standard reference material, expressed as per mil.

Datum

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Abbreviations and Acronyms

AL-US	action level (USEPA)
BBP	Blind Blank Program
BQS	Branch of Quality Systems (USGS)
CDWR	California Department of Water Resources
DDW	State Water Resources Control Board-Division of Drinking Water (formerly the Department of Public Health, or CDPH)
GAMA	Groundwater Ambient Monitoring and Assessment Program
GPS	Global Positioning System
HAL-US	lifetime health-advisory level (USEPA)
HBSL	health-based screening level
IBSP	Inorganic Blind Sample Project
LLNL	Lawrence Livermore National Laboratory
LRL	laboratory reporting level
LT-MDL	long-term method detection level
MCL-CA	maximum contaminant level (SWRCB-DDW)
MCL-US	maximum contaminant level (USEPA)
MDL	method detection limit
MRL	minimum reporting level
MS-SA	Monterey–Salinas Shallow Aquifer study unit
MU	method uncertainty
N	Normal (1-gram-equivalent per liter of solution)
NAD	normalized absolute difference
NAWQA	National Water Quality Assessment Program (USGS)
NDMA	*N*-nitrosodimethylamine
NFM	National Field Manual (USGS)
NL-CA	notification level (SWRCB-DDW)
NWIS	National Water Information System (USGS)
NWQL	National Water Quality Laboratory (USGS)
PBP	Priority Basin Project (GAMA)

Abbreviations and Acronyms—Continued

PCFF	Personal Computer Field Form program designed for USGS sampling
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RL	reporting level
RSD	relative standard deviation
RSD5-US	USEPA risk-specific dose at a risk factor of 10-5 (USEPA)
SC	specific conductance
SD	standard deviation
SMCL-CA	Secondary Maximum Contaminant Level (SWRCB-DDW)
SMCL-US	Secondary Maximum Contaminant Level (USEPA)
S-MS-H	Monterey–Salinas Shallow Aquifer study unit Highlands study area
S-MS-P	Monterey–Salinas Shallow Aquifer study unit Pajaro study area
S-MS-SC	Monterey–Salinas Shallow Aquifer study unit Santa Cruz study area
S-MS-SV	Monterey–Salinas Shallow Aquifer study unit Salinas Valley study area
SRL	study reporting level (concentration cutoff for applying the ≤ symbol in reporting results)
ssL_C	sample-specific critical level
SWRCB-DDW	California State Water Resources Control Board-Division of Drinking Water
TDS	total dissolved solids
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	volatile organic compound
WCR	well-completion report

Acknowledgments

The author thanks the following cooperators for their support: the California State Water Resources Control Board, California Department of Water Resources, and Lawrence Livermore National Laboratory. We especially thank the well owners for allowing the U.S. Geological Survey to collect samples from their wells.

Thank you to Christine J. Lawrence of the U.S. Geological Survey for obtaining sample permissions, project support, and encouragement.

Groundwater-Quality Data in the Monterey–Salinas Shallow Aquifer Study Unit, 2013: Results from the California GAMA Program

By Dara A. Goldrath, Justin T. Kulongoski, and Tracy A. Davis

Abstract

Groundwater quality in the 3,016-square-mile Monterey–Salinas Shallow Aquifer study unit was investigated by the U.S. Geological Survey (USGS) from October 2012 to May 2013 as part of the California State Water Resources Control Board Groundwater Ambient Monitoring and Assessment (GAMA) Program's Priority Basin Project. The GAMA Monterey–Salinas Shallow Aquifer study was designed to provide a spatially unbiased assessment of untreated-groundwater quality in the shallow-aquifer systems in parts of Monterey and San Luis Obispo Counties and to facilitate statistically consistent comparisons of untreated-groundwater quality throughout California. The shallow-aquifer system in the Monterey–Salinas Shallow Aquifer study unit was defined as those parts of the aquifer system shallower than the perforated depth intervals of public-supply wells, which generally corresponds to the part of the aquifer system used by domestic wells. Groundwater quality in the shallow aquifers can differ from the quality in the deeper water-bearing zones; shallow groundwater can be more vulnerable to surficial contamination.

Samples were collected from 170 sites that were selected by using a spatially distributed, randomized grid-based method. The study unit was divided into 4 study areas, each study area was divided into grid cells, and 1 well was sampled in each of the 100 grid cells (grid wells). The grid wells were domestic wells or wells with screen depths similar to those in nearby domestic wells. A greater spatial density of data was achieved in 2 of the study areas by dividing grid cells in those study areas into subcells, and in 70 subcells, samples were collected from exterior faucets at sites where there were domestic wells or wells with screen depths similar to those in nearby domestic wells (shallow-well tap sites).

Field water-quality indicators (dissolved oxygen, water temperature, pH, and specific conductance) were measured, and samples for analysis of inorganic constituents (trace elements, nutrients, major and minor ions, silica, total dissolved solids, and alkalinity) were collected at all 170 sites. In addition to these constituents, the samples from grid wells were analyzed for organic constituents (volatile organic compounds, pesticides and pesticide degradates), constituents of special interest (perchlorate and *N*-nitrosodimethylamine, or NDMA), radioactive constituents (radon-222 and gross-alpha and gross-beta radioactivity), and geochemical and age-dating tracers (stable isotopes of carbon in dissolved inorganic carbon, carbon-14 abundances, stable isotopes of hydrogen and oxygen in water, and tritium activities).

Three types of quality-control samples (blanks, replicates, and matrix spikes) were collected at up to 11 percent of the wells in the Monterey–Salinas Shallow Aquifer study unit, and the results for these samples were used to evaluate the quality of the data from the groundwater samples. With the exception of trace elements, blanks rarely contained detectable concentrations of any constituent, indicating that contamination from sample-collection procedures was not a significant source of bias in the data for the groundwater samples. Low concentrations of some trace elements were detected in blanks; therefore, the data were re-censored at higher reporting levels. Replicate samples generally were within the limits of acceptable analytical reproducibility. The median values of matrix-spike recoveries were within the acceptable range (70 to 130 percent) for the volatile organic compounds (VOCs) and *N*-nitrosodimethylamine (NDMA), but were only approximately 64 percent for pesticides and pesticide degradates.

The sample-collection protocols used in this study were designed to obtain representative samples of groundwater. The quality of groundwater can differ from the quality of drinking water because water chemistry can change as a result of contact with plumbing systems or the atmosphere; because of treatment, disinfection, or blending with water from other sources; or some combination of these. Water quality in domestic wells is not regulated in California, however, to provide context for the water-quality data presented in this report, results were compared to benchmarks established for drinking-water quality. The primary comparison benchmarks were maximum contaminant levels established by the U.S. Environmental Protection Agency and the State of California (MCL-US and MCL-CA, respectively). Non-regulatory benchmarks were used for constituents without maximum contaminant levels (MCLs), including Health

Based Screening Levels (HBSLs) developed by the USGS and State of California secondary maximum contaminant levels (SMCL-CA) and notification levels. Most constituents detected in samples from the Monterey–Salinas Shallow Aquifer study unit had concentrations less than their respective benchmarks.

Of the 148 organic constituents analyzed in the 100 grid-well samples, 38 were detected, and all concentrations were less than the benchmarks. Volatile organic compounds were detected in 26 of the grid wells, and pesticides and pesticide degradates were detected in 28 grid wells. The special-interest constituent NDMA was detected above the HBSL in three samples, one of which also had a perchlorate concentration greater than the MCL-CA.

Of the inorganic constituents, 6 were detected at concentrations above their respective MCL benchmarks in grid-well samples: arsenic (5 grid wells above the MCL of 10 micrograms per liter, µg/L), selenium (3 grid wells, MCL of 50 µg/L), uranium (4 grid wells, MCL of 30 µg/L), nitrate (16 grid wells, MCL of 10 milligrams per liter, mg/L), adjusted gross alpha particle activity (10 grid wells, MCL of 15 picocuries per liter, pCi/L), and gross beta particle activity (1 grid well, MCL of 50 pCi/L). An additional 4 inorganic constituents were detected at concentrations above their respective HBSL benchmarks in grid-well samples: boron (1 grid well above the HBSL of 6,000 µg/L), manganese (8 grid wells, HBSL of 300 µg/L), molybdenum (6 grid wells, HBSL of 40 µg/L), and strontium (6 grid wells, HBSL of 4,000 µg/L). Of the inorganic constituents, 4 were detected at concentrations above their non-health based SMCL benchmarks in grid-well samples: iron (9 grid wells above the SMCL of 300 µg/L), chloride (7 grid wells, SMCL of 500 mg/L), sulfate (14 grid wells, SMCL of 500 mg/L), and total dissolved solids (27 grid wells, SMCL of 1,000 mg/L).

Of the inorganic constituents analyzed in the 70 shallow-well tap sites, 10 were detected at concentrations above the benchmarks. Of the inorganic constituents, 3 were detected at concentrations above their respective MCL benchmarks in shallow-well tap sites: arsenic (2 shallow-well tap sites above the MCL of 10 µg/L), uranium (2 shallow-well tap sites, MCL of 30 µg/L), and nitrate (24 shallow-well tap sites, MCL of 10 mg/L). An additional 3 inorganic constituents were detected above their respective HBSL benchmarks in shallow-well tap sites: manganese (4 shallow-well tap sites above the HBSL of 300 µg/L), molybdenum (4 shallow-well tap sites, HBSL of 40 µg/L), and zinc (2 shallow-well tap sites, HBSL of 2,000 µg/L). Of the inorganic constituents, 4 were detected at concentrations above their non-health based SMCL benchmarks in shallow-well tap sites: iron (6 shallow-well tap sites above the SMCL of 300 µg/L), chloride (1 shallow-well tap site, SMCL of 500 mg/L), sulfate (9 shallow-well tap sites, SMCL of 500 mg/L), and total dissolved solids (15 shallow-well tap sites, SMCL of 1,000 mg/L).

Introduction

About one-half of the water used for the public and domestic drinking-water supply in California is groundwater (Kenny and others, 2009). To assess the quality of ambient groundwater in aquifers drinking-water supply, establish a baseline groundwater-quality monitoring program, and increase the availability of groundwater-quality data to the public, the California State Water Resources Control Board (SWRCB), in cooperation with the U.S. Geological Survey (USGS) and Lawrence Livermore National Laboratory (LLNL), implemented the Groundwater Ambient Monitoring and Assessment (GAMA) Program (California State Water Resources Control Board, 2015, at http://www.waterboards.ca.gov/water_issues/programs/gama/) in 2000 in response to a legislative mandate (State of California, 2001a, 2001b).

The GAMA Program currently consists of four projects: (1) the GAMA Priority Basin Project (PBP), led by the USGS (U.S. Geological Survey, 2015, California Water Science Center website at http://ca.water.usgs.gov/gama/); (2) the GAMA Domestic Well Project, led by the SWRCB; (3) GAMA Special Studies, led by LLNL; and (4) the GeoTracker GAMA publicly accessible on-line groundwater-information system, led by the SWRCB. The first phase of the GAMA-PBP (2004–12) is focused on groundwater used for public drinking-water supply, which is typically the deeper part of an aquifer system in a groundwater basin. The second phase of the GAMA-PBP (the subject of this report) is focused on the shallow-aquifer system typically used by domestic and small-system wells. The GAMA Domestic Well Project samples domestic wells in selected counties, and the GAMA Special Studies Project uses research methods to help explain the source, fate, transport, and presence of chemicals that can affect groundwater quality. The GeoTracker GAMA stores all data collected for the GAMA Program; groundwater-quality data and related reports collected by other State agencies, such as the State Water Resources Control Board-Division of Drinking Water (DDW; formerly the Department of Public Health, or CDPH), California Department of Water Resources (CDWR), California Department of Pesticide Regulation (CDPR); and data collected from environmental monitoring wells at contaminated or remediated sites by the SWRCB and regional boards.

The GAMA-PBP was initiated in response to the Groundwater Quality Monitoring Act of 2001 to assess and monitor the quality of groundwater in California (State of California, 2001b). For the first phase of the GAMA-PBP, the USGS, in collaboration with the SWRCB, developed a monitoring plan to assess groundwater resources used for public drinking-water supply through statistically reliable sampling approaches (Belitz and others, 2003; California State Water Resources Control Board, 2003). Groundwater basins and areas outside of basins were prioritized for sampling primarily on the basis of the distribution of wells listed in the State of California's database of public-supply wells. (The Drinking Water Program that regulates public-supply wells was transferred from the California Department of Public Health to the SWRCB Division of Drinking Water on July 1, 2014.) The 35 study units sampled in the first phase (2004–12) covered approximately 95 percent of the groundwater resources used for public-supply statewide.

In the second phase of the GAMA-PBP, a different method of prioritization was required because there is no statewide database of private wells available to prioritize areas for sampling. To prioritize shallow aquifers, California was divided into 938 groundwater units that correspond to the 463 alluvial groundwater basins defined by the CDWR and 453 areas outside of basins (highland areas; Johnson and Belitz, 2014). The distribution of households relying on domestic wells was estimated from U.S. Census data (U.S. Census Bureau, 1990), and water-use and well-location information was compiled from well-completion reports (WCRs) submitted to the CDWR (Johnson and Belitz, 2015). The groundwater units were prioritized for sampling on the basis of the number and density of households relying on domestic wells. Groundwater units were grouped into study units designed to facilitate comparison of groundwater quality between the shallow aquifer systems assessed in the second phase of the GAMA-PBP and the deeper aquifer systems assessed in the first phase.

The Monterey–Salinas Shallow Aquifer (MS-SA) study unit is the second study unit to be sampled in the second phase of the GAMA-PBP and is in the Southern Coast Ranges hydrogeologic province (fig. 1).

Three types of water-quality assessments are being completed with the data collected in each study unit: (1) *Status*, the current quality of the groundwater resource; (2) *Understanding*, identification of the natural and human factors affecting groundwater quality; and (3) *Trends*, changes in groundwater quality (U.S. Geological Survey, 2013). These three objectives were modeled after those of the USGS National Water Quality Assessment (NAWQA) Program (Hirsch and others, 1988). The sample-collection protocols used in this GAMA study were designed to obtain representative samples of groundwater. The quality of groundwater can differ from the quality of drinking water because water chemistry can change as a result of contact with plumbing systems or the atmosphere; because of treatment, disinfection, blending with water from other sources; or from some combination of these.

In most groundwater basins, domestic and small-system wells typically are shallower than public-supply wells (for example, Burow and others, 2007; Burton and others, 2012). The shallow aquifer system assessed in this study unit is defined as that part of the aquifer in which domestic wells and small-system wells have perforated depth intervals and is generally shallower than the primary aquifer system used by public-supply wells, which was assessed in the first phase of the GAMA-PBP (Kulongoski and Belitz, 2011).

This USGS data-series report is similar to other USGS data series reports written for the first phase of the GAMA-PBP study units sampled to date but is the second in a series of reports (data-series report, scientific investigation report, and fact sheet) presenting the water-quality data collected for the second phase of the GAMA-PBP in the MS-SA study unit. The purposes of this report are to describe (1) the study design and the study methods, (2) the analytical results for groundwater samples collected in the MS-SA study unit, and (3) the results of quality-control (QC) analyses. Groundwater samples were analyzed for field water-quality indicators; organic, special-interest, inorganic, and radioactive constituents; and geochemical and isotopic tracers. To provide context, the water-quality data presented in this report were compared to regulatory and non-regulatory benchmarks established by the U.S. Environmental Protection Agency (USEPA), the State of California, and the USGS for drinking water that do not apply to raw (untreated) groundwater. The factors that influence the distribution of the constituents detected in groundwater samples are to be discussed in forthcoming publications. Published and quality-assured data collected for the GAMA Program are available through the USGS National Water Information System (NWIS) web interface (accessible at http://waterdata.usgs.gov/ca/nwis/) and the SWRCB Geotracker Database (accessible at https://geotracker.waterboards.ca.gov/gama/).

Figure 1. Hydrogeologic provinces of California and the location of the Monterey–Salinas Shallow Aquifer study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project.

Methods

Methods used for the GAMA-PBP shallow aquifer study were selected to achieve the following objectives: (1) to design a sampling plan suitable for statistical representation; (2) collect samples in a consistent manner; (3) to analyze samples by using proven and reliable laboratory methods; (4) to assure the quality of the groundwater data; and (5) to maintain data securely and with relevant documentation. Appendix A contains detailed descriptions of the sample-collection protocols and analytical methods, the quality assurance (QA) methods, and the results of analyses of QC samples both for the grid well and for wells sampled at a tap.

Study Design

The MS-SA study unit is in the Southern Coast Ranges hydrogeologic province described by Belitz and others (2003). The study unit covers approximately 3,020 square miles (mi^2) in Monterey and San Luis Obispo Counties, in the central coast region of California (fig. 2). The MS-SA study unit (phase two) overlaps the area defined as the Monterey Bay and Salinas Valley groundwater basins (MS) study unit for the GAMA-PBP assessment of public-supply aquifers (phase one; Kulongoski and Belitz, 2011). The MS-SA study unit was divided into four study areas: the Santa Cruz (MS-SC) study area, the Pajaro Valley (MS-P) study area, the Salinas Valley (MS-SV) study area, and the Highlands (MS-H) study area (fig. 2).

Together, the MS-SC, MS-P, and MS-SV study areas correspond to the MS study unit of Kulongoski and Belitz (2011), except that the Carmel Valley was included in the MS study unit, but was not included in the MS-SA study areas (fig. 2). The MS-SC covers about 82 mi^2 and includes the following groundwater basins: the Felton Area, Scotts Valley, Santa Cruz Purisima Formation Highlands, West Santa Cruz Terrace, and Soquel Valley groundwater basins (California Department of Water Resources, 2003). The MS-P study area is about 138 mi^2 and covers of the Pajaro Valley groundwater basin. The MS-SV study area is about 772 mi^2 and includes the following groundwater subbasins of the Salinas Valley: 180/400 Foot aquifer, East Side aquifer, Forebay aquifer, Upper Valley aquifer, Paso Robles area, Seaside area, and Corral de Tierra area. In the original GAMA-PBP MS study, the Salinas Valley study area included only the Forebay aquifer and Upper Valley aquifer subbasins; the Paso Robles area was defined as its own study area, and the other four subbasins were combined with the Pajaro Valley Basin to form the Monterey study area (Kulongoski and Belitz, 2007, 2011). For both phases of GAMA studies, the boundaries of the Paso Robles area were defined differently than they were by the CDWR (2003); only parts of the Paso Robles area mapped as having Quaternary alluvium as the surficial geologic unit were included in the GAMA studies. The hydrogeologic setting of the region corresponding to the MS-SC, MS-P, and MS-SV study areas is described in detail by Kulongoski and Belitz (2011), and the description is not repeated here.

The MS-H study area covers about 2,026 mi^2 surrounding the MS-SV study area. The MS-H study area was defined by the extent of the groundwater units in the highlands upgradient from the Salinas Valley groundwater subbasins (Johnson and Belitz, 2013) and approximately corresponds to the watershed of the Salinas River and its tributaries. The study area includes parts of several mountain ranges that have distinct geologic characteristics. On the east side of the Salinas Valley, the MS-H study area extends approximately to the trace of the San Andreas Fault in the Gabilan Range. The bedrock of the Gabilan Range is part of the Salinian Block and consists of Mesozoic granitic rocks at the north end, of the Miocene Pinnacles volcanic field at approximately the latitude of Soledad, and of variably metamorphosed Cenozoic marine sedimentary rocks at the southern end. On the west side of the Salinas Valley, the MS-H study area includes parts of the Santa Lucia Range, a complex mixture of Mesozoic granitic rocks and variably metamorphosed Cretaceous and Cenozoic marine sedimentary rocks (Alt and Hyndman, 2000). The southern part of the MS-H study area also includes the Plio-Pleistocene alluvium of the Paso Robles Area groundwater basin that is not included in the MS-SV study area.

The MS-H groundwater comes from aquifers in granitic, metamorphic, or lithified sedimentary rocks, rather than from sediment deposits in groundwater basins. These rocks typically have low permeability, except where they are extensively fractured. The three-dimensional complexity and variability of fracture systems can cause well yields and water quality to vary widely on a local scale. These hard-rock aquifers are recharged by infiltration of precipitation, snow melt, and water from lakes and streams (California Department of Water Resources, 2011).

A total of 170 sites were sampled in the MS-SA study unit, which were selected to provide a statistically unbiased, spatially distributed assessment of the quality of groundwater resources in the shallow aquifer system. Sites were selected by using a grid-based method; each study area was divided into equal-area grid cells (Scott, 1990), and one site was randomly selected for sampling in each cell.

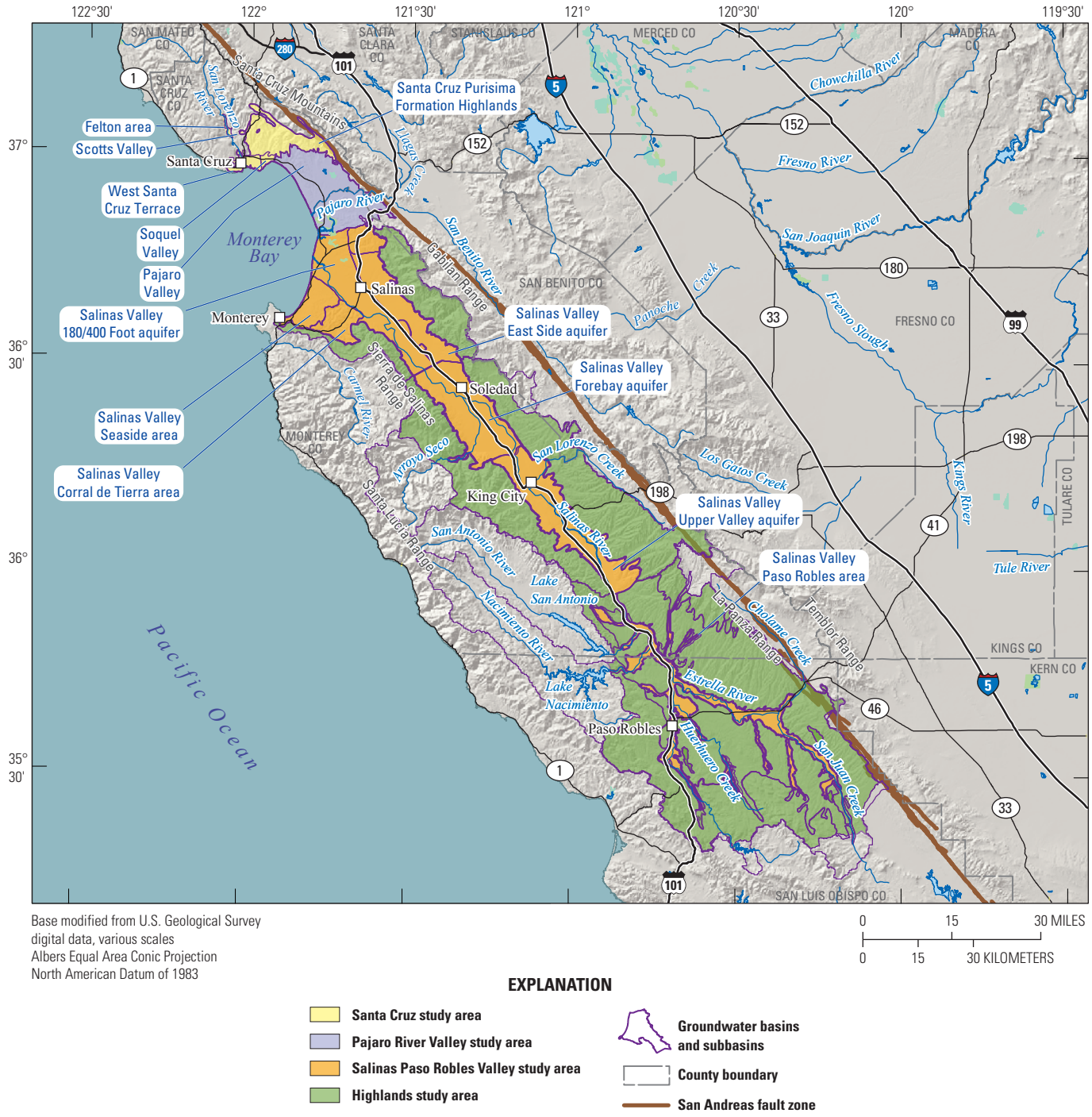


Figure 2. Boundaries of the Monterey–Salinas Shallow Aquifer study unit of the California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project; the Santa Cruz, Pajaro Valley, Salinas River Valley, and Highlands study areas; major cities; topographic features; and hydrologic features.

The target grid-cell size for the three study areas in groundwater basins was 50 square kilometers (km^2), with no fewer than 15 cells per study area. The MS-SC study area was divided into fifteen 14-km^2 grid cells (fig. 3); the MS-P area was divided into fifteen 19-km^2 grid cells (fig. 4); and the MS-SV study area was divided into forty 50-km^2 grid cells (fig. 5). The MS-H study area contained relatively few wells, so to reduce the number of cells potentially containing no wells available for sampling, only a part of the study area was included in the gridded area.

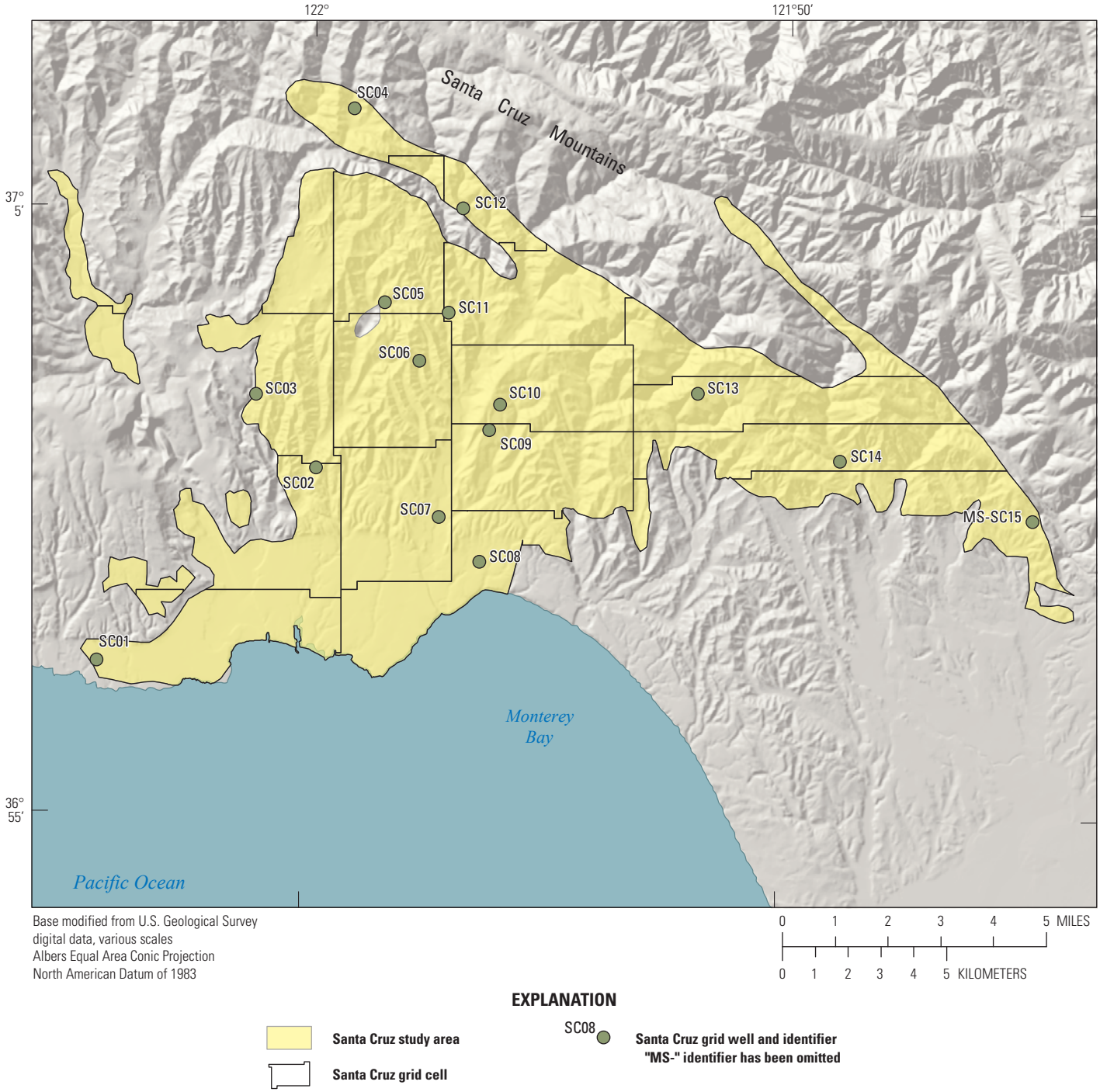


Figure 3. Distribution of grid cells, location of grid wells, and topographic features in the Santa Cruz study area of the Monterey–Salinas Shallow Aquifer study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project.

The Highlands study area (fig. 6) was defined as the collective area of all hydrologic unit code (HUC) watersheds that were, in some part, within 3-km of the boundary of the Salinas Valley. Because the MS-H study area had so few wells, the target grid-cell size was 175 km^2. The study area was divided into thirty, 175-km^2 cells. Geographic features can force a grid cell to be divided into multiple pieces to obtain the designated coverage area for each cell. For instance, a single grid cell may have parts on both sides of the Salinas Valley.

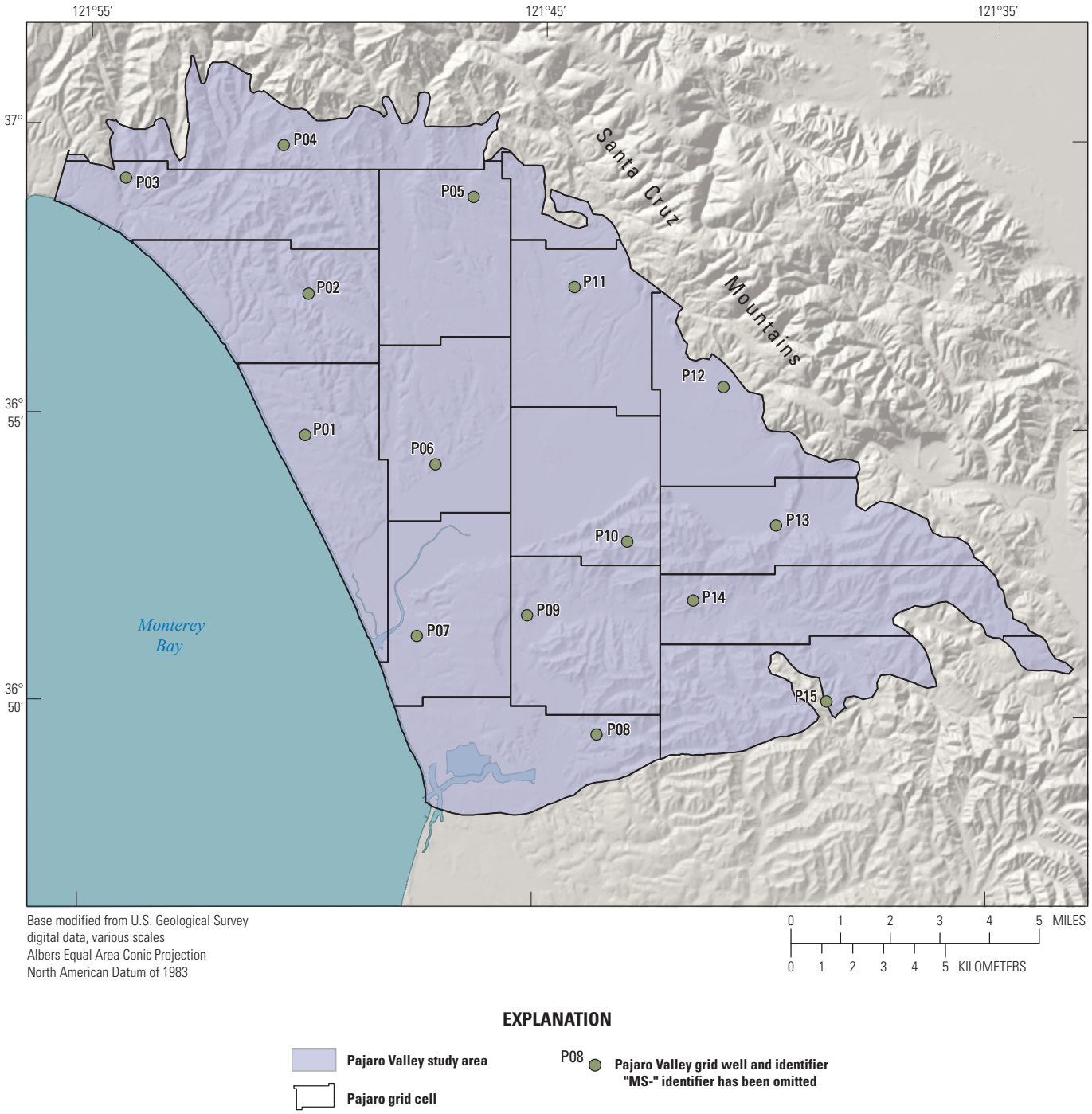


Figure 4. Distribution of grid cells, the location of grid wells, and topographic features in the Pajaro Valley study area of the Monterey–Salinas Shallow Aquifer study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project.

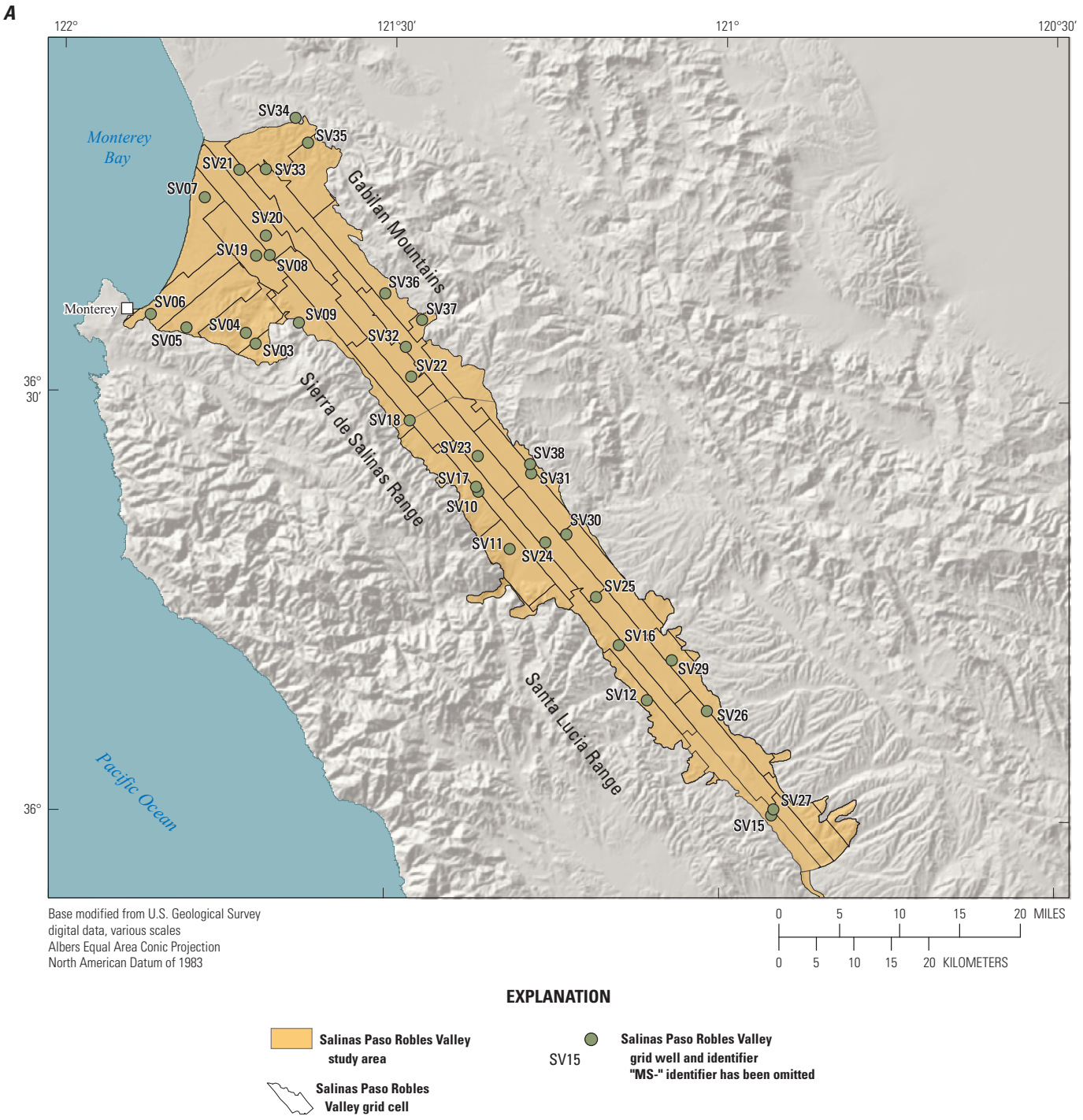


Figure 5. Distribution of grid cells, location of sampled grid wells, and topographic features in the Salinas Valley and Paso Robles study areas of the Monterey–Salinas Shallow Aquifer study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project: *A*, northern part; *B*, southern part.

B

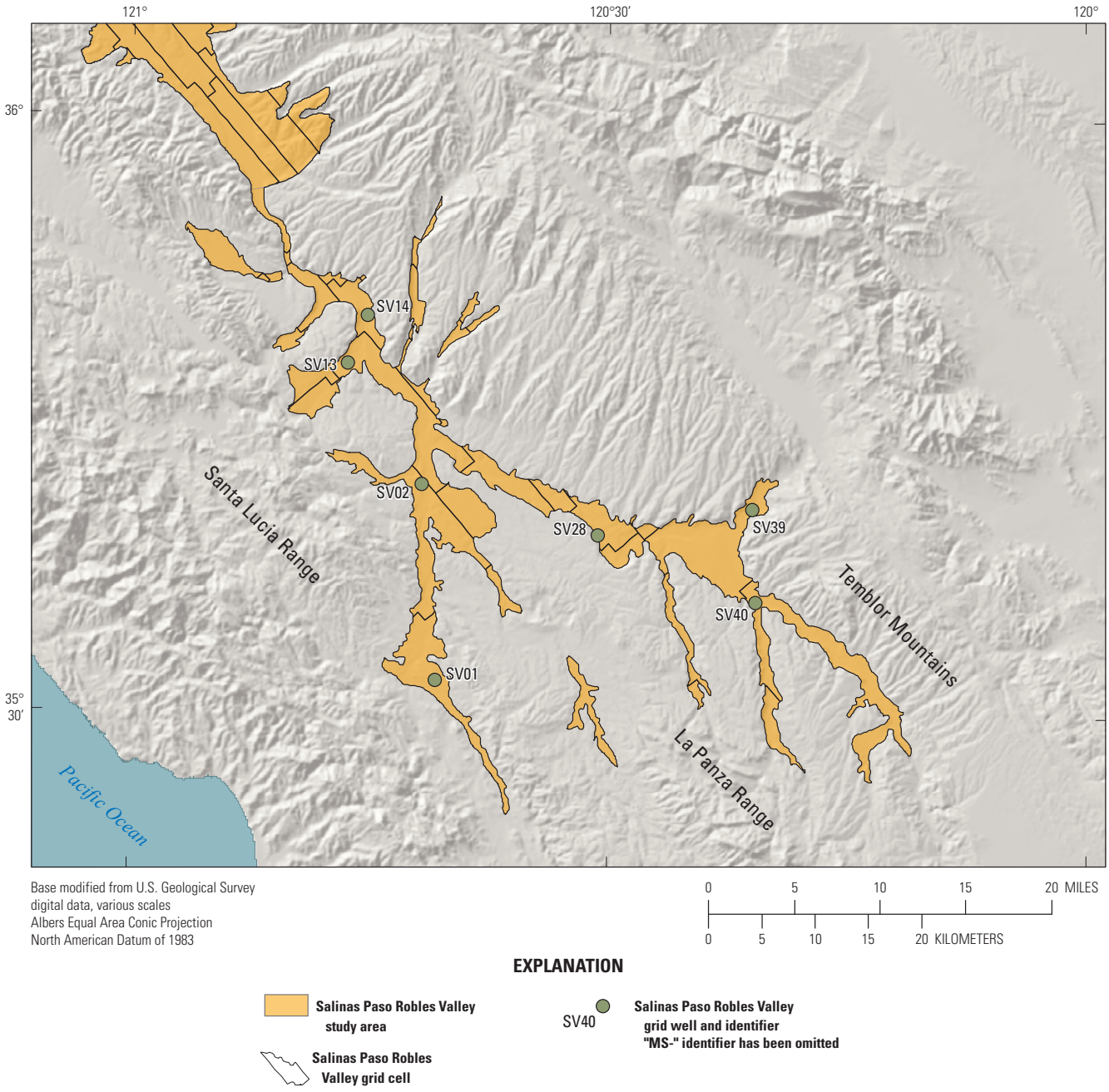


Figure 5.—Continued

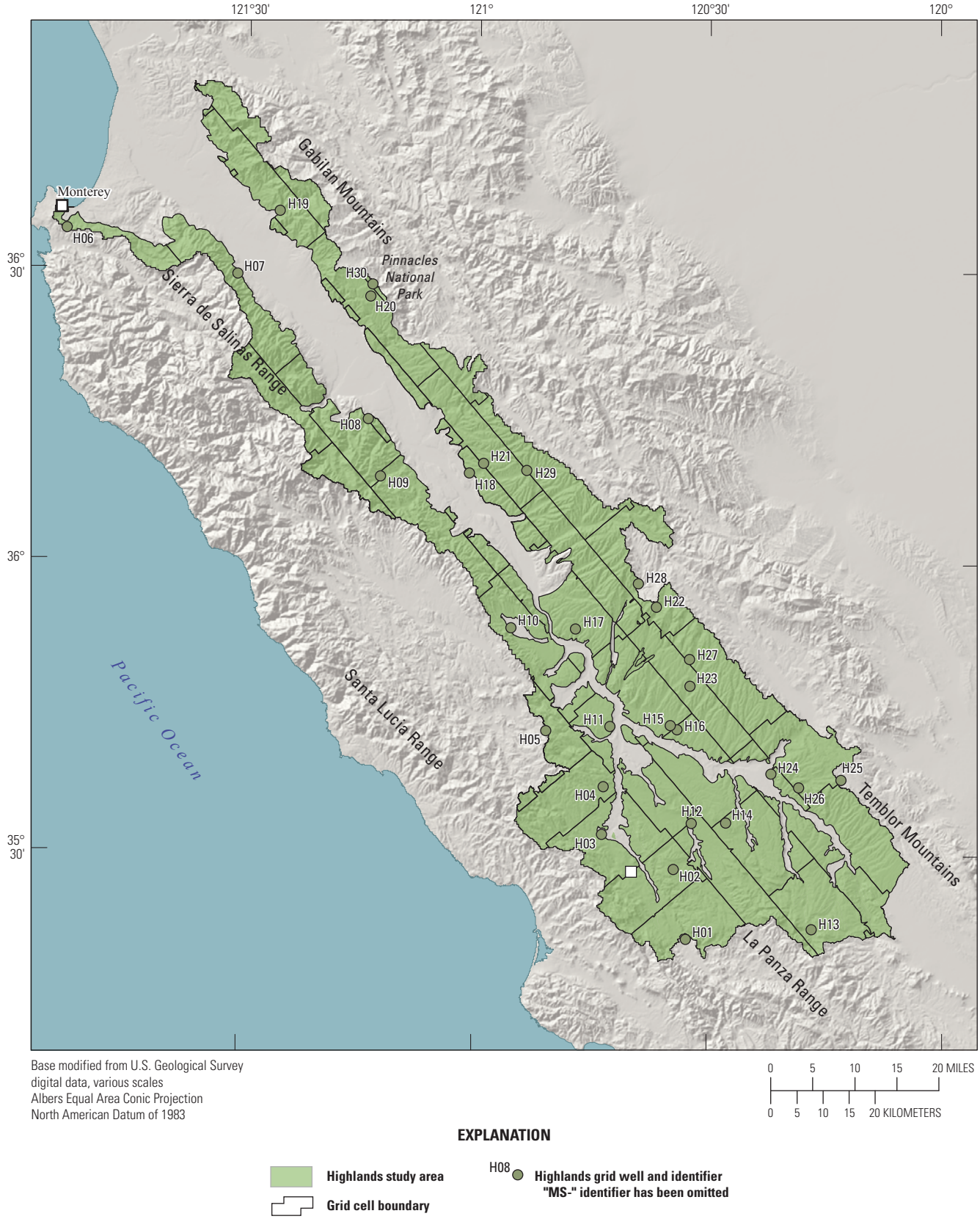


Figure 6. Distribution of the study-area cells, the location of sampled grid wells, and topographic features in the Highlands study area of the Monterey–Salinas Shallow Aquifer study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project.

One well was selected for sampling in each of the one-hundred grid cells in the MS-SA study unit. Wells were primarily identified from CDWR well-completion reports (WCRs). The WCRs for domestic wells that contained location and well-construction information and were shallower than the median depth of the primary aquifer system used by public-supply wells in the study area were compiled for each grid cell. To ensure that wells were randomly selected, a random latitude-longitude point was defined in each cell, and wells closest to the random point were given highest priority. Wells were visited in descending order of priority until permission to sample a suitable well was obtained. For study-area cells that had exhausted available WCRs or had none on file, potential wells were identified by door-to-door canvassing. Wells in these cells were sampled when a well owner volunteered to participate in the MS-SA study. Basic sampling criteria (for example, a sampling point that is prior to water treatment or the capacity to pump for an extended period) were considered prior to sampling.

The 100 grid wells sampled in the MS-SA study unit were named by using the prefixes "S-MS-P" for wells in the Pajaro Valley study area, "S-MS-SC" for wells in the Santa Cruz study area, "S-MS-SV" for wells in the Salinas Valley, and "S-MS-H" for wells in the Highlands study area. A sequence number defined by the number of the grid cell in which the samples were collected in each study area was then added, creating a unique alphanumeric GAMA identification number.

The GAMA identification number for grid wells, the date sampled, well type, well elevation, available well-construction information, and the depth to the water level are shown in table 1. Groundwater samples were collected from October 2012 to May 2013. Well types in table 1 are identified as production or spring. Any site with a pump that brought groundwater to the land surface was considered a production well, whereas any site where the groundwater level intersected the land surface was considered a spring. Grid wells included 99 production wells and 1 spring, but for simplicity, all sampled sites are referred to as wells for the remainder of this report.

Well locations were verified by using a global positioning system (GPS); 1:24,000-scale USGS topographic maps; comparison with existing well information in databases of the USGS and the State ; and information provided by well owners, WCRs, or other sources of construction information. Well locations and information were recorded by hand on field sheets. All information was verified and then uploaded into the USGS NWIS. Well owner and well-use information is confidential.

To increase the spatial density of data for inorganic constituents (nutrients, trace elements, and major ions), 70 additional sites ("shallow-well tap sites") were sampled in the MS-P and MS-SV study areas. Each grid cell in the MS-P study area was divided into two 9.5-km^2 subcells (fig. 7), and each grid cell in the MS-SV study area was divided into three 17-km^2 subcells (figs. 8*A*, *B*). The 95 subcells that did not contain a grid well were searched for appropriated sampling sites. Potential sites were identified from CDWR WCRs and door-to-door canvassing. The site requirements were less stringent than those used for selection of the grid wells. Examination of WCRs during selection of the grid wells indicated that most wells in the MS-SV and MS-P study areas that were coded as domestic wells on WCRs were shallower than the public-supply wells sampled in the same areas by Kulongoski and Belitz (2007, 2011); therefore, sites lacking WCRs or well-construction information were considered eligible for sampling if the site was supplied by a domestic well. In some MS-SV and MS-P areas, irrigation wells and small system public-supply wells were as shallow as domestic wells and were considered eligible for sampling as shallow-well tap sites. In most cases, the sampling point was a hose bib on the outside of a dwelling and was commonly downstream of a pressure tank. Sites with wells not capable of running for long periods of time were considered eligible for sampling as wells were not required to be purged prior to sampling. The first eligible site for which permission to sample could be obtained was selected for sampling, and sites were sampled in 70 of the 95 available subcells. These 70 sites are referred to as "shallow-well tap sites" to distinguish them from the 100 grid wells. The shallow-well tap sites were assigned GAMA identification numbers on basis of the GAMA identification of the grid well in the cell, the prefix "T" appended to the end of the grid-well GAMA identification, and a sequence number (1 or 2) for the number of the subcell.

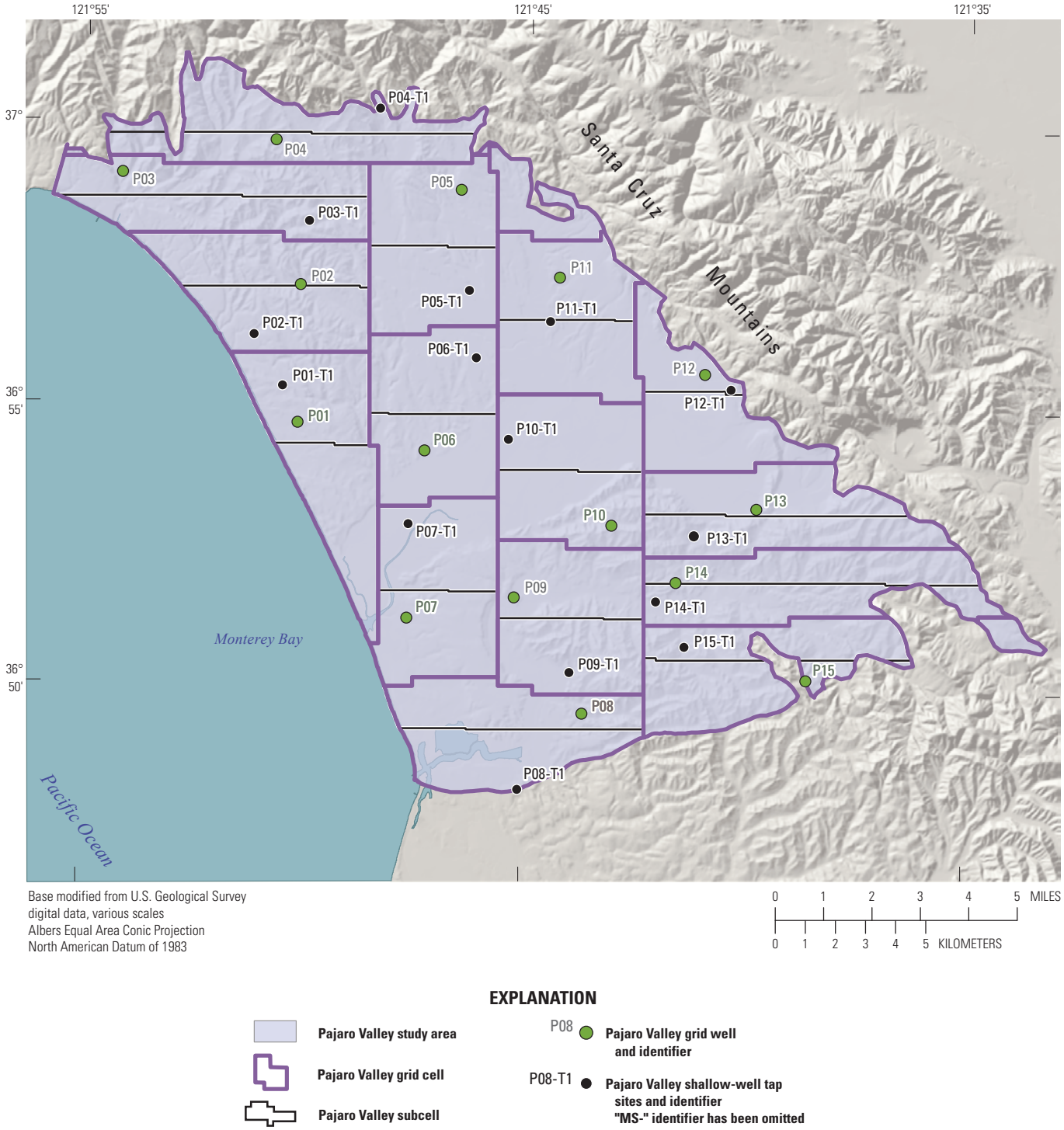


Figure 7. Distribution of the grid cells and subcells, the location of shallow-well tap sites, and topographic features in the Pajaro Valley study area of the Monterey–Salinas Shallow Aquifer study unit, California Groundwater Ambient Monitoring Assessment (GAMA) Priority Basin Project.

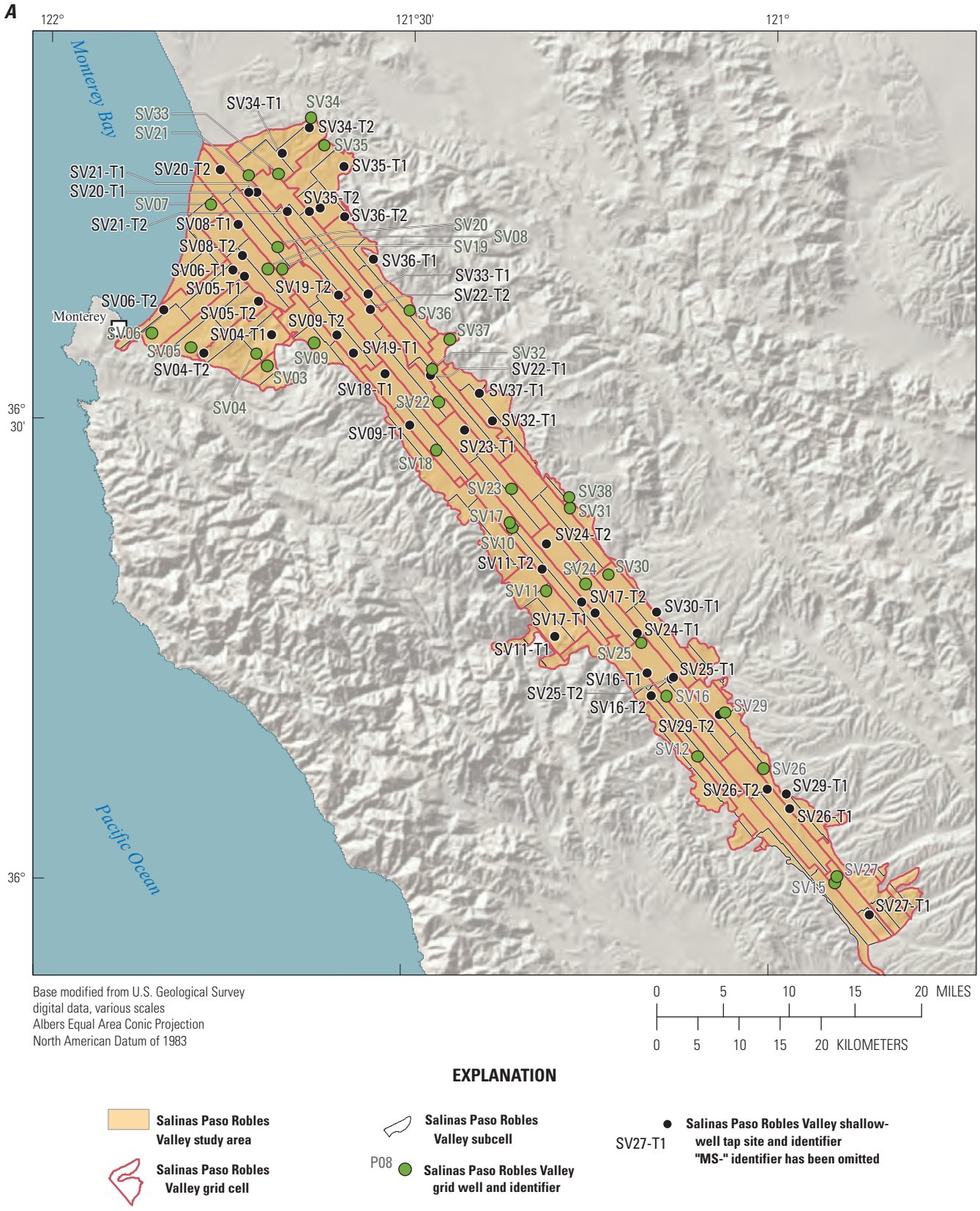


Figure 8. Distribution of the grid cells and subcells, the location of shallow-well tap sites, and topographic features in the Salinas Valley and Paso Robles study area of the Monterey–Salinas Shallow Aquifer study unit, California Groundwater Ambient Monitoring Assessment (GAMA) Priority Basin Project: *A*, northern part, and *B*, southern part.

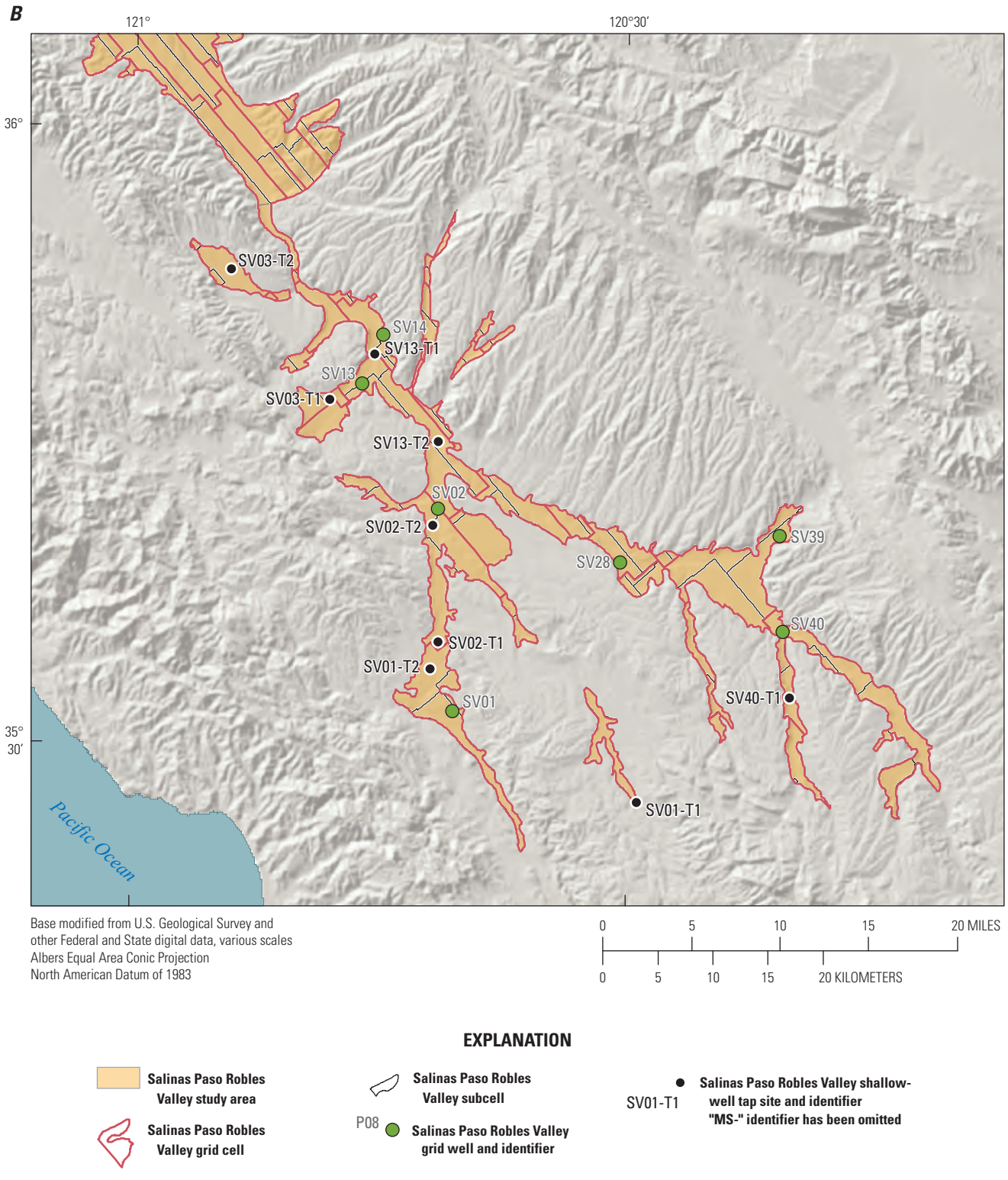


Figure 8.—Continued

Sample Collection and Analysis

Samples from the 100 grid wells were collected in accordance with the USGS National Field Manual (NFM; U.S. Geological Survey, variously dated) and modified USGS NAWQA Program sampling protocols (Koterba and others, 1995). These sampling protocols were followed so that representative samples of groundwater were collected at each well and to ensure that the samples were collected and handled in a manner that minimized the potential for contamination. Samples from the 70 domestic well-tap sites were collected by using a modified version of these methods (see appendix A).

All 100 grid wells in the MS-SA study unit were sampled for a standard set of constituents (table 2). Tables 3*A–G* list the compounds analyzed in each constituent class. Groundwater samples were analyzed for volatile organic compounds (VOCs, table 3*A*), pesticides and pesticide degradates (table 3*B*), constituents of special interest (table 3*C*); trace elements (table 3*D*), nutrients (table 3*E*), major ions (table 3*F*), age-dating and geochemical tracers and radioactive constituents (table 3*G*), and dissolved noble gases (table 3*H*). The shallow-well tap sites were sampled for a subset of the constituents measured in the samples from the grid wells: trace elements, nutrients, and major ions.

The methods used for sample collection and analysis are described in the "Sample Collection and Analysis" section in appendix A.

Data Reporting

The methods and conventions used for reporting the data are described in the "Data Reporting" section in appendix A. Three water-quality indicators—alkalinity, pH, and specific conductance—were measured in the field and at the USGS NWQL. Results from both measurements are reported. Bicarbonate and carbonate concentrations were calculated from the pH and alkalinity results.

Comparison Benchmarks

The sample-collection protocols used in this study were designed to obtain representative samples of groundwater. The quality of groundwater can differ from the quality of drinking water because water chemistry can change as a result of contact with plumbing systems or the atmosphere; because of treatment, disinfection, or blending with water from other sources; or some combination of these. Water quality in domestic wells is not regulated in California; however, to provide context for the water-quality data presented in this report, results were compared to regulatory and non-regulatory benchmarks established for drinking-water quality. A constituent can have values for more than one type of benchmark, and the different benchmarks must be prioritized in order to develop a consistent set of comparisons. For the second phase of the GAMA-PBP, benchmarks were selected in the following order of priority:

Maximum Contaminant Level—MCL. The MCLs are 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 (U.S. Environmental Protection Agency, 2012); California State Water Resources Control Board, Division of Drinking Water, 2015). The MCLs established by the USEPA are the minimum standards to which states are required to comply, and individual states may choose to set more stringent standards. California has established MCLs for additional constituents not regulated by the USEPA as well as lowered the benchmark concentrations for a number of constituents with MCLs established by the USEPA. In this report, a benchmark set by the USEPA and adopted by the State of California is labeled "MCL-US," and one set by the State of California that is more stringent than the MCL-US is labeled "MCL-CA". Well owners are notified when constituents are detected at concentrations greater than an MCL-US or an MCL-CA benchmark in samples collected for the GAMA-PBP, but these detections do not constitute violations of regulations even if the well was a public drinking-water source. As of 2016, Hawaii is the only state that has established an MCL (MCL-HI) for 1,2,3-Trichloropropane (table 3*A*). For lead and copper, the health-based legally enforceable standards that apply to public-water systems are called "action levels." Detections of copper or lead in public water supplies greater than the action-level benchmarks trigger requirements for mandatory water treatment to reduce the corrosiveness of water to pipes. The action levels established by the USEPA and State of California are the same; thus, these benchmarks are labeled "AL-US" in this report. A total of 104 constituents analyzed for in this study have MCL-US, MCL-CA, or AL-US benchmarks.

Health-Based Screening Level—HBSL. The HBSLs are non-regulatory and non-enforceable water-quality benchmarks developed by the USGS in collaboration with the USEPA, New Jersey Department of Environmental Protection, and Oregon Health & Science University. The HBSLs are established by using the same methodologies implemented by the USEPA when establishing drinking-water guidelines and are based on the most recent human-health toxicity information available (Toccalino and others, 2012). The HBSLs are not established for constituents that have MCL-US benchmarks. The HBSLs have been established for many constituents that also have USEPA non-regulatory health-based benchmarks and for a large number of organic constituents for which the USEPA has not yet established benchmarks. For carcinogenic constituents, the HBSL range represents the constituent concentration in drinking water that represents an increased estimated lifetime cancer risk of 1 chance in 1 million to 1 chance in 100 thousand (Toccalino and others, 2012). For non-carcinogens, the HBSLs follow the USEPA assumptions about lifetime ingestion and are calculated by assuming consumption of 2 liters (2.1 quarts) of water per day during a 70-year lifetime by a 70-kilogram (154-pound) adult and that 20 percent of a person's exposure comes from drinking water. For noncarcinogens, the HBSL concentration is the maximum concentration in drinking water that a lifetime of exposure is not expected to cause any adverse effects (Toccalino and others, 2012). Of the constituents analyzed for in this study, 63 have HBSL benchmarks.

Other non-regulatory health-based benchmarks. A total of 45 constituents analyzed for in this study have a non-regulatory health-based benchmark established by the USEPA or the State of California, but do not also have an HBSL. These benchmarks are, in order of priority, the USEPA lifetime health advisory level (HAL-US), the USEPA risk-specific dose (RSD5-US), and the State of California notification level (NL-CA). The HAL-US is 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, and it is calculated by assuming consumption of 2 liters (2.1 quarts) of water per day during a 70-year lifetime by a 70-kilogram (154-pound) adult and that 20 percent of a person's exposure comes from drinking water (U.S. Environmental Protection Agency, 2012). Because the methods used to calculate HAL-US and HBSL benchmarks are the same, for constituents having both an HAL-US and an HBSL, the two generally have the same value. The RSD5-US is the concentration of a constituent in drinking water that corresponds to an additional estimated lifetime cancer risk of 1 in 100,000. The RSD5 is an acronym for risk-specific dose at the 10^{-5} risk level (10^{-5} is 1 per 100,000). The RSD5s are calculated by dividing the 10^{-4} cancer risk concentration established by the USEPA (U.S. Environmental Protection Agency, 2012) by 10. The NL-CA is a health-based standard established by the State for some of the constituents in drinking water that lack MCLs (Division of Drinking Water, 2014). If a constituent is detected in drinking water in a public-water system at concentrations greater than its NL-CA, California State law requires timely notification of local governing bodies and recommends consumer notification.

Secondary Maximum Contaminant Level—SMCL. The SMCLs are non-enforceable standards applied to constituents that affect the aesthetic qualities of drinking water, such as taste, odor, and color, or the technical qualities of drinking water, such as scaling and staining. Both the USEPA and the State define SMCLs, but unlike MCLs, SMCLs established by the State are not required to be at least as stringent as those established by USEPA. For chloride, sulfate, specific conductance, and TDS, the State of California defines a "recommended" and an "upper" SMCL-CA (U.S. Environmental Protection Agency, 2013); detections of these constituents in groundwater samples were compared with the upper level. The SMCL-US levels for these constituents correspond to their recommended SMCL-CAs. The SMCL-US is used for pH because a SMCL-CA has not been defined.

Using this hierarchy to select the comparison benchmark for a constituent with more than one type of established benchmark does not necessarily result in selection of the benchmark with the lowest concentration. For example, the HBSL for boron is 6,000 µg/L, and the NL-CA is 1,000 µg/L, but the comparison benchmark selected by this hierarchy is the HBSL. The comparison benchmarks for all constituents measured for this study are listed in tables 3*A*–*H*, and those for constituents detected in groundwater samples from the MS-SA study unit are listed in tables 4–13 and are illustrated in figure 9. Established benchmarks were not available for all constituents analyzed for this study.

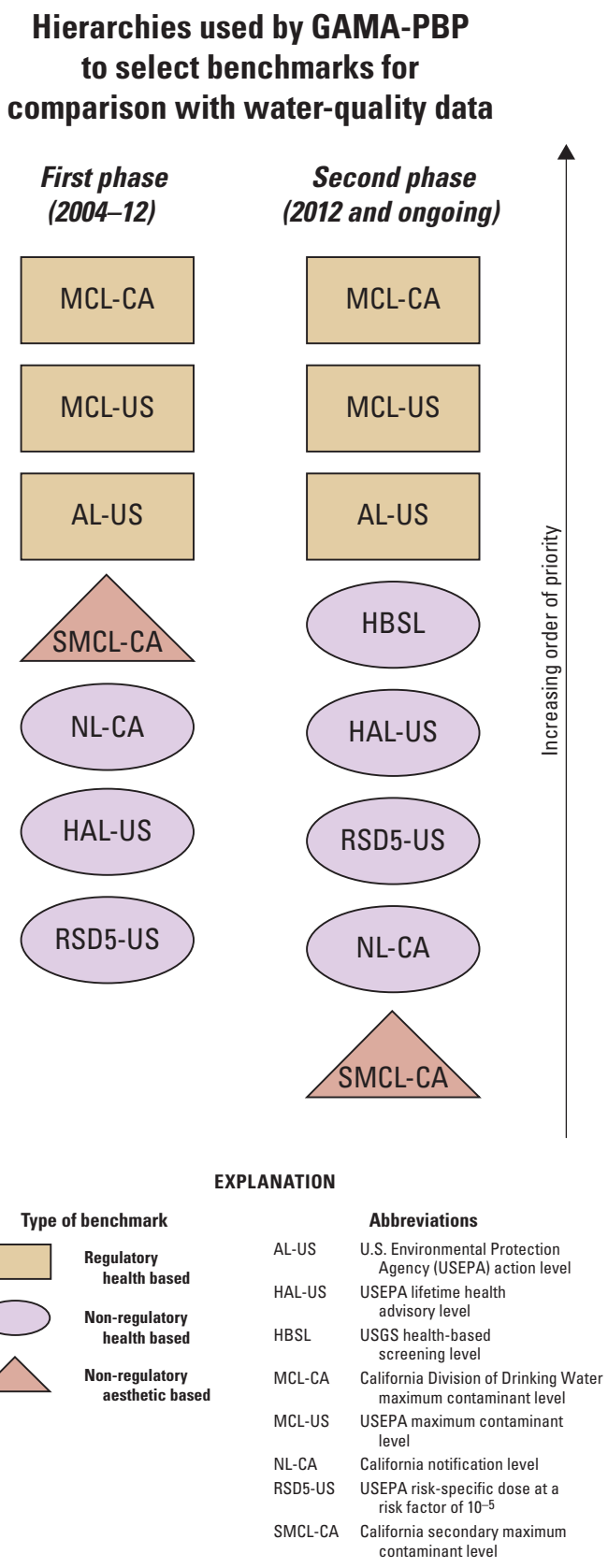


Figure 9. Hierarchies used by the California Groundwater Ambient Monitoring Assessment (GAMA) Priority Basin Project to select benchmarks for comparison with groundwater-quality data.

Quality-Assurance Methods

The quality-assurance and quality-control (QA/QC) procedures used for this study followed the protocols used by the NAWQA Program (Koterba and others, 1995) and are described in the NFM (U.S. Geological Survey, variously dated). The QA plan followed by the NWQL, the primary laboratory used to analyze samples for this study, is described in Stevenson (2012). The QC samples collected in the MS-SA study unit were blanks, replicates, and matrix and surrogate spikes, which were collected to evaluate potential contamination, as well as bias and variability of the data, that could have resulted from sample collection, processing, storage, transportation, and laboratory analysis. The QA/QC procedures and results are described in the "Quality-Control Methods and Results" section in appendix A.

Water-Quality Results

Quality-Control Results

Three types of QC samples (blanks, replicates, and matrix spikes) were collected at up to 11 percent of the wells in the MS-SA study unit, and results of QC analyses were used to evaluate the quality of the data from the groundwater samples. With the exception of some trace elements, few constituents were detected in the blanks, and the detected concentrations were generally below the reporting labels used by the laboratory. On the basis of detections in field blanks collected for this and for previous GAMA-PBP study units, the "study reporting levels" (SRLs) for three volatile organic compounds and eight trace elements were raised (see table A-2 and the "Detections in Field Blanks and Application of SRLs" section in appendix A). Detections of these constituents where concentrations were less than the respective SRL were reported as non-detections for VOCs and were coded by a less than or equal to symbol for trace elements in this report. Additionally, three VOCs and one trace element (cobalt) were detected in some samples; however an assessment of QC results for this and other GAMA-PBP studies indicated that these detections are likely attributable to extrinsic contamination and are not representative of groundwater. Detections of the three VOCs and all results for cobalt were not presented in this report.

Results from the replicates confirm that the procedures used to collect and analyze the samples were consistent. The variability for nearly all of the replicate pairs for constituents detected in samples was within the acceptable limits (see tables A-3*A–C*). The constituent iron showed high variability in two replicate samples. The criteria for acceptable replication are described in the "Quality-Control Methods and Results" section in appendix A.

The median values of matrix-spike recoveries were within the acceptable range (70 to 130 percent) for the volatile organic compounds and *N*-nitrosodimethylamine (NDMA). Midian values of matrix-spike recoveries were below 70 percent for pesticides and pesticide degradates (table 3*B*; see table A-4*A–B*). The constituents that had low recoveries might not have been detected in some samples if they were present in the samples at concentrations near the laboratory reporting levels (LRLs). High recoveries of constituents can indicate that reported concentrations could be greater than what was truly present in the sample. The QC results are described in the "Quality-Control Methods and Results" section in appendix A.

Groundwater-Quality Data

Results from analyses of untreated groundwater samples from the MS-SA study unit are presented in tables 4–13 for grid wells and for wells sampled at taps. Groundwater samples collected in the MS-SA study unit were analyzed for over 200 constituents and water-quality indicators; of these, 106 constituents were not detected in any of the samples. Detections of constituents at concentrations greater than the selected comparative benchmarks listed in tables 3*A–H* are marked with an asterisk (*) in tables 4–13.

For organic and special-interest constituents, the results tables include only those constituents that were detected and those wells that had detections. For the organic constituents, the following summary statistics are presented for all of the grid wells: the number of wells for which each analyte was detected, the frequency at which it was detected (in relation to the number of grid wells in the study unit), and the total number of constituents detected for each well. For the inorganic, isotopic, and radioactive constituents, the tables include all of the constituents and wells that were analyzed.

Water-quality indicators measured in the field and at the NWQL are included in table 4*A* for grid wells and table 4*B* for shallow-well tap sites. The results of groundwater analyses, organized by constituent class, are presented in tables 5–13:

- Organic constituents.
  - Volatile organic compounds (table 5).
  - Pesticides and pesticide degradates (table 6).
- Constituents of special interest (table 7).
- Inorganic constituents.
  - Trace elements (table 8*A* for grid wells and table 8*B* for shallow-well tap sites).
  - Nutrients (table 9*A* for grid wells and table 9*B* for shallow-well tap sites).
  - Major and minor ions, silica, and total dissolved solids (table 10*A* for grid wells and table 10*B* for shallow-well tap sites).
- Radioactive constituents (table 11).
- Isotopic tracers (table 12).
- Noble gases (table 13).

Water-Quality Indicators

Field measurements of dissolved oxygen, water temperature, and field and laboratory measurements of pH, specific conductance (SC), and alkalinity are presented in table 4*A* for grid wells and table 4*B* for shallow-well tap sites, along with values calculated for bicarbonate and carbonate from pH and alkalinity measurements. Dissolved oxygen and alkalinity are used as indicators of natural processes that affect water chemistry. The pH value indicates the acidity or basicity of the water. The SC is a measure of electrical conductivity of the water and is proportional to amount of total dissolved solids (TDS) in the water.

Field pH values were outside of the SMCL-US range at 5 percent of the MS-SA study unit grid wells; five well samples had field pH values less than 6.5 (table 4*A*). Low pH in water can contribute to corrosion of pipes, and high pH in water can contribute to scaling. Laboratory pH values can differ from field pH values because the pH of groundwater can change when it is removed from its ambient environment and exposed to the atmosphere. Field pH values were outside of the SMCL-US range for about 3 percent of the MS-SA study unit shallow-well tap sites; two samples had field pH values less than 6.5, but none of the samples had field pH values greater than 8.5 (table 4*B*). Field SC values were greater than the upper SMCL-CA of 1,600 microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C) for 24 of the 100 grid-well samples (table 4*A*). Field SC values were greater than the upper SMCL-CA of 1,600 (µS/cm at 25 °C) for 15 of the 70 shallow-well tap sites (table 4*B*).

Organic Constituents

Volatile organic compounds (VOCs) are present in paints, solvents, fuels, fuel additives, refrigerants, fumigants, and disinfected water, and are characterized by their tendency to evaporate because groundwater is isolated from the atmosphere, VOCs generally persist longer in groundwater than in surface water. Of the 85 VOCs analyzed for the MS-SA study unit, 14 were detected in groundwater samples, and all of the concentrations detected were less than health-based benchmarks (table 5). One or more VOC was detected in 26 of the 100 grid-well samples (a 26-percent detection frequency). One VOC was detected at a frequency above 10 percent. The trihalomethane chloroform (trichloromethane) was the most frequently detected VOC in the study unit (about 15 percent detection frequency). Chloroform is among the most commonly detected of the VOCs in groundwater nationally (Zogorski and others, 2006). The second most commonly detected VOC was the solvent perchloroethylene (PCE), which was detected at a frequency of 9 percent in the grid wells.

Pesticides include herbicides, insecticides, and fungicides that are used to control weeds, insects, fungi, and other pests in agricultural, urban, and suburban settings. Of the 63 pesticides and pesticide degradates analyzed for the MS-SA study unit, 24 were detected in groundwater samples, but all concentrations were less than health-based benchmark concentrations (table 6). One or more pesticide or pesticide degradate was detected in 28 of the 100 MS-SA study-unit grid-well samples (a 28-percent detection frequency). The herbicide simazine was detected in more than 10 percent of the samples. Simazine is among the Nation's most commonly detected pesticide compounds in groundwater (Gilliom and others, 2006). The herbicide degradate deethylatrazine (2-chloro-4-isopropylamino-6-amino-*s*-triazine) was detected in more than 10 percent of the samples. Deethylatriazine is a degradate of atrazine, which is also a commonly detected pesticide in groundwater.

Constituents of Special Interest

Perchlorate and NDMA were classified as constituents of special interest at the inception of the GAMA-PBP in 2003 because they had recently been detected in some drinking-water supplies in California, and the State was considering whether or not to pursue future regulation of these constituents (Belitz and others, 2003). An MCL-CA for perchlorate was established in 2007 (Division of Drinking Water, 2013). Perchlorate was detected in 60 of 100 grid-well samples (60 percent detection frequency); one well (S-MS-SV29) had a concentration greater than the MCL-CA of 6 micrograms per liter (µg/L; table 7). Of 100 grid-well samples, NDMA was detected in 7 (a 7 percent detection frequency); of these, 3 detections were concentrations greater than the HBSL of 0.007 µg/L, and, in one of these wells, the perchlorate concentration was greater than the MCL-CA as well.

Inorganic Constituents

Unlike the organic constituents, most inorganic constituents are present naturally in groundwater, although their concentrations can be influenced by human activities.

Of the 33 trace elements and major and minor ions analyzed and detected in the MS-SA study unit (tables 8, 10), 21 have regulatory or non-regulatory health-based benchmarks (table 3*D*, 3*F*). Of these 21 constituents, 7 constituents were detected at concentrations greater than their respective benchmarks; all detections of the remaining 14 constituents were at concentrations less than their respective benchmarks. Arsenic was detected at concentrations greater than the MCL-US of 10 µg/L in five grid wells; boron was detected at a concentration greater than the HBSL of 6,000 µg/L in one grid well; manganese was detected at concentrations greater the HBSL of 300 µg/L in eight grid wells; molybdenum was detected at concentrations greater than the HBSL of 40 µg/L in six grid wells; selenium was detected at concentrations greater than the MCL-US of 50 µg/L in three grid wells; strontium was detected at concentrations greater than the HBSL of 4,000 µg/L in six grid wells; and uranium was detected at concentrations greater than the MCL-US of 30 µg/L in four grid wells (table 8*A*).

Of the trace elements and major and minor ions analyzed in the shallow-well tap sites, arsenic was detected at a concentration greater than the MCL-US of 10 µg/L in two shallow-well tap sites; manganese was detected at concentrations greater the HBSL of 300 µg/L in four shallow-well tap sites; molybdenum was detected at concentrations greater than the HBSL of 40 µg/L in four shallow-well tap sites; uranium was detected at concentrations greater than the MCL-US of 30 µg/L in two shallow-well tap sites; and zinc was detected at concentrations greater than the HBSL of 2,000 µg/L in two shallow-well tap sites (table 8).

Nutrients (nitrogen and phosphorus) present in groundwater can affect biological activity in aquifers and in surface-water bodies that receive groundwater discharge. Inorganic nitrogen can be present in the form of ammonia, nitrite, or nitrate, depending on the oxidation-reduction state of the groundwater. High concentrations of nitrate can adversely affect human health, particularly the health of infants. Groundwater samples from 16 grid wells had nitrate (nitrate plus nitrate as N) concentrations greater than the MCL-US of 10 mg/L (table 9*A*). All other nutrient concentrations in MS-SA grid wells were less than health-based benchmarks. Groundwater samples from the 24 shallow-well tap sites had nitrate (nitrate plus nitrate as N) concentrations greater than the MCL-US of 10 mg/L (table 9*B*).

The levels of certain trace elements, major-ion composition, and TDS content in groundwater affect the aesthetic properties of water, such as taste, color, and odor, and the technical properties of water, such as scaling and staining. Although no adverse health effects are directly associated with these properties, they can reduce consumer satisfaction with the water or have economic effects. The SWRCB-DDW has established non-enforceable benchmarks (SMCL-CAs) that are based on aesthetic properties rather than on human-health concerns for iron, manganese, silver, zinc, chloride, sulfate, and TDS. Manganese, silver, and zinc also have HBSLs, which are used as comparison benchmarks in this study (table 3*D*). Iron and manganese are trace elements which have concentrations affected by the oxidation-reduction state of the groundwater. Precipitation of minerals containing iron or manganese can cause orange, brown, or black staining of surfaces.

Iron concentrations greater than the SMCL-CA of 300 µg/L were detected in nine grid-well samples (table 8). Chloride and sulfate concentrations were greater than the upper recommended SMCL-CA of 500 mg/L in 7 and 14 grid-well samples, respectively (table 10*A*). The TDS concentrations were greater than the upper recommended SMCL-CA of 1,000 mg/L in 27 grid-well samples (table 10*A*).

Iron concentrations were greater than the SMCL-CA of 300 µg/L in six shallow-well tap-site samples (table 8*B*). Chloride and sulfate concentrations were greater than the upper recommended SMCL-CA of 500 mg/L in one and nine shallow-well tap-site samples, respectively (table 10*B*). The TDS concentrations were greater than the upper recommended SMCL-CA of 1,000 mg/L in 15 shallow-well tap-site samples (table 10*B*).

Radioactivity is the release of energy or energetic particles during changes in the structure of the nucleus of an atom. Most radioactivity in groundwater comes from decay of natural isotopes of uranium and thorium that are present in minerals in the sediments or fractured rocks of the aquifer. Uranium and thorium decay in a series of steps to eventually form stable isotopes of lead (Soddy, 1913; Faure and Mensing, 2005). In each step in the decay series, one radioactive element turns into a different radioactive element by emitting an alpha, beta, or other particle from its nucleus. Alpha and beta particles emitted during radioactive decay can be hazardous to human health because these energetic particles can damage cells. Radiation damage to cell DNA can increase the risk of getting cancer. Activity often is used instead of concentration for reporting the presence of radioactive constituents. Activity of radioactive constituents in groundwater is measured in units of picocuries per liter (pCi/L), and 1 pCi/L is approximately equal to two atoms decaying per minute. The number of atoms decaying is determined by measuring the particles or energy emitted.

Radon-222, gross alpha particle, and gross beta particle activities were measured in samples in the MS-SA study unit. Radon-222 activity was not detected in any of the grid-well samples at levels greater than the proposed MCL-US of 4,000 pCi/L (table 11). The proposed MCL-US applies if a state or a local water agency has an approved multimedia mitigation program that addresses radon levels of indoor air quality (U.S. Environmental Protection Agency, 1999). The MCL-US of 15 pCi/L for gross alpha particle activity applies to the adjusted gross alpha, not to the measured gross alpha. Adjusted gross alpha is equal to the measured gross alpha minus the alpha activity attributable to uranium. Uranium activities were estimated from the measured uranium concentrations by using a conversion factor of 0.7 (Federal Register, 2000). Adjusted gross-alpha particle activity (72-hour count) was greater than the MCL-US of 15 pCi/L in 10 samples, 3 of which also had gross alpha radioactivity (30-day count) greater than the benchmark (table 11). Three additional grid-well samples that had no results for gross alpha and gross beta radioactivities had uranium concentrations greater than the MCL-US (table 8*A*). Gross beta radioactivity (72-hour count) was greater than the MCL-CA of 50 pCi/L in one grid-well sample (table 11).

Isotopic Tracers

Isotopic tracers can be used to help interpret hydrologic processes affecting groundwater quality (Clark and Fritz, 1997). Tritium activities (table 12) and helium isotopes provide information about the age (time since recharge) of groundwater. Tritium is a short-lived radioactive isotope of hydrogen that is incorporated into the water molecule. Low levels of tritium are produced continuously by interaction of cosmic radiation with the Earth's atmosphere, and a large amount of tritium was produced as a result of atmospheric testing of nuclear weapons between 1952 and 1963. Thus, concentrations of tritium greater than background generally indicate the presence of water recharged after the early 1950s. Helium isotopes are used in conjunction with tritium concentrations to estimate ages for young groundwater. Of the isotope-tracer constituents analyzed for this study, tritium is the only one with a health-based benchmark. The measured tritium activities in samples from the MS-SA study unit were less than 1/1,000 of the MCL-CA benchmark (table 12).

Carbon-14 (table 12), a radioactive isotope of carbon, is also an age-dating tracer. Low levels of carbon-14 are produced continuously by interaction of cosmic radiation with the Earth's atmosphere and are incorporated into atmospheric carbon dioxide. Carbon dioxide dissolves in precipitation, surface water, and groundwater exposed to the atmosphere, thereby entering the hydrologic cycle. Because carbon-14 decays with a half-life of approximately 5,730 years, low activities of carbon-14, relative to modern values, generally indicate a presence of groundwater that is several thousand years old or more.

The stable isotopic ratios of hydrogen and oxygen in water (table 12) aid in the interpretation of the sources of groundwater recharge (see the "Notation" section in appendix A for a description of how stable isotopic ratios are derived and reported). These stable isotopic ratios reflect the altitude, latitude, and temperature of precipitation and the extent of evaporation of the water in surface-water bodies or soils prior to infiltration into the aquifer.

Gases dissolve in water that is in contact with the atmosphere, and the solubilities of the different gas species vary with temperature. Noble-gas concentrations in groundwater are a function of the partial pressure of the gases and the temperature and salinity of water at the time of recharge. Concentrations of dissolved noble gases can be used to estimate the conditions of groundwater recharge, particularly the temperature of the water when it was last in contact with the atmosphere. Results of analyses of dissolved noble gases (argon, helium, krypton, neon, and xenon) are reported in table 13. These results are stored in a database separate from the NWIS database and maintained by GAMA-PBP project staff.

Future Work

Further GAMA reports for the MS-SA study unit will focus on assessment of the data presented in this report by using a variety of statistical, qualitative, and quantitative approaches to evaluate the natural and human factors affecting groundwater quality in the MS-SA study unit. If available, additional water-quality data are to be compiled, evaluated, and used with the data presented in this report.

Summary

Groundwater quality in the approximately 3,020-square-mile Monterey–Salinas Shallow Aquifer (MS-SA) study unit was investigated by the U.S. Geological Survey (USGS) from October 2012 to May 2013 as part of the California State Water Resources Control Board (SWRCB) Groundwater Ambient Monitoring and Assessment (GAMA) Program's priority Basin Project (PBP). The GAMA Program was created to provide a comprehensive baseline of groundwater quality in the State. The GAMA-PBP was created as a result of the Groundwater Quality Monitoring Act of 2001 (Sections 10780–10782.3 of the California Water Code, Assembly Bill 599) to assess and monitor the quality of groundwater. The GAMA-PBP is being carried out by the USGS in cooperation with the SWRCB and Lawrence Livermore National Laboratory.

The GAMA MS-SA study was designed to provide a spatially unbiased assessment of untreated-groundwater quality in the shallow aquifer system and to facilitate statistically consistent comparisons of untreated groundwater quality throughout California. The shallow aquifer system is defined as that part of the aquifer in which domestic wells are drilled, and it is generally shallower than the depth intervals of the wells listed in the California State Water Resources Control Board-Division of Drinking Water (SWRCB-DDW) database for the MS-SA study unit. The quality of groundwater in shallow or deeper water-bearing zones can differ from that in the primary aquifer system; shallow groundwater can be more vulnerable to surficial contamination.

This assessment characterized the quality of groundwater in the MS-SA study unit, not the quality of drinking water used by consumers served by public drinking-water suppliers; after withdrawal from the aquifer, groundwater can be treated prior to use as drinking water. Domestic and small water-supply systems that usually tap shallow aquifers rarely treat the drinking water, however. Regulatory benchmarks apply to treated water that is served to the consumer of the public water sources, not to untreated groundwater. To provide some context for the results, however, concentrations of constituents measured in the untreated groundwater were compared with regulatory and non-regulatory health-based benchmarks established by the U.S. Environmental Protection Agency (USEPA), SWRCB-DDW, and USGS and with non-regulatory benchmarks established for aesthetic concerns by SWRCB-DDW.

The MS-SA study unit is in the Southern Coast Ranges hydrogeologic province and includes groundwater basins defined by the California Department of Water Resources and surrounding highlands areas outside of the groundwater basins. The MS-SA study included assessment of the groundwater quality from 100 grid wells in Monterey and San Luis Obispo Counties. The wells were selected by using a randomized grid approach to achieve a statistically unbiased representation of groundwater used mostly for domestic drinking-water sources (grid wells). Additionally, samples were collected from 70 wells sampled at taps in the MS-SV and MS-P study areas in order to provide a greater spatial density of data to define the distribution of inorganic constituents.

Field water-quality indicators were measured, and samples for analysis of inorganic constituents were collected at all 170 sites. In addition to these constituents, the samples from grid wells were analyzed for organic constituents, constituents of special interest, radioactive constituents, and geochemical and age-dating tracers. In total, over 200 constituents were measured for this study.

Three types of quality-control samples (blanks, replicates, and matrix spikes) were collected at up to 11 percent of the wells in the MS-SA study unit, and the results for these samples were used to evaluate the quality of the data for the groundwater samples. With the exception of trace elements, blanks rarely contained detectable concentrations of any constituent, indicating that contamination from sample-collection procedures was not a significant source of bias in the data for the groundwater samples. Low concentrations of some trace elements were detected in blanks; therefore, the data were re-censored with higher reporting levels. Replicate samples generally were within the limits of acceptable analytical reproducibility. The median values of matrix-spike recoveries were within the acceptable range (70 to 130 percent) for the volatile organic compounds (VOCs) and *N*-nitrosodimethylamine (NDMA), but were only approximately 64 percent for pesticides and pesticide degradates.

Of the 148 organic constituents analyzed in the 100 grid-well samples, 38 were detected, and all concentrations were less than the benchmarks. The VOCs were detected in 26 of the grid wells, and pesticides and pesticide degradates were detected in 28 grid wells. The special-interest constituent NDMA was detected above the health-based screening level (HBSL) in three samples, one of which also had a perchlorate concentration greater than the MCL-CA.

Of the inorganic constituents, 6 were detected at concentrations above their respective maximum contaminant level (MCL) benchmarks in grid-well samples: arsenic was detected in 5 grid wells (MCL is 10 µg/L), selenium in 3 grid wells (50 µg/L), uranium in 4 grid wells (30 µg/L), nitrate in 16 grid wells (10 mg/L), adjusted gross alpha particle activity in 10 grid wells (15 pCi/L), and gross beta particle activity in 1 grid well (50 pCi/L). An additional 4 inorganic constituents were detected at concentrations above their respective HBSL benchmarks in grid-well samples: boron in one grid well (6,000 µg/L), manganese in eight grid wells (300 µg/L), molybdenum in 6 grid wells (40 µg/L), and strontium in 6 grid wells (4,000 µg/L). Of the inorganic constituents, 4 were detected at concentrations above their non-health-based secondary maximum contaminant level (SMCL) benchmarks in grid-well samples: iron in 9 grid wells (300 µg/L), chloride in 7 grid wells (500 mg/L), sulfate in 14 grid wells (500 mg/L), and TDS in 27 grid wells (1,000 mg/L).

Of the inorganic constituents analyzed in the 70 shallow-well tap sites, 10 were detected at concentrations above the benchmarks. Of the inorganic constituents, 3 were detected at concentrations above their respective MCL benchmarks in shallow-well tap sites: arsenic at 2 shallow-well tap sites (MCL is 10 µg/L), uranium at 2 shallow-well tap sites (30 µg/L), and nitrate at 24 shallow-well tap site (10 mg/L). An additional 3 inorganic constituents were detected above their respective HBSL benchmarks in shallow-well tap sites: manganese at 4 shallow-well tap sites (300 µg/L), molybdenum at 4 shallow-well tap sites (40 µg/L), and zinc at 2 shallow-well tap sites (2,000 µg/L). Of the inorganic constituents, 4 were detected at concentrations above their non-health based SMCL benchmarks in shallow-well tap sites: iron in 6 shallow-well tap sites (300 µg/L), chloride in 1 shallow-well tap site (500 mg/L), sulfate in 9 shallow-well tap sites (500 mg/L), and TDS in 15 shallow-well tap sites (1,000 mg/L).

References Cited

Alt, D.D., and Hyndman, D.W., 2000, Roadside geology of Northern and Central California: Missoula, Montana, Mountain Press Publishing, 369 p.

Belitz, Kenneth, Dubrovsky, N.M., Burow, Karen, Jurgens, Bryant, and Johnson, Tyler, 2003, Framework for a ground-water quality monitoring and assessment program for California: U.S. Geological Survey Water-Resources Investigations Report 2003–4166, 78 p., https://pubs.er.usgs.gov/publication/wri034166.

Burow, K.R., Dubrovsky, N.M., and Shelton, J.L., 2007, Temporal trends in concentrations of DBCP and nitrate in groundwater in the eastern San Joaquin Valley, California, USA: Hydrogeology Journal, v. 15, no. 5, p. 991–1007, doi:10.1007/s10040-006-0148-7, accessed March 14, 2011, at http://www.springerlink.com/content/wk64558523hr1833/.

Burton, C.A., Shelton, J.L., and Belitz, Kenneth, 2012, Status and understanding of groundwater quality in the two southern San Joaquin Valley study units, 2005–2006—California GAMA Priority Basin Project: U.S. Geological Survey Scientific Investigations Report 2011–5218, 106 p., https://pubs.er.usgs.gov/publication/sir20115218.

California Department of Water Resources, 2003, California's groundwater update 2003: California Department of Water Resources Bulletin 118, 246 p., accessed October 27, 2011, at http://www.water.ca.gov/groundwater/bulletin118/update2003.cfm.

California Department of Water Resources, 2011, Water Facts 1—Ground water in fractured hard rock, accessed January 18, 2013, at http://www.water.ca.gov/waterconditions/drought/docs/water_facts_1.pdf.

California State Water Resources Control Board, 2003, Report to the Governor and Legislature—A comprehensive groundwater quality monitoring program for California: Assembly Bill 599, March 2003, 121 p., accessed October 27, 2011, at http://www.waterboards.ca.gov/gama/docs/final_ab_599_rpt_to_legis_7_31_03.pdf.

California State Water Resources Control Board, 2009, Geotracker GAMA: State Water Resources Control Board database, accessed June 11, 2013, at https://geotracker.waterboards.ca.gov/gama/.

California State Water Resources Control Board, 2015, California drinking water-related laws: Drinking water-related regulations (Title 22) (pdf document), accessed August 3, 2015, at http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Lawbook.shtml.

Clark, I.D., and Fritz, Peter, 1997, Environmental isotopes in hydrogeology: Boca Raton, Florida, CRC Press LLC, 352 p.

Division of Drinking Water, 2010, Drinking water notification levels and response levels—An overview: California Department of Public Health Drinking Water Program, 14 p., accessed 2016, at http://www.swrcb.ca.gov/drinking_water/certlic/drinkingwater/documents/notificationlevels/notificationlevels.pdf.

Department of Drinking Water, 2013, California regulations related to drinking water, Title 22: Code of regulations, 339 p., accessed 2016, at http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Perchlorate.shtml.

Faure, Gunter, and Mensing, T.M., 2004, Isotopes—Principles and applications (3d ed.): Hoboken, N.J., John Wiley & Sons, Inc., 928 p.

Federal Register, 2000, National primary drinking water regulations; radionuclides; final rule, accessed on April 20, 2015, at https://www.federalregister.gov/articles/2000/12/07/00-30421/national-primary-drinking-water-regulations-radionuclides-final-rule.

Gilliom, R.J., Barbash, J.E., Crawford, C.G., Hamilton, P.A., Martin, J.D., Nakagaki, Naomi, Nowell, L.H., Scott, J.C., Stackelberg, P.E., Thelin, G.P., and Wolock, D.M., 2006, The quality of our nation's waters—Pesticides in the nation's streams and ground water, 1992–2001: U.S. Geological Survey Circular 1291, 173 p., https://pubs.er.usgs.gov/publication/cir1291.

Hirsch, R.M., Alley, W.M., and Wilber, W.G., 1988, Concepts for a national water-quality assessment program, U.S. Geological Survey Circular 1021, 42 p., https://pubs.er.usgs.gov/publication/cir1021.

Johnson, T.D., and Belitz, Kenneth, 2014, California groundwater units: U.S. Geological Survey Data Series 796, 34 p., http://dx.doi.org/10.3133/ds796.

Johnson, T.D., and Belitz, Kenneth, 2015, Identifying the location and population served by domestic wells in California: Journal of Hydrology: Regional Studies, v. 3, p. 31–86, doi:10.1016/j.ejrh.2014.09.002, http://www.sciencedirect.com/science/article/pii/S2214581814000305.

Kenny, J.F., Barber, N.L., Hutson, S.S., Linsey, K.S., Lovelace, J.K., and Maupin, M.A., 2009, Estimated use of water in the United States in 2005: U.S. Geological Survey Circular 1344, 52 p., https://pubs.er.usgs.gov/publication/cir1344.

Koterba, M.T., Wilde, F.D., and Lapham, W.W., 1995, Ground-water data-collection protocols and procedures for the National Water-Quality Assessment Program—Collection and documentation of water-quality samples and related data: U.S. Geological Survey Open-File Report 95–399, 114 p., https://pubs.er.usgs.gov/publication/ofr95399.

Kulongoski, J.T., and Belitz, Kenneth, 2007, Ground-water quality data in the Monterey Bay and Salinas Valley basins, California, 2005—Results from the California GAMA program: U.S. Geological Survey Data Series 258, 84 p., https://pubs.er.usgs.gov/publication/ds258.

Kulongoski, J.T., and Belitz, Kenneth, 2011, Status and understanding of groundwater quality in the Monterey Bay and Salinas Valley basins, 2005: California GAMA priority basin project: U.S. Geological Survey Scientific Investigations Report 2011–5058, 60 p., https://pubs.er.usgs.gov/publication/sir20115058.

Scott, J.C., 1990, Computerized stratified random site-selection approaches for design of a ground-water-quality sampling network: U.S. Geological Survey Water-Resources Investigations Report 90–4101, 109 p., https://pubs.er.usgs.gov/publication/wri904101.

Soddy, Frederick, 1913, Radioactivity: Annual Reports on the Progress of Chemistry, v. 10, p. 262–288, http://dx.doi.org/10.1039/AR9131000262.

State of California, 2001a, Assembly Bill No. 599, chap. 522, 4 p., accessed October 27, 2011, at http://www.swrcb.ca.gov/gama/docs/ab_599_bill_20011005_chaptered.pdf.

State of California, 2001b, Groundwater Monitoring Act of 2001: California Water Code, part 2.76, Sections 10780–10782.3, accessed October 27, 2011, at http://www.leginfo.ca.gov/cgi-bin/displaycode?section=wat&group=10001-11000&file=10780-10782.3.

Stevenson, D.L., 2012, Quality management system, U.S. Geological Survey National Water Quality Laboratory: unpublished U.S. Geological Survey Report, version 2.0, January 3, 2012, 74 p., http://nwql.usgs.gov/elec/QMS_v2.pdf.

Toccalino, P.L., Norman, J.E., Booth, N.L, Thompson, J.L., and Zogorski, J.S., 2012, Health-based screening levels for evaluating water-quality data: U.S. Geological Survey, National Water-Quality Assessment Program, http://water.usgs.gov/nawqa/HBSL/.

U.S. Census Bureau, 1990, Census of population and housing, summary tape file 3A, accessed June 6, 2013, at ftp://ftp2.census.gov/census_1990/.

U.S. Environmental Protection Agency, 1999, National primary drinking water regulations; Radon-222: Federal Register, v. 64, no. 211, p. 59, 245–59, 294.

U.S. Environmental Protection Agency, 2012, 2012 Edition of the Drinking Water Standards and Health Advisories, EPA 822-S-12-001, https://www.epa.gov/sites/production/files/2015-09/documents/dwstandards2012.pdf.

U.S. Environmental Protection Agency, 2013, Secondary drinking water regulations: Guidance for nuisance chemicals, accessed April 20, 2015, at http://water.epa.gov/drink/contaminants/secondarystandards.cfm.

U.S. Geological Survey, [variously dated], National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A1–A9, accessed October 27, 2011, at http://water.usgs.gov/owq/FieldManual/.

U.S. Geological Survey, 2013a, What is the GAMA?: California Water Science Center website, accessed June 6, 2013, at http://ca.water.usgs.gov/gama/.

U.S. Geological Survey, 2013b, California Groundwater Ambient Monitoring and Assessment (GAMA) Program Priority Basin Project—Shallow aquifer assessment: U.S. Geological Survey Fact Sheet 2012–3136, 2 p., https://pubs.er.usgs.gov/publication/fs20123136.

U.S. Geological Survey, 2013c, Publications: California Water Science Center website, accessed June 6, 2013, at http://ca.water.usgs.gov/gama/includes/GAMA_publications.html.

Zogorski, J.S., Carter, J.M., Ivahnenko, Tamara, Lapham, W.W., Moran, M.J., Rowe, B.L., Squillace, P.J., and Toccalino, P.L., 2006, Volatile organic compounds in the Nation's ground water and drinking-water supply wells: U.S. Geological Survey Circular 1292, 101 p., https://pubs.er.usgs.gov/publication/cir1292.

Table 1. Identification, sampling, construction, and water-level information for grid wells sampled for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[Land-surface datum (LSD) is a datum plane that is approximately at land surface at each well. The altitude of the LSD is described in feet above the North American Vertical Datum of 1988 (NAVD 88). **GAMA well identification numbers**: S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well; S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well. **Abbreviations**: ft, feet; mm/dd/yyyy, month/day/year; na, not available]

Sampling information				Construction information			Depth to water level (ft below LSD)
GAMA well identification number	Date sampled (mm/dd/yyyy)	Well type	Altitude of LSD (ft above NAVD 88)	Well depth (ft below LSD)	Depth to top perforation (ft below LSD)	Depth to bottom perforation (ft below LSD)	
MS-SA study unit grid wells (100 wells sampled)							
Santa Cruz study area wells (15 wells sampled)							
S-MS-SC01	01/10/2013	Production	59	300	na	na	185
S-MS-SC02	01/10/2013	Production	372	520	380	520	na
S-MS-SC03	12/10/2012	Production	560	122	60	122	38.3
S-MS-SC04	01/08/2013	Production	929	100	32	100	na
S-MS-SC05	01/14/2013	Production	423	510	390	510	108.5
S-MS-SC06	02/12/2013	Production	632	325	85	325	na
S-MS-SC07	03/06/2013	Production	49	116	60	116	na
S-MS-SC08	03/04/2013	Production	117	150	106	150	41.1
S-MS-SC09	03/18/2013	Production	632	440	na	na	na
S-MS-SC10	02/04/2013	Production	739	136	116	136	109.1
S-MS-SC11	12/10/2012	Production	412	170	70	170	29
S-MS-SC12	01/09/2013	Production	811	244	100	244	82.5
S-MS-SC13	03/06/2013	Production	1,596	900	500	800	na
S-MS-SC14	01/08/2013	Production	410	240	100	240	na
S-MS-SC15	02/14/2013	Production	373	270	220	270	16.9
Pajaro Valley study area (15 wells sampled)							
S-MS-P01	02/11/2013	Production	179	378	na	na	na
S-MS-P02	02/05/2013	Production	141	200	80	190	136.8
S-MS-P03	01/07/2013	Production	154	290	180	290	93
S-MS-P04	02/05/2013	Production	465	600	480	590	407.2
S-MS-P05	02/11/2013	Spring	262	0	na	na	na
S-MS-P06	04/25/2013	Production	53	200	160	190	na
S-MS-P07	03/05/2013	Production	83	190	140	160	na
S-MS-P08	03/05/2013	Production	90	180	128	176	na
S-MS-P09	02/13/2013	Production	33	180	140	180	na
S-MS-P10	03/04/2013	Production	157	260	220	260	na
S-MS-P11	02/06/2013	Production	123	300	260	300	113.5
S-MS-P12	02/12/2013	Production	96	460	340	440	84.9
S-MS-P13	02/06/2013	Production	95	440	310	430	79.9
S-MS-P14	02/07/2013	Production	198	520	420	520	na
S-MS-P15	02/07/2013	Production	528	480	na	na	80.8

Table 1. Identification, sampling, construction, and water-level information for grid wells sampled for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[Land-surface datum (LSD) is a datum plane that is approximately at land surface at each well. The altitude of the LSD is described in feet above the North American Vertical Datum of 1988 (NAVD 88). **GAMA well identification numbers**: S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well; S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well. **Abbreviations**: ft, feet; mm/dd/yyyy, month/day/year; na, not available]

Sampling information				Construction information			Depth to water level (ft below LSD)
GAMA well identification number	Date sampled (mm/dd/yyyy)	Well type	Altitude of LSD (ft above NAVD 88)	Well depth (ft below LSD)	Depth to top perforation (ft below LSD)	Depth to bottom perforation (ft below LSD)	
MS-SA study unit grid wells (100 wells sampled)—Continued							
Salinas Valley study area (40 wells sampled)							
S-MS-SV01	11/08/2012	Production	864	280	140	280	na
S-MS-SV02	03/20/2013	Production	673	290	170	290	59.7
S-MS-SV03	10/31/2012	Production	571	460	210	450	na
S-MS-SV04	10/29/2012	Production	352	340	140	340	na
S-MS-SV05	10/30/2012	Production	388	500	160	480	219.7
S-MS-SV06	11/08/2012	Production	121	275	20	275	na
S-MS-SV07	11/08/2012	Production	10	392	352	392	na
S-MS-SV08	11/05/2012	Production	34	290	258	288	43.4
S-MS-SV09	10/29/2012	Production	370	700	449	700	255.4
S-MS-SV10	03/19/2013	Production	243	190	150	190	81.4
S-MS-SV11	11/06/2012	Production	385	410	370	410	na
S-MS-SV12	11/07/2012	Production	546	258	178	258	147.9
S-MS-SV13	03/13/2013	Production	598	340	120	330	na
S-MS-SV14	03/13/2013	Production	593	395	na	na	46.6
S-MS-SV15	11/27/2012	Production	530	180	100	180	na
S-MS-SV16	02/26/2013	Production	287	165	120	160	na
S-MS-SV17	11/26/2012	Production	197	160	100	160	38.9
S-MS-SV18	12/13/2012	Production	149	85	na	na	37.1
S-MS-SV19	10/30/2012	Production	38	370	355	365	51.5
S-MS-SV20	11/05/2012	Production	42	500	na	na	53.4
S-MS-SV21	11/05/2012	Production	62	240	200	240	na
S-MS-SV22	03/14/2013	Production	120	540	420	540	na
S-MS-SV23	01/29/2013	Production	179	300	na	na	na
S-MS-SV24	11/06/2012	Production	293	670	550	650	na
S-MS-SV25	03/20/2013	Production	333	275	115	220	na
S-MS-SV26	03/14/2013	Production	425	100	60	100	na
S-MS-SV27	02/26/2013	Production	471	130	80	130	na
S-MS-SV28	03/26/2013	Production	870	127	na	na	na
S-MS-SV29	11/08/2012	Production	345	84	70	80	na
S-MS-SV30	03/19/2013	Production	257	200	na	na	na

Table 1. Identification, sampling, construction, and water-level information for grid wells sampled for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[Land-surface datum (LSD) is a datum plane that is approximately at land surface at each well. The altitude of the LSD is described in feet above the North American Vertical Datum of 1988 (NAVD 88). **GAMA well identification numbers**: S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well; S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well. **Abbreviations**: ft, feet; mm/dd/yyyy, month/day/year; na, not available]

Sampling information				Construction information			Depth to water level (ft below LSD)
GAMA well identification number	Date sampled (mm/dd/yyyy)	Well type	Altitude of LSD (ft above NAVD 88)	Well depth (ft below LSD)	Depth to top perforation (ft below LSD)	Depth to bottom perforation (ft below LSD)	
MS-SA study unit grid wells (100 wells sampled)—Continued							
Salinas Valley study area (40 wells sampled)—Continued							
S-MS-SV31	03/12/2013	Production	224	125	na	na	na
S-MS-SV32	04/25/2013	Production	198	285	na	na	na
S-MS-SV33	11/05/2012	Production	138	260	220	260	143
S-MS-SV34	11/07/2012	Production	594	630	168	609	na
S-MS-SV35	03/07/2013	Production	421	472	432	472	na
S-MS-SV36	11/06/2012	Production	245	700	480	680	na
S-MS-SV37	11/01/2012	Production	452	330	160	320	na
S-MS-SV38	04/08/2013	Production	269	200	112	166	na
S-MS-SV39	04/24/2013	Production	1,091	322	152	312	na
S-MS-SV40	03/21/2013	Production	1,213	292	na	na	na
Highlands study area (30 wells sampled)							
S-MS-H01	12/12/2012	Production	1,153	480	180	480	na
S-MS-H02	01/17/2013	Production	1,342	360	160	360	na
S-MS-H03	01/16/2013	Production	784	na	na	na	21.9
S-MS-H04	11/27/2012	Production	1,146	235	115	235	77.7
S-MS-H05	01/16/2013	Production	1,236	na	na	na	276.5
S-MS-H06	12/11/2012	Production	764	400	200	380	na
S-MS-H07	04/11/2013	Production	604	24	na	na	na
S-MS-H08	02/28/2013	Production	678	100	na	na	na
S-MS-H09	11/29/2012	Production	819	140	80	140	76.7
S-MS-H10	11/28/2012	Production	842	118	na	na	70.6
S-MS-H11	11/28/2012	Production	771	410	na	na	na
S-MS-H12	12/12/2012	Production	1,074	137	na	na	na
S-MS-H13	04/10/2013	Production	1,987	480	na	na	na
S-MS-H14	01/15/2013	Production	1,636	740	600	740	na
S-MS-H15	12/11/2012	Production	1,077	470	410	470	423.5
S-MS-H16	01/17/2013	Production	881	320	260	320	183.6
S-MS-H17	04/09/2013	Production	763	400	200	400	na
S-MS-H18	01/30/2013	Production	509	400	na	na	na
S-MS-H19	03/25/2013	Production	529	150	na	na	na
S-MS-H20	04/11/2013	Production	1610	125	50	125	na

Table 1. Identification, sampling, construction, and water-level information for grid wells sampled for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[Land-surface datum (LSD) is a datum plane that is approximately at land surface at each well. The altitude of the LSD is described in feet above the North American Vertical Datum of 1988 (NAVD 88). **GAMA well identification numbers**: S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well; S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well. **Abbreviations**: ft, feet; mm/dd/yyyy, month/day/year; na, not available]

Sampling information				Construction information			Depth to water level (ft below LSD)
GAMA well identification number	Date sampled (mm/dd/yyyy)	Well type	Altitude of LSD (ft above NAVD 88)	Well depth (ft below LSD)	Depth to top perforation (ft below LSD)	Depth to bottom perforation (ft below LSD)	
MS-SA study unit grid wells (100 wells sampled)—Continued							
Highlands study area (30 wells sampled)—Continued							
S-MS-H21	04/23/2013	Production	758	400	380	400	na
S-MS-H22	04/23/2013	Production	2,057	154	na	na	na
S-MS-H23	01/15/2013	Production	1,468	695	520	695	na
S-MS-H24	01/31/2013	Production	1,112	500	300	500	na
S-MS-H25	05/23/2013	Production	2,084	na	na	na	na
S-MS-H26	01/29/2013	Production	1,368	505	105	405	na
S-MS-H27	04/09/2013	Production	1,619	500	na	na	na
S-MS-H28	04/22/2013	Production	1,253	60	na	na	na
S-MS-H29	01/30/2013	Production	961	88	34	50	na
S-MS-H30	02/25/2013	Production	1,990	425	380	na	na

Table 2. Classes of chemical constituents and field water-quality indicators measured in groundwater samples from the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[—, no data]

Constituent classes	Constituent-list table	Results table
Field water-quality indicators		
Dissolved oxygen, temperature, pH, and specific conductance	—	4*A*, 4*B*
Field alkalinity, bicarbonate, and carbonate	—	4*A*
Organic constituents		
Volatile organic compounds (VOCs)	3*A*	5
Pesticides and pesticide degradates	3*B*	6
Constituent of special interest		
Perchlorate	3*C*	7
N-Nitrosodimethylamine (NDMA)	3*C*	7
Inorganic constituents		
Trace elements	3*D*	8*A*, 8*B*
Nutrients	3*E*	9*A*, 9*B*
Major and minor ions, silica, and total dissolved solids (TDS)	3*F*	10*A*, 10*B*
Laboratory alkalinity, bicarbonate, and carbonate	3*F*	4*A*, 4*B*
Radioactive constituents		
Radon-222	3*G*	11
Gross alpha and gross beta radioactivity (72-hour and 30-day counts)	3*G*	11
Isotopic tracers		
Stable isotopes of hydrogen and oxygen in water	3*G*	12
Stable isotopes of carbon in dissolved inorganic carbon and carbon-14 abundance	3*G*	12
Tritium	3*G*	12
Noble gases	3*H*	13

Table 3*A*. Volatile organic compounds (VOCs), primary uses or sources, comparison benchmarks, and reporting information for the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL) Schedule 2020.

[The five-digit USGS parameter code is used to uniquely identify a specific constituent or property. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; HBSL, USGS Health-Based Screening Level; MCL-CA, California maximum contaminant level; MCL-HI, Hawaii Department of Health maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; RSD5-US, USEPA risk-specific dose at a risk factor of 10^{-5}. Maximum contaminant level benchmarks 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 Abstracts Service; CASRN®, Chemical Abstracts Service Registry Number®; LRL, laboratory reporting level; SRL, study reporting level; THM, trihalomethane; D, detected in groundwater samples; na, not available; µg/L, micrograms per liter; —, not detected]

Constituent (synonym or abbreviation)	Primary use or source	USGS parameter code	CASRN®[1]	LRL (µg/L)	Benchmark type[2]	Benchmark level (µg/L)[2]	Detection
Acetone	Solvent	81552	67-64-1	3.4	HBSL (na)	6,000 (na)	—[3]
Acrylonitrile	Organic synthesis	34215	107-13-1	0.48	HBSL (RSD5-US)	0.6 (0.6)	—
tert-Amyl methyl ether (TAME)	Gasoline oxygenate	50005	994-05-8	0.06	na	na	D
Benzene	Gasoline hydrocarbon	34030	71-43-2	0.026	MCL-CA	1	—
Bromobenzene	Solvent	81555	108-86-1	0.022	HBSL (HAL-US)	60 (60)	—
Bromochloromethane	Fire retardant	77297	74-97-5	0.06	HBSL (HAL-US)	90 (90)	—
Bromodichloromethane	Disinfection byproduct (THM)	32101	75-27-4	0.034	MCL-US	[4]80	D
Bromoform (Tribromomethane)	Disinfection byproduct (THM)	32104	75-25-2	0.1	MCL-US	[4]80	D
Bromomethane (Methyl bromide)	Fumigant	34413	74-83-9	0.2	HBSL (HAL-US)	100 (10)	—
n-Butylbenzene	Gasoline hydrocarbon	77342	104-51-8	0.08	NL-CA	260	—
sec-Butylbenzene	Gasoline hydrocarbon	77350	135-98-8	0.034	NL-CA	260	—
tert-Butylbenzene	Gasoline hydrocarbon	77353	98-06-6	0.06	NL-CA	260	—
Carbon disulfide	Organic synthesis	77041	75-15-0	0.1	HBSL (NL-CA)	700 (160)	D
Carbon tetrachloride (Tetrachloromethane)	Solvent	32102	56-23-5	0.06	MCL-CA	0.5	D
Chlorobenzene	Solvent	34301	108-90-7	0.026	MCL-CA	70	—
Chloroethane	Solvent	34311	75-00-3	0.06	na	na	—
Chloroform (Trichloromethane)	Disinfection byproduct (THM)	32106	67-66-3	0.03	MCL-US	[4]80	D
Chloromethane	Solvent	34418	74-87-3	0.1	na	na	—
3-Chloropropene	Organic synthesis	78109	107-05-1	0.08	na	na	—
2-Chlorotoluene	Solvent	77275	95-49-8	0.028	HBSL (NL-CA)	100 (140)	—
4-Chlorotoluene	Solvent	77277	106-43-4	0.042	HBSL (NL-CA)	100 (140)	—
Dibromochloromethane	Disinfection byproduct (THM)	32105	124-48-1	0.12	MCL-US	[4]80	D
1,2-Dibromo-3-chloro-propane (DBCP)	Fumigant	82625	96-12-8	0.4	MCL-US	0.2	—
1,2-Dibromoethane (EDB)	Fumigant	77651	106-93-4	0.028	MCL-US	0.05	—
Dibromomethane	Solvent	30217	74-95-3	0.05	na	na	—
1,2-Dichlorobenzene	Solvent	34536	95-50-1	0.028	MCL-US	600	—
1,3-Dichlorobenzene	Solvent	34566	541-73-1	0.024	HBSL (HAL-US)	600 (600)	—
1,4-Dichlorobenzene	Fumigant	34571	106-46-7	0.026	MCL-CA	5	—
trans-1,4-Dichloro-2-butene	Organic synthesis	73547	110-57-6	2	na	na	—

Table 3*A*. Volatile organic compounds (VOCs), primary uses or sources, comparison benchmarks, and reporting information for the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL) Schedule 2020.—Continued

[The five-digit USGS parameter code is used to uniquely identify a specific constituent or property. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; HBSL, USGS Health-Based Screening Level; MCL-CA, California maximum contaminant level; MCL-HI, Hawaii Department of Health maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; RSD5-US, USEPA risk-specific dose at a risk factor of 10^{-5}. Maximum contaminant level benchmarks 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 Abstracts Service; CASRN®, Chemical Abstracts Service Registry Number®; LRL, laboratory reporting level; SRL, study reporting level; THM, trihalomethane; D, detected in groundwater samples; na, not available; µg/L, micrograms per liter; —, not detected]

Constituent (synonym or abbreviation)	Primary use or source	USGS parameter code	CASRN®[1]	LRL (µg/L)	Benchmark type[2]	Benchmark level (µg/L)[2]	Detection
Dichlorodifluoromethane (CFC-12)	Refrigerant	34668	75-71-8	0.1	HBSL (NL-CA)	1,000 (1,000)	D
1,1-Dichloroethane (1,1-DCA)	Solvent	34496	75-34-3	0.044	MCL-CA	5	—
1,2-Dichloroethane (1,2-DCA)	Solvent	32103	107-06-2	0.08	MCL-CA	0.5	—
1,1-Dichloroethene (1,1-DCE)	Organic synthesis	34501	75-35-4	0.022	MCL-CA	6	—
cis-1,2-Dichloroethene (*cis*-1,2-DCE)	Solvent	77093	156-59-2	0.022	MCL-CA	6	—
trans-1,2-Dichloroethene (*trans*-1,2-DCE)	Solvent	34546	156-60-5	0.018	MCL-CA	10	—
1,2-Dichloropropane	Fumigant	34541	78-87-5	0.026	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	0.1	MCL-CA	0.5	—
trans-1,3-Dichloro-propene	Fumigant	34699	10061-02-6	0.14	MCL-CA	0.5	—
Diethyl ether	Solvent	81576	60-29-7	0.1	HBSL	1,000	—
Diisopropyl ether (DIPE)	Gasoline oxygenate	81577	108-20-3	0.06	na	na	—
Ethylbenzene	Gasoline hydrocarbon	34371	100-41-4	0.036	MCL-CA	300	—
Ethyl *tert*-butyl ether (ETBE)	Gasoline oxygenate	50004	637-92-3	0.032	na	na	—
Ethyl methacrylate	Organic synthesis	73570	97-63-2	0.2	na	na	—
o-Ethyl toluene (1-Ethyl-2-methyl benzene)	Gasoline hydrocarbon	77220	611-14-3	0.032	na	na	—
Hexachlorobutadiene	Organic synthesis	39702	87-68-3	0.08	HBSL (RSD5-US)	90 (9)	—
Hexachloroethane	Solvent	34396	67-72-1	0.1	HBSL (HAL-US)	0.7 (1)	—
2-Hexanone (*n*-Butyl methyl ketone)	Solvent	77103	591-78-6	0.4	HBSL (na)	40 (na)	—
Iodomethane (Methyl iodide)	Organic synthesis	77424	74-88-4	0.26	na	na	—
Isopropylbenzene	Gasoline hydrocarbon	77223	98-82-8	0.042	HBSL (NL-CA)	700 (770)	—
4-Isopropyl-1-methyl benzene	Gasoline hydrocarbon	77356	99-87-6	0.06	na	na	—
Methyl acrylate	Organic synthesis	49991	96-33-3	0.8	na	na	—
Methyl acrylonitrile	Organic synthesis	81593	126-98-7	0.26	HBSL (na)	0.7	—

Table 3*A*. Volatile organic compounds (VOCs), primary uses or sources, comparison benchmarks, and reporting information for the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL) Schedule 2020.—Continued

[The five-digit USGS parameter code is used to uniquely identify a specific constituent or property. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; HBSL, USGS Health-Based Screening Level; MCL-CA, California maximum contaminant level; MCL-HI, Hawaii Department of Health maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; RSD5-US, USEPA risk-specific dose at a risk factor of 10^{-5}. Maximum contaminant level benchmarks 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 Abstracts Service; CASRN®, Chemical Abstracts Service Registry Number®; LRL, laboratory reporting level; SRL, study reporting level; THM, trihalomethane; D, detected in groundwater samples; na, not available; µg/L, micrograms per liter; —, not detected]

Constituent (synonym or abbreviation)	Primary use or source	USGS parameter code	CASRN®[1]	LRL (µg/L)	Benchmark type[2]	Benchmark level (µg/L)[2]	Detection
Methyl *tert*-butyl ether (MTBE)	Gasoline oxygenate	78032	1634-04-4	0.1	MCL-CA	13	D
Methyl *iso*-butyl ketone (MIBK)	Solvent	78133	108-10-1	0.32	NL-CA	120	—
Methylene chloride (Dichloromethane)	Solvent	34423	75-09-2	0.04	MCL-US	5	—
Methyl ethyl ketone (2-butanone, MEK)	Solvent	81595	78-93-3	1.6	HBSL (HAL-US)	4,000 (4,000)	—[3]
Methyl methacrylate	Organic synthesis	81597	80-62-6	0.22	HBSL (na)	10,000 (na)	—
Naphthalene	Gasoline hydrocarbon	34696	91-20-3	0.18	HBSL (NL-CA)	100 (17)	—
Perchloroethene (PCE, Tetrachloroethene)	Solvent	34475	127-18-4	0.026	MCL-US	5	D
n-Propylbenzene	Solvent	77224	103-65-1	0.036	NL-CA	260	—
Styrene	Gasoline hydrocarbon	77128	100-42-5	0.042	MCL-US	100	—
1,1,1,2-Tetrachloro-ethane	Solvent	77562	630-20-6	0.04	HBSL (HAL-US)	70 (70)	—
1,1,2,2-Tetrachloro-ethane	Solvent	34516	79-34-5	0.14	MCL-CA	1	—
Tetrahydrofuran	Solvent	81607	109-99-9	1.4	na	na	—[3]
1,2,3,4-Tetramethyl-benzene	Gasoline hydrocarbon	49999	488-23-3	0.1	na	na	—
1,2,3,5-Tetramethyl-benzene	Gasoline hydrocarbon	50000	527-53-7	0.08	na	na	—
Toluene	Gasoline hydrocarbon	34010	108-88-3	0.018	MCL-CA	150	D
1,2,3-Trichlorobenzene	Organic synthesis	77613	87-61-6	0.06	na	na	—
1,2,4-Trichlorobenzene	Solvent	34551	120-82-1	0.08	MCL-CA	5	—
1,1,1-Trichloroethane (1,1,1-TCA)	Solvent	34506	71-55-6	0.03	MCL-US	200	—
1,1,2-Trichloroethane (1,1,2-TCA)	Solvent	34511	79-00-5	0.046	MCL-US	5	—
Trichloroethene (TCE)	Solvent	39180	79-01-6	0.022	MCL-US	5	—
Trichlorofluoromethane (CFC-11)	Refrigerant	34488	75-69-4	0.06	MCL-CA	150	D
1,2,3-Trichloropropane (1,2,3-TCP)	Solvent/organic synthesis	77443	96-18-4	0.12	MCL-HI[5] (NL-CA)	0.6 (0.005)	—
Trichlorotrifluoroethane (CFC-113)	Refrigerant	77652	76-13-1	0.022	MCL-CA	1,200	D
1,2,3-Trimethylbenzene	Gasoline hydrocarbon	77221	526-73-8	0.06	na	na	—
1,2,4-Trimethylbenzene	Gasoline hydrocarbon	77222	95-63-6	0.032	NL-CA	330	—
1,3,5-Trimethylbenzene	Organic synthesis	77226	108-67-8	0.032	NL-CA	330	—

Table 3*A*. Volatile organic compounds (VOCs), primary uses or sources, comparison benchmarks, and reporting information for the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL) Schedule 2020.—Continued

[The five-digit USGS parameter code is used to uniquely identify a specific constituent or property. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; HBSL, USGS Health-Based Screening Level; MCL-CA, California maximum contaminant level; MCL-HI, Hawaii Department of Health maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; RSD5-US, USEPA risk-specific dose at a risk factor of 10^{-5}. Maximum contaminant level benchmarks 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 Abstracts Service; CASRN®, Chemical Abstracts Service Registry Number®; LRL, laboratory reporting level; SRL, study reporting level; THM, trihalomethane; D, detected in groundwater samples; na, not available; µg/L, micrograms per liter; —, not detected]

Constituent (synonym or abbreviation)	Primary use or source	USGS parameter code	CASRN®[1]	LRL (µg/L)	Benchmark type[2]	Benchmark level (µg/L)[2]	Detection
Vinyl bromide (Bromoethene)	Fire retardant	50002	593-60-2	0.12	na	na	—
Vinyl chloride (Chloroethene)	Organic synthesis	39175	75-01-4	0.06	MCL-CA	0.5	—
m- plus *p*-Xylene	Gasoline hydrocarbon	85795	108-38-3 / 106-42-3	0.08	MCL-CA	[6]1,750	—
o-Xylene	Gasoline hydrocarbon	77135	95-47-6	0.032	MCL-CA	[6]1,750	—

[1]This report contains CASRNs®, which is a Registered Trademark of the American Chemical Society. CAS recommends the verification of the CASRNs through CAS Client Services℠.

[2]For constituents with HBSLs, the benchmark types and values of other non-regulatory health-based benchmarks are listed in parentheses for comparison.

[3]Study reporting levels (SRLs) determined on the basis of the quality-control data collected between May 2004 and September 2010 for the first 21 study units of the California Groundwater Ambient Monitoring and Assessment Priority Basin Project (Fram and others, 2012) resulted in censoring all groundwater detections when applied to 3 VOCs for the Monterey–Salinas Shallow Aquifer study unit. All detections of acetone, 2-butanone, and tetrahydrofuran were censored from this dataset and coded in the NWIS database as "reviewed and rejected." See appendix table A-2 for more information about VOC SRLs.

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

[5] Currently (2016), Hawaii is the only jurisdiction that has an enforcable maximum contaminant level for 1,2,3-TCP (Hooker, E.P., Fulcher, K.G., and Gibb, H.J., 2012, Report to the Hawaii Department of Health, Safe Drinking Water Branch, regarding the human health risks of 1,2,3-trichloropropane in tap water: Tetra Tech Services, 101 p., accessed June 12, 2013, at http://eha-web.doh.hawaii.gov/eha-cma/documents/fd65a6d2-73d1-4d5c-88c6-97a47ba36650).

[6]The MCL-CA benchmarks for *m*- plus *p*-xylene and *o*-xylene is the sum of all three xylene compounds.

Table 3*B*. Pesticides and pesticide degradates, primary uses or sources, comparison benchmarks, and reporting information for the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL) Schedule 2003.

[The five-digit USGS parameter code is used to uniquely identify a specific constituent or property. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; HBSL, USGS Health-Based Screening Level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; RSD5-US, USEPA risk specific dose at a risk factor of 10^{-5}. Maximum contaminant level benchmarks 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**: CASRN®, Chemical Abstracts Service Registry Number®; D, detected in groundwater samples; LRL, laboratory reporting level; na, not available; µg/L, micrograms per liter; —, not detected]

Constituent (synonym or abbreviation)	Primary use or source	USGS parameter code	CASRN®	LRL (µg/L)	Benchmark type[1]	Benchmark level (µg/L)[1]	Detection
Acetochlor	Herbicide	49260	34256-82-1	0.01	HBSL	10	—
Alachlor	Herbicide	46342	15972-60-8	0.008	MCL-US	2	—
Atrazine	Herbicide	39632	1912-24-9	0.008	MCL-CA	1	D
Azinphos-methyl	Insecticide	82686	86-50-0	0.12	HBSL (na)	10 (na)	—
Azinphos-methyl oxon	Insecticide degradate	61635	961-22-8	0.042	na	na	—[2]
Benfluralin	Herbicide	82673	1861-40-1	0.014	HBSL	4	D[2]
Carbaryl	Insecticide	82680	63-25-2	0.06	HBSL[3] (RSD5-US)	400 (400)	—
2-Chloro-2,6-diethylacetanilide	Herbicide degradate	61618	6967-29-9	0.01	na	na	—
4-Chloro-2-methylphenol	Herbicide degradate	61633	1570-64-5	0.008	na	na	—
Chlorpyrifos	Insecticide	38933	2921-88-2	0.0036	HBSL (HAL-US)	2 (2)	D
Chlorpyrifos oxon	Insecticide degradate	61636	5598-15-2	0.08	HBSL	0.8	—
Cyfluthrin	Insecticide	61585	68359-37-5	0.016	HBSL	200	—[2]
Cypermethrin	Insecticide	61586	52315-07-8	0.02	HBSL	40	D[2]
Dacthal (DCPA)	Herbicide	82682	1861-32-1	0.0076	HBSL (HAL-US)	70 (70)	D
Deethylatrazine (2-Chloro-4-iso-propylamino-6-amino-*s*-triazine)	Herbicide degradate	04040	6190-65-4	0.006	na	na	D[2]
Desulfinylfipronil	Insecticide degradate	62170	na	0.012	na	na	D
Desulfinylfipronil amide	Insecticide degradate	62169	na	0.029	na	na	—
Diazinon	Insecticide	39572	333-41-5	0.006	HBSL (NL-CA)	1 (1.2)	D
3,4-Dichloroaniline	Herbicide degradate	61625	95-76-1	0.006	na	na	D
Dichlorvos	Insecticide	38775	62-73-7	0.04	na	na	—[2]
Dicrotophos	Insecticide	38454	141-66-2	0.08	HBSL	0.05	—[2]
Dieldrin	Insecticide	39381	60-57-1	0.008	HBSL (RSD5-US)	0.02 (0.02)	D
2,6-Diethylaniline	Herbicide degradate	82660	579-66-8	0.006	na	na	—
Dimethoate	Insecticide	82662	60-51-5	0.006	HBSL (na)	2 (na)	D[2]
Ethion	Insecticide	82346	563-12-2	0.01	HBSL (na)	4 (na)	D[2]
Ethion monoxon	Insecticide degradate	61644	17356-42-2	0.021	na	na	—
2-Ethyl-6-methylaniline	Herbicide degradate	61620	24549-06-2	0.01	na	na	—
Fenamiphos	Insecticide	61591	22224-92-6	0.03	HBSL (HAL-US)	0.7 (0.7)	—
Fenamiphos sulfone	Insecticide degradate	61645	31972-44-8	0.054	na	na	—
Fenamiphos sulfoxide	Insecticide degradate	61646	31972-43-7	0.08	na	na	—[2]
Fipronil	Insecticide	62166	120068-37-3	0.018	HBSL	0.1	D
Fipronil sulfide	Insecticide degradate	62167	120067-83-6	0.012	na	na	D
Fipronil sulfone	Insecticide degradate	62168	120068-36-2	0.024	na	na	D[2]
Fonofos	Insecticide	04095	944-22-9	0.0048	HBSL (HAL-US)	10 (10)	—
Hexazinone	Herbicide	04025	51235-04-2	0.012	HBSL (HAL-US)	400 (400)	D[2]

Table 3*B*. Pesticides and pesticide degradates, primary uses or sources, comparison benchmarks, and reporting information for the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL) Schedule 2003.—Continued

[The five-digit USGS parameter code is used to uniquely identify a specific constituent or property. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; HBSL, USGS Health-Based Screening Level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; RSD5-US, USEPA risk specific dose at a risk factor of 10^{-5}. Maximum contaminant level benchmarks 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. **Other abbreviations**: CASRN®, Chemical Abstracts Service Registry Number®; D, detected in groundwater samples; LRL, laboratory reporting level; na, not available; µg/L, micrograms per liter; —, not detected]

Constituent (synonym or abbreviation)	Primary use or source	USGS parameter code	CASRN®	LRL (µg/L)	Benchmark type[1]	Benchmark level (µg/L)[1]	Detection
Iprodione	Fungicide	61593	36734-19-7	0.014	HBSL	80	—[2]
Isofenphos	Insecticide	61594	25311-71-1	0.008	HBSL	6	D
Malaoxon	Insecticide degradate	61652	1634-78-2	0.022	na	na	—
Malathion	Insecticide	39532	121-75-5	0.016	HBSL (HAL-US)	500 (500)	—
Metalaxyl	Fungicide	61596	57837-19-1	0.014	HBSL	500	—
Methidathion	Insecticide	61598	950-37-8	0.012	HBSL	1	—
Metolachlor	Herbicide	39415	51218-45-2	0.02	HBSL (HAL-US)	700 (700)	D
Metribuzin	Herbicide	82630	21087-64-9	0.012	HBSL (HAL-US)	90 (70)	—
Myclobutanil	Fungicide	61599	88671-89-0	0.01	HBSL	200	—
1-Naphthol	Insecticide degradate	49295	90-15-3	0.036	na	na	—[2]
Paraoxon-methyl	Insecticide degradate	61664	950-35-6	0.014	na	na	—[2]
Parathion-methyl	Insecticide	82667	298-00-0	0.008	HBSL (HAL-US)	1 (1)	—
Pendimethalin	Herbicide	82683	40487-42-1	0.012	HBSL	20	D[2]
cis-Permethrin	Insecticide	82687	54774-45-7	0.01	HBSL	400	D[2]
Phorate	Insecticide	82664	298-02-2	0.02	HBSL	4	—[2]
Phorate oxon	Insecticide degradate	61666	2600-69-3	0.027	na	na	—
Phosmet	Insecticide	61601	732-11-6	0.08	HBSL	4	—
Phosmet oxon	Insecticide degradate	61668	3735-33-9	0.0511	na	na	—[2]
Prometon	Herbicide	04037	1610-18-0	0.012	HBSL (HAL-US)	400 (400)	—
Prometryn	Herbicide	04036	7287-19-6	0.01	HBSL	300	D
Pronamide (Propyzamide)	Herbicide	82676	23950-58-5	0.0036	HBSL (RSD5-US)	10 (10)	—
Simazine	Herbicide	04035	122-34-9	0.006	MCL-US	4	D
Tebuthiuron	Herbicide	82670	34014-18-1	0.028	HBSL (HAL-US)	1,000 (500)	—
Terbufos	Insecticide	82675	13071-79-9	0.018	HBSL (HAL-US)	0.4 (0.4)	—[2]
Terbufos oxon sulfone	Insecticide degradate	61674	56070-15-6	0.045	na	na	—[2]
Terbuthylazine	Herbicide	04022	5915-41-3	0.008	HBSL	2	—
Tribufos	Defoliant	61610	78-48-8	0.018	HBSL	7	D[2]
Trifluralin	Herbicide	82661	1582-09-8	0.018	HBSL (HAL-US)	20 (10)	D[2]

[1]For constituents with HBSLs, the benchmark types and values of other non-regulatory health-based benchmarks are listed in parentheses for comparison.

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

[3]An HBSL range of 40 to 4,000 µg/L is defined; 400 µg/L is selected as the comparison benchmark in this report.

Table 3*C*. Constituents of special interest, primary uses or sources, comparison benchmarks, and reporting information for analyses performed by Weck Laboratories, Inc. (Weck), City of Industry, California.

[The five-digit USGS parameter code is used to uniquely identify a specific constituent or property. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level; NL-CA, California notification level. Maximum contaminant level benchmarks 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**: CASRN®, Chemical Abstracts Service Registry Number®; D, detected in groundwater samples; MRL, minimum reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter]

Constituent (synonym or abbreviation)	Primary use or source	USGS parameter code	CASRN®	MRL (µg/L)	Benchmark type	Benchmark level (µg/L)	Detection
Perchlorate	Rocket fuel, fireworks, flares, natural	63790	14797-73-0	0.10	MCL-CA	6	D
N-Nitrosodimethylamine (NDMA)	Disinfection byproduct	34438	62-75-9	0.002	NL-CA	0.01	D

Table 3*D*. Trace elements, comparison benchmarks, and reporting information for the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL) Schedule 1948.

[The five-digit USGS parameter code is used to uniquely identify a specific constituent or property. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; HBSL, USGS health-based screening level; MCL CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: CASRN®, Chemical Abstracts Service Registry Number®; D, detected in groundwater samples; LT-MDL, long-term method detection level; na, not available; µg/L, micrograms per liter]

Constituent	USGS parameter code	CASRN®	LT-MDL (µg/L)	Benchmark type[1]	Benchmark level (µg/L)[1]	Detection
Aluminum	01106	7429-90-5	2.2	MCL-CA	1,000	D
Antimony	01095	7440-36-0	0.027	MCL-US	6	D
Arsenic	01000	7440-38-2	0.03	MCL-US	10	D
Barium	01005	7440-39-3	0.07	MCL-CA	1,000	D
Beryllium	01010	7440-41-7	0.006	MCL-US	4	D
Boron	01020	7440-42-8	3	HBSL (NL-CA)	6,000 (1,000)	D
Cadmium	01025	7440-43-9	0.016	MCL-US	5	D
Chromium	01030	7440-47-3	0.07	MCL-CA	50	D
Cobalt	01035	7440-48-4	0.021	na	na	na[2]
Copper	01040	7440-50-8	0.08	AL-US	1,300	D
Iron	01046	7439-89-6	3.2	SMCL-CA	300	D
Lead	01049	7439-92-1	0.025	AL-US	15	D
Lithium	01130	7439-93-2	0.22	na	na	D
Manganese	01056	7439-96-5	0.13	HBSL (SMCL-CA)	300 (50)	D
Molybdenum	01060	7439-98-7	0.014	HBSL (HAL-US)	40 (40)	D
Nickel	01065	7440-02-0	0.09	MCL-CA	100	D
Selenium	01145	7782-49-2	0.03	MCL-US	50	D
Silver	01075	7440-22-4	0.005	HBSL (SMCL-CA)	100 (100)	D
Strontium	01080	7440-24-6	0.2	HBSL (HAL-US)	4,000 (4,000)	D
Thallium	01057	7440-28-0	0.01	MCL-US	2	D
Uranium	22703	7440-61-1	0.003	MCL-US	30	D
Vanadium	01085	7440-62-2	0.08	NL-CA	50	D
Zinc	01090	7440-66-6	1.4	HBSL (SMCL-CA)	2,000 (5,000)	D

[1]For constituents with HBSLs, the benchmark types and values of other non-regulatory health-based benchmarks are listed in parentheses for comparison.

[2]On the basis of quality-control data collected October 2009 through March 2013, all results for cobalt were coded as reviewed and rejected in the USGS National Water Information System (NWIS) database and are not presented in this report (Davis, T.A., Olsen, L.D., Fram, M.S., and Belitz, Kenneth, 2014, Updated study reporting levels (SRLs) for trace-element data collected for the California Groundwater Ambient Monitoring and Assessment Priority Basin Project, October 2009–March 2013: U.S. Geological Survey Scientific Investigations Report 2014–5105, 52 p., http://dx.doi.org/10.3133/sir20145105).

Table 3*E*. Nutrients, comparison benchmarks, and reporting information for the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL) Schedule 2755.

[The five-digit USGS parameter code is used to uniquely identify a specific constituent or property. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level. Maximum contaminant level benchmarks 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**: CASRN®, Chemical Abstracts Service Registry Number®; D, detected in groundwater samples; LT-MDL, long-term method detection level; MDL, method detection limit; mg/L, milligrams per liter; na, not available]

Constituent	USGS parameter code	CASRN®	LT-MDL or MDL (mg/L)	Bench-mark type	Benchmark level (mg/L)	Detection
Ammonia (as nitrogen)	00608	7664-41-7	0.010	HAL-US	[1]24.7	D
Nitrite (as nitrogen)	00613	14797-65-0	0.0010	MCL-US	1	D
Nitrite plus nitrate (as nitrogen)[2]	00631	na	0.04	MCL-US	10	D
Total nitrogen (ammonia + nitrite + nitrate + organic nitrogen)	62854	17778-88-0	0.05	na	na	D
Orthophosphate (as phosphorus)	00671	14265-44-2	0.004	na	na	D

[1]The HAL-US is 30 mg/L "as ammonia." To facilitate comparison to the analytical results, we have converted and reported this HAL-US as 24.7 mg/L "as nitrogen."

[2]Nitrite plus nitrate (as nitrogen) is referred to as nitrate in the text for clarity.

Table 3*F*. Major and minor ions, silica, total dissolved solids (TDS), and alkalinity, comparison benchmarks, and reporting information for the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL) Schedule 1948.

[The five-digit USGS parameter code is used to uniquely identify a specific constituent or property. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: $CaCO_3$, calcium carbonate; CASRN®, Chemical Abstracts Service Registry Number®; D, detected in groundwater samples; LT-MDL, long-term method detection level; MDL, method detection limit; mg/L, milligrams per liter; na, not available; SiO_2, silicon dioxide]

Constituent (synonym or abbreviation)	USGS parameter code	CASRN®	LT-MDL or MDL (mg/L)	Benchmark type	Benchmark level (mg/L)	Detection
Bromide	71870	24959-67-9	0.010	na	na	D
Calcium	00915	7440-70-2	0.022	na	na	D
Chloride	00940	16887-00-6	0.06	SMCL-CA	[1]250 (500)	D
Fluoride	00950	16984-48-8	0.04	MCL-CA	2	D
Magnesium	00925	7439-95-4	0.011	na	na	D
Potassium	00935	7440-09-7	0.03	na	na	D
Sodium	00930	7440-23-5	0.06	na	na	D
Sulfate	00945	14808-79-8	0.09	SMCL-CA	[1]250 (500)	D
Silica (as SiO_2)	00955	7631-86-9	0.018	na	na	D
Total dissolved solids (TDS)	70300	na	10	SMCL-CA	[1]500 (1,000)	D
Laboratory alkalinity (as $CaCO_3$) [2]	29801	na	4.6	na	na	D

[1]The SMCL-CA for chloride, sulfate, and TDS have recommended and upper benchmark values. The upper benchmark value is shown in parentheses.

[2]Laboratory alkalinity results are presented in table 4.

Table 3*G*. Isotopic tracers, radioactive constituents, comparison benchmarks, and reporting information for laboratory analyses.

[The five-digit USGS parameter code is used to uniquely identify a specific constituent or property. Stable isotope ratios are reported in the standard delta notation (δ), the ratio of a heavier isotope to the more common lighter isotope of that element, relative to a standard reference material. Laboratory entity codes in the USGS National Water Information System (NWIS) for laboratories other than the USGS National Water Quality Laboratory (NWQL) are given in parentheses after the laboratory names in table footnotes. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. Maximum contaminant level benchmarks 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. **Elements**: C, carbon; H, hydrogen; O, oxygen. **Reporting units**: pCi/L, picocuries per liter. **Abbreviations**: CASRN®, Chemical Abstracts Service Registry Number®; CSU, 1-sigma combined standard uncertainty; D, detected in groundwater samples; na, not available; pmc, percent modern carbon; ssL_C, sample-specific critical level; USGS, U.S. Geological Survey]

Constituent	USGS parameter code	CASRN®	Reporting level	Reporting uncertainty	Reporting units	Benchmark type	Benchmark level	Detection
Isotopic tracers								
δ^2H in water[1]	82082	na	na	2	per mil	na	na	D
$\delta^{18}O$ in water[1]	82085	na	na	0.20	per mil	na	na	D
$\delta^{13}C$ in dissolved inorganic carbon[2]	82081	na	na	0.05	per mil	na	na	D
Radioactive constituents								
Carbon-14[2]	49933	14762-75-5	na	0.0015	pmc	na	na	D
Tritium[3]	07000	10028-17-8	ssL_C	CSU	pCi/L	MCL-CA	20,000	D
Radon-222[4]	82303	14859-67-7	ssL_C	CSU	pCi/L	MCL-US (Proposed)	4,000	D
Gross alpha radioactivity, 72-hour and 30-day counts[5]	62636, 62639	12587-46-1	ssL_C	CSU	pCi/L	MCL-US	[6]15	D
Gross beta radioactivity, 72-hour and 30-day counts[5]	62642, 62645	12587-47-2	ssL_C	CSU	pCi/L	MCL-CA	50	D

[1]USGS Stable Isotope Laboratory, Reston, Virginia.

[2]Woods Hole Oceanographic Institution, National Ocean Sciences Accelerator Mass Spectrometry Facility, Woods Hole, Massachusetts.

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

[4]USGS National Water Quality Laboratory.

[5]Eberline Analytical Services, Richmond, California.

[6]The MCL-US benchmark for gross alpha activity applies to adjusted gross alpha, which is equal to measured gross alpha activity minus uranium activity.

Table 3*H*. Noble gases, comparative thresholds, and reporting information for dissolved gases analyzed by the Lawrence Livermore National Laboratory (LLNL).

[Results for noble gas analyses by the LLNL are stored in a database maintained by Groundwater Ambient Monitoring and Assessment Priority Basin Project project staff. Benchmark types and benchmark levels as of May 23, 2013. **Abbreviations**: CASRN®, Chemical Abstracts Service Registry Number®; cm^3STP/g, cubic centimeters of gas at standard temperature and pressure per gram of water; D, detected in groundwater samples; MU, method uncertainty; na, not available]

Constituent	CASRNs®[1]	MU (percent)	Reporting units	Benchmark type	Benchmark level	Detection
Noble gases						
Argon	7440-37-1	2	cm^3STP/g	na	na	D
Helium-3 / Helium-4 ratio	na / 7440-59-7	0.75	atom ratio	na	na	D
Helium-4	7440-59-7	2	cm^3STP/g	na	na	D
Krypton	7439-90-9	2	cm^3STP/g	na	na	D
Neon	7440-01-09	2	cm^3STP/g	na	na	D
Xenon	7440-63-3	2	cm^3STP/g	na	na	D

[1]This report contains CASRNs®, which is a Registered Trademark of the American Chemical Society. CAS recommends the verification of the CASRNs through CAS Client Services℠.

Table 4*A*. Water-quality indicators in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: SMCL-CA, California maximum contaminant level; SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level. **Abbreviations**: $CaCO_3$, calcium carbonate; mg/L, milligrams per liter; na, not available; nc, not collected; RL, reporting level or range; USGS, U.S. Geological Survey; µS/cm, microsiemens per centimeter; *, concentration greater than the benchmark level; **, concentration greater than the upper benchmark; <, less than; >, greater than; °C, degrees Celsius; —, not detected]

GAMA well identification number	Dissolved oxygen, field (mg/L) (00300)	Water temperature, field (°C) (00010)	pH, field (standard units) (00400)	pH, laboratory (standard units) (00403)	Specific conductance, field (µS/cm at 25 °C) (00095)	Specific conductance, laboratory (µS/cm at 25 °C) (90095)	Alkalinity, field (mg/L as $CaCO_3$) (29802)	Alkalinity, laboratory (mg/L as $CaCO_3$) (29801)	Bicarbonate, field (mg/L) (63786)	Bicarbonate, laboratory[2] (mg/L)	Carbonate, field (mg/L) (63788)	Carbonate, laboratory[2] (mg/L)
Benchmark type	na	na	SMCL-US	SMCL-US	SMCL-CA	SMCL-CA	na	na	na	na	na	na
Benchmark level	na	na	<6.5 or >8.5	<6.5 or >8.5	[1]900 (1,600)	[1]900 (1,600)	na	na	na	na	na	na
RL	0.2	0.0–38.5	0–14	0–14	5	5	1	4.6	1	1	1	1
MS-SA study unit grid wells (100 wells sampled)												
Santa Cruz study area wells (15 wells sampled)												
S-MS-SC01	<0.2	20.0	7.2	7.2	1,240	1,250	160	186	194	226	0.2	0.2
S-MS-SC02	0.7	18.0	7.3	7.6	430	530	nc	163	nc	198	nc	0.2
S-MS-SC03	0.5	15.0	6.7	6.8	1,170	1,120	nc	137	nc	167	nc	0.0
S-MS-SC04	<0.2	16.5	7.0	7.2	961	1,000	nc	213	nc	259	nc	0.1
S-MS-SC05	0.2	21.5	7.1	7.5	994	1,110	nc	365	nc	445	nc	0.3
S-MS-SC06	1.7	19.5	7.5	7.8	368	377	nc	153	nc	186	nc	0.3
S-MS-SC07	<0.2	20.0	7.7	7.9	496	383	nc	157	nc	191	nc	0.4
S-MS-SC08	<0.2	18.5	7.4	7.5	**1,760	**1,810	330	339	401	412	0.6	0.5
S-MS-SC09	0.4	18.0	7.2	7.6	878	862	nc	330	nc	402	nc	0.3
S-MS-SC10	5.2	15.0	6.9	7.2	580	607	nc	250	nc	305	nc	0.1
S-MS-SC11	1.3	17.5	7.0	7.2	252	259	nc	98.4	nc	120	nc	0.1
S-MS-SC12	0.3	17.0	6.9	6.9	470	509	nc	226	nc	275	nc	0.1
S-MS-SC13	0.4	17.0	7.3	7.6	511	541	nc	225	nc	274	nc	0.3
S-MS-SC14	<0.2	14.0	7.7	7.9	398	406	nc	202	nc	245	nc	0.6
S-MS-SC15	<0.2	15.0	7.4	7.7	660	678	nc	283	nc	344	nc	0.4

Table 4*A*. Water-quality indicators in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013. —Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: SMCL-CA, California secondary maximum contaminant level; SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level. **Abbreviations**: $CaCO_3$, calcium carbonate; mg/L, milligrams per liter; na, not available; nc, not collected; RL, reporting level or range; USGS, U.S. Geological Survey; µS/cm, microsiemens per centimeter; *, concentration greater than the benchmark level; **, concentration greater than the upper benchmark; <, less than; >, greater than; °C, degrees Celsius; —, not detected]

GAMA well identification number	Dissolved oxygen, field (mg/L) (00300)	Water temperature, field (°C) (00010)	pH, field (standard units) (00400)	pH, laboratory (standard units) (00403)	Specific conductance, field (µS/cm at 25 °C) (00095)	Specific conductance, laboratory (µS/cm at 25 °C) (90095)	Alkalinity, field (mg/L as $CaCO_3$) (29802)	Alkalinity, laboratory (mg/L as $CaCO_3$) (29801)	Bicarbonate, field (mg/L) (63786)	Bicarbonate, laboratory[2] (mg/L)	Carbonate, field (mg/L) (63788)	Carbonate, laboratory[2] (mg/L)
MS-SA study unit grid wells (100 wells sampled)—Continued												
Pajaro Valley grid wells (15 wells sampled)												
S-MS-P01	4.5	19.0	7.6	7.8	416	439	159	168	193	204	0.4	0.4
S-MS-P02	7.0	17.0	7.2	7.2	210	212	nc	85.7	nc	104	nc	0.1
S-MS-P03	<0.2	18.5	8.1	8.1	586	597	nc	240	nc	289	nc	1.7
S-MS-P04	6.9	16.5	7.2	7.4	375	382	nc	106	nc	129	nc	0.1
S-MS-P05	3.7	11.0	*6.0	*6.3	278	284	nc	54.4	nc	66	nc	0.0
S-MS-P06	0.5	17.0	7.3	7.6	746	752	nc	222	nc	270	nc	0.2
S-MS-P07	6.8	18.0	7.1	7.5	**1,790	**1,800	nc	114	nc	139	nc	0.1
S-MS-P08	8.0	18.5	6.9	7.3	295	293	nc	72.7	nc	89	nc	0.0
S-MS-P09	<0.2	18.0	7.1	7.4	**5,290	**5,270	nc	182	nc	222	nc	0.1
S-MS-P10	7.8	18.5	7.4	7.5	446	416	nc	87.7	nc	107	nc	0.1
S-MS-P11	2.2	17.0	7.7	7.9	538	537	206	221	250	268	0.4	0.6
S-MS-P12	0.9	20.0	7.6	7.7	691	702	nc	238	nc	289	nc	0.5
S-MS-P13	0.6	18.0	7.4	7.6	1,210	1,190	nc	314	nc	382	nc	0.4
S-MS-P14	1.8	21.0	7.5	7.7	746	747	nc	295	nc	359	nc	0.5
S-MS-P15	6.0	17.5	7.4	7.9	424	430	nc	116	nc	141	nc	0.2
Salinas Valley grid wells (40 wells sampled)												
S-MS-SV01	5.2	19.5	7.2	7.6	786	778	nc	238	nc	290	nc	0.2
S-MS-SV02	0.3	20.5	7.3	7.6	1,230	1,210	nc	270	nc	329	nc	0.3
S-MS-SV03	4.1	18.5	6.8	7.2	1,120	1,130	nc	225	nc	274	nc	0.1
S-MS-SV04	0.7	17.5	*6.2	6.6	698	731	nc	103	nc	126	nc	0.0
S-MS-SV05	6.2	20.0	*6.4	6.7	1,460	1,480	48.7	53.2	59.4	65	—	0.0

Table 4*A*. Water-quality indicators in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013. —Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: SMCL-CA, California secondary maximum contaminant level; SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level. **Abbreviations**: $CaCO_3$, calcium carbonate; mg/L, milligrams per liter; na, not available; nc, not collected; RL, reporting level or range; USGS, U.S. Geological Survey; µS/cm, microsiemens per centimeter; *, concentration greater than the benchmark level; **, concentration greater than the upper benchmark; <, less than; >, greater than; °C, degrees Celsius; —, not detected]

GAMA well identification number	Dissolved oxygen, field (mg/L) (00300)	Water temperature, field (°C) (00010)	pH, field (standard units) (00400)	pH, laboratory (standard units) (00403)	Specific conductance, field (µS/cm at 25 °C) (00095)	Specific conductance, laboratory (µS/cm at 25 °C) (90095)	Alkalinity, field (mg/L as $CaCO_3$) (29802)	Alkalinity, laboratory (mg/L as $CaCO_3$) (29801)	Bicarbonate, field (mg/L) (63786)	Bicarbonate, laboratory[2] (mg/L)	Carbonate, field (mg/L) (63788)	Carbonate, laboratory[2] (mg/L)
MS-SA study unit grid wells (100 wells sampled)—Continued												
Salinas Valley grid wells (40 wells sampled)—Continued												
S-MS-SV06	6.6	18.5	7.1	7.5	828	838	nc	179	nc	218	nc	0.1
S-MS-SV07	2.2	19.0	7.6	7.8	**2,690	**2,140	nc	170	nc	206	nc	0.4
S-MS-SV08	1.8	20.5	7.4	7.8	844	824	nc	196	nc	238	nc	0.3
S-MS-SV09	6.2	19.0	6.5	6.8	1,220	1,260	nc	104	nc	127	nc	0.0
S-MS-SV10	6.1	18.0	7.0	7.4	1,310	1,290	nc	210	nc	256	nc	0.1
S-MS-SV11	6.0	15.0	7.6	7.8	382	437	nc	138	nc	168	nc	0.3
S-MS-SV12	5.9	20.0	7.4	7.8	704	697	148	155	180	189	0.3	0.2
S-MS-SV13	0.4	23.0	7.7	7.9	**1,940	**1,930	nc	452	nc	549	nc	1.3
S-MS-SV14	1.5	23.5	7.1	7.4	1,510	1,500	228	245	277	298	0.2	0.2
S-MS-SV15	1.0	17.5	7.5	7.6	669	682	nc	193	nc	235	nc	0.3
S-MS-SV16	3.0	17.5	7.7	7.7	647	654	nc	178	nc	216	nc	0.5
S-MS-SV17	6.8	19.0	7.5	7.7	506	531	nc	136	nc	165	nc	0.2
S-MS-SV18	1.2	17.0	7.2	7.5	981	997	nc	249	nc	303	nc	0.2
S-MS-SV19	1.4	20.0	7.4	7.7	737	765	nc	208	nc	253	nc	0.3
S-MS-SV20	0.8	19.5	7.1	7.4	1,570	**1,620	nc	378	nc	460	nc	0.3
S-MS-SV21	—	17.0	*6.4	6.8	**2,840	**3,050	nc	90.4	nc	110	nc	0.0
S-MS-SV22	2.3	16.5	7.2	7.7	1,240	1,150	nc	243	nc	296	nc	0.2
S-MS-SV23	1.1	16.5	7.3	7.6	893	917	nc	198	nc	241	nc	0.2
S-MS-SV24	1.1	22.5	7.5	7.8	629	691	nc	186	nc	226	nc	0.3
S-MS-SV25	0.6	17.5	7.4	7.7	743	734	nc	194	nc	236	nc	0.3

Table 4*A*. Water-quality indicators in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013. —Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: SMCL-CA, California secondary maximum contaminant level; SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level. **Abbreviations**: $CaCO_3$, calcium carbonate; mg/L, milligrams per liter; na, not available; nc, not collected; RL, reporting level or range; USGS, U.S. Geological Survey; µS/cm, microsiemens per centimeter; *, concentration greater than the benchmark level; **, concentration greater than the upper benchmark; <, less than; >, greater than; °C, degrees Celsius; —, not detected]

GAMA well identification number	Dissolved oxygen, field (mg/L) (00300)	Water temperature, field (°C) (00010)	pH, field (standard units) (00400)	pH, laboratory (standard units) (00403)	Specific conductance, field (µS/cm at 25 °C) (00095)	Specific conductance, laboratory (µS/cm at 25 °C) (90095)	Alkalinity, field (mg/L as $CaCO_3$) (29802)	Alkalinity, laboratory (mg/L as $CaCO_3$) (29801)	Bicarbonate, field (mg/L) (63786)	Bicarbonate, laboratory[2] (mg/L)	Carbonate, field (mg/L) (63788)	Carbonate, laboratory[2] (mg/L)
MS-SA study unit grid wells (100 wells sampled)—Continued												
Salinas Valley grid wells (40 wells sampled)—Continued												
S-MS-SV26	0.3	19.5	7.0	7.4	**2,910	*2,890	nc	261	nc	318	nc	0.1
S-MS-SV27	2.5	17.0	7.5	7.7	433	438	nc	149	nc	181	nc	0.3
S-MS-SV28	2.8	20.5	7.7	7.8	671	688	229	232	278	282	0.6	0.6
S-MS-SV29	4.4	19.5	7.2	7.5	**3,970	**3,990	nc	197	nc	240	nc	0.2
S-MS-SV30	3.2	16.5	7.2	7.5	**3,940	**4,000	303	340	369	414	0.5	0.3
S-MS-SV31	4.6	17.0	7.5	7.7	876	883	nc	184	nc	224	nc	0.3
S-MS-SV32	4.4	20.0	7.1	7.4	1,530	1,540	nc	251	nc	306	nc	0.2
S-MS-SV33	—	19.0	6.6	7.1	438	470	nc	69.1	nc	84	nc	0.0
S-MS-SV34	2.4	20.5	7.4	7.6	376	406	88.6	95.7	108	116	0.1	0.1
S-MS-SV35	0.3	22.5	7.3	7.8	796	930	nc	189	nc	230	nc	0.2
S-MS-SV36	9.5	18.0	6.6	7.2	1,270	1,260	nc	124	nc	151	nc	0.0
S-MS-SV37	6.6	17.0	6.9	7.3	687	711	nc	230	nc	280	nc	0.1
S-MS-SV38	3.7	19.0	7.1	7.4	**2,230	**2,260	nc	206	nc	251	nc	0.1
S-MS-SV39	<0.2	21.5	7.2	7.5	**2,260	**2,200	nc	200	nc	243	nc	0.2
S-MS-SV40	4.2	19.0	7.0	7.3	1,450	1,450	nc	199	nc	242	nc	0.1
Highlands grid wells (30 wells sampled)												
S-MS-H01	0.2	13.5	7.9	8.0	821	819	243	258	293	312	1.4	1.1
S-MS-H02	0.2	20.5	6.9	7.2	**2,560	**2,510	nc	214	nc	261	nc	0.1
S-MS-H03	<0.2	17.5	7.2	7.4	1,050	1,050	nc	343	nc	418	nc	0.3
S-MS-H04	4.3	20.5	7.0	7.1	1,060	1,070	[3]na	438	179	534	0.2	0.2
S-MS-H05	<0.2	24.0	7.5	7.7	**2,240	**2,200	406	413	492	502	1.9	0.7

Table 4*A*. Water-quality indicators in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013. —Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: SMCL-CA, California secondary maximum contaminant level; SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level. **Abbreviations**: $CaCO_3$, calcium carbonate; mg/L, milligrams per liter; na, not available; nc, not collected; RL, reporting level or range; USGS, U.S. Geological Survey; µS/cm, microsiemens per centimeter; *, concentration greater than the benchmark level; **, concentration greater than the upper benchmark; <, less than; >, greater than; °C, degrees Celsius; —, not detected]

GAMA well identification number	Dissolved oxygen, field (mg/L) (00300)	Water temperature, field (°C) (00010)	pH, field (standard units) (00400)	pH, laboratory (standard units) (00403)	Specific conductance, field (µS/cm at 25 °C) (00095)	Specific conductance, laboratory (µS/cm at 25 °C) (90095)	Alkalinity, field (mg/L as $CaCO_3$) (29802)	Alkalinity, laboratory (mg/L as $CaCO_3$) (29801)	Bicarbonate, field (mg/L) (63786)	Bicarbonate, laboratory[2] (mg/L)	Carbonate, field (mg/L) (63788)	Carbonate, laboratory[2] (mg/L)
MS-SA study unit grid wells (100 wells sampled)—Continued												
Highlands grid wells (30 wells sampled)—Continued												
S-MS-H06	2.1	19.5	7.0	7.3	607	626	nc	211	nc	257	nc	0.1
S-MS-H07	7.5	16.0	6.7	7.2	1,040	1,060	nc	294	nc	358	nc	0.1
S-MS-H08	6.2	18.5	7.1	7.3	**2,850	**2,870	nc	458	nc	558	nc	0.3
S-MS-H09	0.2	19.5	*6.4	6.8	**3,880	**3,950	nc	473	nc	577	nc	0.1
S-MS-H10	<0.2	19.0	6.9	7.1	**2,610	**2,640	nc	234	nc	285	nc	0.1
S-MS-H11	1.0	24.0	7.8	8.0	1,040	1,040	nc	326	nc	395	nc	1.1
S-MS-H12	4.2	18.5	7.2	7.4	1140	1,010	nc	242	nc	295	nc	0.2
S-MS-H13	4.9	21.0	6.9	7.4	**2,230	**2,320	nc	259	nc	316	nc	0.1
S-MS-H14	<0.2	31.5	6.9	7.2	**8,210	**9,730	nc	1730	nc	2108	nc	0.8
S-MS-H15	0.2	24.0	8.2	8.3	572	569	nc	209	nc	251	nc	1.8
S-MS-H16	3.1	22.0	7.7	8.0	555	559	nc	174	nc	211	nc	0.5
S-MS-H17	6.1	24.0	7.5	7.7	594	593	nc	179	nc	218	nc	0.3
S-MS-H18	4.4	24.0	7.4	7.6	**2,100	**2,120	nc	138	nc	168	nc	0.2
S-MS-H19	6.3	17.5	6.9	7.3	683	695	nc	233	nc	284	nc	0.1
S-MS-H20	5.8	19.0	7.0	7.3	**2,170	**2,200	242	258	295	314	0.2	0.1
S-MS-H21	<0.2	26.5	7.2	7.4	**1,810	**1,830	nc	174	nc	212	nc	0.2
S-MS-H22	1.0	21.0	7.0	7.3	985	984	nc	309	nc	376	nc	0.2
S-MS-H23	7.1	20.5	7.5	7.7	601	619	nc	214	nc	260	nc	0.4
S-MS-H24	1.9	23.0	7.0	7.3	**2,540	**2,770	nc	146	nc	178	nc	0.1
S-MS-H25	8.3	22.0	7.5	7.9	*946	963	nc	312	nc	379	nc	0.6

Table 4*A*. Water-quality indicators in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013. —Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: SMCL-CA, California secondary maximum contaminant level; SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level. **Abbreviations**: $CaCO_3$, calcium carbonate; mg/L, milligrams per liter; na, not available; nc, not collected; RL, reporting level or range; USGS, U.S. Geological Survey; µS/cm, microsiemens per centimeter; *, concentration greater than the benchmark level; **, concentration greater than the upper benchmark; <, less than; >, greater than; °C, degrees Celsius; —, not detected]

GAMA well identification number	Dissolved oxygen, field (mg/L) (00300)	Water temperature, field (°C) (00010)	pH, field (standard units) (00400)	pH, laboratory (standard units) (00403)	Specific conductance, field (µS/cm at 25 °C) (00095)	Specific conductance, laboratory (µS/cm at 25 °C) (90095)	Alkalinity, field (mg/L as $CaCO_3$) (29802)	Alkalinity, laboratory (mg/L as $CaCO_3$) (29801)	Bicarbonate, field (mg/L) (63786)	Bicarbonate, laboratory[2] (mg/L)	Carbonate, field (mg/L) (63788)	Carbonate, laboratory[2] (mg/L)
MS-SA study unit grid wells (100 wells sampled)—Continued												
Highlands grid wells (30 wells sampled)—Continued												
S-MS-H26	5.9	22.0	7.6	7.8	992	1,010	122	129	148	157	0.2	0.3
S-MS-H27	3.1	21.0	7.1	7.6	831	842	nc	271	nc	330	nc	0.2
S-MS-H28	0.6	17.0	7.0	7.3	**2,180	**2,220	nc	474	nc	577	nc	0.3
S-MS-H29	4.8	19.0	7.3	7.5	**3,710	**3,720	nc	269	nc	327	nc	0.3
S-MS-H30	5.9	20.0	7.2	7.5	1,040	1,030	nc	224	nc	273	nc	0.2

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

[2]Bicarbonate and carbonate concentrations were calculated from the laboratory alkalinity and pH values by using the advanced speciation method (http://or.water.usgs.gov/alk/methods.html) with $pK_1 = 6.35$, $pK_2 = 10.33$, and $pK_W = 14$.

[3]Possible sample swap; value rejected.

Table 4*B*. Water-quality indicators in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area tap sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area tap sample. Benchmark type, benchmark level, and LT-MDL as of May 23, 2013. **Benchmark types**: SMCL-CA, California secondary maximum contaminant level; SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level. **Abbreviations**: $CaCO_3$, calcium carbonate; mg/L, milligrams per liter; na, not available; RL, reporting level or range; USGS, U.S. Geological Survey; *, measured value less than the benchmark level; **, concentration greater than the upper benchmark level; °C, degrees Celsius; µS/cm, microsiemens per centimeter; <, less than; >, greater than]

GAMA tap identification number	Dissolved oxygen, field (mg/L) (00300)	Water temperature, field (°C) (00010)	pH, field (standard units) (00400)	pH, laboratory (standard units) (00403)	Specific conductance, field (µS/cm at 25 °C) (00095)	Specific conductance, laboratory (µS/cm at 25 °C) (90095)	Alkalinity, laboratory (mg/L as $CaCO_3$) (29801)	Bicarbonate, laboratory[2] (mg/L)	Carbonate, laboratory[2] (mg/L)
Benchmark type	na	na	SMCL-US	SMCL-US	SMCL-CA	SMCL-CA	na	na	na
Benchmark	na	na	<6.5 or >8.5	<6.5 or >8.5	[1]900 (1,600)	[1]900 (1,600)	na	na	na
RL	0.2	0.0–38.5	0–14	0–14	5	5	1	1	1
MS-SA shallow-well tap-site samples (70 taps sampled)									
Pajaro Valley study area shallow-well tap-site samples (15 taps sampled)									
S-MS-P01-T1	8.6	15.0	7.1	7.4	474	484	119	145	0.08
S-MS-P02-T1	6.5	17.0	7.4	7.8	314	320	131	159	0.18
S-MS-P03-T1	8.3	18.0	7.7	8	167	167	77.2	94	0.22
S-MS-P04-T1	4.8	16.0	7.8	8.1	405	415	200	242	0.70
S-MS-P05-T1	na	17.0	6.7	7	508	528	85.7	104	0.02
S-MS-P06-T1	3.9	15.0	6.9	7.3	636	644	177	216	0.08
S-MS-P07-T1	na	18.0	*6.1	6.6	646	653	20.6	25	0.00
S-MS-P08-T1	na	16.0	7.8	8.1	810	817	94.3	114	0.33
S-MS-P09-T1	na	20.0	6.8	7.2	746	751	76.8	94	0.03
S-MS-P10-T1	1.3	18.5	7.2	7.7	768	769	314	382	0.28
S-MS-P11-T1	na	22.5	6.9	7.3	1,290	1,300	406	495	0.18
S-MS-P12-T1	na	18.5	7.2	7.6	1,260	1,280	379	461	0.34
S-MS-P13-T1	na	16.5	6.6	7.2	355	360	79	96	0.02
S-MS-P14-T1	na	17.0	6.9	7.4	755	762	127	155	0.06
S-MS-P15-T1	na	19.0	6.5	6.9	551	557	103	126	0.02
Salinas Valley study area shallow-well tap-site samples (40 taps sampled)									
S-MS-SV01-T1	6.7	14.0	*5.8	6.9	328	333	109	133	0.00
S-MS-SV01-T2	7.2	17.0	7.2	7.6	**1,910	**1,940	280	341	0.25
S-MS-SV02-T1	9.3	14.5	7.4	7.5	724	731	190	231	0.27
S-MS-SV02-T2	7.5	21.0	7.1	7.6	987	976	249	303	0.18
S-MS-SV03-T1	7.4	20.5	7.7	8	360	362	138	167	0.39
S-MS-SV03-T2	1.6	19.0	7	7.4	**2,010	**2,030	205	250	0.11
S-MS-SV04-T1	10.7	14.0	7.8	8.2	844	845	252	305	0.89
S-MS-SV04-T2	3.5	20.0	6.7	7.1	1,540	1,530	247	301	0.07
S-MS-SV05-T1	0.6	17.5	7	7.6	1,340	1,360	314	382	0.18
S-MS-SV05-T2	6.7	15.0	6.6	7.8	1,050	1,060	239	291	0.05

Table 4*B*. Water-quality indicators in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013. —Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area tap sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area tap sample. Benchmark type, benchmark level, and LT-MDL as of May 23, 2013. **Benchmark types**: SMCL-CA, California secondary maximum contaminant level; SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level. **Abbreviations**: $CaCO_3$, calcium carbonate; mg/L, milligrams per liter; na, not available; RL, reporting level or range; USGS, U.S. Geological Survey; *, measured value less than the benchmark level; **, concentration greater than the upper benchmark level; °C, degrees Celsius; µS/cm, microsiemens per centimeter; <, less than; >, greater than]

GAMA tap identification number	Dissolved oxygen, field (mg/L) (00300)	Water temperature, field (°C) (00010)	pH, field (standard units) (00400)	pH, laboratory (standard units) (00403)	Specific conductance, field (µS/cm at 25 °C) (00095)	Specific conductance, laboratory (µS/cm at 25 °C) (90095)	Alkalinity, laboratory (mg/L as $CaCO_3$) (29801)	Bicarbonate, laboratory[2] (mg/L)	Carbonate, laboratory[2] (mg/L)
MS-SA shallow-well tap-site samples (70 taps sampled)—Continued									
Salinas Valley study area shallow-well tap-site samples (40 taps sampled)—Continued									
S-MS-SV06-T1	2.7	18.5	7.3	7.6	646	657	118	144	0.13
S-MS-SV06-T2	7	21.0	7	7.6	827	843	116	141	0.07
S-MS-SV08-T1	0.8	16.0	7.2	7.4	**4,920	**4,990	183	223	0.16
S-MS-SV08-T2	0.8	15.5	7.5	7.7	976	1,000	285	346	0.50
S-MS-SV09-T1	1.4	15.0	7.1	7.4	907	924	230	280	0.16
S-MS-SV09-T2	2.7	13.0	7.3	7.6	813	824	232	282	0.26
S-MS-SV11-T1	4.4	13.0	7.2	7.5	**1,610	**1,620	329	401	0.29
S-MS-SV11-T2	6.1	17.0	7.2	7.5	**1,850	**1,900	221	269	0.20
S-MS-SV13-T1	0.3	19.0	8	7.9	**1,770	**1,810	265	320	1.47
S-MS-SV13-T2	0.4	20.5	7.5	7.9	949	945	248	301	0.44
S-MS-SV16-T1	4.1	17.0	7.3	7.6	1,330	E1340	212	258	0.24
S-MS-SV16-T2	5.4	20.5	7	7.6	1,380	1,450	249	303	0.14
S-MS-SV17-T1	5.5	16.5	7.1	7.4	**2,020	**2,050	197	240	0.14
S-MS-SV17-T2	4.4	17.0	7.3	7.6	1,560	1,580	176	214	0.20
S-MS-SV18-T1	3.6	16.0	7.6	7.8	**1,770	**1780	374	454	0.83
S-MS-SV19-T1	3.6	19.0	7	7.5	912	923	306	373	0.17
S-MS-SV19-T2	0.1	19.5	7.2	7.7	881	880	224	273	0.20
S-MS-SV20-T1	0.9	15.5	7.2	7.5	1,460	1,480	169	206	0.15
S-MS-SV20-T2	1.5	20.0	7.5	7.9	611	620	158	192	0.28
S-MS-SV21-T1	5.6	14.0	7.4	7.7	586	587	186	226	0.26
S-MS-SV21-T2	6.2	18.5	6.8	7.4	1,400	1,410	156	190	0.06
S-MS-SV22-T1	6.7	16.5	7.2	7.4	**2,490	**2,460	345	420	0.31
S-MS-SV22-T2	5.9	20.0	6.9	7.2	837	824	182	222	0.08
S-MS-SV23-T1	10.8	13.5	7.8	7.8	**2,350	**2,360	286	347	1.01
S-MS-SV24-T1	10.2	17.0	7.7	7.8	570	578	155	188	0.43

Table 4*B*. Water-quality indicators in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013. —Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area tap sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area tap sample. Benchmark type, benchmark level, and LT-MDL as of May 23, 2013. **Benchmark types**: SMCL-CA, California secondary maximum contaminant level; SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level. **Abbreviations**: $CaCO_3$, calcium carbonate; mg/L, milligrams per liter; na, not available; RL, reporting level or range; USGS, U.S. Geological Survey; *, measured value less than the benchmark level; **, concentration greater than the upper benchmark level; °C, degrees Celsius; µS/cm, microsiemens per centimeter; <, less than; >, greater than]

GAMA tap identification number	Dissolved oxygen, field (mg/L) (00300)	Water temperature, field (°C) (00010)	pH, field (standard units) (00400)	pH, laboratory (standard units) (00403)	Specific conductance, field (µS/cm at 25 °C) (00095)	Specific conductance, laboratory (µS/cm at 25 °C) (90095)	Alkalinity, laboratory (mg/L as $CaCO_3$) (29801)	Bicarbonate, laboratory[2] (mg/L)	Carbonate, laboratory[2] (mg/L)
MS-SA shallow-well tap-site samples (70 taps sampled)—Continued									
Salinas Valley study area shallow-well tap-site samples (40 taps sampled)—Continued									
S-MS-SV24-T2	8.1	16.0	7.5	7.9	389	394	124	151	0.22
S-MS-SV25-T1	3.2	17.0	7.2	7.6	**2,430	**2,420	322	392	0.29
S-MS-SV25-T2	2.1	16.5	7.3	7.7	**1,640	**1,630	277	337	0.31
S-MS-SV26-T1	2.5	19.0	7.5	7.8	427	426	139	169	0.25
S-MS-SV26-T2	6.2	17.0	7	7.5	**2,880	**2,940	272	331	0.15
S-MS-SV27-T1	1.2	24.0	7.1	7.3	**2,430	**2,430	296	360	0.21
S-MS-SV29-T1	6.9	18.0	7.1	7.5	**2,820	**2,850	232	283	0.16
S-MS-SV29-T2	6.3	21.0	7.5	7.9	608	605	157	191	0.28
S-MS-SV30-T1	6.8	17.0	7.8	8	1,060	1,070	212	257	0.75
S-MS-SV32-T1	8	20.0	7.2	7.5	1,160	1,180	224	273	0.20
S-MS-SV33-T1	4.8	23.0	7.1	7.5	584	585	177	216	0.12
S-MS-SV33-T2	4.9	17.0	6.7	7	1,050	1,040	216	263	0.06
S-MS-SV34-T1	8	14.5	6.8	7.1	293	292	55.8	68	0.02
S-MS-SV34-T2	8.7	16.0	6.7	7.1	383	385	62.5	76	0.02
S-MS-SV35-T1	6	13.0	6.7	7.5	945	937	255	311	0.07
S-MS-SV35-T2	7.8	17.0	7.3	7.6	964	952	161	196	0.18
S-MS-SV36-T1	9.5	14.5	7.1	7.5	1,120	1,130	178	217	0.13
S-MS-SV36-T2	8	15.0	7.2	7.5	1,520	1,530	130	158	0.12
S-MS-SV37-T1	8.6	21.0	7.1	7.5	700	711	195	237	0.14
S-MS-SV40-T1	E11.1	E14.6	6.5	7.8	553	558	196	239	0.03

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

[2]Bicarbonate and carbonate concentrations were calculated from the laboratory alkalinity and pH values by using the advanced speciation method (http://or.water.usgs.gov/alk/methods.html) with $pK_1 = 6.35$, $pK_2 = 10.33$, and $pK_W = 14$.

Table 5. Volatile organic compounds (VOCs) detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed, but only samples with detections are listed. Detected constituents are grouped by primary use or source and listed in order of decreasing detection frequency in the 100 grid wells. All constituents are listed in table 3*A*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California notification level. Maximum contaminant level benchmarks 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**: E, estimated or having a higher degree of uncertainty; LRL, laboratory reporting level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; —, not detected]

Primary use or source	Trihalomethanes				Solvent		Refrigerant			Natural, organic synthesis	Gasoline oxygenate		Gasoline hydrocarbon	Fumigant		
GAMA well identification number	Chloroform (trichloromethane) (µg/L) (32106)	Bromoform (tribromomethane) (µg/L) (32104)	Bromodichloromethane (µg/L) (32101)	Dibromochloromethane (µg/L) (32105)	Perchloroethylene (PCE) (µg/L) (34475)	Carbon tetrachloride (Tetrachloromethane) (µg/L) (32102)	Trichlorofluoromethane (CFC-11) (µg/L) (34488)	Trichlorotrifluoroethane (CFC-113) (µg/L) (77652)	Dichlorodifluoromethane (CFC-12) (µg/L) (34668)	Carbon disulfide (µg/L) (77041)	Methyl *tert*-butyl ether (MTBE) (µg/L) (78032)	Methyl *tert*-pentyl ether, *tert*-Amyl methyl ether (TAME) (µg/L) (50005)	Toluene (µg/L) (34010)	1,2-Dichloropropane (µg/L) (34541)	Detections per well	VOC detection summary
Benchmark type	MCL-US	MCL-US	MCL-US	MCL-US	MCL-US	MCL-CA	MCL-CA	MCL-CA	NL-CA	NL-CA	MCL-CA	na	MCL-CA	MCL-US	na	na
Benchmark level	[1]80	[1]80	[1]80	[1]80	5	0.5	150	1,200	1,000	160	13	na	150	5	na	na
LRL or SRL	0.03	0.1	0.034	0.12	0.026	0.06	0.06	0.022	0.1	[2]0.1	0.1	0.06	[2]0.69	0.026	na	na
MS-SA study unit grid wells (100 wells sampled)																
Number of wells with detections	15	2	1	1	9	1	3	2	2	2	3	1	1	1	—	26
Detection frequency (percent)	15	2	1	1	9	1	3	2	2	2	3	1	1	1	—	26
Total detections (number)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	41
Santa Cruz study area wells (15 wells sampled)																
S-MS-SC02	0.04	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
S-MS-SC08	—	—	—	—	0.022	—	—	—	—	—	—	—	—	—	1	—
S-MS-SC12	—	—	—	—	—	—	—	0.162	—	—	—	—	—	—	1	—
S-MS-SC13	—	—	—	—	0.035	—	—	—	—	—	—	—	—	—	1	—

Table 5. Volatile organic compounds (VOCs) detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed, but only samples with detections are listed. Detected constituents are grouped by primary use or source and listed in order of decreasing detection frequency in the 100 grid wells. All constituents are listed in table 3*A*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California notification level. Maximum contaminant level benchmarks 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**: E, estimated or having a higher degree of uncertainty; LRL, laboratory reporting level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; —, not detected]

Primary use or source	Trihalomethanes				Solvent		Refrigerant			Natural, organic synthesis	Gasoline oxygenate		Gasoline hydrocarbon	Fumigant		
GAMA well identification number	Chloroform (trichloromethane) (µg/L) (32106)	Bromoform (tribromomethane) (µg/L) (32104)	Bromodichloromethane (µg/L) (32101)	Dibromochloromethane (µg/L) (32105)	Perchloroethylene (PCE) (µg/L) (34475)	Carbon tetrachloride (Tetrachloromethane) (µg/L) (32102)	Trichlorofluoromethane (CFC-11) (µg/L) (34488)	Trichlorotrifluoroethane (CFC-113) (µg/L) (77652)	Dichlorodifluoromethane (CFC-12) (µg/L) (34668)	Carbon disulfide (µg/L) (77041)	Methyl *tert*-butyl ether (MTBE) (µg/L) (78032)	Methyl *tert*-pentyl ether, *tert*-Amyl methyl ether (TAME) (µg/L) (50005)	Toluene (µg/L) (34010)	1,2-Dichloropropane (µg/L) (34541)	Detections per well	VOC detection summary
MS-SA study unit grid wells (100 wells sampled)—Continued																
Santa Cruz study area wells (15 wells sampled)—Continued																
Number of wells with detections	1	—	—	—	2	—	—	1	—	—	—	—	—	—	—	4
Detection frequency (percent)	7	—	—	—	13	—	—	7	—	—	—	—	—	—	—	27
Total detections (number)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
Pajaro Valley study area wells (15 wells sampled)																
S-MS-P04	0.11	0.11	—	—	0.055	—	—	—	—	—	1.27	—	—	—	4	—
S-MS-P08	0.03	—	—	—	0.013	—	—	—	—	—	—	—	—	—	2	—
S-MS-P10	E0.04	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
S-MS-P12	[3]0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
S-MS-P15	0.61	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—

Table 5. Volatile organic compounds (VOCs) detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed, but only samples with detections are listed. Detected constituents are grouped by primary use or source and listed in order of decreasing detection frequency in the 100 grid wells. All constituents are listed in table 3*A*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California notification level. Maximum contaminant level benchmarks 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**: E, estimated or having a higher degree of uncertainty; LRL, laboratory reporting level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; —, not detected]

Primary use or source	Trihalomethanes				Solvent		Refrigerant			Natural, organic synthesis	Gasoline oxygenate		Gasoline hydrocarbon	Fumigant		
GAMA well identification number	Chloroform (trichloromethane) (µg/L) (32106)	Bromoform (tribromomethane) (µg/L) (32104)	Bromodichloromethane (µg/L) (32101)	Dibromochloromethane (µg/L) (32105)	Perchloroethylene (PCE) (µg/L) (34475)	Carbon tetrachloride (Tetrachloromethane) (µg/L) (32102)	Trichlorofluoromethane (CFC-11) (µg/L) (34488)	Trichlorotrifluoroethane (CFC-113) (µg/L) (77652)	Dichlorodifluoromethane (CFC-12) (µg/L) (34668)	Carbon disulfide (µg/L) (77041)	Methyl *tert*-butyl ether (MTBE) (µg/L) (78032)	Methyl *tert*-pentyl ether, *tert*-Amyl methyl ether (TAME) (µg/L) (50005)	Toluene (µg/L) (34010)	1,2-Dichloropropane (µg/L) (34541)	Detections per well	VOC detection summary
MS-SA study unit grid wells (100 wells sampled)—Continued																
Pajaro Valley study area wells (15 wells sampled)—Continued																
Number of wells with detections	5	1	—	—	2	—	—	—	—	—	1	—	—	—	—	5
Detection frequency (percent)	33	7	—	—	13	—	—	—	—	—	7	—	—	—	—	33
Total detections (number)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	9
Salinas Valley study area wells (40 wells sampled)																
S-MS-SV03	—	—	—	—	[3]0.013	—	—	—	—	—	—	—	—	—	1	
S-MS-SV04	[3]0.01	—	—	—	0.02	—	—	—	—	—	—	—	—	—	2	
S-MS-SV08	0.87	E1	0.258	0.25	—	—	—	—	—	—	—	—	—	—	4	—
S-MS-SV09	—	—	—	—	0.077	—	—	—	—	—	—	—	—	—	1	—
S-MS-SV15	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—

Table 5. Volatile organic compounds (VOCs) detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed, but only samples with detections are listed. Detected constituents are grouped by primary use or source and listed in order of decreasing detection frequency in the 100 grid wells. All constituents are listed in table 3*A*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California notification level. Maximum contaminant level benchmarks 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**: E, estimated or having a higher degree of uncertainty; LRL, laboratory reporting level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; —, not detected]

Primary use or source	Trihalomethanes				Solvent		Refrigerant			Natural, organic synthesis	Gasoline oxygenate		Gasoline hydrocarbon	Fumigant		
GAMA well identification number	Chloroform (trichloromethane) (µg/L) (32106)	Bromoform (tribromomethane) (µg/L) (32104)	Bromodichloromethane (µg/L) (32101)	Dibromochloromethane (µg/L) (32105)	Perchloroethylene (PCE) (µg/L) (34475)	Carbon tetrachloride (Tetrachloromethane) (µg/L) (32102)	Trichlorofluoromethane (CFC-11) (µg/L) (34488)	Trichlorotrifluoroethane (CFC-113) (µg/L) (77652)	Dichlorodifluoromethane (CFC-12) (µg/L) (34668)	Carbon disulfide (µg/L) (77041)	Methyl *tert*-butyl ether (MTBE) (µg/L) (78032)	Methyl *tert*-pentyl ether, *tert*-Amyl methyl ether (TAME) (µg/L) (50005)	Toluene (µg/L) (34010)	1,2-Dichloropropane (µg/L) (34541)	Detections per well	VOC detection summary
MS-SA study unit grid wells (100 wells sampled)—Continued																
Salinas Valley study area wells (40 wells sampled)—Continued																
S-MS-SV20	—	—	—	—	—	—	0.05	0.032	E0.16	—	—	—	—	—	3	—
S-MS-SV26	—	—	—	—	—	—	—	—	—	E3.6	—	—	—	0.51	2	—
S-MS-SV29	—	—	—	—	—	—	[3]0.01	—	—	—	—	—	—	—	1	—
S-MS-SV32	—	—	—	—	—	0.03	—	—	—	—	—	—	—	—	1	—
S-MS-SV33	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
S-MS-SV34	0.61	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
S-MS-SV35	1.4	—	—	—	0.121	—	—	—	—	E0.6	—	0.03	10.8	—	5	—
S-MS-SV38	—	—	—	—	0.03	—	—	—	—	—	—	—	—	—	1	—

Table 5. Volatile organic compounds (VOCs) detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed, but only samples with detections are listed. Detected constituents are grouped by primary use or source and listed in order of decreasing detection frequency in the 100 grid wells. All constituents are listed in table 3*A*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California notification level. Maximum contaminant level benchmarks 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**: E, estimated or having a higher degree of uncertainty; LRL, laboratory reporting level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; —, not detected]

Primary use or source	Trihalomethanes				Solvent		Refrigerant			Natural, organic synthesis	Gasoline oxygenate		Gasoline hydrocarbon	Fumigant		
GAMA well identification number	Chloroform (trichloromethane) (µg/L) (32106)	Bromoform (tribromomethane) (µg/L) (32104)	Bromodichloromethane (µg/L) (32101)	Dibromochloromethane (µg/L) (32105)	Perchloroethylene (PCE) (µg/L) (34475)	Carbon tetrachloride (Tetrachloromethane) (µg/L) (32102)	Trichlorofluoromethane (CFC-11) (µg/L) (34488)	Trichlorotrifluoroethane (CFC-113) (µg/L) (77652)	Dichlorodifluoromethane (CFC-12) (µg/L) (34668)	Carbon disulfide (µg/L) (77041)	Methyl *tert*-butyl ether (MTBE) (µg/L) (78032)	Methyl *tert*-pentyl ether, *tert*-Amyl methyl ether (TAME) (µg/L) (50005)	Toluene (µg/L) (34010)	1,2-Dichloropropane (µg/L) (34541)	Detections per well	VOC detection summary
MS-SA study unit grid wells (100 wells sampled)—Continued																
Salinas Valley study area wells (40 wells sampled)—Continued																
Number of wells with detections	6	1	1	1	5	1	2	1	1	2	0	1	1	1	—	13
Detection frequency (percent)	15	2.5	2.5	2.5	15	2.5	7.5	2.5	5	5	2.5	2.5	2.5	2.5	—	33
Total detections (number)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	24
Highlands study area wells (30 wells sampled)																
S-MS-H09	0.04	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
S-MS-H14[4]	0.05	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
S-MS-H20	0.03	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
S-MS-H25	—	—	—	—	—	—	—	—	—	—	0.47	—	—	—	1	—

Table 5. Volatile organic compounds (VOCs) detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed, but only samples with detections are listed. Detected constituents are grouped by primary use or source and listed in order of decreasing detection frequency in the 100 grid wells. All constituents are listed in table 3*A*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California notification level. Maximum contaminant level benchmarks 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**: E, estimated or having a higher degree of uncertainty; LRL, laboratory reporting level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; —, not detected]

Primary use or source	Trihalomethanes				Solvent		Refrigerant			Natural, organic synthesis	Gasoline oxygenate		Gasoline hydrocarbon	Fumigant		
GAMA well identification number	Chloroform (trichloromethane) (µg/L) (32106)	Bromoform (tribromomethane) (µg/L) (32104)	Bromodichloromethane (µg/L) (32101)	Dibromochloromethane (µg/L) (32105)	Perchloroethylene (PCE) (µg/L) (34475)	Carbon tetrachloride (Tetrachloromethane) (µg/L) (32102)	Trichlorofluoromethane (CFC-11) (µg/L) (34488)	Trichlorotrifluoroethane (CFC-113) (µg/L) (77652)	Dichlorodifluoromethane (CFC-12) (µg/L) (34668)	Carbon disulfide (µg/L) (77041)	Methyl *tert*-butyl ether (MTBE) (µg/L) (78032)	Methyl *tert*-pentyl ether, *tert*-Amyl methyl ether (TAME) (µg/L) (50005)	Toluene (µg/L) (34010)	1,2-Dichloropropane (µg/L) (34541)	Detections per well	VOC detection summary
MS-SA study unit grid wells (100 wells sampled)—Continued																
Highlands study area wells (30 wells sampled)																
Number of wells with detections	3	—	—	—	—	—	—	—	—	—	1	—	—	—	—	4
Detection frequency (percent)	10	—	—	—	—	—	—	—	—	—	3.3	—	—	—	—	13
Total detections (number)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4

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

[2]Study reporting levels (SRLs) determined on the basis of the quality-control data collected between May 2004 and September 2010 for the first 32 study units of the California GAMA Priority Basin Project (Fram and others, 2012) were applied to three VOCs. Detections of carbon disulfide, *m*- plus *p*-xylene, and toluene at concentrations less than the respective SRL were reclassified as non-detections. The LRL for carbon disulfide is greater than the SRL (0.03 µg/L), and is listed as the reporting level in this table. The SRLs could not be determined for three other VOCs (acetone, 2-butanone, and tetrahydrofuran), and instead all detections for these VOCs were coded in the USGS database as "reviewed and rejected" and are not presented in this report. See appendix table A-2 for more information.

[3]Reported value is less than the long-term method detection level.

[4]Sample was not preserved with acid to a pH of less than 2 at time of collection.

Table 6*A*. Herbicide and herbicide degradates detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed, but only samples with detections are listed. Detected constituents are grouped by primary use or source and then listed in order of decreasing detection frequency in the 100 grid wells. All constituents are listed in table 3*B*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HBSL, USGS health-based screening level; MCL-CA; California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level. Maximum contaminant level benchmarks 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**: E, estimated or having a higher degree of uncertainty; LRL, laboratory reporting level; na, not available; USGS, U.S. Geological Survey; µg/L, micrograms per liter; —, not detected]

Primary use or source	Herbicide										Herbicide degradate			
GAMA well identification number	Simazine (µg/L) (04035)	Atrazine (µg/L) (39632)	Tri-fluralin (µg/L) (82661)	Ben-fluralin (µg/L) (82673)	Dacthal (DCPA) (µg/L) (82682)	Hexa-zinone (µg/L) (04025)	Meto-lachlor (µg/L) (39415)	Pendi-methalin (µg/L) (82683)	Pro-metryn (µg/L) (04036)	Tri-buphos (µg/L) (61610)	Deethylatrazine (2-Chloro-4-isopropyl-amino-6-amino-*s*-triazine) (µg/L) (04040)	3,4-Di-chloro-aniline (µg/L) (61625)	Detections per well	Pesticide detection summary
Benchmark type	MCL-US	MCL-CA	HBSL	HBSL	HBSL	HBSL	HBSL	HBSL	HBSL	HBSL	na	na	na	na
Benchmark level	4	1	20	4	70	400	700	20	300	7	na	na	na	na
LRL	0.006	0.008	0.018	0.014	0.0076	0.012	0.02	0.012	0.01	0.018	0.006	0.006	na	na
MS-SA study unit grid wells (100 wells sampled)														
Number of wells with detections	16	7	4	3	2	1	1	1	1	1	15	1	—	28
Detection frequency (percent)	16	7	4	3	2	1	1	1	1	1	15	1	—	28
Total detections (number)	—	—	—	—	—	—	—	—	—	—	—	—	—	37
Santa Cruz study area wells (15 wells sampled)														
S-MS-SC08	—	—	[1]0.002	—	—	—	—	—	—	—	—	—	1	—
Number of wells with detections	—	—	1	—	—	—	—	—	—	—	—	—	—	[2]1
Detection frequency (percent)	—	—	6.7	—	—	—	—	—	—	—	—	—	—	[2]7
Total detections (number)	—	—	—	—	—	—	—	—	—	—	—	—	—	[2]1
Pajaro Valley study area wells (15 wells sampled)														
S-MS-P02	—	—	[1]0.001	[1]0.002	—	—	—	—	—	—	—	—	2	—
S-MS-P03	—	—	[1]0.002	[1]0.003	—	—	—	—	—	—	—	—	2	—
S-MS-P06	—	—	[1]0.004	[1]0.004	[1]0.0012	—	[1]0.004	—	[1]0.002	E0.011	—	—	17	—

Table 6*A*. Herbicide and herbicide degradates detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed, but only samples with detections are listed. Detected constituents are grouped by primary use or source and then listed in order of decreasing detection frequency in the 100 grid wells. All constituents are listed in table 3*B*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HBSL, USGS health-based screening level; MCL-CA; California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level. Maximum contaminant level benchmarks 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**: E, estimated or having a higher degree of uncertainty; LRL, laboratory reporting level; na, not available; USGS, U.S. Geological Survey; µg/L, micrograms per liter; —, not detected]

Primary use or source	Herbicide										Herbicide degradate			
GAMA well identification number	Simazine (µg/L) (04035)	Atrazine (µg/L) (39632)	Tri-fluralin (µg/L) (82661)	Ben-fluralin (µg/L) (82673)	Dacthal (DCPA) (µg/L) (82682)	Hexa-zinone (µg/L) (04025)	Meto-lachlor (µg/L) (39415)	Pendi-methalin (µg/L) (82683)	Pro-metryn (µg/L) (04036)	Tri-buphos (µg/L) (61610)	Deethylatrazine (2-Chloro-4-isopropyl-amino-6-amino-*s*-triazine) (µg/L) (04040)	3,4-Di-chloro-aniline (µg/L) (61625)	Detections per well	Pesticide detection summary
MS-SA study unit grid wells (100 wells sampled)—Continued														
Pajaro Valley study area wells (15 wells sampled)—Continued														
Number of wells with detections	—	—	3	3	1	—	1	—	1	1	—	—	—	3
Detection frequency (percent)	—	—	20	20	6.7	—	6.7	—	6.7	6.7	—	—	—	20
Total detections (number)	—	—	—	—	—	—	—	—	—	—	—	—	—	21
Salinas Valley study area wells (40 wells sampled)														
S-MS-SV01	—	—	—	—	—	—	—	—	—	—	E0.004	—	1	—
S-MS-SV02	0.006	0.005	—	—	—	—	—	—	—	—	E0.006	—	3	—
S-MS-SV04	—	—	—	—	—	—	—	—	—	—	E0.004	—	1	—
S-MS-SV10	0.016	0.004	—	—	—	—	—	—	—	—	E0.006	—	3	—
S-MS-SV12	0.007	—	—	—	—	—	—	—	—	—	E0.003	—	2	—
S-MS-SV16	0.005	—	—	—	—	—	—	—	—	—	—	—	1	—
S-MS-SV18	—	—	—	—	—	—	—	—	—	—	E0.004	—	1	—
S-MS-SV20	—	[1]0.003	—	—	—	—	—	—	—	—	E0.006	—	2	—
S-MS-SV23	0.004	—	—	—	—	—	—	—	—	—	—	—	1	—
S-MS-SV25	0.006	—	—	—	—	—	—	—	—	—	—	—	1	—

Table 6*A*. Herbicide and herbicide degradates detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed, but only samples with detections are listed. Detected constituents are grouped by primary use or source and then listed in order of decreasing detection frequency in the 100 grid wells. All constituents are listed in table 3*B*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HBSL, USGS health-based screening level; MCL-CA; California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level. Maximum contaminant level benchmarks 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**: E, estimated or having a higher degree of uncertainty; LRL, laboratory reporting level; na, not available; USGS, U.S. Geological Survey; µg/L, micrograms per liter; —, not detected]

Primary use or source	Herbicide										Herbicide degradate			
GAMA well identification number	Simazine (µg/L) (04035)	Atrazine (µg/L) (39632)	Tri-fluralin (µg/L) (82661)	Ben-fluralin (µg/L) (82673)	Dacthal (DCPA) (µg/L) (82682)	Hexa-zinone (µg/L) (04025)	Meto-lachlor (µg/L) (39415)	Pendi-methalin (µg/L) (82683)	Pro-metryn (µg/L) (04036)	Tri-buphos (µg/L) (61610)	Deethylatrazine (2-Chloro-4-isopropyl-amino-6-amino-*s*-triazine) (µg/L) (04040)	3,4-Di-chloro-aniline (µg/L) (61625)	Detections per well	Pesticide detection summary
MS-SA study unit grid wells (100 wells sampled)—Continued														
Salinas Valley study area wells (40 wells sampled)—Continued														
S-MS-SV27	0.005	—	—	—	—	—	—	—	—	—	—	—	1	—
S-MS-SV29	0.006	—	—	—	—	—	—	—	—	—	—	—	1	—
S-MS-SV30	0.004	—	—	—	—	—	—	—	—	—	E0.006	—	2	—
S-MS-SV31	0.005	—	—	—	—	—	—	—	—	—	—	—	1	—
S-MS-SV32	0.005	—	—	—	—	—	—	—	—	—	E0.004	—	2	—
S-MS-SV35	—	0.005	—	—	[1]0.0013	—	—	0.011	—	—	—	—	5	—
S-MS-SV36	—	[1]0.003	—	—	—	—	—	—	—	—	E0.005	—	2	—
S-MS-SV37	0.004	—	—	—	—	—	—	—	—	—	—	—	1	—
S-MS-SV38	0.019	—	—	—	—	—	—	—	—	—	—	—	1	—
S-MS-SV40	—	—	—	—	—	—	—	—	—	—	E0.006	—	1	—
Number of wells with detections	14	5	—	—	1	—	—	1	—	—	12	—	—	[1]20
Detection frequency (percent)	35	12.5	—	—	2.5	—	—	2.5	—	—	30	—	—	[1]50
Total detections (number)	—	—	—	—	—	—	—	—	—	—	—	—	—	[1]33

Table 6*A*. Herbicide and herbicide degradates detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed, but only samples with detections are listed. Detected constituents are grouped by primary use or source and then listed in order of decreasing detection frequency in the 100 grid wells. All constituents are listed in table 3*B*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HBSL, USGS health-based screening level; MCL-CA; California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level. Maximum contaminant level benchmarks 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**: E, estimated or having a higher degree of uncertainty; LRL, laboratory reporting level; na, not available; USGS, U.S. Geological Survey; µg/L, micrograms per liter; —, not detected]

Primary use or source	Herbicide										Herbicide degradate			
GAMA well identification number	Simazine (µg/L) (04035)	Atrazine (µg/L) (39632)	Tri-fluralin (µg/L) (82661)	Ben-fluralin (µg/L) (82673)	Dacthal (DCPA) (µg/L) (82682)	Hexa-zinone (µg/L) (04025)	Meto-lachlor (µg/L) (39415)	Pendi-methalin (µg/L) (82683)	Pro-metryn (µg/L) (04036)	Tri-buphos (µg/L) (61610)	Deethylatrazine (2-Chloro-4-isopropyl-amino-6-amino-*s*-triazine) (µg/L) (04040)	3,4-Di-chloro-aniline (µg/L) (61625)	Detections per well	Pesticide detection summary
MS-SA study unit grid wells (100 wells sampled)—Continued														
Highlands study area wells (30 wells sampled)														
S-MS-H06	—	—	—	—	—	—	—	—	—	—	—	[1]E0.0017	1	—
S-MS-H12	0.017	0.033	—	—	—	0.006	—	—	—	—	E0.066	—	4	—
S-MS-H16	0.004	[1]0.004	—	—	—	—	—	—	—	—	E0.005	—	3	—
S-MS-H18	—	—	—	—	—	—	—	—	—	—	E0.005	—	1	—
Number of wells with detections	2	2	—	—	—	1	—	—	—	—	3	1	—	4
Detection frequency (percent)	6.7	6.7	—	—	—	3.3	—	—	—	—	10	3.3	—	13
Total detections (number)	—	—	—	—	—	—	—	—	—	—	—	—	—	9

[1]Reported value is less than the long-term method detection level.

[2]Count of detections per well and pesticide detection summary includes insecticide detections on table 6*B*.

Table 6*B*. Insecticide and insecticide degradates detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed, but only samples with detections are listed. Detected constituents are grouped by primary use or source and then listed in order of decreasing detection frequency in the 100 grid wells. All constituents are listed in table 3*B*. **GAMA well identification numbers**: S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark type**: HBSL, USGS health-based screening level. **Abbreviations**: E, estimated or having a higher degree of uncertainty; LRL, laboratory reporting level; na, not available; USGS, U.S. Geological Survey; µg/L, micrograms per liter; —, not detected]

Primary use or source	Insecticide									Insecticide degradate		
GAMA well identification number	Chlorpyrifos (µg/L) (38933)	*cis*-Permethrin (µg/L) (82687)	Cypermethrin (µg/L) (61586)	Diazinon (µg/L) (39572)	Dieldrin (µg/L) (39381)	Dimethoate (µg/L) (82662)	Ethion (µg/L) (82346)	Fipronil (µg/L) (62166)	Isofenphos (µg/L) (61594)	Desulfinyl fipronil (µg/L) (62170)	Fipronil sulfide (µg/L) (62167)	Fipronil sulfone (µg/L) (62168)
Benchmark type	HBSL	HBSL	HBSL	HBSL	HBSL	HBSL	HBSL	HBSL	HBSL	na	na	na
Benchmark level	2	400	40	1	0.02	2	4	0.1	6	na	na	na
LRL	0.0036	0.01	0.02	0.006	0.008	0.006	0.01	0.018	0.008	0.012	0.012	0.024
MS-SA study unit grid wells (100 wells sampled)												
Pajaro Valley study area wells (15 wells sampled)												
S-MS-P06	0.0031	0.005	E0.007	0.0017	0.006	—	0.006	E0.008	0.004	0.004	0.01	0.019
Number of wells with detections	1	1	1	1	1	—	1	1	1	1	1	1
Detection frequency (percent)[1]	6.7	6.7	6.7	6.7	6.7	—	6.7	6.7	6.7	6.7	6.7	6.7
Total detections (number)[1]	—	—	—	—	—	—	—	—	—	—	—	—
Salinas Valley study area wells (40 wells sampled)												
S-MS-SV35	0.0028	—	—	—	—	E0.0036	—	—	—	—	—	—
Number of wells with detections	1	—	—	—	—	1	—	—	—	—	—	—
Detection frequency (percent)[1]	—	—	—	—	—	—	—	—	—	—	—	—
Total detections (number)[1]	—	—	—	—	—	—	—	—	—	—	—	—

[1]Total detection frequency (percent) and total detections (number) on table 6*A*.

Table 7. Constituents of special interest detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed, but only samples with detections are listed. Information about the constituents is given in table 3*C*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California notification level. Maximum contaminant level benchmarks 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**: MRL, minimum reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark]

GAMA well identification number	Perchlorate (µg/L) (63790)	*N*-Nitrosodimethylamine (µg/L) (34438)
Benchmark type	MCL-CA	NL-CA
Benchmark level	6	0.01
MRL	0.10	0.002
MS-SA study unit grid wells (100 wells sampled)		
Santa Cruz study area wells (15 wells sampled)		
S-MS-SC09	—	0.0027
S-MS-SC10	0.12	—
Pajaro Valley study area wells (15 wells sampled)		
S-MS-P01	0.20	—
S-MS-P02	0.23	—
S-MS-P04	0.44	—
S-MS-P05	0.35	—
S-MS-P06	0.77	—
S-MS-P07	4.75	—
S-MS-P08	0.71	—
S-MS-P09	0.47	—
S-MS-P10	0.75	—
S-MS-P12	0.23	—
S-MS-P14	0.18	—
S-MS-P15	0.73	—
Salinas Valley study area wells (40 wells sampled)		
S-MS-SV01	0.92	—
S-MS-SV02	0.14	—
S-MS-SV03	0.99	—
S-MS-SV04	0.36	—
S-MS-SV05	1.98	—
S-MS-SV07	0.26	—
S-MS-SV08	0.15	—
S-MS-SV09	1.61	—
S-MS-SV10	2.69	—
S-MS-SV12	1.44	0.0036
MS-SA study unit grid wells (100 wells sampled)—Continued		
Salinas Valley study area wells (40 wells sampled)—Continued		
S-MS-SV14	0.19	—
S-MS-SV15	1.24	—
S-MS-SV17	0.72	—
S-MS-SV18	0.69	—
S-MS-SV20	1.44	—
S-MS-SV21	2.01	—
S-MS-SV22	0.42	—
S-MS-SV23	0.41	—
S-MS-SV24	—	0.0039
S-MS-SV25	0.12	—
S-MS-SV28	0.25	—
S-MS-SV29	*7.09	*0.0211
S-MS-SV30	2.49	0.0056
S-MS-SV32	3.34	—
S-MS-SV33	0.91	—
S-MS-SV34	0.52	—
S-MS-SV36	1.77	*0.0258
S-MS-SV37	0.33	—
S-MS-SV38	1.51	*0.0227
S-MS-SV40	0.63	—
Highlands study area wells (30 wells sampled)		
S-MS-H04	0.50	—
S-MS-H08	0.21	—
S-MS-H12	1.03	—
S-MS-H15	0.34	—
S-MS-H16	1.27	—

Table 7. Constituents of special interest detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed, but only samples with detections are listed. Information about the constituents is given in table 3*C*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California notification level. Maximum contaminant level benchmarks 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**: MRL, minimum reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark]

GAMA well identification number	Perchlorate (µg/L) (63790)	*N*-Nitrosodimethylamine (µg/L) (34438)
MS-SA study unit grid wells (100 wells sampled)—Continued		
Highlands study area wells (30 wells sampled)—Continued		
S-MS-H17	3.02	—
S-MS-H18	3.04	—
S-MS-H19	0.41	—
S-MS-H20	4.72	—
S-MS-H21	0.42	—
S-MS-H22	0.30	—
S-MS-H23	3.17	—
S-MS-H24	0.32	—
S-MS-H25	1.99	—
S-MS-H26	2.76	—
S-MS-H27	1.39	—
S-MS-H29	2.09	—
S-MS-H30	2.46	—

Table 8*A*. Trace elements detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA well identification number	Aluminum (µg/L) (01106)	Antimony (µg/L) (01095)	Arsenic (µg/L) (01000)	Barium (µg/L) (01005)	Beryllium (µg/L) (01010)	Boron (µg/L) (01020)	Cadmium (µg/L) (01025)	Chromium (µg/L) (01030)	Copper (µg/L) (01040)	Iron (µg/L) (01046)	Lead (µg/L) (01049)
Benchmark type	MCL-CA	MCL-US	MCL-US	MCL-CA	MCL-US	HBSL	MCL-US	MCL-CA	AL-US	SMCL-CA	AL-US
Benchmark level	1,000	6	10	1,000	4	6,000	5	50	1,300	300	15
LT-MDL or SRL	2.2	0.027	0.04	0.10	0.006	3	0.016	0.07	[1]2.1	[1]6	[1]0.82
MS-SA study unit grid wells (100 wells sampled)											
Santa Cruz study area wells (15 wells sampled)											
S-MS-SC01	—	0.03	0.09	54.1	0.044	569	—	—	—	*1,240	≤0.03
S-MS-SC02	2.3	0.046	0.14	23.1	0.008	291	0.026	—	≤0.9	—	≤0.08
S-MS-SC03	—	—	0.57	42	0.014	76	—	—	≤1.3	*1,950	≤0.08
S-MS-SC04	2.5	—	0.09	12.1	—	112	0.016	—	3.0	*857	≤0.07
S-MS-SC05	—	—	0.26	37.4	0.02	498	—	—	—	209	≤0.15
S-MS-SC06	3.2	—	0.58	39.5	—	54	—	—	≤0.96	—	0.97
S-MS-SC07	3.3	—	—	13.4	—	60	—	0.12	—	172	≤0.04
S-MS-SC08	11.0	—	—	11.7	2.15	68	—	—	—	*2,250	—
S-MS-SC09	3.8	0.059	0.35	6.41	0.006	197	—	—	≤2.0	9.8	≤0.51
S-MS-SC10	—	0.042	2.8	2.3	—	15	—	7.5	2.6	≤5.5	≤0.27
S-MS-SC11	2.3	0.03	*12.9	4.57	—	18	—	0.21	≤1.8	42.3	≤0.36
S-MS-SC12	3.2	—	0.35	81.6	—	42	—	0.44	2.8	38.5	≤0.51
S-MS-SC13	2.9	0.044	0.34	47.8	0.007	129	—	—	≤1.5	15.2	≤0.04
S-MS-SC14	3.8	—	2.5	11.5	—	20	—	—	—	207	—
S-MS-SC15	2.6	—	0.25	27.2	0.012	251	—	0.09	—	137	—

MS-SA study unit grid wells (100 wells sampled)—Continued

Table 8*A*. Trace elements detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA well identification number	Aluminum (µg/L) (01106)	Antimony (µg/L) (01095)	Arsenic (µg/L) (01000)	Barium (µg/L) (01005)	Beryllium (µg/L) (01010)	Boron (µg/L) (01020)	Cadmium (µg/L) (01025)	Chromium (µg/L) (01030)	Copper (µg/L) (01040)	Iron (µg/L) (01046)	Lead (µg/L) (01049)
Pajaro Valley study area wells (15 wells sampled)											
S-MS-P01	2.7	—	0.24	7.12	—	62	—	20.4	3.2	—	≤0.18
S-MS-P02	2.7	—	0.35	9.77	—	17	—	34.3	3.6	—	≤0.14
S-MS-P03	2.7	—	2.0	1.44	—	32	—	—	—	32.3	≤0.13
S-MS-P04	5.0	—	0.14	7.98	—	18	—	19.9	—	7.63	≤0.22
S-MS-P05	4.5	—	0.14	243	—	14	0.051	0.44	—	6.88	≤0.05
S-MS-P06	—	—	0.4	55.8	—	66	—	4.1	3.7	—	0.92
S-MS-P07	4.4	—	1.1	160	0.819	55	—	1.2	—	6.83	≤0.14
S-MS-P08	2.4	—	0.54	26.8	—	29	—	24.4	≤1.2	11.7	≤0.09
S-MS-P09	6.6	—	0.61	304	3.01	308	0.238	15.9	5.6	13.5	≤0.19
S-MS-P10	2.6	—	0.57	39.3	—	47	—	10.9	≤1.0	17.4	≤0.11
S-MS-P11	21.4	—	1.5	57.3	—	150	—	11.4	—	28.3	≤0.04
S-MS-P12	—	0.03	1.3	51.2	—	164	—	12.1	≤0.88	≤4.4	1.67
S-MS-P13	—	0.05	0.6	142	0.015	410	0.02	—	—	68.3	≤0.30
S-MS-P14	—	—	0.4	85.3	0.01	294	0.02	9.4	≤1.3	6.93	≤0.27
S-MS-P15	3.2	0.106	4.6	20.2	—	33	—	9.1	—	—	≤0.04
Salinas Valley study area wells (40 wells sampled)											
S-MS-SV01	2.3	0.061	4.2	294	—	32	0.024	1.1	≤0.83	—	≤0.23
S-MS-SV02	2.3	0.052	1.4	120	0.012	378	0.052	0.84	—	—	≤0.04
S-MS-SV03	—	0.032	*21.3	38.3	0.009	70	—	—	≤1.6	—	≤0.70
S-MS-SV04	2.7	0.061	*33.7	53.3	0.023	66	0.054	0.1	≤1.5	≤5.5	≤0.35
S-MS-SV05	3.2	0.082	5.9	169	0.015	90	1.55	0.56	7.4	8.4	≤0.32

Table 8*A*. Trace elements detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA well identification number	Aluminum (µg/L) (01106)	Antimony (µg/L) (01095)	Arsenic (µg/L) (01000)	Barium (µg/L) (01005)	Beryllium (µg/L) (01010)	Boron (µg/L) (01020)	Cadmium (µg/L) (01025)	Chromium (µg/L) (01030)	Copper (µg/L) (01040)	Iron (µg/L) (01046)	Lead (µg/L) (01049)
MS-SA study unit grid wells (100 wells sampled)—Continued											
Salinas Valley study area wells (40 wells sampled)—Continued											
S-MS-SV06	—	—	0.78	201	—	85	—	—	—	31.5	≤0.17
S-MS-SV07	6.6	—	3.7	54.1	—	85	0.072	6.5	—	—	—
S-MS-SV08	—	0.056	1.4	49.6	—	106	0.05	4.7	≤1.1	19.2	≤0.20
S-MS-SV09	—	0.031	0.15	33.7	0.014	37	—	—	11.2	19.8	≤0.50
S-MS-SV10	—	—	0.51	51.8	—	79	0.068	11.5	4.9	≤5.9	2.69
S-MS-SV11	—	0.052	0.71	44.8	—	22	0.097	0.99	—	10.6	2.99
S-MS-SV12	2.6	0.093	*22.7	144	—	98	0.547	1.9	—	—	≤0.15
S-MS-SV13	—	0.03	0.28	135	0.009	83	—	—	—	107	≤0.10
S-MS-SV14	—	0.054	0.92	13.9	0.014	314	0.084	—	≤1.1	75.7	≤0.18
S-MS-SV15	—	0.113	1.3	53.7	—	100	0.154	0.7	≤0.99	≤4.3	≤0.09
S-MS-SV16	—	0.155	2.5	25.3	—	165	0.254	0.62	≤1.2	—	≤0.47
S-MS-SV17	—	0.053	0.83	47.7	—	101	0.074	2.1	≤1.4	—	≤0.09
S-MS-SV18	—	0.034	0.72	63.6	—	151	0.084	1.8	6.4	—	1.18
S-MS-SV19	—	0.072	1.2	70.9	—	90	0.08	1.9	—	19.7	≤0.17
S-MS-SV20	—	0.049	1.1	79.7	—	187	0.018	2.9	—	≤5.2	1.33
S-MS-SV21	4.4	—	0.33	308	—	31	—	17	3.8	19.7	≤0.07
S-MS-SV22	—	0.062	1.2	59.1	—	162	0.088	3.0	2.6	≤4.5	≤0.81
S-MS-SV23	—	0.058	1.1	91.3	—	88	0.142	2.5	—	—	≤0.22
S-MS-SV24	2.3	0.051	1.5	32.3	0.012	279	0.071	4.6	≤1	≤4.9	≤0.35
S-MS-SV25	2.3	0.129	2.2	38.5	—	152	0.13	1.1	≤1.1	—	≤0.06

Table 8*A*. Trace elements detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA well identification number	Aluminum (µg/L) (01106)	Antimony (µg/L) (01095)	Arsenic (µg/L) (01000)	Barium (µg/L) (01005)	Beryllium (µg/L) (01010)	Boron (µg/L) (01020)	Cadmium (µg/L) (01025)	Chromium (µg/L) (01030)	Copper (µg/L) (01040)	Iron (µg/L) (01046)	Lead (µg/L) (01049)
MS-SA study unit grid wells (100 wells sampled)—Continued											
Salinas Valley study area wells (40 wells sampled)—Continued											
S-MS-SV26	4.4	0.084	0.12	20.4	0.538	[2]1,890	—	—	—	73.7	—
S-MS-SV27	—	0.116	1.3	36.8	—	98	0.087	0.47	≤0.96	—	≤0.21
S-MS-SV28	—	0.052	1.6	53.2	0.016	371	0.038	—	—	21.0	≤0.62
S-MS-SV29	4.4	0.113	1.0	72	0.04	[2]1,360	0.7	8.9	4.7	—	≤0.69
S-MS-SV30	6.6	0.118	1.7	25.8	1.15	[2]1,440	0.434	9.9	—	—	≤0.12
S-MS-SV31	—	0.127	2.3	16.5	0.006	206	0.109	0.52	—	≤5.3	≤0.13
S-MS-SV32	—	—	0.68	47.2	—	124	—	4.8	2.2	10.9	≤0.15
S-MS-SV33	3.4	—	0.38	41.8	—	37	—	15.1	—	18.8	≤0.06
S-MS-SV34	—	0.031	0.67	27.2	—	25	—	4.2	≤1.2	60.9	≤0.59
S-MS-SV35	23.2	0.084	6.7	144	0.01	311	0.058	0.57	—	162	≤0.14
S-MS-SV36	—	0.072	1.6	42.8	—	31	0.018	0.68	3.3	33.6	≤0.65
S-MS-SV37	—	0.033	1.0	61.9	0.009	246	0.022	0.3	—	—	≤0.04
S-MS-SV38	—	0.119	0.78	206	0.017	400	0.02	2.2	4.3	9.1	≤0.55
S-MS-SV39	11.0	0.317	5.3	19.2	0.192	[2]1,180	0.082	—	—	127	≤0.12
S-MS-SV40	—	0.07	0.8	62.2	0.008	193	0.019	1.0	—	—	≤0.32
Highlands study area wells (30 wells sampled)											
S-MS-H01	—	—	—	10.4	—	152	—	—	—	33.3	≤0.21
S-MS-H02	4.4	—	0.12	18.4	0.123	41	—	—	—	*3,700	—
S-MS-H03	—	0.092	0.81	122	—	69	0.08	—	1.4	—	≤0.29
S-MS-H04	3.4	0.069	6.2	40.2	—	32	0.103	2.1	≤1.4	23.2	≤0.16
S-MS-H05	4.4	—	0.09	14.1	0.072	682	—	—	—	13.1	—

Table 8*A*. Trace elements detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA well identification number	Aluminum (µg/L) (01106)	Antimony (µg/L) (01095)	Arsenic (µg/L) (01000)	Barium (µg/L) (01005)	Beryllium (µg/L) (01010)	Boron (µg/L) (01020)	Cadmium (µg/L) (01025)	Chromium (µg/L) (01030)	Copper (µg/L) (01040)	Iron (µg/L) (01046)	Lead (µg/L) (01049)
MS-SA study unit grid wells (100 wells sampled)—Continued											
Highlands study area wells (30 wells sampled)—Continued											
S-MS-H06	3.3	—	1.0	124	0.008	47	1.14	—	2.3	8.5	≤0.32
S-MS-H07	—	—	0.1	49.7	0.008	27	0.031	0.12	4.5	*455	≤0.60
S-MS-H08	4.4	0.117	1.5	12.8	0.869	617	0.207	0.22	—	95.8	≤0.05
S-MS-H09	4.4	—	0.49	11.8	0.028	146	0.183	—	7.0	*1,360	≤0.29
S-MS-H10	4.4	—	0.16	14.5	0.022	344	0.597	—	—	28.2	≤0.07
S-MS-H11	—	0.129	7.8	24.1	0.024	[2]1,220	0.239	—	—	—	≤0.08
S-MS-H12	—	0.045	1.3	80.7	—	85	0.041	0.33	2.4	23.6	1.18
S-MS-H13	6.6	—	0.15	52.1	0.162	81	—	—	—	*870	≤0.13
S-MS-H14	21.8	—	0.9	493	0.425	*12,700	—	—	—	*806	—
S-MS-H15	6.6	0.162	4.2	117	—	129	0.094	—	—	—	≤0.10
S-MS-H16	—	0.063	6.8	141	—	161	0.163	3.7	≤1.0	—	≤0.10
S-MS-H17	2.6	0.047	2.0	176	—	74	0.031	2.3	≤2.0	—	≤0.76
S-MS-H18	—	0.088	0.99	8.79	0.051	[2]1,370	0.637	1.0	3.3	12.1	0.88
S-MS-H19	—	0.029	0.9	70.2	0.014	297	0.025	0.21	2.2	≤4.8	≤0.25
S-MS-H20	3.2	0.029	0.43	455	0.019	114	—	0.13	2.3	—	≤0.32
S-MS-H21	6.6	—	6.1	28.2	0.031	608	0.894	—	—	13.5	0.99
S-MS-H22	3.2	—	[4]0.12	[4]25.7	0.008	88	0.031	—[4]	—	[4]34.6	≤0.18
S-MS-H23	—	0.069	*10.7	164	0.006	174	0.022	5.0	—	—	≤0.05
S-MS-H24	4.4	—	1.6	53.8	1.4	723	0.05	0.56	≤1.6	10.0	≤0.35
S-MS-H25	2.2	0.097	7.3	254	0.017	443	0.07	1.1	3.4	—	≤0.26

Table 8*A*. Trace elements detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA well identification number	Aluminum (µg/L) (01106)	Antimony (µg/L) (01095)	Arsenic (µg/L) (01000)	Barium (µg/L) (01005)	Beryllium (µg/L) (01010)	Boron (µg/L) (01020)	Cadmium (µg/L) (01025)	Chromium (µg/L) (01030)	Copper (µg/L) (01040)	Iron (µg/L) (01046)	Lead (µg/L) (01049)
MS-SA study unit grid wells (100 wells sampled)—Continued											
Highlands study area wells (30 wells sampled)—Continued											
S-MS-H26	2.6	—	1.9	38.9	0.019	499	0.057	3.6	≤1.6	—	≤0.40
S-MS-H27	—	0.11	3.7	46.7	—	106	0.068	0.18	—	28.2	≤0.18
S-MS-H28	6.6	0.198	2.4	13.9	0.225	532	0.187	—	—	—	≤0.48
S-MS-H29	6.6	0.109	7.2	15.9	2.71	[2]1,190	0.134	3.1	—	22.9	≤0.48
S-MS-H30	—	1.3	3.7	77.5	0.009	41	0.019	—	4.0	—	≤0.73

Table 8*A*. Trace elements detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA well identification number	Lithium (µg/L) (01130)	Manganese (µg/L) (01056)	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)
Benchmark type	na	HBSL	HBSL	MCL-CA	MCL-US	HBSL	HBSL	MCL-US	na	MCL-US	NL-CA	HBSL
Benchmark level	na	300	40	100	50	100	4,000	2	na	30	50	2,000
LT-MDL or SRL	0.22	[1]0.66	[1]0.023	[1]0.21	0.03	0.005	0.2	0.01	[1]0.023	0.004	0.08	[1]6.2
MS-SA study unit grid wells (100 wells sampled)—Continued												
Santa Cruz study area wells (15 wells sampled)—Continued												
S-MS-SC01	98.2	*398	0.165	0.7	0.05	—	647	0.08	0.030	0.007	0.16	≤1.8
S-MS-SC02	51.6	9.32	8.82	0.9	0.03	—	352	—	0.130	0.048	0.15	9.3
S-MS-SC03	82.1	*1,280	1.38	4.9	0.05	—	796	—	—	0.004	0.58	8.1
S-MS-SC04	64.5	*427	5.24	0.7	—	—	275	—	0.042	—	—	8.1
S-MS-SC05	72.6	[3]149	4.37	0.7	—	—	457	—	4.40	0.03	0.12	—
S-MS-SC06	38	2.89	2.19	0.3	—	—	345	—	0.127	0.025	0.69	≤2.4
S-MS-SC07	29.2	44.1	2.25	≤0.2	—	—	323	—	0.286	—	0.11	≤3.6
S-MS-SC08	94.2	[3]268	10.9	0.5	—	—	1,420	—	—	0.024	—	—
S-MS-SC09	135	12.4	1.57	0.8	—	—	502	—	0.084	8.26	1.3	142
S-MS-SC10	14.8	≤0.52	0.305	1.1	0.36	—	308	—	0.080	0.637	5.5	≤3.0
S-MS-SC11	37.4	27.5	1.31	0.4	0.04	—	120	—	≤0.010	0.09	3.8	6.5
S-MS-SC12	38.8	*346	1.15	2.0	0.09	—	400	—	—	0.027	0.59	20.2
S-MS-SC13	65	[3]72.1	1.47	0.3	—	—	304	—	≤0.023	0.024	0.17	≤1.7
S-MS-SC14	14.5	*533	0.464	0.3	—	—	137	—	≤0.018	—	—	≤2.2
S-MS-SC15	16.8	[3]190	0.626	0.2	—	—	172	—	0.245	0.035	0.3	—

Table 8*A*. Trace elements detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA well identification number	Lithium (µg/L) (01130)	Manganese (µg/L) (01056)	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)
MS-SA study unit grid wells (100 wells sampled)—Continued												
Pajaro Valley study area wells (15 wells sampled)—Continued												
S-MS-P01	6.36	—	1.56	≤0.2	0.62	—	191	—	—	0.313	5.7	≤3.4
S-MS-P02	5.33	—	0.327	0.3	0.35	—	74	—	—	0.014	9.0	9.3
S-MS-P03	6.49	33.4	1.16	0.3	—	—	144	—	≤0.020	0.411	—	15.0
S-MS-P04	3.45	1.56	0.062	0.9	0.13	—	174	—	—	0.1	7.3	448
S-MS-P05	1.47	≤0.54	0.075	4.6	0.06	—	200	—	—	0.006	0.89	≤2.6
S-MS-P06	17.9	—	0.468	0.5	1.3	—	438	—	—	0.7	2.6	27.4
S-MS-P07	12.3	—	1.81	0.7	0.60	—	1,100	—	—	0.899	3.0	7.9
S-MS-P08	2.83	18	0.174	0.9	0.59	—	117	—	—	0.022	12.9	6.5
S-MS-P09	10.4	[3]88.5	2.82	2.5	0.64	0.027	3,510	—	—	1.81	7.2	14.4
S-MS-P10	4.81	≤0.48	0.677	0.3	0.85	—	164	—	0.025	0.027	10.6	45.8
S-MS-P11	12.2	5.41	2.03	0.3	2.6	—	360	—	0.036	0.904	5.4	13.1
S-MS-P12	14.3	5.35	4.14	0.4	9.6	—	675	—	0.098	2.89	8.9	26.3
S-MS-P13	13.9	*356	4.41	0.6	0.10	—	928	—	≤0.014	0.865	5.9	≤2.4
S-MS-P14	10.1	48.9	6.8	0.4	0.20	—	555	—	0.078	2.55	8.5	48.2
S-MS-P15	11.6	≤0.56	1.93	0.4	1.2	—	195	—	0.921	0.253	8.2	≤2.4
Salinas Valley study area wells (40 wells sampled)												
S-MS-SV01	13.9	—	3.19	0.5	1.7	—	496	—	—	3.03	14.9	≤5.4
S-MS-SV02	32	0.72	11.9	3.4	0.64	—	1,250	—	≤0.020	9.45	15.4	≤4.4
S-MS-SV03	65.5	≤0.34	2.35	0.5	1.4	0.007	378	—	0.074	2.12	8.2	19.8
S-MS-SV04	31.3	[3]263	2.68	0.7	0.77	—	208	—	≤0.010	0.024	2.7	≤5.4
S-MS-SV05	18.9	≤0.24	3.46	3.4	4.8	0.005	362	—	0.025	0.021	6.7	6.3

Table 8*A*. Trace elements detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA well identification number	Lithium (µg/L) (01130)	Manganese (µg/L) (01056)	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)
MS-SA study unit grid wells (100 wells sampled)—Continued												
Salinas Valley study area wells (40 wells sampled)—Continued												
S-MS-SV06	8.02	37.4	4.5	0.4	0.07	—	419	—	0.034	0.008	0.39	97.9
S-MS-SV07	26.1	1.24	4.94	0.5	0.87	0.025	894	—	0.038	2.59	19.4	—
S-MS-SV08	17.7	0.97	5.18	0.4	1.4	—	579	—	0.025	7.13	6.5	17.9
S-MS-SV09	78.2	3.54	1.47	1.0	2.7	0.005	365	—	≤0.023	5.43	0.65	18.1
S-MS-SV10	24.5	≤0.16	6.12	0.8	4.8	0.006	720	—	0.044	7.79	6.5	13.5
S-MS-SV11	6.79	1.06	7.53	0.3	0.74	—	240	—	0.146	2.28	2.2	—
S-MS-SV12	10.6	—	6.62	0.5	3.6	—	172	—	≤0.019	3.3	9.8	≤3.1
S-MS-SV13	45.3	21.8	0.392	≤0.1	0.13	—	477	—	0.051	0.172	—	≤1.4
S-MS-SV14	111	2.87	32.3	0.8	4.6	—	1,290	—	≤0.013	13.7	6.0	36.5
S-MS-SV15	11.2	—	8.75	0.4	6.1	—	426	—	—	3.96	3.1	≤3.0
S-MS-SV16	15.4	≤0.27	11	0.6	2.3	—	356	—	—	3.18	5.7	≤3.4
S-MS-SV17	8.97	—	5.7	≤0.2	1.6	—	304	—	0.058	3.15	3.6	—
S-MS-SV18	12.7	≤0.6	8.12	0.8	6.8	—	535	—	—	8.77	4.6	16.5
S-MS-SV19	19.1	5.17	6.2	0.5	0.43	—	474	—	≤0.014	7.19	3.7	≤3.8
S-MS-SV20	41.4	≤0.36	2.52	0.6	6.3	—	1,210	—	0.024	22	7.8	25.8
S-MS-SV21	8.3	1.14	0.543	6.7	4.0	0.01	1,530	—	—	0.329	5.0	≤4.1
S-MS-SV22	17.2	—	6.4	0.9	6.5	—	761	—	≤0.014	10.5	4.3	7.1
S-MS-SV23	9.28	≤0.32	3.57	1.0	4.4	—	527	—	≤0.022	10	3.7	≤1.7
S-MS-SV24	34.4	≤0.43	25.5	0.2	0.78	—	457	—	≤0.015	8.15	16.4	7.8
S-MS-SV25	13.8	—	8.16	0.5	1.9	—	459	—	—	4.16	4.8	≤2.6

Table 8*A*. Trace elements detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA well identification number	Lithium (µg/L) (01130)	Manganese (µg/L) (01056)	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)
MS-SA study unit grid wells (100 wells sampled)—Continued												
Salinas Valley study area wells (40 wells sampled)—Continued												
S-MS-SV26	116	[3]103	0.245	0.7	0.12	—	1,990	0.22	0.043	0.313	0.23	—
S-MS-SV27	10	3.89	5.07	0.3	0.53	—	285	—	≤0.012	1.17	3.3	≤2.9
S-MS-SV28	112	8.68	16.8	≤0.2	*72.8	—	1,060	—	0.035	6.95	3.1	≤2.9
S-MS-SV29	255	1.41	5.47	1.5	14.6	0.024	*4,130	—	—	4.42	2.4	9.0
S-MS-SV30	36.4	—	3.03	5.3	*51.9	—	1,940	—	—	*33	4.1	—
S-MS-SV31	27.5	11.7	11	0.7	4.6	—	423	—	≤0.018	1.56	6.8	≤2.3
S-MS-SV32	34.9	2.13	1.96	0.6	5.0	—	860	—	—	9.47	10.7	≤5.9
S-MS-SV33	8.45	≤0.22	0.555	1.3	1.1	—	124	—	—	0.035	8.7	≤2.5
S-MS-SV34	12.4	29.1	0.992	0.3	0.51	—	108	—	0.506	0.314	6.9	114
S-MS-SV35	8.58	[3]56	16.6	0.8	0.04	—	412	—	0.153	0.137	0.44	≤5.2
S-MS-SV36	37.8	0.8	3.18	0.6	0.65	—	488	—	≤0.011	7.53	5.2	≤1.4
S-MS-SV37	27.6	—	6.65	0.4	0.68	—	265	—	0.037	6.4	3.6	—
S-MS-SV38	40	5.59	5.14	2.2	2.9	0.012	1,410	—	—	9.33	0.54	15.8
S-MS-SV39	196	[3]149	39.6	1.3	0.42	—	*4,490	0.03	0.050	19.5	4.1	52.7
S-MS-SV40	23.5	—	1.42	0.7	10.7	—	1,120	—	0.025	5.75	2.7	≤5.4
Highlands study area wells (30 wells sampled)												
S-MS-H01	29.8	1.32	0.794	≤0.2	—	—	460	—	0.218	0.009	0.11	≤2.7
S-MS-H02	323	*2,700	0.441	1.3	0.06	—	1,490	—	—	1.27	—	7.5
S-MS-H03	10.9	[3]114	4.44	1.6	8.4	—	1,050	—	—	2.48	1.5	≤4.2
S-MS-H04	8.7	1.07	17.9	3.3	1.6	—	546	0.03	≤0.019	2.03	21.8	≤2.3
S-MS-H05	170	3.84	0.336	0.5	—	—	*4,680	—	0.182	0.34	—	—

Table 8*A*. Trace elements detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA well identification number	Lithium (µg/L) (01130)	Manganese (µg/L) (01056)	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)
MS-SA study unit grid wells (100 wells sampled)—Continued												
Highlands study area wells (30 wells sampled)—Continued												
S-MS-H06	7.22	2.81	11.8	3.6	0.14	—	462	—	≤0.013	0.102	0.3	38.4
S-MS-H07	15.5	8.02	3.79	0.9	0.64	—	766	—	≤0.022	4.85	1.3	12.8
S-MS-H08	138	11.5	*47.9	7.3	8.6	—	1,400	—	—	14.2	2.0	13.7
S-MS-H09	174	[3]90.3	9.2	3.2	0.15	—	*4,700	—	0.046	0.857	0.21	11.2
S-MS-H10	79.9	*498	*304	1.0	0.13	—	1,090	—	0.040	0.059	—	≤3.3
S-MS-H11	57.4	15.1	*126	—	0.03	—	372	—	0.178	9.25	25.2	39.5
S-MS-H12	45.3	1.14	4.04	1.0	6.6	—	913	—	—	9.26	7.0	7.4
S-MS-H13	127	37.2	6.66	0.3	—	—	*5,080	—	0.086	6.84	—	—
S-MS-H14	767	43.6	3.14	0.5	0.98	—	2,180	—	0.384	—	1.8	32.1
S-MS-H15	14.2	9.87	2.84	2.2	0.43	—	584	—	0.038	2.71	2.8	—
S-MS-H16	72.9	6.54	28.8	0.2	4.2	—	871	—	0.135	11.9	9.0	21.5
S-MS-H17	44.8	—	11.3	≤0.2	1.2	—	556	—	≤0.017	4.78	15.1	≤4.1
S-MS-H18	142	1.63	*240	0.6	19.4	—	821	—	≤0.011	4.9	5.0	11.8
S-MS-H19	27.4	1.22	7.25	0.4	0.79	—	278	—	0.057	5.85	2.9	16.8
S-MS-H20	27.4	0.85	0.703	0.5	1.6	0.191	1,560	—	0.065	1.5	19.6	≤4.5
S-MS-H21	95.7	[3]82.9	*334	0.5	22.1	—	984	—	—	*41.9	—	120
S-MS-H22	60.4	[3,4]133	18.4	[4]0.4	[4]0.59	—	[4]1,100	—	≤0.023	[4]0.81	—[4]	[4]97.4
S-MS-H23	61.3	—	6.99	0.4	7.9	—	692	—	0.038	9.54	36	≤2.2
S-MS-H24	62.2	—	2	1.7	1.4	—	*5,000	—	≤0.022	15.6	4.0	82.9
S-MS-H25	115	—	23.7	0.3	5.5	0.007	1,100	—	≤0.020	*34.9	31.9	≤4.5

Table 8*A*. Trace elements detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA well identification number	Lithium (µg/L) (01130)	Manganese (µg/L) (01056)	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)
MS-SA study unit grid wells (100 wells sampled)—Continued												
Highlands study area wells (30 wells sampled)—Continued												
S-MS-H26	55.8	—	15.5	0.3	10.9	—	1,340	—	0.312	6.69	5.8	14.5
S-MS-H27	101	4.23	22.6	0.6	*84.8	—	887	—	0.052	16.2	10.1	41.3
S-MS-H28	271	—	*41.7	2.8	2.9	—	1,270	0.05	—	*53.5	1.6	—
S-MS-H29	348	0.94	38.7	1.5	19.3	—	1,660	—	0.033	9.43	13.2	8.6
S-MS-H30	27.2	4.27	4.05	0.6	0.65	—	1,500	0.05	0.096	0.879	0.29	27.6

[1]The SRLs are based on quality-control results from October 2009 through March 2013 (Davis, T.A., Olsen, L.D., Fram, M.S., and Belitz, Kenneth, 2014, Updated study reporting levels (SRLs) for trace-element data collected for the GAMA Priority Basin Project, October 2009–March 2013: U.S. Geological Survey Scientific Investigations Report 2014–5105, 52 p., http://dx.doi.org/10.3133/sir20145105). All results for cobalt were censored from this dataset and coded in the USGS National Water Information System (NWIS) database as "reviewed and rejected." All detections of copper, iron, lead, manganese, molybdenum, nickel, tungsten, and zinc at concentrations less than the respective SRLs are reported as less than or equal to (≤) the value reported by the laboratory.

[2]Concentration of boron greater the NL-CA of 1,000 µg/L.

[3]Concentration of manganese greater than the SMCL-CA of 50 µg/L.

[4]Results for the environmental and replicate samples collected at S-MS-H22 were outside the limits of acceptible precision for 13 inorganic constituents, including the trace elements arsenic, barium, chromium, iron, manganese, nickel, selenium, strontium, uranium, vanadium, and zinc. See appendix table A-3*B* for more information.

Table 8*B*. Trace elements detected in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area tap sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area tap sample. Benchmark type, benchmark level, LT-MDL, and Study Reporting Level as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection limit; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA tap identification number	Aluminum (µg/L) (01106)	Antimony (µg/L) (01095)	Arsenic (µg/L) (01000)	Barium (µg/L) (01005)	Beryllium (µg/L) (01010)	Boron (µg/L) (01020)	Cadmium (µg/L) (01025)	Chromium (µg/L) (01030)	Copper (µg/L) (01040)	Iron (µg/L) (01046)	Lead (µg/L) (01049)
Benchmark type	MCL-CA	MCL-US	MCL-US	MCL-CA	MCL-US	HBSL	MCL-US	MCL-CA	AL-US	SMCL-CA	AL-US
Benchmark level	1,000	6	10	1,000	4	6,000	5	50	1,300	300	15
LT-MDL or SRL	2.2	0.027	0.04	0.10	0.006	3	0.016	0.07	[1]2.1	[1]6	[1]0.82
MS-SA study unit shallow-well tap-site samples (70 taps sampled)											
Pajaro Valley study area shallow-well tap-site samples (15 taps sampled)											
S-MS-P01-T1	2.4	—	0.25	12.2	—	22	—	9.4	2.4	≤4.3	1.75
S-MS-P02-T1	3.5	—	0.15	1.19	—	16	—	30.4	≤0.95	—	≤0.06
S-MS-P03-T1	3.8	—	0.16	1.16	—	10	—	36	10.3	6.8	≤0.36
S-MS-P04-T1	3.9	—	6.4	3.63	—	16	—	—	—	180	—
S-MS-P05-T1	3.8	0.071	0.12	103	—	17	0.524	0.09	3.1	*314	≤0.18
S-MS-P06-T1	—	0.058	0.36	54.8	—	65	0.016	0.66	13.9	≤4.0	≤0.67
S-MS-P07-T1	13.3	0.032	0.19	66.9	—	91	0.103	—	11.5	≤4.1	≤0.47
S-MS-P08-T1	—	—	*12.6	59.4	0.006	59	0.017	—	—	26.5	≤0.06
S-MS-P09-T1	3.3	—	0.3	71.2	—	28	0.016	8.7	7.1	—	≤0.38
S-MS-P10-T1	—	0.038	0.65	69.4	0.008	140	—	6.1	3.5	—	≤0.25
S-MS-P11-T1	2.6	0.218	3.8	386	0.007	136	0.025	—	—	*791	≤0.09
S-MS-P12-T1	—	0.076	0.59	79.8	0.008	216	0.033	2.5	3.8	—	≤0.31
S-MS-P13-T1	3.1	—	0.33	29.4	—	25	—	11	2.4	—	≤0.28
S-MS-P14-T1	2.5	—	0.23	107	—	29	0.078	0.23	3.8	14.3	≤0.43
S-MS-P15-T1	3.2	—	0.28	58.0	—	22	—	10.1	15.7	—	≤0.16

Table 8*B*. Trace elements detected in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area tap sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area tap sample. Benchmark type, benchmark level, LT-MDL, and Study Reporting Level as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection limit; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA tap identification number	Aluminum (µg/L) (01106)	Antimony (µg/L) (01095)	Arsenic (µg/L) (01000)	Barium (µg/L) (01005)	Beryllium (µg/L) (01010)	Boron (µg/L) (01020)	Cadmium (µg/L) (01025)	Chromium (µg/L) (01030)	Copper (µg/L) (01040)	Iron (µg/L) (01046)	Lead (µg/L) (01049)
MS-SA study unit shallow-well tap-site samples (70 taps sampled)—Continued											
Salinas Valley study area shallow-well tap sites (55 taps sampled)											
S-MS-SV01-T1	2.3	0.098	0.56	43.3	—	38	0.053	—	2.6	≤5.6	≤0.54
S-MS-SV01-T2	—	0.282	4.1	36.2	—	141	2.14	0.64	5.6	6.7	4.12
S-MS-SV02-T1	—	0.155	1.5	52.6	—	67	0.182	0.29	≤1.7	10.1	≤0.13
S-MS-SV02-T2	—	0.057	2.8	481	0.009	181	0.034	2	3.4	10.2	2.01
S-MS-SV03-T1	2.5	0.144	2.1	188	—	47	0.023	10.9	7.1	—	2.35
S-MS-SV03-T2	2.3	—	5.4	17.8	—	64	0.141	—	—	*380	—
S-MS-SV04-T1	2.8	0.046	1.8	49.4	0.006	56	0.082	1.6	6.0	—	≤0.38
S-MS-SV04-T2	3.0	0.168	6.1	54.9	0.03	109	2.72	0.07	—	255	≤0.04
S-MS-SV05-T1	—	0.053	1.8	97.0	—	183	1.05	—	≤1.7	—	≤0.07
S-MS-SV05-T2	3.2	0.045	2.3	73.2	0.009	93	0.095	0.17	23.6	≤5.4	≤0.59
S-MS-SV06-T1	—	0.049	1.7	40.0	—	110	0.112	2.5	2.4	—	≤0.78
S-MS-SV06-T2	—	0.076	2.2	54.2	—	96	0.085	0.45	6.5	26.5	≤0.41
S-MS-SV08-T1	11.0	—	0.74	161	—	232	—	—	—	*597	—
S-MS-SV08-T2	—	0.059	0.96	77.5	0.007	167	0.934	—	39.7	8.2	≤0.32
S-MS-SV09-T1	—	—	0.38	36.8	—	83	0.073	1.2	4.7	≤5.6	≤0.49
S-MS-SV09-T2	—	0.037	0.62	61.1	0.009	104	0.091	0.29	≤1.5	—	≤0.06
S-MS-SV11-T1	—	0.042	2.6	14.1	0.009	172	0.054	—	3.8	113	≤0.16
S-MS-SV11-T2	—	0.069	0.43	180	0.01	141	0.878	0.38	≤1.5	30.5	≤0.33
S-MS-SV13-T1	—	0.034	1.3	14.8	0.082	[2]2,000	0.053	—	—	*2,930	—
S-MS-SV13-T2	2.4	0.117	4.4	62.4	0.015	460	0.06	1.1	≤0.99	—	0.93

Table 8*B*. Trace elements detected in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area tap sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area tap sample. Benchmark type, benchmark level, LT-MDL, and Study Reporting Level as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection limit; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA tap identification number	Aluminum (µg/L) (01106)	Antimony (µg/L) (01095)	Arsenic (µg/L) (01000)	Barium (µg/L) (01005)	Beryllium (µg/L) (01010)	Boron (µg/L) (01020)	Cadmium (µg/L) (01025)	Chromium (µg/L) (01030)	Copper (µg/L) (01040)	Iron (µg/L) (01046)	Lead (µg/L) (01049)
MS-SA study unit shallow-well tap-site samples (70 taps sampled)—Continued											
Salinas Valley study area shallow-well tap sites (55 taps sampled)—Continued											
S-MS-SV16-T1	—	0.154	2.8	33.6	0.007	178	0.366	1.2	≤0.86	7.1	—
S-MS-SV16-T2	—	0.09	6.3	214	—	152	2.49	1.4	26.4	≤5.5	≤0.29
S-MS-SV17-T1	—	0.063	0.57	71.8	—	58	1.15	2.2	2.7	—	≤0.22
S-MS-SV17-T2	—	0.091	2.5	68.7	0.008	171	0.117	4.2	2.2	—	≤0.25
S-MS-SV18-T1	—	0.105	3.3	70.1	0.021	220	0.652	—	≤1.1	16.0	≤0.10
S-MS-SV19-T1	—	0.055	1.1	70.2	—	122	0.211	1.2	6.4	—	≤0.18
S-MS-SV19-T2	—	0.048	1.3	47.6	—	156	0.092	0.5	24.5	—	≤0.25
S-MS-SV20-T1	—	0.052	1.3	295	—	51	0.017	4.1	5.1	12.1	1.17
S-MS-SV20-T2	2.7	0.029	1.0	68.2	—	34	0.028	0.93	—	24.3	—
S-MS-SV21-T1	—	0.054	3.0	70.0	—	131	0.033	4.7	5.5	7.9	≤0.25
S-MS-SV21-T2	—	0.041	0.51	236	—	21	0.02	3.9	5.0	6.4	≤0.13
S-MS-SV22-T1	—	0.044	0.86	35.0	0.013	424	0.049	8.9	—	6.8	≤0.48
S-MS-SV22-T2	19.8	0.168	1.2	23.1	0.007	22	0.097	0.2	≤2.0	11.1	≤0.53
S-MS-SV23-T1	11.0	—	1.2	36.2	3.21	394	—	4.8	9.3	—	≤0.26
S-MS-SV24-T1	—	0.167	2.9	27.8	—	96	0.085	1.2	≤1.3	—	≤0.17
S-MS-SV24-T2	—	0.061	0.77	44.2	—	16	0.095	0.76	2.8	6.3	≤0.23
S-MS-SV25-T1	—	0.105	1.5	49.1	0.03	887	0.137	23.3	3.2	—	≤0.65
S-MS-SV25-T2	—	0.099	1.5	58.3	0.016	490	0.11	13.9	2.6	8.8	≤0.51
S-MS-SV26-T1	—	0.147	1.9	31.4	—	134	0.03	0.19	—	9.6	0.96
S-MS-SV26-T2	4.4	0.928	3.7	51.4	0.057	705	0.925	—	≤1.6	42.4	≤0.29

Table 8*B*. Trace elements detected in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area tap sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area tap sample. Benchmark type, benchmark level, LT-MDL, and Study Reporting Level as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection limit; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA tap identification number	Aluminum (µg/L) (01106)	Antimony (µg/L) (01095)	Arsenic (µg/L) (01000)	Barium (µg/L) (01005)	Beryllium (µg/L) (01010)	Boron (µg/L) (01020)	Cadmium (µg/L) (01025)	Chromium (µg/L) (01030)	Copper (µg/L) (01040)	Iron (µg/L) (01046)	Lead (µg/L) (01049)
MS-SA study unit shallow-well tap-site samples (70 taps sampled)—Continued											
Salinas Valley study area shallow-well tap sites (55 taps sampled)—Continued											
S-MS-SV27-T1	2.3	0.033	3.0	19.8	0.019	497	0.047	—	—	*6,720	≤0.55
S-MS-SV29-T1	6.6	0.125	1.6	17.1	0.589	741	0.299	2.8	—	21.6	—
S-MS-SV29-T2	—	0.092	1.9	42.7	—	180	0.056	0.32	22.0	—	≤0.26
S-MS-SV30-T1	—	0.118	2.4	33.0	0.011	280	0.045	2.1	36.7	—	≤0.06
S-MS-SV32-T1	2.9	—	0.41	136	—	38	0.027	0.73	≤1.0	≤5.9	≤0.25
S-MS-SV33-T1	—	0.078	5.2	31.9	0.01	101	0.023	5.1	≤1.5	≤5.0	≤0.17
S-MS-SV33-T2	2.5	0.17	0.32	206	0.01	54	0.017	1.2	6.3	≤4.1	≤0.43
S-MS-SV34-T1	2.5	—	0.13	39.4	—	24	0.046	2.2	93.7	49.5	≤0.38
S-MS-SV34-T2	—	—	0.21	53.6	—	21	—	9.2	27.2	—	2.13
S-MS-SV35-T1	—	0.107	0.39	286	—	43	—	0.11	14.4	14.2	—
S-MS-SV35-T2	—	0.094	0.37	148	—	26	0.028	1.3	5.9	6.1	≤0.22
S-MS-SV36-T1	—	0.109	*18.8	42.1	0.008	107	0.036	0.27	3.5	11.5	≤0.26
S-MS-SV36-T2	—	0.054	0.71	92.7	—	34	0.03	0.13	17.9	20.0	≤0.05
S-MS-SV37-T1	—	—	0.59	43.6	—	75	0.034	0.16	3.4	7.8	≤0.20
S-MS-SV40-T1	—	0.048	0.92	36.0	—	78	1.99	0.88	≤1.2	—	1.59

Table 8*B*. Trace elements detected in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area tap sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area tap sample. Benchmark type, benchmark level, LT-MDL, and Study Reporting Level as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection limit; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA tap identification number	Lithium (µg/L) (01130)	Manganese (µg/L) (01056)	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)
Benchmark type	na	HBSL	HBSL	MCL-CA	MCL-US	HBSL	HBSL	MCL-US	na	MCL-US	NL-CA	HBSL
Benchmark level	na	300	40	100	50	100	4,000	2	na	30	50	2,000
LT-MDL or SRL	0.22	[1]0.66	0.023	[1]0.21	0.03	0.005	0.2	0.01	0.023	0.004	0.08	[1]6.2
MS-SA study unit shallow-well tap-site samples (70 taps sampled)—Continued												
Pajaro Valley study area shallow-well tap-site samples (15 taps sampled)—Continued												
S-MS-P01-T1	4.42	≤0.25	0.2	0.22	0.11	0.005	217	—	—	0.047	4.5	42.8
S-MS-P02-T1	11.9	2.31	0.1	≤0.16	0.38	—	128	0.01	—	0.175	7.8	9.9
S-MS-P03-T1	2.94	≤0.31	0.1	—	0.16	0.005	54.6	0.02	≤0.013	0.009	17.5	47.0
S-MS-P04-T1	13.3	12.5	0.6	≤0.15	—	—	197	0.02	0.029	0.007	—	≤3.5
S-MS-P05-T1	7.52	[3]270	0.3	4.6	0.56	—	455	—	—	0.008	0.4	*5,040
S-MS-P06-T1	11.4	0.7	1.5	4.3	1.2	—	348	0.02	—	0.43	1.4	15.7
S-MS-P07-T1	4.89	*1,210	0.9	3.1	—	—	307	0.02	—	0.058	0.21	81.5
S-MS-P08-T1	28.5	[3]88.2	2.1	≤0.19	0.05	—	510	—	0.116	0.022	0.24	242
S-MS-P09-T1	2.27	1.61	0.3	1.8	1.1	—	353	—	—	0.028	6.3	36.1
S-MS-P10-T1	16.8	2.34	2.3	0.92	2.2	—	494	0.01	—	1.87	4.4	≤5
S-MS-P11-T1	9.79	*4,210	8.6	1.7	0.23	—	801	—	≤0.02	3.41	5.3	61
S-MS-P12-T1	22.3	1.19	8.1	1.7	6.1	—	968	—	0.031	13.3	4.7	≤5.8
S-MS-P13-T1	4.07	1.18	0.3	2.2	0.81	—	125	—	—	0.009	6.0	41.6
S-MS-P14-T1	3.16	12.2	0.3	2.4	0.32	—	421	—	—	0.033	2.5	391
S-MS-P15-T1	3.67	2.08	0.2	3.1	0.68	—	308	—	—	0.044	7	9.2

Table 8*B*. Trace elements detected in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area tap sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area tap sample. Benchmark type, benchmark level, LT-MDL, and Study Reporting Level as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection limit; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA tap identification number	Lithium (µg/L) (01130)	Manganese (µg/L) (01056)	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)
MS-SA study unit shallow-well tap-site samples (70 taps sampled)—Continued												
Salinas Valley study area shallow-well tap sites (55 taps sampled)—Continued												
S-MS-SV01-T1	10.1	4.16	1.2	0.82	0.19	—	199	—	—	0.442	6.9	≤3.6
S-MS-SV01-T2	15.3	≤0.22	*56.6	3.1	25.9	—	1,400	—	0.147	24.7	12.6	59.2
S-MS-SV02-T1	9.11	0.84	6.6	0.82	7.1	—	508	—	0.041	2.85	7.6	59.5
S-MS-SV02-T2	34.9	≤0.43	4.0	0.62	3.0	—	688	—	≤0.01	4.78	37.7	6.7
S-MS-SV03-T1	6.19	≤0.16	2.5	0.24	1.0	—	261	—	0.028	0.93	10	24.1
S-MS-SV03-T2	43.2	[3]185	*62.3	0.86	0.11	—	859	—	0.119	2.47	0.1	—
S-MS-SV04-T1	19.2	≤0.39	6.0	0.27	1.8	—	604	—	0.052	8.37	5.9	88.9
S-MS-SV04-T2	34.7	47.9	*69.1	11.3	5.0	0.006	558	—	—	6.85	2.2	≤4.1
S-MS-SV05-T1	21.0	[3]267	9.2	2.2	5.0	—	872	—	0.054	17.5	4.0	18.8
S-MS-SV05-T2	38.8	1.6	10.8	0.96	1.9	0.008	422	—	≤0.019	2.91	7.7	204
S-MS-SV06-T1	14.1	≤0.47	5.6	0.28	0.6	0.006	346	—	≤0.015	1.19	7.3	7.4
S-MS-SV06-T2	23.7	32.8	2.4	3.0	2.5	—	366	—	≤0.014	0.384	2.3	8.2
S-MS-SV08-T1	50.4	29.5	5.9	3.3	0.22	—	2,540	—	—	12.8	2.1	58.6
S-MS-SV08-T2	15.2	43.1	13.6	1.4	0.15	0.018	562	—	≤0.012	8.94	3	429
S-MS-SV09-T1	15.4	0.92	4.4	0.62	2.8	—	489	—	≤0.017	8.76	6.2	71.4
S-MS-SV09-T2	15.4	7.58	4.1	0.3	2.6	—	592	—	0.042	6.62	3.6	17.6
S-MS-SV11-T1	32.9	38.5	23.4	1.1	0.08	—	1,280	—	—	12.7	0.71	22.1
S-MS-SV11-T2	17.0	8.62	2.7	4.2	4.5	0.013	1,040	—	0.03	9.28	1.4	*2,460
S-MS-SV13-T1	53.4	[3]75.4	26.5	0.27	0.13	—	890	0.04	0.735	8.04	1.1	≤4.9
S-MS-SV13-T2	75.4	≤0.35	20.0	0.28	3.6	0.006	1,130	—	0.058	16.2	23.5	≤1.7

Table 8*B*. Trace elements detected in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area tap sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area tap sample. Benchmark type, benchmark level, LT-MDL, and Study Reporting Level as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection limit; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA tap identification number	Lithium (µg/L) (01130)	Manganese (µg/L) (01056)	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)
MS-SA study unit shallow-well tap-site samples (70 taps sampled)—Continued												
Salinas Valley study area shallow-well tap sites (55 taps sampled)—Continued												
S-MS-SV16-T1	23.8	0.87	10.6	1.1	7.7	—	785	—	—	7.43	5.4	12.4
S-MS-SV16-T2	46.5	1.07	*40.4	1.5	10.7	0.008	347	—	—	8.24	15.7	144
S-MS-SV17-T1	17.0	≤0.43	3.8	1.1	7.1	0.01	1,000	—	0.024	15.5	1.8	11.7
S-MS-SV17-T2	23.2	≤0.2	4.7	0.74	20.2	—	945	—	—	5.15	5.5	15.7
S-MS-SV18-T1	15.9	*1,120	34.2	1.6	41.6	—	1,070	—	0.05	*50.1	10	38.1
S-MS-SV19-T1	9.03	[3]55.7	15.2	2.3	3.8	—	548	—	—	8.85	2.9	≤2.4
S-MS-SV19-T2	18.1	9.0	3.8	0.58	1.8	—	424	—	0.05	6.63	5.7	41.0
S-MS-SV20-T1	37.1	0.68	1.5	1.6	0.76	0.007	1,030	—	0.025	3.9	10.1	501
S-MS-SV20-T2	20.5	1.39	0.4	—	0.22	0.017	357	—	≤0.012	1.28	12	20.1
S-MS-SV21-T1	34.2	≤0.33	8.1	0.92	0.65	—	267	—	0.025	2.18	15.2	61.5
S-MS-SV21-T2	12.8	—	1.6	0.75	0.78	—	784	—	—	5.08	5.8	—
S-MS-SV22-T1	30.3	0.95	3.9	1.3	6.3	—	1,180	—	≤0.012	28.1	6.5	16.5
S-MS-SV22-T2	0.72	[3]85	0.6	1.3	0.31	—	90.3	0.01	0.106	0.029	0.42	6.8
S-MS-SV23-T1	37.2	1.32	7.1	1.5	4.6	—	1,390	—	—	24.2	3.6	13.1
S-MS-SV24-T1	10.3	≤0.48	7.1	0.47	1.5	—	358	—	≤0.013	2.01	4.9	≤2.9
S-MS-SV24-T2	5.64	≤0.55	3.1	0.26	0.81	0.008	221	—	0.055	1.8	2.3	19.6
S-MS-SV25-T1	47.8	≤0.16	5.4	1.8	6.6	—	1,260	—	—	12.1	3.2	≤4.1
S-MS-SV25-T2	29.7	—	5.1	1.7	5.9	—	928	—	—	7.67	3.3	≤3.6
S-MS-SV26-T1	10.2	1.4	6.5	0.4	0.63	—	275	—	—	1.33	3.6	10.6
S-MS-SV26-T2	59.1	*1,820	35.1	28.0	14.3	—	2,190	—	—	*42.8	2.4	20.7

Table 8*B*. Trace elements detected in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in table 3*D*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area tap sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area tap sample. Benchmark type, benchmark level, LT-MDL, and Study Reporting Level as of May 23, 2013. **Benchmark types**: AL-US, U.S. Environmental Protection Agency (USEPA) action level; HBSL, USGS health-based screening level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level; NL-CA, California notification level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection limit; na, not available; SRL, study reporting level; USGS, U.S. Geological Survey; µg/L, micrograms per liter; *, concentration greater than the benchmark level; —, not detected; ≤, less than or equal to]

GAMA tap identification number	Lithium (µg/L) (01130)	Manganese (µg/L) (01056)	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)
MS-SA study unit shallow-well tap-site samples (70 taps sampled)—Continued												
Salinas Valley study area shallow-well tap sites (55 taps sampled)—Continued												
S-MS-SV27-T1	265	[3]202	15.6	0.97	0.12	0.006	3,100	—	0.118	0.635	0.19	79.5
S-MS-SV29-T1	153	0.99	13.9	6.5	11.2	—	1,980	—	—	14.9	4.6	≤4.6
S-MS-SV29-T2	14.8	3.02	8.0	0.44	1.2	—	376	—	0.043	1.11	2.8	10.4
S-MS-SV30-T1	17.9	≤0.35	5.2	1.2	3.8	—	663	—	≤0.017	5.58	3.4	38.6
S-MS-SV32-T1	31.4	≤0.66	5.2	0.41	1.5	0.006	592	—	≤0.011	10.6	10.1	32.8
S-MS-SV33-T1	29.1	≤0.53	6.3	0.26	0.92	0.006	232	—	0.034	2.67	18	15.7
S-MS-SV33-T2	13.1	0.78	1.2	1.7	0.27	—	544	—	—	8.99	2.2	≤5.1
S-MS-SV34-T1	2.36	11.6	0.1	1.6	0.41	0.006	109	—	—	0.015	4.2	16.00
S-MS-SV34-T2	2.25	2.46	0.1	1.9	0.53	—	182	—	—	0.009	7.8	30.8
S-MS-SV35-T1	19.3	[3]166	5.6	1.8	0.31	—	538	—	—	3.04	—	≤3.5
S-MS-SV35-T2	10.5	3.98	1.5	0.46	0.46	—	573	—	—	11.9	2.2	25.1
S-MS-SV36-T1	59.7	6.8	11.8	1.2	0.93	0.01	284	—	0.184	3.93	9.8	536
S-MS-SV36-T2	41.6	12.7	2.3	0.92	0.68	0.013	685	—	—	2.67	4.8	145
S-MS-SV37-T1	25.8	0.91	6.1	0.29	1.3	0.015	264	—	—	2.63	11.5	19.3
S-MS-SV40-T1	17.9	≤0.21	3.0	0.68	1.7	—	421	—	0.06	4.36	3.5	412

[1]The SRLs were based on examination of quality-control results from October 2009 through March 2013 (Davis, T.A., Olsen, L.D., Fram, M.S., and Belitz, Kenneth, 2014, Updated study reporting levels (SRLs) for trace-element data collected for the California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2009–March 2013: U.S. Geological Survey Scientific Investigations Report 2014–5105, 52 p., http://dx.doi.org/10.3133/sir20145105). All results for cobalt were censored from this dataset and coded in the USGS National Water Information System (NWIS) database as "reviewed and rejected." All detections of copper, iron, lead, manganese, molybdenum, nickel, tungsten, and zinc at concentrations less than their respective SRLs are reported as less than or equal to (≤) the value reported by the laboratory.

[2]Concentration of boron greater than the NL-CA of 1,000 µg/L.

[3]Concentration of manganese greater than the SMCL-CA of 50 µg/L.

Table 9*A*. Nutrients detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed, but only samples with detections are listed. Information about the constituents is given in table 3*E*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; MDL, method detection limit; mg/L, milligrams per liter; na, not available; USGS, U.S. Geological Survey; *, concentration greater than the benchmark level; —, not detected]

GAMA well identification number	Ammonia (as nitrogen) (mg/L) (00608)	Nitrite (as nitrogen) (mg/L) (00613)	Nitrite plus nitrate (as nitrogen)[1] (mg/L) (00631)	Total nitrogen (ammonia + nitrate + nitrite + organic nitrogen) (mg/L) (62854)	Orthophosphate (as phosphorus) (mg/L) (00671)
Benchmark type	HAL-US	MCL-US	MCL-US	na	na
Benchmark level	[2]24.7	1	10	na	na
LT-MDL or MDL	0.010	0.0010	0.04	0.05	0.004
MS-SA study unit grid wells (100 wells sampled)					
Santa Cruz study area wells (15 wells sampled)					
S-MS-SC01	0.97	—	—	1.06	0.061
S-MS-SC02	0.15	0.007	0.13	0.30	0.032
S-MS-SC03	0.51	0.002	—	0.54	0.042
S-MS-SC04	1.1	0.012	0.15	1.31	0.084
S-MS-SC05	0.78	0.002	—	0.88	0.152
S-MS-SC06	0.12	0.021	0.15	0.28	0.074
S-MS-SC07	0.46	—	—	0.46	0.054
S-MS-SC08	0.39	0.001	—	0.44	0.039
S-MS-SC09	0.07	0.033	0.43	0.54	0.04
S-MS-SC10	—	—	2.68	2.77	0.269
S-MS-SC11	0.03	—	0.33	0.35	0.329
S-MS-SC12	0.56	0.001	0.23	0.79	0.097
S-MS-SC13	0.12	0.006	0.68	0.84	0.155
S-MS-SC14	0.02	—	—	—	0.05
S-MS-SC15	0.41	—	—	0.43	0.092
Pajaro Valley study area wells (15 wells sampled)					
S-MS-P01	—	—	1.68	1.71	0.121
S-MS-P02	—	—	0.46	0.43	0.139
S-MS-P03	0.04	0.002	—	0.06	0.018
S-MS-P04	—	—	5.79	6.14	0.064
S-MS-P05	—	—	5.38	5.92	0.033
S-MS-P06	—	—	2.91	2.86	0.035
S-MS-P07	—	—	*64.3	57.7	0.08
S-MS-P08	—	—	1.19	1.23	0.173
S-MS-P09	0.15	—	2.14	2.2	0.097
S-MS-P10	—	—	*11.1	10.5	0.165

Table 9*A*. Nutrients detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed, but only samples with detections are listed. Information about the constituents is given in table 3*E*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; MDL, method detection limit; mg/L, milligrams per liter; na, not available; USGS, U.S. Geological Survey; *, concentration greater than the benchmark level; —, not detected]

GAMA well identification number	Ammonia (as nitrogen) (mg/L) (00608)	Nitrite (as nitrogen) (mg/L) (00613)	Nitrite plus nitrate (as nitrogen)[1] (mg/L) (00631)	Total nitrogen (ammonia + nitrate + nitrite + organic nitrogen) (mg/L) (62854)	Orthophosphate (as phosphorus) (mg/L) (00671)
MS-SA study unit grid wells (100 wells sampled)—Continued					
Pajaro Valley study area wells (15 wells sampled)—Continued					
S-MS-P11	0.01	—	0.08	0.11	0.095
S-MS-P12	—	—	0.93	0.98	0.019
S-MS-P13	0.02	—	—	0.06	0.025
S-MS-P14	—	—	0.20	0.19	0.036
S-MS-P15	—	—	1.11	1.15	0.083
Salinas Valley study area wells (40 wells sampled)					
S-MS-SV01	—	—	7.35	7.46	0.015
S-MS-SV02	—	—	1.30	1.41	0.027
S-MS-SV03	—	0.001	3.53	3.54	0.182
S-MS-SV04	—	—	2.36	2.39	0.776
S-MS-SV05	—	—	1.46	1.52	0.534
S-MS-SV06	0.25	0.026	0.19	0.41	0.137
S-MS-SV07	—	—	0.63	0.64	0.021
S-MS-SV08	—	—	0.44	0.39	0.016
S-MS-SV09	—	—	*18.1	34.0	0.015
S-MS-SV10	0.01	—	*35.9	39.5	0.048
S-MS-SV11	—	—	0.21	0.19	0.018
S-MS-SV12	—	—	4.72	4.83	0.02
S-MS-SV13	0.29	—	—	0.30	0.03
S-MS-SV14	—	—	0.61	0.62	0.018
S-MS-SV15	—	—	1.14	1.18	0.067
S-MS-SV16	—	—	1.56	1.62	0.037
S-MS-SV17	—	—	2.50	3.13	0.023
S-MS-SV18	—	—	*12.1	11.9	0.061
S-MS-SV19	—	0.001	0.15	0.14	0.021
S-MS-SV20	—	—	*10.2	20.5	0.019

Table 9*A*. Nutrients detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed, but only samples with detections are listed. Information about the constituents is given in table 3*E*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; MDL, method detection limit; mg/L, milligrams per liter; na, not available; USGS, U.S. Geological Survey; *, concentration greater than the benchmark level; —, not detected]

GAMA well identification number	Ammonia (as nitrogen) (mg/L) (00608)	Nitrite (as nitrogen) (mg/L) (00613)	Nitrite plus nitrate (as nitrogen)[1] (mg/L) (00631)	Total nitrogen (ammonia + nitrate + nitrite + organic nitrogen) (mg/L) (62854)	Orthophosphate (as phosphorus) (mg/L) (00671)
MS-SA study unit grid wells (100 wells sampled)—Continued					
Salinas Valley study area wells (40 wells sampled)—Continued					
S-MS-SV21	—	0.001	*13.5	27.5	0.071
S-MS-SV22	—	—	*12.5	12.7	0.024
S-MS-SV23	—	—	8.60	8.25	0.041
S-MS-SV24	—	0.003	0.21	0.15	0.014
S-MS-SV25	—	—	*10.3	10.5	0.034
S-MS-SV26	0.69	—	—	0.75	0.047
S-MS-SV27	—	0.001	0.27	0.29	0.063
S-MS-SV28	0.13	—	0.35	0.5	0.015
S-MS-SV29	—	—	*30.3	27.9	0.03
S-MS-SV30	0.01	—	*70.9	71.2	0.042
S-MS-SV31	—	—	4.83	4.94	0.052
S-MS-SV32	—	—	*15.6	14.7	0.039
S-MS-SV33	—	—	1.11	1.12	0.171
S-MS-SV34	—	0.002	0.29	0.26	0.085
S-MS-SV35	0.06	—	—	0.06	0.073
S-MS-SV36	—	—	*50.2	50.2	0.067
S-MS-SV37	—	—	3.53	3.63	0.051
S-MS-SV38	—	—	*16.6	16.8	0.014
S-MS-SV39	0.08	—	—	0.05	0.017
S-MS-SV40	—	—	4.88	4.86	0.016
Highlands study area wells (30 wells sampled)					
S-MS-H01	0.35	0.001	—	0.40	0.021
S-MS-H02	0.10	0.002	—	0.14	0.017
S-MS-H03	0.05	0.002	0.65	0.75	0.091
S-MS-H04	—	—	1.23	1.26	0.023
S-MS-H05	1.7	0.003	—	1.97	0.011

Table 9*A*. Nutrients detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed, but only samples with detections are listed. Information about the constituents is given in table 3*E*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California maximum contaminant level; MCL-US, USEPA maximum contaminant level. Maximum contaminant level benchmarks 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**: LT-MDL, long-term method detection level; MDL, method detection limit; mg/L, milligrams per liter; na, not available; USGS, U.S. Geological Survey; *, concentration greater than the benchmark level; —, not detected]

GAMA well identification number	Ammonia (as nitrogen) (mg/L) (00608)	Nitrite (as nitrogen) (mg/L) (00613)	Nitrite plus nitrate (as nitrogen)[1] (mg/L) (00631)	Total nitrogen (ammonia + nitrate + nitrite + organic nitrogen) (mg/L) (62854)	Orthophosphate (as phosphorus) (mg/L) (00671)
MS-SA study unit grid wells (100 wells sampled)—Continued					
Highlands study area wells (30 wells sampled)—Continued					
S-MS-H06	0.02	0.035	0.25	0.28	0.128
S-MS-H07	—	—	0.07	0.15	0.006
S-MS-H08	0.23	—	2.52	2.92	0.057
S-MS-H09	9.2	0.001	0.05	9.46	0.009
S-MS-H10	0.15	—	—	0.21	0.089
S-MS-H11	0.12	—	—	0.10	0.018
S-MS-H12	—	—	5.32	5.42	0.022
S-MS-H13	0.07	—	—	—	0.019
S-MS-H14	25.2	0.001	—	23.5	0.148
S-MS-H15	—	0.001	0.75	0.76	0.025
S-MS-H16	0.01	0.001	3.93	4.09	0.027
S-MS-H17	—	—	9.99	10.1	0.014
S-MS-H18	—	—	8.64	8.78	0.025
S-MS-H19	—	—	2.33	2.35	0.034
S-MS-H20	—	—	*23.5	21.2	0.022
S-MS-H21	0.49	0.018	0.47	0.97	0.014
S-MS-H22	0.71	0.02	2.14	2.91	0.029
S-MS-H23	—	—	8.02	8.01	0.031
S-MS-H24	—	—	1.81	1.85	0.017
S-MS-H25	—	—	7.67	8.15	0.021
S-MS-H26	—	—	*15.4	14.9	0.009
S-MS-H27	—	—	6.52	6.87	0.029
S-MS-H28	—	—	—	0.21	0.073
S-MS-H29	—	—	6.81	6.89	0.131
S-MS-H30	—	0.006	0.14	0.12	0.009

[1]Nitrite plus nitrate (as nitrogen) is referred to as nitrate in the text for clarity.

[2]The HAL-US is 30 mg/L "as ammonia." To facilitate comparison to the analytical results, we have converted and reported this HAL-US as 24.7 mg/L "as nitrogen."

Table 9*B*. Nutrients detected in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in tables 3*E–F*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area shallow-well tap-site sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area shallow-well tap sample. Benchmark type, benchmark level, and LT-MDL as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level. Maximum contaminant level benchmarks are listed as MCL-US when the MCL-US and MCL-CA are identical. **Abbreviations**: LT-MDL, long-term method detection limit; mg/L, milligrams per liter; USGS, U.S. Geological Survey; *, concentration greater than the recommended benchmark level; —, not detected]

GAMA tap identification number	Nitrite plus nitrate (as nitrogen)[1] (mg/L) (00631)
Benchmark type	MCL-US
Benchmark	10
LT-MDL	0.04
MS-SA shallow-well tap-site samples (70 taps sampled)	
Pajaro Valley study area shallow-well tap-site samples (15 taps sampled)	
S-MS-P01-T1	*12.6
S-MS-P02-T1	0.48
S-MS-P03-T1	0.33
S-MS-P04-T1	—
S-MS-P05-T1	*19.5
S-MS-P06-T1	7.71
S-MS-P07-T1	5.44
S-MS-P08-T1	0.13
S-MS-P09-T1	*20.6
S-MS-P10-T1	2.58
S-MS-P11-T1	—
S-MS-P12-T1	*17.1
S-MS-P13-T1	4.34
S-MS-P14-T1	*11.2
S-MS-P15-T1	7.03
Salinas Valley study area shallow-well tap-site samples (40 wells sampled)	
S-MS-SV01-T1	0.97
S-MS-SV01-T2	7.01
S-MS-SV02-T1	1.03
S-MS-SV02-T2	8.12
S-MS-SV03-T1	3.90
S-MS-SV03-T2	—
S-MS-SV04-T1	2.06
S-MS-SV04-T2	0.23
S-MS-SV05-T1	8.54
S-MS-SV05-T2	0.51
S-MS-SV06-T1	2.30
S-MS-SV06-T2	5.93
S-MS-SV08-T1	—
S-MS-SV08-T2	3.85
S-MS-SV09-T1	2.38
S-MS-SV09-T2	1.80
S-MS-SV11-T1	0.18
S-MS-SV11-T2	*51.5
S-MS-SV13-T1	—
S-MS-SV13-T2	2.90
S-MS-SV16-T1	*21.8
S-MS-SV16-T2	*31.4
S-MS-SV17-T1	*54.6
S-MS-SV17-T2	*17.5
S-MS-SV18-T1	*17.7
S-MS-SV19-T1	6.85
S-MS-SV19-T2	2.24
S-MS-SV20-T1	1.68
S-MS-SV20-T2	0.44
S-MS-SV21-T1	0.67
S-MS-SV21-T2	*27.0
S-MS-SV22-T1	*65.6
S-MS-SV22-T2	7.42
S-MS-SV23-T1	*56.4
S-MS-SV24-T1	5.33

MS-SA shallow-well tap-site samples (70 taps sampled)—Continued
Salinas Valley study area shallow-well tap-site samples (40 wells sampled)—Continued

Table 9*B*. Nutrients detected in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in tables 3*E–F*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area shallow-well tap-site sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area shallow-well tap sample. Benchmark type, benchmark level, and LT-MDL as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level. Maximum contaminant level benchmarks are listed as MCL-US when the MCL-US and MCL-CA are identical. **Abbreviations**: LT-MDL, long-term method detection limit; mg/L, milligrams per liter; USGS, U.S. Geological Survey; *, concentration greater than the recommended benchmark level; —, not detected

GAMA tap identification number	Nitrite plus nitrate (as nitrogen)[1] (mg/L) (00631)
MS-SA shallow-well tap-site samples (70 taps sampled)—Continued	
Salinas Valley study area shallow-well tap-site samples (40 wells sampled)—Continued	
S-MS-SV24-T2	1.91
S-MS-SV25-T1	*45.1
S-MS-SV25-T2	*38.2
S-MS-SV26-T1	0.44
S-MS-SV26-T2	*23.5
S-MS-SV27-T1	—
S-MS-SV29-T1	*40.4
S-MS-SV29-T2	1.55
S-MS-SV30-T1	*15.3
S-MS-SV32-T1	*11
S-MS-SV33-T1	1.13
S-MS-SV33-T2	*28.4
S-MS-SV34-T1	3.81
S-MS-SV34-T2	*10.9
S-MS-SV35-T1	0.08
S-MS-SV35-T2	*42.6
S-MS-SV36-T1	*21.1
S-MS-SV36-T2	5.23
S-MS-SV37-T1	5.79
S-MS-SV40-T1	9.26

[1]Nitrite plus nitrate (as nitrogen) is referred to as nitrate in the text for clarity.

[2]The HAL-US (USEPA lifetime health advisory level) is 30 mg/L "as ammonia." To facilitate comparison to the analytical results, we have converted and reported this HAL-US as 24.7 mg/L "as nitrogen."

Table 10*A*. Major and minor ions, silica, and total dissolved solids (TDS) detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*F*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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. The SMCL-CA benchmarks for chloride, sulfate, and TDS have recommended and upper benchmark levels. The upper benchmark levels are shown in parentheses. **Abbreviations**: E, estimated or having a higher degree of uncertainty; LT-MDL, long-term method detection level; MDL, method detection limit; mg/L, milligrams per liter; na, not available; nc, not collected; SiO_2, silicon dioxide; USGS, U.S. Geological Survey; **, concentration greater than upper benchmark level; —, not detected]

GAMA well identification number	Bromide (mg/L) (71870)	Calcium (mg/L) (00915)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Sulfate (mg/L) (00945)	Silica (as SiO_2) (mg/L) (00955)	TDS (mg/L) (70300)
Benchmark type	na	na	SMCL-CA	MCL-CA	na	na	na	SMCL-CA	na	SMCL-CA
Benchmark level	na	na	250 (500)	2	na	na	na	250 (500)	na	500 (1,000)
LT-MDL or MDL	0.010	0.022	0.06	0.04	0.011	0.03	0.06	0.09	0.018	10
MS-SA study unit grid wells (100 wells sampled)										
Santa Cruz study area wells (15 wells sampled)										
S-MS-SC01	0.72	86.6	218	0.92	12.9	6.46	149	113	38.1	770
S-MS-SC02	0.10	34.1	35.0	0.9	15.8	5.78	61.9	77.7	43.8	385
S-MS-SC03	0.18	137	54.2	0.55	42.4	5.13	50.4	368	51.7	825
S-MS-SC04	—	81.2	53.9	0.24	57.2	13.1	48.8	248	65.0	716
S-MS-SC05	—	58.4	68.1	0.76	24.8	4.39	157	138	26.4	695
S-MS-SC06	0.03	40.6	9.01	0.14	16.4	7.47	11.3	37.2	67.4	252
S-MS-SC07	0.08	39.2	11.1	0.22	15.4	4.89	15.4	32.0	73.1	293
S-MS-SC08	0.54	176	203	0.16	100	7.08	63.8	399	50.0	**1,210
S-MS-SC09	0.10	84.7	31.6	0.1	18.4	5.08	81.1	107	38.7	570
S-MS-SC10	0.10	94.5	30.8	0.09	13.4	1.73	16.5	23.8	59.4	404
S-MS-SC11	E0.034	17.4	11.9	0.18	17.0	2.84	9.27	16.1	33.5	213
S-MS-SC12	0.10	52.4	16.3	0.16	20.5	12.5	23.2	32.0	74.1	363
S-MS-SC13	0.08	42.7	12.2	0.16	18.0	11.4	41.9	46.4	62.2	379
S-MS-SC14	0.07	49.1	8.38	0.15	19.8	2.33	11.0	12.8	33.8	232
S-MS-SC15	0.14	34	41.6	0.09	27.1	2.01	77.7	31.5	45.0	408

Table 10*A*. Major and minor ions, silica, and total dissolved solids (TDS) detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*F*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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. The SMCL-CA benchmarks for chloride, sulfate, and TDS have recommended and upper benchmark levels. The upper benchmark levels are shown in parentheses. **Abbreviations**: E, estimated or having a higher degree of uncertainty; LT-MDL, long-term method detection level; MDL, method detection limit; mg/L, milligrams per liter; na, not available; nc, not collected; SiO_2, silicon dioxide; USGS, U.S. Geological Survey; **, concentration greater than upper benchmark level; —, not detected]

GAMA well identification number	Bromide (mg/L) (71870)	Calcium (mg/L) (00915)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Sulfate (mg/L) (00945)	Silica (as SiO_2) (mg/L) (00955)	TDS (mg/L) (70300)
MS-SA study unit grid wells (100 wells sampled)—Continued										
Pajaro Valley study area wells (15 wells sampled)										
S-MS-P01	0.07	31.6	19.7	0.21	25.9	2.22	19.2	33.7	47.2	254
S-MS-P02	0.04	10.2	10.7	0.14	12.4	1.0	15.2	7.78	52.3	147
S-MS-P03	0.11	41.6	37.8	0.14	38.4	4.66	28.7	30.1	20.7	334
S-MS-P04	0.06	28.5	29.0	0.05	22.3	1.07	13.0	23.2	45.8	242
S-MS-P05	0.10	15.8	27.1	—	11.2	0.34	20.8	22.6	28.8	165
S-MS-P06	0.15	75.9	44.1	0.16	34.5	2.83	25.0	111	35.9	493
S-MS-P07	—	127	251	0.07	95.4	5.57	84.8	209	34.6	**1,100
S-MS-P08	0.13	12.2	41.9	0.18	11.4	1.17	27.8	6.02	50.3	202
S-MS-P09	4.96	500	**1,650	0.11	323	5.6	105	234	30.8	**3,280
S-MS-P10	0.18	24.9	36.2	0.16	14.9	1.21	30.0	16.4	47.0	253
S-MS-P11	0.08	49.1	28.1	0.22	23.8	2.21	33.0	36.2	35.0	313
S-MS-P12	0.11	62.8	37.7	0.21	32.6	2.98	39.7	92.2	29.8	430
S-MS-P13	0.39	103	119	0.2	64.8	2.11	61.6	197	26.5	765
S-MS-P14	0.14	49.3	45.3	0.12	37.9	2.33	55.6	51.9	31.7	442
S-MS-P15	0.17	32.3	58.1	0.18	7.13	1.25	41.2	7.95	57.9	269
Salinas Valley study area wells (40 wells sampled)										
S-MS-SV01	0.23	95.6	78.1	0.22	32.2	1.15	22.2	32.0	44.7	468
S-MS-SV02	0.36	94.1	160	[1]0.23	49.1	2.7	88.3	131	36.4	762
S-MS-SV03	0.51	70.3	206	0.12	23.1	2.64	126	21.5	42.7	653
S-MS-SV04	0.39	29.9	147	0.33	16.4	2.63	92.4	21.9	57.3	453
S-MS-SV05	1.07	36	408	0.19	34.8	4.67	195	31.0	51.2	832

Table 10*A*. Major and minor ions, silica, and total dissolved solids (TDS) detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*F*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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. The SMCL-CA benchmarks for chloride, sulfate, and TDS have recommended and upper benchmark levels. The upper benchmark levels are shown in parentheses. **Abbreviations**: E, estimated or having a higher degree of uncertainty; LT-MDL, long-term method detection level; MDL, method detection limit; mg/L, milligrams per liter; na, not available; nc, not collected; SiO_2, silicon dioxide; USGS, U.S. Geological Survey; **, concentration greater than upper benchmark level; —, not detected]

GAMA well identification number	Bromide (mg/L) (71870)	Calcium (mg/L) (00915)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Sulfate (mg/L) (00945)	Silica (as SiO_2) (mg/L) (00955)	TDS (mg/L) (70300)
MS-SA study unit grid wells (100 wells sampled)—Continued										
Salinas Valley study area wells (40 wells sampled)—Continued										
S-MS-SV06	0.40	57.7	122	0.12	17.9	4.05	93.3	61.5	37.5	480
S-MS-SV07	E1.63	133	**524	0.28	53.1	3.5	198	88.9	37.7	**1,210
S-MS-SV08	0.21	101	47.3	0.15	24.7	3.88	48.9	175	39.9	565
S-MS-SV09	0.64	75.1	254	0.19	23.7	1.74	131	51.0	42.3	731
S-MS-SV10	0.50	114	139	0.35	46.1	2.36	81.4	132	32.7	827
S-MS-SV11	0.03	56.0	8.49	0.21	13.0	2.56	18.6	74.3	24.4	292
S-MS-SV12	E0.195	64.6	68.7	0.13	15.4	2.37	62.0	83.0	43.7	460
S-MS-SV13	1.09	19.2	289	0.32	11.2	2.65	360	118	34.1	**1,140
S-MS-SV14	0.26	150	39.7	0.29	68.4	4.63	101	**574	40.6	**1,190
S-MS-SV15	E0.233	72.1	53.0	0.24	27.6	1.51	32.0	76.9	33.4	434
S-MS-SV16	0.11	51.5	31.6	0.25	25.8	1.6	47.6	116	35.4	423
S-MS-SV17	0.10	56.3	33.1	0.24	13.8	3.19	32.1	69.8	32.6	368
S-MS-SV18	0.21	114	47.4	0.27	34.3	3.99	57.2	179	33.2	689
S-MS-SV19	NC	94.2	34.4	0.16	24.5	3.91	40.2	149	38.1	529
S-MS-SV20	E0.582	160	215	0.17	53.2	5.37	110	114	40.7	975
S-MS-SV21	[2]2.00	203	**922	0.05	140	4.69	151	28.1	51.8	**1,950
S-MS-SV22	0.23	126	64.1	0.15	47.1	3.54	60.4	239	33.5	802
S-MS-SV23	0.23	126	50.9	0.15	29.3	3.64	31.1	185	33.1	601
S-MS-SV24	0.12	53.9	36.2	0.26	29.2	2.55	55.6	126	42.4	445
S-MS-SV25	0.13	71.5	31.3	[1]0.22	29.7	1.84	41.4	126	35.2	498

Table 10*A*. Major and minor ions, silica, and total dissolved solids (TDS) detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*F*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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. The SMCL-CA benchmarks for chloride, sulfate, and TDS have recommended and upper benchmark levels. The upper benchmark levels are shown in parentheses. **Abbreviations**: E, estimated or having a higher degree of uncertainty; LT-MDL, long-term method detection level; MDL, method detection limit; mg/L, milligrams per liter; na, not available; nc, not collected; SiO_2, silicon dioxide; USGS, U.S. Geological Survey; **, concentration greater than upper benchmark level; —, not detected]

GAMA well identification number	Bromide (mg/L) (71870)	Calcium (mg/L) (00915)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Sulfate (mg/L) (00945)	Silica (as SiO_2) (mg/L) (00955)	TDS (mg/L) (70300)
MS-SA study unit grid wells (100 wells sampled)—Continued										
Salinas Valley study area wells (40 wells sampled)—Continued										
S-MS-SV26	1.50	211	458	0.27	86.9	6.97	307	**932	37.0	**2,100
S-MS-SV27	0.06	42.1	14.2	0.22	18.1	1.28	23.6	61.1	31.2	285
S-MS-SV28	0.18	38.2	40.5	[1]0.17	20.4	2.43	73.4	67.6	35.8	436
S-MS-SV29	2.65	308	**972	0.08	123	10.0	335	350	37.4	**2,500
S-MS-SV30	1.62	376	315	E0.08	175	6.78	347	**1,430	32.9	**3,340
S-MS-SV31	0.31	48.6	59.7	0.29	35.5	2.18	85.3	176	33.3	573
S-MS-SV32	0.67	127	155	0.41	54.8	4.36	130	301	31.9	**1,020
S-MS-SV33	[2]2.89	15.8	95.5	0.18	12.5	1.58	58.0	7.11	58.2	301
S-MS-SV34	0.22	18.4	66.3	0.22	10.4	2.34	53.1	7.31	48.1	273
S-MS-SV35	0.46	40.6	154	0.36	14.3	2.3	107	8.92	26.8	485
S-MS-SV36	1.30	97.1	159	0.49	42.9	2.56	90.8	70.6	37.7	727
S-MS-SV37	0.24	64.1	63.7	0.85	23.1	3.17	51.6	26.7	30.5	408
S-MS-SV38	1.22	154	**506	0.52	64.1	6.49	201	112	22.9	**1,310
S-MS-SV39	1.15	137	331	0.21	33.3	7.0	329	**528	38.3	**1,500
S-MS-SV40	0.59	221	200	[1]0.08	25.1	3.41	57.1	256	38.6	**1,020
Highlands study area wells (30 wells sampled)										
S-MS-H01	0.09	23.9	16.5	0.19	14.9	3.97	135	152	41.3	555
S-MS-H02	0.53	300	134	1.01	111	9.6	135	**1,110	35.2	**2,090
S-MS-H03	0.17	149	47.2	0.3	36.1	0.61	39.3	185	28.2	728
S-MS-H04	0.12	126	33.3	0.26	64.1	1.6	21.6	122	39.8	632
S-MS-H05	0.26	43.8	71.3	0.83	58.2	5.47	199	**658	22.5	**1,480

Table 10*A*. Major and minor ions, silica, and total dissolved solids (TDS) detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*F*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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. The SMCL-CA benchmarks for chloride, sulfate, and TDS have recommended and upper benchmark levels. The upper benchmark levels are shown in parentheses. **Abbreviations**: E, estimated or having a higher degree of uncertainty; LT-MDL, long-term method detection level; MDL, method detection limit; mg/L, milligrams per liter; na, not available; nc, not collected; SiO_2, silicon dioxide; USGS, U.S. Geological Survey; **, concentration greater than upper benchmark level; —, not detected]

GAMA well identification number	Bromide (mg/L) (71870)	Calcium (mg/L) (00915)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Sulfate (mg/L) (00945)	Silica (as SiO_2) (mg/L) (00955)	TDS (mg/L) (70300)
MS-SA study unit grid wells (100 wells sampled)—Continued										
Highlands study area wells (30 wells sampled)—Continued										
S-MS-H06	0.22	62.9	60.9	0.35	16.7	2.28	46.8	23.8	32.8	395
S-MS-H07	0.34	122	91.0	0.30	30.4	5.74	57.6	156	21.5	655
S-MS-H08	0.82	299	93.4	1.2	157	9.03	219	**1,210	40.3	**2,440
S-MS-H09	0.83	617	299	0.24	241	17.3	98.9	**1,750	12.6	**3,420
S-MS-H10	E0.924	343	240	0.77	138	3.84	114	**1,040	36.3	**2,100
S-MS-H11	0.19	18.2	40.0	0.38	10.8	2.19	207	165	44.1	658
S-MS-H12	0.26	96.2	86.6	0.23	28.4	3.7	70.9	122	42.8	600
S-MS-H13	0.39	220	99.1	0.44	184	8.44	108	**1,080	59.9	**2,000
S-MS-H14	14.80	52.7	**2,520	0.29	17.6	34.3	2,160	1.0	42.4	**5,970
S-MS-H15	NC	15.2	29.8	0.46	7.7	1.3	101	40.2	18.2	369
S-MS-H16	0.21	35.8	55.4	0.41	27.1	2.04	36.7	18.8	38.2	344
S-MS-H17	0.17	49.6	48.7	0.40	22.2	2.52	38.2	14.0	44.6	377
S-MS-H18	1.53	116	381	0.5	43.6	9.68	262	323	32.7	**1,340
S-MS-H19	0.23	58.4	61.7	[1]0.77	21.4	3.37	46.6	26.6	28.2	421
S-MS-H20	1.46	232	**525	0.54	53.3	3.92	122	85.3	40.3	**1,330
S-MS-H21	0.86	150	183	0.38	36.6	8.87	200	**541	26.4	**1,270
S-MS-H22	0.38	118	35.8	0.25	42.1	[3]5.12	[3]58.1	179	49.6	672
S-MS-H23	—	52.3	32.3	0.53	31.2	1.91	28.4	33.7	43.0	382
S-MS-H24	1.17	361	496	0.05	63.5	13.1	394	**737	78.2	**1,960
S-MS-H25	0.37	50.6	107	1.26	31.3	1.12	110	17.8	34.8	572

Table 10*A*. Major and minor ions, silica, and total dissolved solids (TDS) detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 wells were analyzed. Information about the constituents is given in table 3*F*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types, benchmark levels, and reporting levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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. The SMCL-CA benchmarks for chloride, sulfate, and TDS have recommended and upper benchmark levels. The upper benchmark levels are shown in parentheses. **Abbreviations**: E, estimated or having a higher degree of uncertainty; LT-MDL, long-term method detection level; MDL, method detection limit; mg/L, milligrams per liter; na, not available; nc, not collected; SiO_2, silicon dioxide; USGS, U.S. Geological Survey; **, concentration greater than upper benchmark level; —, not detected]

GAMA well identification number	Bromide (mg/L) (71870)	Calcium (mg/L) (00915)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Sulfate (mg/L) (00945)	Silica (as SiO_2) (mg/L) (00955)	TDS (mg/L) (70300)
MS-SA study unit grid wells (100 wells sampled)—Continued										
Highlands study area wells (30 wells sampled)—Continued										
S-MS-H26	0.44	63	125	0.55	9.22	2.58	122	120	28.4	628
S-MS-H27	0.09	76.5	23.1	0.49	46.8	3.11	39.4	131	33.9	591
S-MS-H28	0.34	258	33.4	0.34	100	6.14	159	**868	35.7	**1,830
S-MS-H29	1.78	241	351	—	101	24.6	478	**1,320	58.4	**2,860
S-MS-H30	0.45	106	149	0.57	34.0	3.77	53.0	103	25.5	612

[1]Fluoride results were not reported by the USGS National Water Quality Laboratory (NWQL) for five MS-SA groundwater samples: S-MS-SV02, S-MS-SV25, S-MS-28, S-MS-SV40, and S-MS-H19.

[2]Results for the environmental and replicate samples collected at S-MS-SV21 and S-MS-SV33 were outside the limits of acceptable precision for bromide; possible dilution error. See appendix table A-3*B* for more information.

[3]Results for the environmental and replicate samples collected at S-MS-H22 were outside the limits of acceptible precision for 13 inorganic constituents, including the major and minor ions potassium and sodium. See appendix table A-3*B* for more information.

Table 10*B*. Major and minor ions, silica, and total dissolved solids (TDS) detected in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in tables 3*E–F*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area tap sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area tap sample. Benchmark type, benchmark level, and LT-MDL as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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. The SMCL-CA benchmark for chloride, sulfate, and TDS have recommended and upper benchmark levels. The upper benchmark level is shown in parentheses. **Abbreviations**: E, estimated or having a higher degree of uncertainty; LT-MDL, long-term method detection limit; MDL, method detection limit; mg/L, milligrams per liter; na, not available; nc, not collected; SiO_2, silicon dioxide; USGS, U.S. Geological Survey; **, concentration greater than upper benchmark level; —, not detected]

GAMA tap identification number	Bromide (mg/L) (71870)	Calcium (mg/L) (00915)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Sulfate (mg/L) (00945)	Silica (as SiO_2) (mg/L) (00955)	TDS (mg/L) (70300)
Benchmark type	na	na	SMCL-CA	MCL-CA	na	na	na	SMCL-CA	na	SMCL-CA
Benchmark level	na	na	250 (500)	2	na	na	na	250 (500)	na	500 (1,000)
LT-MDL or MDL	0.010	0.022	0.06	0.04	0.011	0.03	0.06	0.09	0.018	10
MS-SA study unit wells shallow-well tap-site samples (70 taps sampled)										
Pajaro Valley study area shallow-well tap-site samples (15 taps sampled)										
S-MS-P01-T1	0.19	25.0	34.3	0.08	24.2	1.37	32.7	30.2	43.2	306
S-MS-P02-T1	0.08	27.0	20.8	0.09	17.6	1.66	13.7	3.85	56.4	216
S-MS-P03-T1	E0.032	10.2	7.2	0.12	11.0	0.87	8.68	1.14	54.5	129
S-MS-P04-T1	0.04	34.8	11.1	0.14	27.4	2.43	13.7	13.8	25.2	235
S-MS-P05-T1	0.48	37.7	42.5	0.06	16.2	2.31	40.8	47.7	38.7	359
S-MS-P06-T1	1.58	63.5	26.8	0.21	29.9	1.33	28.7	97.3	28.3	420
S-MS-P07-T1	0.06	57.9	19.5	0.2	29.0	2.47	28.1	258	39.1	477
S-MS-P08-T1	0.59	53.7	177	0.1	17.0	3.25	79.9	26.9	27.8	503
S-MS-P09-T1	1.72	36.4	113	0.15	29.5	1.88	60.9	41.3	52.2	473
S-MS-P10-T1	0.17	80.4	34.6	0.15	35.1	2.6	42.6	60.2	35.7	477
S-MS-P11-T1	0.35	113	173	0.27	66.5	2.68	57.9	42.9	36.7	735
S-MS-P12-T1	2.25	186	59.1	0.31	41.3	1.91	47	191	27.0	877
S-MS-P13-T1	0.26	15.7	45.2	0.2	12.8	0.94	37.4	12.4	52.4	232
S-MS-P14-T1	0.52	52.2	117	0.15	22.4	1.75	62.5	33.8	38.8	444
S-MS-P15-T1	0.80	30.7	71.6	0.14	20.6	1.33	49.3	34.3	51.7	356

Table 10*B*. Major and minor ions, silica, and total dissolved solids (TDS) detected in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in tables 3*E–F*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area tap sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area tap sample. Benchmark type, benchmark level, and LT-MDL as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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. The SMCL-CA benchmark for chloride, sulfate, and TDS have recommended and upper benchmark levels. The upper benchmark level is shown in parentheses. **Abbreviations**: E, estimated or having a higher degree of uncertainty; LT-MDL, long-term method detection limit; MDL, method detection limit; mg/L, milligrams per liter; na, not available; nc, not collected; SiO_2, silicon dioxide; USGS, U.S. Geological Survey; **, concentration greater than upper benchmark level; —, not detected]

GAMA tap identification number	Bromide (mg/L) (71870)	Calcium (mg/L) (00915)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Sulfate (mg/L) (00945)	Silica (as SiO_2) (mg/L) (00955)	TDS (mg/L) (70300)
MS-SA study unit wells shallow-well tap-site samples (70 taps sampled)—Continued										
Salinas Valley study area shallow-well tap-site samples (40 taps sampled)										
S-MS-SV01-T1	0.10	29.6	30.1	0.27	7.07	1.03	26.2	11.3	28.9	197
S-MS-SV01-T2	0.72	258	200	0.15	67.6	1.57	94.4	**541	36.5	**1,430
S-MS-SV02-T1	0.10	79.8	42.1	0.28	29.7	0.96	34.6	141	31.4	498
S-MS-SV02-T2	0.43	100	142	0.22	36.0	1.84	49.4	37.2	40.1	569
S-MS-SV03-T1	0.07	34.1	15.3	0.12	16.0	1.28	16.7	14.4	43.0	238
S-MS-SV03-T2	0.61	296	166	E0.09	105	4.94	41.5	**790	36.2	**1,630
S-MS-SV04-T1	0.21	100	69.9	NC	23.9	3.14	49.3	107	38.1	566
S-MS-SV04-T2	0.77	144	250	NC	34.5	5.46	137	202	47.8	986
S-MS-SV05-T1	0.40	155	108	0.21	51.1	4.38	79.7	249	37.3	917
S-MS-SV05-T2	0.55	74.5	182	0.23	25.9	4.02	106	36.9	38.5	615
S-MS-SV06-T1	0.31	55.2	90.7	0.27	19.6	2.98	43.4	61.2	40.1	405
S-MS-SV06-T2	0.51	54.6	137	0.14	17.4	4.11	88	69.6	43.6	527
S-MS-SV08-T1	4.75	464	**1,460	0.06	135	11.1	333	204	36.4	**2,900
S-MS-SV08-T2	0.28	98.1	60.2	0.22	34.2	4.32	77.8	162	34.5	662
S-MS-SV09-T1	0.26	118	64.5	0.34	27.2	4.09	49.3	165	38.1	613
S-MS-SV09-T2	0.18	97.1	37.4	NC	24.8	4.21	45	163	32.3	567
S-MS-SV11-T1	0.28	166	49.3	0.66	71.3	2.95	119	**532	32.8	**1,260
S-MS-SV11-T2	0.70	204	273	0.17	55.2	5.74	96.9	165	27.2	**1,200
S-MS-SV13-T1	0.90	46.9	242	0.29	22.8	2.79	301	304	22.1	**1,110
S-MS-SV13-T2	0.23	46.1	87.2	0.4	47.1	2.63	85.4	135	49.5	612

Table 10*B*. Major and minor ions, silica, and total dissolved solids (TDS) detected in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in tables 3*E–F*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area tap sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area tap sample. Benchmark type, benchmark level, and LT-MDL as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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. The SMCL-CA benchmark for chloride, sulfate, and TDS have recommended and upper benchmark levels. The upper benchmark level is shown in parentheses. **Abbreviations**: E, estimated or having a higher degree of uncertainty; LT-MDL, long-term method detection limit; MDL, method detection limit; mg/L, milligrams per liter; na, not available; nc, not collected; SiO_2, silicon dioxide; USGS, U.S. Geological Survey; **, concentration greater than upper benchmark level; —, not detected]

GAMA tap identification number	Bromide (mg/L) (71870)	Calcium (mg/L) (00915)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Sulfate (mg/L) (00945)	Silica (as SiO_2) (mg/L) (00955)	TDS (mg/L) (70300)
MS-SA study unit wells shallow-well tap-site samples (70 taps sampled)—Continued										
Salinas Valley study area shallow-well tap-site samples (40 taps sampled)—Continued										
S-MS-SV16-T1	2.94	131	85.1	0.25	53.5	2.8	88.3	328	34.7	960
S-MS-SV16-T2	0.60	163	199	0.51	36.2	3.87	86.4	107	42.4	921
S-MS-SV17-T1	0.66	242	238	0.11	68.3	5.81	86.6	358	31.5	**1,350
S-MS-SV17-T2	0.70	152	243	0.14	58.6	3.36	79.2	228	37.1	975
S-MS-SV18-T1	0.45	155	75.1	NC	86.7	3.93	141	**517	30.1	**1,330
S-MS-SV19-T1	0.26	96.8	35.2	0.49	39.6	2.52	47	130	30.8	601
S-MS-SV19-T2	0.21	74.0	48.5	0.37	32.4	3.21	74.7	180	35.2	592
S-MS-SV20-T1	1.10	161	338	0.12	42.9	3.71	61.1	37.1	41.1	821
S-MS-SV20-T2	0.33	48.7	96.5	NC	15.5	2.37	57.1	12.0	41.6	376
S-MS-SV21-T1	E0.112	35.4	63.3	0.29	10.8	2.11	68.3	19.1	44.0	364
S-MS-SV21-T2	0.94	155	265	0.23	36.8	2.59	60.3	38.3	28.2	869
S-MS-SV22-T1	0.94	215	194	0.18	98.5	4.74	204	491	33.6	**1,760
S-MS-SV22-T2	0.44	71.9	125	0.46	30.6	3.07	60.2	132	38.0	645
S-MS-SV23-T1	0.80	209	192	0.13	105	4.87	162	**592	34.2	**1,720
S-MS-SV24-T1	0.09	54.2	25.2	0.29	23.6	1.49	30.8	89.7	33.9	386
S-MS-SV24-T2	0.03	49.8	7.75	0.21	12.7	2.25	15.1	63.9	28.9	286
S-MS-SV25-T1	0.78	175	184	0.17	99.0	3.84	236	**662	34.8	**1,830
S-MS-SV25-T2	0.38	133	86.2	0.19	71.6	2.74	129	389	33.3	**1,220
S-MS-SV26-T1	0.08	42.8	21.9	NC	17.1	1.52	23.4	51.3	28.9	274
S-MS-SV26-T2	0.84	345	226	0.2	130	4.54	206	**1,160	25.8	**2,430

Table 10*B*. Major and minor ions, silica, and total dissolved solids (TDS) detected in shallow-well tap-site samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 70 taps were analyzed. Information about the constituents is given in tables 3*E–F*. **GAMA well identification numbers**: S-MS-P01-T1, Monterey–Salinas Shallow Aquifer Pajaro Valley study area tap sample; S-MS-SV01-T1, Monterey–Salinas Shallow Aquifer Valley and Plains study area tap sample. Benchmark type, benchmark level, and LT-MDL as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency (USEPA) maximum contaminant level; SMCL-CA, California secondary maximum contaminant level. Maximum contaminant level benchmarks 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. The SMCL-CA benchmark for chloride, sulfate, and TDS have recommended and upper benchmark levels. The upper benchmark level is shown in parentheses. **Abbreviations**: E, estimated or having a higher degree of uncertainty; LT-MDL, long-term method detection limit; MDL, method detection limit; mg/L, milligrams per liter; na, not available; nc, not collected; SiO_2, silicon dioxide; USGS, U.S. Geological Survey; **, concentration greater than upper benchmark level; —, not detected]

GAMA tap identification number	Bromide (mg/L) (71870)	Calcium (mg/L) (00915)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Sulfate (mg/L) (00945)	Silica (as SiO_2) (mg/L) (00955)	TDS (mg/L) (70300)
MS-SA study unit wells shallow-well tap-site samples (70 taps sampled)—Continued										
Salinas Valley study area shallow-well tap-site samples (40 taps sampled)—Continued										
S-MS-SV27-T1	0.69	234	137	—	122	21.6	163	**986	40.8	**1,980
S-MS-SV29-T1	1.03	264	306	0.18	113	7.46	211	**892	38.5	**2,120
S-MS-SV29-T2	0.15	51.0	46.1	0.29	21.4	1.65	45.2	87.2	30.6	390
S-MS-SV30-T1	0.25	95.6	60.1	0.24	45.7	2.17	68.6	224	32.0	733
S-MS-SV32-T1	0.67	95.3	208	0.42	39.3	4.68	86.5	19.2	24.8	660
S-MS-SV33-T1	E0.133	30.6	64.1	0.82	14.0	2.47	73.7	19.1	38.2	341
S-MS-SV33-T2	1.71	113	100	NC	23.4	1.39	68.7	81.2	27.6	649
S-MS-SV34-T1	0.13	11.7	44.2	0.13	8.52	1.44	30.3	3.68	50.8	187
S-MS-SV34-T2	0.14	18.1	44.1	0.14	11.4	1.2	36.4	13.7	16.5	254
S-MS-SV35-T1	3.12	131	68.8	NC	24.7	1.43	41.4	165	18.7	635
S-MS-SV35-T2	1.98	109	69.3	NC	22.6	1.87	48.6	70.3	26.0	634
S-MS-SV36-T1	0.53	72.2	190	1.55	36.4	2.07	99.2	22.1	44.3	629
S-MS-SV36-T2	0.94	109	390	0.28	44.1	1.84	112	6.9	52.1	857
S-MS-SV37-T1	0.31	38.8	85.1	0.83	22.7	2.76	77.2	12.8	30.7	409
S-MS-SV40-T1	0.08	75.9	18.1	NC	13.5	2.21	27.7	37.7	36.7	353

[1]Nitrite plus nitrate (as nitrogen) is referred to as nitrate in the text for clarity.

Table 11. Radioactive constituents detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed. Information about the constituents is given in table 3*G*. Measured values less than the sample-specific critical level (ssL_C) are reported as non-detections (—). **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types and benchmark levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. Maximum contaminant level benchmarks 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**: CSU, 1-sigma combined standard uncertainty; nc, not collected; pCi/L, picocuries per liter; RL, reporting level; USGS, U.S. Geological Survey; *, concentration greater than the recommended benchmark level; —, not detected; ±, plus or minus]

GAMA well identification number	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)	
Benchmark type	Proposed MCL-US		MCL-US[1]		MCL-US[1]		MCL-CA		MCL-CA	
Benchmark	4,000		15		15		50		50	
RL	Result ± CSU	ssL_C	Result ± CSU	ssL_C	Result ± CSU	ssL_C	Result ± CSU	ssL_C	Result ± CSU	ssL_C
MS-SA grid wells (100 wells sampled)										
Santa Cruz study area wells (15 wells sampled)										
S-MS-SC01	600 ± 36	11.876	10.3 ± 2.1	1.2	3.1 ± 1.3	1.6	7.56 ± 0.61	0.53	6.93 ± 0.61	0.62
S-MS-SC02	1,646 ± 91	11.944	6.0 ± 1.1	0.6	—	1.1	7.57 ± 0.65	0.63	5.78 ± 0.77	0.97
S-MS-SC03	1,920 ± 110	14.128	*42.2 ± 5.2	1.4	13 ± 2	0.8	18.1 ± 1.2	0.57	13.4 ± 0.89	0.54
S-MS-SC04	226 ± 17	11.799	—	0.8	—	1	[2]11± 1	0.96	11 ± 1	0.9
S-MS-SC05	413 ± 27	13.474	1.9 ± 1.2	1.6	—	1.6	4.82 ± 0.66	0.82	4.63 ± 0.65	0.84
S-MS-SC06	214 ± 17	12.269	—	0.58	—	0.95	6.9 ± 0.6	0.61	5.88 ± 0.73	0.84
S-MS-SC07	253 ± 19	13.063	1.19 ± 0.48	0.45	—	0.61	4.0 ± 0.5	0.64	3.75 ± 0.48	0.61
S-MS-SC08	368 ± 24	11.698	—	2.3	—	2.1	8.34 ± 0.88	0.98	8.4 ± 0.97	1.2
S-MS-SC09	350 ± 24	12.751	9.8 ± 1.8	1.1	5.0 ± 1.4	1.5	3.82 ± 0.68	0.92	8.07 ± 0.87	0.91
S-MS-SC10	295 ± 21	13.413	0.92 ± 0.66	0.74	0.87 ± 0.66	0.76	1.4 ± 0.6	0.94	1.0 ± 0.6	0.92
S-MS-SC11	308 ± 22	13.972	—	0.67	—	0.62	2.65 ± 0.57	0.79	2.11 ± 0.56	0.79
S-MS-SC12	524 ± 33	13.737	0.41 ± 0.38	0.37	—	1	11.6 ± 0.91	0.81	11.6 ± 0.95	0.83
S-MS-SC13	304 ± 21	13.210	2.51 ± 0.75	0.61	—	0.78	11.5 ± 0.91	0.78	10.1 ± 0.82	0.76
S-MS-SC14	274 ± 19	11.711	1 ± 0.47	0.53	—	0.7	1.86 ± 0.36	0.5	2.42 ± 0.57	0.83
S-MS-SC15	nc[3]	nc	—	1.2	—	1.1	2.33 ± 0.66	1	1.84 ± 0.66	1.1

Table 11. Radioactive constituents detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed. Information about the constituents is given in table 3*G*. Measured values less than the sample-specific critical level (ssL_C) are reported as non-detections (—). **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types and benchmark levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. Maximum contaminant level benchmarks 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**: CSU, 1-sigma combined standard uncertainty; nc, not collected; pCi/L, picocuries per liter; RL, reporting level; USGS, U.S. Geological Survey; *, concentration greater than the recommended benchmark level; —, not detected; ±, plus or minus]

GAMA well identification number	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)	
MS-SA grid wells (100 wells sampled)—Continued										
Pajaro Valley study area wells (15 wells sampled)										
S-MS-P01	211 ± 17	13.690	1.1 ± 0.51	0.55	—	0.91	2.35 ± 0.36	0.5	1.8 ± 0.56	0.82
S-MS-P02	178 ± 14	11.558	0.46 ± 0.26	0.34	—	0.57	0.94 ± 0.27	0.41	0.78 ± 0.41	0.65
S-MS-P03	352 ± 23	11.804	—	0.7	—	0.64	4.13 ± 0.55	0.74	3.86 ± 0.54	0.75
S-MS-P04	285 ± 20	11.527	—	0.47	—	0.72	0.93 ± 0.38	0.58	—	0.85
S-MS-P05	1,567 ± 88	13.826	1.00 ± 0.39	0.45	—	0.91	0.80 ± 0.32	0.48	1.31 ± 0.46	0.68
S-MS-P06	265 ± 21	17.214	nc[4]	nc	nc[4]	nc	nc[4]	nc	nc[4]	nc
S-MS-P07	388 ± 25	11.003	5 ± 2	2.3	3.3 ± 1.8	2	6.16 ± 0.73	0.93	6.18 ± 0.73	0.9
S-MS-P08	272 ± 19	11.118	1.02 ± 0.61	0.55	—	0.76	1.9 ± 0.56	0.82	1.11 ± 0.49	0.77
S-MS-P09	217 ± 16	10.685	—	5.3	—	6.3	2.3 ± 1.5	2.3	5.7 ± 1.4	2.2
S-MS-P10	272 ± 19	11.499	0.6 ± 0.4	0.44	—	0.7	1.1 ± 0.41	0.64	1.3 ± 0.4	0.6
S-MS-P11	309 ± 21	10.775	1.05 ± 0.61	0.67	0.77 ± 0.56	0.7	1.44 ± 0.51	0.81	1.36 ± 0.51	0.77
S-MS-P12	509 ± 32	12.463	1.27 ± 0.86	1	2.6 ± 0.8	0.65	3.1 ± 0.58	0.86	3.24 ± 0.58	0.8
S-MS-P13	346 ± 23	10.921	3.1 ± 1.1	1.2	—	1.5	2.78 ± 0.48	0.66	2.14 ± 0.43	0.62
S-MS-P14	nc[3]	nc	4.4 ± 1.1	1	4.3 ± 1.2	1.1	[2]1.82 ± 0.66	1	3.72 ± 0.68	0.99
S-MS-P15	[5]427 ± 34	27.600	2.25 ± 0.98	1	—	1.1	[2]0.71 ± 0.55	0.89	0.22 ± 0.55	0.86
S-MS-SV01	889 ± 51	11.628	4.5 ± 1.1	1.2	1.92 ± 0.92	0.95	1.18 ± 0.55	0.86	1.2 ± 0.6	0.99
S-MS-SV02	324 ± 21	10.418	10.9 ± 2.5	2.2	9.3 ± 2.4	2.2	3.18 ± 0.77	1.1	4.51 ± 0.65	0.85
S-MS-SV03	490 ± 31	12.774	6.2 ± 1.7	1.4	2.3 ± 1.2	1.6	1.6 ± 0.5	0.74	2.28 ± 0.48	0.72
S-MS-SV04	625 ± 39	14.831	[2]0.48 ± 0.65	0.8	—	0.81	[2]2.58 ± 0.46	0.64	2.4 ± 0.4	0.57
S-MS-SV05	286 ± 21	13.260	4.9 ± 1.8	2	—	1.3	[2]4.5 ± 0.6	0.76	5.61 ± 0.59	0.71

Table 11. Radioactive constituents detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed. Information about the constituents is given in table 3*G*. Measured values less than the sample-specific critical level (ssL_C) are reported as non-detections (—). **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types and benchmark levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. Maximum contaminant level benchmarks 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**: CSU, 1-sigma combined standard uncertainty; nc, not collected; pCi/L, picocuries per liter; RL, reporting level; USGS, U.S. Geological Survey; *, concentration greater than the recommended benchmark level; —, not detected; ±, plus or minus]

GAMA well identification number	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)	
MS-SA grid wells (100 wells sampled)—Continued										
Salinas Valley study area wells (40 wells sampled)										
S-MS-SV06	284 ± 20	11.788	3.6 ± 1.1	1.2	—	0.81	3.57 ± 0.63	0.89	3.83 ± 0.59	0.83
S-MS-SV07	233 ± 17	11.596	5.2 ± 2.1	2.3	—	2.5	4.11 ± 0.93	1.3	4.36 ± 0.93	1.3
S-MS-SV08	347 ± 24	13.768	10.4 ± 1.8	1.1	6.8 ± 1.6	1.2	4.34 ± 0.47	0.55	5.73 ± 0.52	0.54
S-MS-SV09	1,830 ± 100	15.068	2.7 ± 1.5	2	—	1.6	[2]2.09 ± 0.44	0.62	1.78 ± 0.39	0.56
S-MS-SV10	564 ± 34	11.349	7.6 ± 2.5	2.6	—	2.3	3.6 ± 0.68	0.96	4.8 ± 0.7	0.91
S-MS-SV11	841 ± 49	12.443	4.24 ± 0.91	0.68	2.67 ± 0.75	0.62	2.5 ± 0.49	0.7	2.69 ± 0.47	0.66
S-MS-SV12	1,011 ± 58	13.112	4.1 ± 1.1	0.91	2.8 ± 0.8	0.7	1.42 ± 0.56	0.84	3.18 ± 0.58	0.8
S-MS-SV13	3,930 ± 210	11.459	10.4 ± 3.1	3.5	11.2 ± 2.8	2.4	[2]3.7 ± 0.73	1	8.14 ± 0.87	1
S-MS-SV14	453 ± 28	11.497	13.8 ± 2.8	2.1	8.3 ± 2.1	1.9	[2]5.69 ± 0.63	0.76	8.21 ± 0.71	0.7
S-MS-SV15	631 ± 39	13.778	4.04 ± 0.99	0.76	2.09 ± 0.83	0.84	1.38 ± 0.51	0.8	2.22 ± 0.56	0.82
S-MS-SV16	687 ± 41	12.760	3 ± 1	1.1	2.4 ± 0.88	0.89	1.9 ± 0.61	0.96	2.41 ± 0.61	0.94
S-MS-SV17	665 ± 41	14.993	5 ± 1	0.77	2.41 ± 0.79	0.73	3.02 ± 0.49	0.67	4.1 ± 0.6	0.77
S-MS-SV18	774 ± 45	11.453	7.6 ± 1.6	1.3	2.81 ± 0.95	0.65	3.36 ± 0.63	0.83	5.49 ± 0.52	0.56
S-MS-SV19	nc[3]	nc	12.2 ± 1.9	0.86	9.0 ± 1.6	0.84	3.48 ± 0.73	1	3.82 ± 0.73	1
S-MS-SV20	289 ± 21	14.060	*22.4 ± 3.9	2.5	13.3 ± 2.7	1.9	6.74 ± 0.84	1.1	11.6 ± 1.1	1.2
S-MS-SV21	276 ± 20	14.145	—	4.3	—	4	4.4 ± 1.1	1.6	4.3 ± 0.93	1.3
S-MS-SV22	378 ± 24	10.601	[2]9.9 ± 2.3	2.3	8.2 ± 1.9	1.3	[2]3.12 ± 0.52	0.72	5.11 ± 0.56	0.66
S-MS-SV23	379 ± 25	13.514	9 ± 1.8	1	6.9 ± 1.5	1.3	4.01 ± 0.47	0.56	5.46 ± 0.51	0.54
S-MS-SV24	705 ± 42	13.522	8.9 ± 1.6	1.2	6.4 ± 1.3	0.81	3.09 ± 0.58	0.8	5.07 ± 0.66	0.87
S-MS-SV25	534 ± 32	10.626	3 ± 1	1	—	1.2	1.65 ± 0.38	0.54	2.2 ± 0.4	0.57

Table 11. Radioactive constituents detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed. Information about the constituents is given in table 3*G*. Measured values less than the sample-specific critical level (ssL_C) are reported as non-detections (—). **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types and benchmark levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. Maximum contaminant level benchmarks 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**: CSU, 1-sigma combined standard uncertainty; nc, not collected; pCi/L, picocuries per liter; RL, reporting level; USGS, U.S. Geological Survey; *, concentration greater than the recommended benchmark level; —, not detected; ±, plus or minus]

GAMA well identification number	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)	
MS-SA grid wells (100 wells sampled)—Continued										
Salinas Valley study area wells (40 wells sampled)—Continued										
S-MS-SV26	588 ± 35	10.795	—[2]	4.8	—	3.3	[2]8.2 ± 1.1	1.5	—	1.3
S-MS-SV27	629 ± 38	12.975	1.76 ± 0.63	0.72	1.7 ± 0.67	0.63	2.63 ± 0.52	0.76	1.11 ± 0.55	0.87
S-MS-SV28	655 ± 40	13.382	9.8 ± 1.7	0.75	9.6 ± 1.8	1.1	2.79 ± 0.67	1	3.85 ± 0.83	1.2
S-MS-SV29	467 ± 29	11.697	—	5.3	—	5.2	8.6 ± 1.4	1.9	9.0 ± 1.4	1.9
S-MS-SV30	465 ± 29	11.252	*38 ± 7.6	3.9	*31.5 ± 6.8	4.7	7.5 ± 1.5	2.3	13.4 ± 1.9	2.5
S-MS-SV31	491 ± 31	13.186	2.3 ± 1.3	1.7	—	1.4	[2]2.23 ± 0.39	0.56	2.36 ± 0.42	0.59
S-MS-SV32	700 ± 44	17.476	nc[4]	nc	nc[4]	nc	nc[4]	nc	nc[4]	nc
S-MS-SV33	489 ± 31	14.022	—	0.75	—	0.58	2.3 ± 0.5	0.71	1.56 ± 0.49	0.75
S-MS-SV34	2,300 ± 130	12.298	1.31 ± 0.52	0.53	—	0.8	2.8 ± 0.37	0.48	1.67 ± 0.56	0.8
S-MS-SV35	1,341 ± 75	11.122	8.0 ± 1.5	1.2	—	1.1	4.74 ± 0.65	0.87	1.6 ± 0.61	0.96
S-MS-SV36	nc[3]	nc	11.1 ± 2.4	2	2.8 ± 1.6	1.7	6.26 ± 0.83	0.98	5.03 ± 0.62	0.73
S-MS-SV37	1,447 ± 80	10.617	6.6 ± 1.3	0.84	4 ± 1	0.73	3.43 ± 0.58	0.8	3.83 ± 0.64	0.85
S-MS-SV38	292 ± 21	12.672	*16 ± 4	3.6	8.4 ± 2.8	2.9	7.8 ± 1.1	1.5	7.2 ± 1.1	1.5
S-MS-SV39	756 ± 44	11.885	nc[4]	nc	nc[4]	nc	nc[4]	nc	nc[4]	nc
S-MS-SV40	348 ± 23	11.237	14.8 ± 2.7	1.6	6.2 ± 1.8	1.6	[2]4.2 ± 0.6	0.8	4.49 ± 0.56	0.76
Highlands study area wells (30 wells sampled)										
S-MS-H01	324 ± 22	13.316	0.81 ± 0.85	1.1	2.61 ± 0.84	0.58	2.71 ± 0.72	1	2.82 ± 0.82	1.2
S-MS-H02	2,220 ± 120	11.281	*212 ± 24	3.9	*35.2 ± 5.7	3.3	*63.8 ± 3.9	1.4	37.3 ± 2.4	1.3
S-MS-H03	1,424 ± 79	10.484	1.96 ± 0.97	1.2	1.93 ± 0.87	0.98	1.0 ± 0.6	0.89	1.21 ± 0.55	0.89
S-MS-H04	496 ± 31	13.361	3 ± 1	1	—	1.5	1.09 ± 0.39	0.6	1.68 ± 0.42	0.62
S-MS-H05	895 ± 52	12.938	*17.9 ± 3.9	3.3	13.8 ± 3.1	2.2	14.5 ± 1.2	1	13.2 ± 1.2	1.2

Table 11. Radioactive constituents detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed. Information about the constituents is given in table 3*G*. Measured values less than the sample-specific critical level (ssL_C) are reported as non-detections (—). **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types and benchmark levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. Maximum contaminant level benchmarks 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**: CSU, 1-sigma combined standard uncertainty; nc, not collected; pCi/L, picocuries per liter; RL, reporting level; USGS, U.S. Geological Survey; *, concentration greater than the recommended benchmark level; —, not detected; ±, plus or minus]

GAMA well identification number	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)	
MS-SA grid wells (100 wells sampled)—Continued										
Highlands study area wells (30 wells sampled)—Continued										
S-MS-H06	274 ± 20	14.025	2.04 ± 0.88	0.91	1.22 ± 0.66	0.69	3.6 ± 0.63	0.86	2.26 ± 0.56	0.81
S-MS-H07	530 ± 32	11.005	[2]6.0 ± 1.6	1.6	4.2 ± 1.6	1.6	[2]6.34 ± 0.58	0.59	9.14 ± 0.71	0.64
S-MS-H08	1,779 ± 98	10.763	[2]*23.9 ± 5.6	4.8	5.2 ± 3.4	4.5	[2]9.5 ± 1.4	1.8	13.1 ± 1.4	1.7
S-MS-H09	158 ± 13	11.305	19 ± 5	4.7	—	6	18.8 ± 1.7	1.8	20 ± 2	2.3
S-MS-H10	507 ± 32	12.801	4.7 ±1.8	1.9	—	2.4	4.97 ± 0.75	0.98	3.98 ± 0.69	0.91
S-MS-H11	892 ± 52	12.613	7.6 ± 1.7	1.5	9.3 ± 1.8	1	2.36 ± 0.47	0.68	5.88 ± 0.53	0.55
S-MS-H12	732 ± 43	12.527	7.9 ± 1.9	1.8	6.4 ± 1.9	1.8	4.01 ± 0.59	0.76	6.4 ± 0.7	0.8
S-MS-H13	2,660 ± 140	10.679	*73.6 ± 9.7	2.5	*22.5 ± 4.5	3.2	28 ± 2	1.4	15 ± 1.4	1.4
S-MS-H14	452 ± 28	11.410	na[6]	na	na[6]	na	31.4 ± 3.8	4.7	30.9 ± 3.7	4.5
S-MS-H15	593 ± 36	13.743	2.79 ±0.85	0.78	1.99 ± 0.73	0.71	1.56 ± 0.47	0.71	2.6 ± 0.5	0.7
S-MS-H16	582 ± 35	11.392	*18.2 ± 2.3	0.67	10.4 ± 1.5	0.54	2.09 ± 0.51	0.74	4.19 ± 0.48	0.57
S-MS-H17	502 ± 31	11.282	8.6 ± 1.5	0.84	3.4 ± 1.1	1.1	2.85 ± 0.57	0.85	2.6 ± 0.71	1
S-MS-H18	2,100 ± 120	11.753	7.4 ± 2.3	2.3	5.6 ± 2.5	2.6	10.9 ± 0.92	0.87	8.9 ± 0.9	1
S-MS-H19	1,390 ± 79	15.288	5.6 ± 1.3	1.1	3 ± 1	1	3.88 ± 0.45	0.55	5.33 ± 0.51	0.56
S-MS-H20	247 ± 18	10.896	[2]9.5 ± 3.2	3.3	—	4	[2]5.1 ± 1.2	1.7	4.27 ± 0.93	1.4
S-MS-H21	1,599 ± 90	13.605	nc[4]	nc	nc[4]	nc	nc[4]	nc	nc[4]	nc
S-MS-H22	723 ± 43	13.218	nc[4]	nc	nc[4]	nc	nc[4]	nc	nc[4]	nc
S-MS-H23	435 ± 28	11.489	11.7 ± 1.7	0.57	6.8 ± 1.3	0.88	1.98 ± 0.51	0.75	4.5 ± 0.6	0.76
S-MS-H24	410 ± 26	10.358	*33 ± 5.9	3.4	12.7 ± 3.9	3.9	8.3 ± 1.2	1.6	9.4 ± 1.2	1.5
S-MS-H25	591 ± 35	11.311	nc[4]	nc	nc[4]	nc	nc[4]	nc	nc[4]	nc

Table 11. Radioactive constituents detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Samples from all 100 grid wells were analyzed. Information about the constituents is given in table 3*G*. Measured values less than the sample-specific critical level (ssL_C) are reported as non-detections (—). **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types and benchmark levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. Maximum contaminant level benchmarks 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**: CSU, 1-sigma combined standard uncertainty; nc, not collected; pCi/L, picocuries per liter; RL, reporting level; USGS, U.S. Geological Survey; *, concentration greater than the recommended benchmark level; —, not detected; ±, plus or minus]

GAMA well identification number	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)	
MS-SA grid wells (100 wells sampled)—Continued										
Highlands study area wells (30 wells sampled)—Continued										
S-MS-H26	463 ± 30	13.357	14.9 ± 2.3	0.87	8.2 ± 1.5	0.99	4.02 ± 0.73	0.99	4.7 ± 0.7	0.95
S-MS-H27	233 ± 17	11.120	14.1 ± 2.2	1.1	10.8 ± 1.9	1.2	4.46 ± 0.79	0.96	8.18 ± 0.65	0.57
S-MS-H28	1,860 ± 100	12.871	nc[4]	nc	nc[4]	nc	nc[4]	nc	nc[4]	nc
S-MS-H29	791 ± 46	11.566	13.2 ± 4.2	4.4	7.9 ± 3.7	4.4	26.4 ± 2.1	1.9	25.3 ± 2.1	2
S-MS-H30	218 ± 17	13.829	3.2 ± 1.3	1.5	—	1.4	2.59 ± 0.71	1	4.04 ± 0.69	0.84

[1]The MCL-US applies to adjusted gross alpha radioactivity, which is equal to gross alpha radioactivity minus uranium activity. Results were not adjusted for uranium activity.

[2]Counted 4 to 6 days after sample collection.

[3]Radon samples were not collected for four MS-SA grid wells: S-MS-SC15, S-MS-P14, S-MS-SV19, and S-MS-SV36. Sampling factors that affected those grid-well samples include time constraint for running a well, no sample tank before pressure tank, and sample vial broke during shipment to the laboratory.

[4]Gross alpha and beta were not collected for some wells due to laboratory contract ending.

[5]Radon sample was analyzed after radon half-life of 3.92 days.

[6]The raw reported values for gross alpha radioactivity for S-MS-H14 had CSUs up to 11 pCi/L and ssL_Cs up to 17 pCi/L. Because of the high uncertainty of the results and because the detection levels were greater than the MCL-US for gross alpha radioactivity, the results were considered unreliable. Gross alpha radioacitivity (72-hour count and the 30-day count) were coded as "reviewed and rejected" in the USGS National Water Information Systems (NWIS) database and are not presented in this report.

Table 12. Isotopic tracers detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Information about the constituents is given in table 3*G*. Samples from all 100 grid wells were analyzed. Stable isotope ratios of hydrogen, oxygen, and carbon 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. Measured values of tritium less than the sample-specific critical level (ssL_C) are reported as not detected (—). **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types and benchmark levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. Maximum contaminant level benchmarks 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**: C, Carbon; CSU, 1-sigma combined standard uncertainty; H, hydrogen; na, not available; O, oxygen; pCi/L, picocuries per liter; RL, reporting level; USGS, U.S. Geological Survey; —, not detected; ±, plus or minus]

GAMA well identification number	$\delta^{13}C$ in dissolved inorganic carbon (per mil) (82081)	C-14 in water (percent modern) (49933)	$\delta^{2}H$ in water (per mil) (82082)	$\delta^{18}O$ in water (per mil) (82085)	Tritium (pCi/L) (07000)	
Benchmark type	na	na	na	na	MCL-CA	
Benchmark	na	na	na	na	20,000	
[RL]	na	na	na	na	Result ± CSU	ssL_C
MS-SA study unit grid wells (100 wells sampled)						
Santa Cruz study area wells (15 wells sampled)						
S-MS-SC01	–16.19	40.39	–35.7	–5.66	1.49 ± 0.34	0.31
S-MS-SC02	–14.56	33.33	–31.9	–5.38	—	0.47
S-MS-SC03	–18.67	76.27	–32.9	–5.70	3.95 ± 0.39	0.32
S-MS-SC04	–17.82	62.52	–36.3	–5.88	2.26 ± 0.40	0.36
S-MS-SC05	–14.76	27.31	–36.7	–6.06	1.57 ± 0.38	0.36
S-MS-SC06	–13.60	46.84	–36.8	–5.92	0.74 ± 0.26	0.25
S-MS-SC07	–14.45	45.24	–34.5	–5.80	—	0.50
S-MS-SC08	–15.68	64.54	–31.7	–5.17	3.72 ± 0.51	0.46
S-MS-SC09	–16.22	61.04	–36.3	–5.97	—	0.24
S-MS-SC10	–17.79	86.09	–36.0	–5.90	3.66 ± 0.39	0.33
S-MS-SC11	–17.88	104.90	–34.5	–5.72	4.40 ± 0.40	0.32
S-MS-SC12	–19.23	92.60	–35.0	–6.02	4.01 ± 0.56	0.51
S-MS-SC13	–16.31	75.43	–36.4	–6.20	0.42 ± 0.42	0.41
S-MS-SC14	–16.42	75.04	–37.8	–6.17	—	0.46
S-MS-SC15	na[1]	na[1]	–37.4	–6.19	1.45 ± 0.26	0.24
Pajaro Valley study area wells (15 wells sampled)						
S-MS-P01	–14.42	76.09	–37.2	–6.14	0.54 ± 0.25	0.24
S-MS-P02	–19.54	69.69	–37.6	–6.03	—	0.24
S-MS-P03	–18.97	67.04	–34.2	–5.64	—	0.46
S-MS-P04	–17.60	101.30	–36.3	–5.84	3.52 ± 0.39	0.33
S-MS-P05	–20.52	102.00	–36.1	–5.87	6.04 ± 0.37	0.25
S-MS-P06	–16.81	78.81	–37.4	–5.87	0.73 ± 0.45	0.44
S-MS-P07	–18.24	97.02	–35.5	–5.49	6.11 ± 0.53	0.44
S-MS-P08	–18.12	91.35	–40.6	–6.13	0.79 ± 0.52	0.51
S-MS-P09	–16.32	80.61	–38.8	–5.88	0.48 ± 0.25	0.24
S-MS-P10	–18.92	89.61	–38.9	–6.02	4.45 ± 0.49	0.42

Table 12. Isotopic tracers detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Information about the constituents is given in table 3*G*. Samples from all 100 grid wells were analyzed. Stable isotope ratios of hydrogen, oxygen, and carbon 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. Measured values of tritium less than the sample-specific critical level (ssL_C) are reported as not detected (—). **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types and benchmark levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. Maximum contaminant level benchmarks 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**: C, Carbon; CSU, 1-sigma combined standard uncertainty; H, hydrogen; na, not available; O, oxygen; pCi/L, picocuries per liter; RL, reporting level; USGS, U.S. Geological Survey; —, not detected; ±, plus or minus]

GAMA well identification number	$\delta^{13}C$ in dissolved inorganic carbon (per mil) (82081)	C-14 in water (percent modern) (49933)	$\delta^{2}H$ in water (per mil) (82082)	$\delta^{18}O$ in water (per mil) (82085)	Tritium (pCi/L) (07000)	
MS-SA study unit grid wells (100 wells sampled)—Continued						
Pajaro Valley study area wells (15 wells sampled)—Continued						
S-MS-P11	–15.05	71.45	–38.1	–6.17	—	0.24
S-MS-P12	–15.69	43.88	–39.4	–6.05	—	0.24
S-MS-P13	–13.95	84.35	–37.4	–5.36	4.18 ± 0.32	0.24
S-MS-P14	–15.74	74.95	–41.9	–6.23	—	0.24
S-MS-P15	–12.49	54.22	–42.0	–6.42	—	0.24
Salinas Valley study area wells (40 wells sampled)						
S-MS-SV01	–13.37	41.95	–38.7	–5.66	2.52 ± 0.28	0.24
S-MS-SV02	–12.91	79.74	–40.6	–5.97	3.12 ± 0.29	0.24
S-MS-SV03	–17.30	65.36	–45.2	–6.65	1.22 ± 0.27	0.26
S-MS-SV04	–18.74	93.53	–44.7	–6.67	0.84 ± 0.29	0.28
S-MS-SV05	–16.44	75.15	–42.8	–6.21	4.41 ± 0.31	0.24
S-MS-SV06	–13.22	52.72	–40.8	–5.98	3.86 ± 0.42	0.35
S-MS-SV07	–13.61	43.76	–43.5	–6.46	—	0.35
S-MS-SV08	–12.95	54.62	–45.2	–6.82	2.94 ± 0.27	0.23
S-MS-SV09	–17.27	102.70	–44.4	–6.58	4.76 ± 0.33	0.25
S-MS-SV10	–14.56	98.47	–46.0	–6.77	2.29 ± 0.29	0.25
S-MS-SV11	–9.88	79.76	–44.6	–6.79	0.64 ± 0.44	0.43
S-MS-SV12	–12.36	65.58	–39.7	–5.60	1.85 ± 0.28	0.26
S-MS-SV13	–10.90	0.81	–56.9	–7.88	—	0.43
S-MS-SV14	–11.65	40.89	–50.1	–7.15	—	0.26
S-MS-SV15	–14.10	90.19	–32.5	–4.43	4.61 ± 0.49	0.41
S-MS-SV16	–13.28	97.88	–30.9	–4.21	4.50 ± 0.48	0.42
S-MS-SV17	–10.34	78.92	–46.4	–7.17	1.20 ± 0.38	0.36
S-MS-SV18	–15.16	100.40	–35.0	–5.04	4.52 ± 0.52	0.46
S-MS-SV19	–11.73	72.98	–41.0	–6.30	0.59 ± 0.25	0.25
S-MS-SV20	–16.25	88.14	–40.7	–5.72	1.55 ± 0.29	0.27

Table 12. Isotopic tracers detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Information about the constituents is given in table 3*G*. Samples from all 100 grid wells were analyzed. Stable isotope ratios of hydrogen, oxygen, and carbon 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. Measured values of tritium less than the sample-specific critical level (ssL_C) are reported as not detected (—). **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types and benchmark levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. Maximum contaminant level benchmarks 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**: C, Carbon; CSU, 1-sigma combined standard uncertainty; H, hydrogen; na, not available; O, oxygen; pCi/L, picocuries per liter; RL, reporting level; USGS, U.S. Geological Survey; —, not detected; ±, plus or minus]

GAMA well identification number	$\delta^{13}C$ in dissolved inorganic carbon (per mil) (82081)	C-14 in water (percent modern) (49933)	$\delta^{2}H$ in water (per mil) (82082)	$\delta^{18}O$ in water (per mil) (82085)	Tritium (pCi/L) (07000)	
MS-SA study unit grid wells (100 wells sampled)—Continued						
Salinas Valley study area wells (40 wells sampled)—Continued						
S-MS-SV21	–17.82	80.59	–39.5	–5.98	—	0.35
S-MS-SV22	–14.01	98.68	–37.3	–5.74	6.05 ± 0.35	0.23
S-MS-SV23	–13.10	97.83	–39.3	–5.85	3.74 ± 0.39	0.32
S-MS-SV24	–11.85	32.54	–37.9	–5.80	—	0.35
S-MS-SV25	–13.50	99.66	–30.9	–4.35	4.31 ± 0.35	0.27
S-MS-SV26	–13.79	89.13	–39.0	–5.56	2.58 ± 0.27	0.22
S-MS-SV27	–12.81	96.29	–32.9	–4.66	4.26 ± 0.56	0.50
S-MS-SV28	–12.85	17.18	–52.5	–7.25	—	0.22
S-MS-SV29	–15.79	77.75	–40.6	–5.07	1.44 ± 0.39	0.37
S-MS-SV30	–14.73	109.20	–36.2	–5.05	5.24 ± 0.34	0.24
S-MS-SV31	–13.25	100.40	–32.0	–4.45	5.71 ± 0.60	0.51
S-MS-SV32	–14.21	88.88	–43.7	–6.49	—	0.43
S-MS-SV33	–18.15	84.55	–40.4	–6.12	—	0.35
S-MS-SV34	–16.43	59.71	–40.7	–6.39	—	0.31
S-MS-SV35	–9.79	44.06	–43.2	–6.52	0.70 ± 0.43	0.42
S-MS-SV36	–14.97	102.20	–42.1	–6.05	3.70 ± 0.29	0.23
S-MS-SV37	–14.91	104.30	–46.7	–6.88	5.32 ± 0.33	0.24
S-MS-SV38	–20.28	68.79	–46.9	–6.18	3.70 ± 0.34	0.27
S-MS-SV39	–11.95	38.32	–53.7	–7.18	0.96 ± 0.44	0.43
S-MS-SV40	–15.50	81.43	–49.2	–6.78	1.97 ± 0.29	0.26
Highlands study area wells (30 wells sampled)						
S-MS-H01	–9.93	0.67	–50.6	–7.34	—	0.45
S-MS-H02	–12.02	37.37	–44.2	–6.49	1.53 ± 0.40	0.38
S-MS-H03	–15.03	79.27	–35.7	–5.46	3.38 ± 0.40	0.35
S-MS-H04	–11.49	23.20	–38.9	–5.67	—	0.37
S-MS-H05	–13.83	5.16	–53.2	–7.84	—	0.36

Table 12. Isotopic tracers detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[The five-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Information about the constituents is given in table 3*G*. Samples from all 100 grid wells were analyzed. Stable isotope ratios of hydrogen, oxygen, and carbon 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. Measured values of tritium less than the sample-specific critical level (ssL_C) are reported as not detected (—). **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. Benchmark types and benchmark levels as of May 23, 2013. **Benchmark types**: MCL-CA, California maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. Maximum contaminant level benchmarks 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**: C, Carbon; CSU, 1-sigma combined standard uncertainty; H, hydrogen; na, not available; O, oxygen; pCi/L, picocuries per liter; RL, reporting level; USGS, U.S. Geological Survey; —, not detected; ±, plus or minus]

GAMA well identification number	$\delta^{13}C$ in dissolved inorganic carbon (per mil) (82081)	C-14 in water (percent modern) (49933)	$\delta^{2}H$ in water (per mil) (82082)	$\delta^{18}O$ in water (per mil) (82085)	Tritium (pCi/L) (07000)	
MS-SA study unit grid wells (100 wells sampled)—Continued						
Highlands study area wells (30 wells sampled)—Continued						
S-MS-H06	–11.16	16.30	–38.9	–5.82	—	0.34
S-MS-H07	–14.95	104.30	–50.1	–7.40	3.17 ± 0.47	0.42
S-MS-H08	–7.02	21.04	–53.4	–7.41	1.06 ± 0.42	0.41
S-MS-H09	–9.93	13.54	–46.3	–6.55	—	0.43
S-MS-H10	–13.27	80.74	–44.1	–6.12	1.72 ± 0.38	0.35
S-MS-H11	–9.52	0.53	–58.1	–8.02	—	0.47
S-MS-H12	–15.34	95.43	–44.7	–6.47	2.68 ± 0.49	0.46
S-MS-H13	–13.45	58.63	–49.5	–7.04	—	0.25
S-MS-H14	4.40	0.09	–51.8	–6.57	—	0.34
S-MS-H15	–13.48	7.52	–53.9	–7.39	—	0.36
S-MS-H16	–13.08	51.79	–45.7	–6.10	—	0.37
S-MS-H17	–11.73	38.05	–47.3	–6.30	—	0.25
S-MS-H18	–10.23	26.98	–43.9	–5.64	—	0.34
S-MS-H19	–15.06	104.20	–46.1	–6.78	4.92 ± 0.34	0.24
S-MS-H20	–13.20	106.80	–50.3	–6.57	4.66 ± 0.35	0.26
S-MS-H21	–15.14	97.00	–47.1	–5.91	—	0.42
S-MS-H22	–11.90	47.65	–50.3	–7.16	0.94 ± 0.44	0.43
S-MS-H23	–13.01	71.99	–45.3	–6.01	1.02 ± 0.37	0.36
S-MS-H24	–13.80	51.38	–51.5	–7.10	—	0.33
S-MS-H25	–14.84	92.78	–52.2	–6.48	1.62 ± 0.31	0.29
S-MS-H26	–10.38	10.29	–56.4	–7.45	—	0.33
S-MS-H27	–12.91	71.84	–51.3	–7.07	1.81	0.23
S-MS-H28	–11.34	16.20	–47.6	–6.90	4.70 ± 0.31	0.22
S-MS-H29	–11.50	68.67	–47.6	–6.36	—	0.33
S-MS-H30	–11.44	48.86	–53.0	–7.48	—	0.33

[1]Bottle broke before sample could be analyzed.

Table 13. Dissolved noble gases detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[Information about the constituents is given in table 3*H*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. **Abbreviations**: $cm^3STP/g\ H_2O$, cubic centimeters at standard temperature and pressure per gram of water; nv, no value]

GAMA identification number	Helium-4 ($cm^3STP/g\ H_2O$) (85561)	Neon ($cm^3STP/g\ H_2O$) (61046)	Argon ($cm^3STP/g\ H_2O$) (85563)	Krypton ($cm^3STP/g\ H_2O$) (85565)	Xenon ($cm^3STP/g\ H_2O$) (85567)	Helium-3/Helium-4 (atom ratio) (61040)
	$\times 10^{-7}$	$\times 10^{-7}$	$\times 10^{-4}$	$\times 10^{-8}$	$\times 10^{-8}$	$\times 10^{-6}$
MS-SA study unit grid wells (100 wells sampled)						
Santa Cruz study area wells (15 wells sampled)						
S-MS-SC01	7.14	2.95	4.83	8.88	1.43	1.05
S-MS-SC02	2.06	2.69	4.18	9.19	1.38	0.57
S-MS-SC03	0.51	2.22	3.84	8.41	1.31	1.38
S-MS-SC04	0.87	3.43	4.31	9.02	1.28	1.40
S-MS-SC05	4.52	3.03	4.59	9.72	1.39	0.27
S-MS-SC06	0.54	2.33	3.80	8.47	1.24	1.39
S-MS-SC07	0.70	2.36	3.83	8.42	1.20	1.12
S-MS-SC08	0.78	3.41	4.69	9.28	1.24	1.50
S-MS-SC09	0.56	2.45	4.15	9.58	1.51	1.30
S-MS-SC10	0.46	1.93	3.53	8.17	1.20	1.34
S-MS-SC11	1.36	5.14	5.49	10.23	1.34	1.52
S-MS-SC12	1.06	4.33	5.21	10.13	1.51	1.41
S-MS-SC13	1.22	5.14	5.46	10.65	1.53	1.37
S-MS-SC14	0.88	3.61	4.86	10.07	1.38	1.38
S-MS-SC15	nv	nv	nv	nv	nv	nv
Pajaro Valley study area wells (15 wells sampled)						
S-MS-P01	1.34	5.24	5.50	10.91	1.47	1.38
S-MS-P02	0.80	3.26	4.09	8.97	1.18	1.39
S-MS-P03	0.56	2.39	4.08	9.17	1.34	1.36
S-MS-P04	0.49	2.10	3.47	7.89	1.10	1.35
S-MS-P05	11.85	38.23	12.50	31.84	2.96	1.19
S-MS-P06	3.81	2.83	4.34	9.57	1.35	0.41
S-MS-P07	0.60	2.45	3.85	8.59	1.18	1.64
S-MS-P08	0.47	1.95	3.31	7.47	1.07	1.36
S-MS-P09	0.57	2.22	3.53	7.97	1.15	1.32
S-MS-P10	0.54	2.26	3.64	8.17	1.13	1.44
S-MS-P11	0.83	3.44	4.98	10.26	1.64	1.30
S-MS-P12	0.74	3.01	4.34	9.48	1.33	1.33
S-MS-P13	0.57	2.39	3.78	8.31	1.19	2.28
S-MS-P14	0.64	2.42	3.87	8.85	1.29	1.20
S-MS-P15	0.77	3.00	3.95	8.42	1.22	1.30

Table 13. Dissolved noble gases detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.
—Continued

[Information about the constituents is given in table 3*H*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. **Abbreviations**: $cm^3STP/g\ H_2O$, cubic centimeters at standard temperature and pressure per gram of water; nv, no value]

GAMA identification number	Helium-4 ($cm^3STP/g\ H_2O$) (85561)	Neon ($cm^3STP/g\ H_2O$) (61046)	Argon ($cm^3STP/g\ H_2O$) (85563)	Krypton ($cm^3STP/g\ H_2O$) (85565)	Xenon ($cm^3STP/g\ H_2O$) (85567)	Helium-3/Helium-4 (atom ratio) (61040)
	$\times 10^{-7}$	$\times 10^{-7}$	$\times 10^{-4}$	$\times 10^{-8}$	$\times 10^{-8}$	$\times 10^{-6}$
MS-SA study unit grid wells (100 wells sampled)—Continued						
Salinas Valley study area wells (40 wells sampled)						
S-MS-SV01	1.47	4.50	5.03	9.84	1.31	0.99
S-MS-SV02	0.80	2.30	3.65	8.35	1.12	1.08
S-MS-SV03	0.46	1.87	3.50	8.26	1.12	1.31
S-MS-SV04	0.69	2.81	4.19	8.29	1.15	1.31
S-MS-SV05	0.46	1.89	3.20	7.26	0.99	1.31
S-MS-SV06	4.89	19.95	10.56	19.39	2.13	1.39
S-MS-SV07	2.98	3.26	4.51	9.38	1.39	0.34
S-MS-SV08	1.32	3.18	4.28	9.65	1.29	0.95
S-MS-SV09	0.75	2.91	3.93	8.49	1.23	1.43
S-MS-SV10	0.68	2.82	4.01	8.96	1.25	1.45
S-MS-SV11	1.22	5.33	5.33	10.33	1.35	1.53
S-MS-SV12	0.59	2.27	3.49	7.72	1.05	1.36
S-MS-SV13	28.74	2.49	3.86	8.46	1.27	0.27
S-MS-SV14	1.26	3.53	4.26	8.82	1.13	0.99
S-MS-SV15	0.49	2.09	3.49	7.92	1.10	1.41
S-MS-SV17	0.87	3.53	4.62	9.45	1.43	1.53
S-MS-SV18	0.61	2.56	3.78	8.35	1.14	1.47
S-MS-SV20	0.66	2.41	3.80	8.66	1.30	1.38
S-MS-SV21	0.57	2.24	3.61	8.02	1.13	1.32
S-MS-SV22	0.67	2.47	3.86	8.83	1.16	2.04
S-MS-SV23	0.68	2.69	4.07	8.78	1.23	1.56
S-MS-SV24	1.48	2.30	3.76	8.79	1.14	0.86
S-MS-SV25	0.54	2.25	3.51	7.85	1.14	1.46
S-MS-SV26	38.84	1.92	3.29	7.49	1.06	0.50
S-MS-SV27	0.47	1.98	3.41	7.83	1.10	1.47
S-MS-SV28	1.43	2.32	3.56	8.09	1.08	0.59
S-MS-SV29	4.30	2.12	3.30	7.46	0.97	0.52
S-MS-SV30	0.66	2.62	3.72	8.19	1.15	1.48

Table 13. Dissolved noble gases detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[Information about the constituents is given in table 3*H*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. **Abbreviations**: $cm^3STP/g\ H_2O$, cubic centimeters at standard temperature and pressure per gram of water; nv, no value]

GAMA identification number	Helium-4 ($cm^3STP/g\ H_2O$) (85561)	Neon ($cm^3STP/g\ H_2O$) (61046)	Argon ($cm^3STP/g\ H_2O$) (85563)	Krypton ($cm^3STP/g\ H_2O$) (85565)	Xenon ($cm^3STP/g\ H_2O$) (85567)	Helium-3/Helium-4 (atom ratio) (61040)
	$\times 10^{-7}$	$\times 10^{-7}$	$\times 10^{-4}$	$\times 10^{-8}$	$\times 10^{-8}$	$\times 10^{-6}$
MS-SA study unit grid wells (100 wells sampled)—Continued						
Salinas Valley study area wells (40 wells sampled)—Continued						
S-MS-SV31	0.73	2.63	3.86	8.55	1.12	1.31
S-MS-SV32	0.92	2.60	3.92	8.62	1.19	1.11
S-MS-SV33	0.52	2.07	3.40	7.75	1.08	1.31
S-MS-SV34	1.10	2.38	3.58	7.83	1.06	0.74
S-MS-SV35	nv	nv	nv	nv	nv	nv
S-MS-SV36	nv	nv	nv	nv	nv	nv
S-MS-SV37	1.28	4.62	4.95	9.18	1.24	1.33
S-MS-SV38	3.41	2.22	3.45	7.39	1.10	0.30
S-MS-SV39	1.67	2.32	3.59	7.63	1.11	0.81
S-MS-SV40	1.04	3.36	4.43	9.14	1.19	1.40
Highland study area wells (30 wells sampled)						
S-MS-H01	8.13	2.72	4.30	9.82	1.42	1.40
S-MS-H02	4.29	2.98	4.18	8.75	1.19	0.26
S-MS-H03	1.23	2.38	3.63	7.90	1.05	0.65
S-MS-H04	5.70	2.25	3.29	7.24	1.04	1.35
S-MS-H05	1.03	3.08	4.48	9.79	1.23	0.09
S-MS-H07	0.57	2.18	3.74	8.51	1.24	1.22
S-MS-H08	0.50	1.86	3.17	6.73	0.95	1.23
S-MS-H09	0.75	2.56	3.58	7.81	1.24	1.17
S-MS-H10	8.51	2.78	4.09	8.82	1.32	0.25
S-MS-H11	0.66	2.17	3.52	7.90	1.07	1.17
S-MS-H12	0.87	3.39	4.38	9.10	1.18	1.42
S-MS-H13	1.56	3.29	4.43	9.18	1.21	0.53
S-MS-H15	0.95	2.71	3.76	8.25	1.12	0.91
S-MS-H16	0.58	2.27	3.35	7.07	0.98	1.37
S-MS-H17	0.58	2.21	3.15	6.71	0.86	1.24
S-MS-H18	8.17	2.21	3.23	6.76	0.91	0.46
S-MS-H19	0.48	2.02	3.38	7.61	1.13	1.38
S-MS-H20	0.54	2.03	3.16	6.86	0.94	1.37
S-MS-H21	5.01	1.66	2.75	6.11	0.82	0.47
S-MS-H22	1.36	2.31	3.55	7.77	1.06	0.55

Table 13. Dissolved noble gases detected in grid-well samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013. —Continued

[Information about the constituents is given in table 3*H*. **GAMA well identification numbers**: S-MS-H, Monterey–Salinas Shallow Aquifer Highlands study area well; S-MS-P, Monterey–Salinas Shallow Aquifer Pajaro Valley study area well; S-MS-SC, Monterey–Salinas Shallow Aquifer Santa Cruz study area well; S-MS-SV, Monterey–Salinas Shallow Aquifer Salinas Valley study area well. **Abbreviations**: $cm^3STP/g\ H_2O$, cubic centimeters at standard temperature and pressure per gram of water; nv, no value]

GAMA identification number	Helium-4 ($cm^3STP/g\ H_2O$) (85561)	Neon ($cm^3STP/g\ H_2O$) (61046)	Argon ($cm^3STP/g\ H_2O$) (85563)	Krypton ($cm^3STP/g\ H_2O$) (85565)	Xenon ($cm^3STP/g\ H_2O$) (85567)	Helium-3/Helium-4 (atom ratio) (61040)
	$\times 10^{-7}$	$\times 10^{-7}$	$\times 10^{-4}$	$\times 10^{-8}$	$\times 10^{-8}$	$\times 10^{-6}$
MS-SA study unit grid wells (100 wells sampled)—Continued						
Highland study area wells (30 wells sampled)—Continued						
S-MS-H23	0.62	2.55	3.56	7.53	1.03	1.37
S-MS-H24	1.31	2.38	3.69	8.21	1.16	0.95
S-MS-H25	0.43	1.85	3.02	6.74	0.96	1.39
S-MS-H26	0.76	2.08	3.29	7.45	0.97	0.96
S-MS-H27	0.95	3.92	5.47	11.29	1.57	1.33
S-MS-H28	0.56	2.35	3.82	8.65	1.16	1.32
S-MS-H29	0.64	2.18	3.28	7.16	1.00	1.21
S-MS-H30	0.78	2.72	3.68	7.81	1.04	1.14

Appendix A

This appendix includes discussions of the methods used to collect and analyze groundwater samples and to report the resulting water-quality data for wells and shallow-well tap sites. These methods were selected to obtain representative samples of the groundwater from each well and to minimize the potential for contamination of the samples or bias in the data. Procedures used to collect and assess quality control (QC) data and the results of the QC assessments also are discussed.

In the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, both for grid wells and wells sampled at the tap, groundwater samples were collected, and quality assurance (QA) procedures were implemented, by using standard and modified U.S. Geological Survey (USGS) protocols from the National Water Quality and Assessment (NAWQA) Program (Koterba and others, 1995), the National Field Manual (NFM; U.S. Geological Survey, variously dated), and protocols described by Shelton and others (2001) and Wright and others (2005). The QA plan followed by the National Water Quality Laboratory (NWQL), the primary laboratory used to analyze samples for this study, is described in Stevenson (2012).

Sample Collection and Analysis

Three protocols were used to collect samples for this study because three types of sites were sampled; ninety-nine pumping wells were sampled as grid wells, 1 spring was sampled as a grid well, and 70 sites with pumping wells or holding tanks were sampled as shallow-well tap sites. Sites classified as pumping wells are vertically drilled into the ground and have pumps that bring the groundwater from the aquifer. The spring site was classified as a spring because groundwater could discharge naturally where the aquifer intersected the land surface and flow into the distribution system without the use of a pump. In most cases, grid wells were pumped continuously to purge at least three casing volumes of water from the well prior to sampling (Wilde and others, 1999). In some cases, continuous pumping was limited, either because of limited space in storage tanks for the pumped water or because of drawdown of the water table. In these cases, a minimum of one casing volume of groundwater was pumped from the grid well before sampling. The limitation on pumping did not allow sufficient time to complete the sampling of a few wells, and some constituent groups were not collected from these wells. If a well could not be pumped long enough to remove three casing volumes during the purge prior to sampling it was noted in the field notes for future reference. Purging was not required for the spring site because the water was already flowing continuously. Wells at the shallow-well tap sites were not purged prior to sample collection and, in some cases, were pumped intermittently.

Sites were sampled by using Teflon® tubing with brass and stainless-steel fittings attached to a sampling point (usually a hose-bib fitting). For grid wells and the one spring, the sampling point was as close to the well head as possible on the well-discharge pipe. The sampling point was upstream from water-storage tanks and from well-head treatment systems, if present. If a chlorinating system was attached to the well, the chlorinator was shut off, when possible, before the well was purged and sampled in order to clear all chlorine out of the system. The absence of free chlorine was verified by using a Hach® field test kit. For the shallow-well tap sites, the sampling point was on the outside of the house and often was downstream of a storage tank. All samples were collected outdoors by connecting a 1–3-foot (ft) length of Teflon® tubing to the sampling point (Lane and others, 2003). All fittings and lengths of tubing were cleaned between samples (Wilde, 2004).

Both for grid wells and shallow-well tap sites, measurements of field water-quality parameters were taken by routing water through a flow-through chamber that was attached to the sampling point and fitted with a multi-probe meter that simultaneously measured the field water-quality indicators dissolved oxygen, temperature, pH, and specific conductance (SC). Field measurements were made in accordance with protocols in the NFM (Radtke and others, 2005; Wilde and Radtke, 2005; Lewis, 2006; Wilde, 2006; Ritz and Collins, 2008; Ritz and Collins, 2008). All sensors on the multi-probe meter were calibrated daily. Measured dissolved oxygen, temperature, pH, and SC values were recorded at 3 to 5-minute intervals, and when these values remained stable, samples for laboratory analyses were collected. Field measurements and instrument calibrations were recorded by hand on field record sheets and electronically in the Personal Computer Field Form (PCFF) program. Analytical service requests for the NWQL were managed by the PCFF program, whereas analytical service requests for non-NWQL analysis were entered into laboratory-specific spreadsheets. Information from the PCFF was uploaded directly into the USGS National Water Information System (NWIS) at the end of every week of sample collection.

The protocols for preparing, filling, and shipping sample bottles were the same at grid wells and shallow-well tap sites. Polyethylene sample bottles were pre-rinsed three times with deionized water and then once with native water before sample collection. Samples requiring acidification were acidified to a pH between 2 and 1 by using the appropriate acids from ampoules of certified, traceable concentrated acids obtained from the NWQL. Temperature-sensitive samples were stored on ice prior to and during daily shipping to the various laboratories. The non-temperature-sensitive samples for tritium, stable isotopes of hydrogen and oxygen in water, and dissolved noble gases were shipped monthly. Temperature-sensitive or time-sensitive samples for volatile organic compounds (VOCs), pesticides and pesticide degradates, *N*-nitrosodimethylamine (NDMA), perchlorate, trace elements, nutrients, major and minor ions, silica, total dissolved solids (TDS), laboratory alkalinity, radon-222, and gross alpha and gross beta radioactivity were shipped daily whenever possible. The temperature-sensitive samples for analysis of stable isotopes of carbon in dissolved inorganic carbon and analysis of carbon-14 abundance were stored on ice, archived in a laboratory refrigerator, and shipped after results of the laboratory alkalinity measurements were received.

Detailed sampling protocols for individual analyses and groups of analytes are described in Koterba and others (1995), the NFM (Wilde and others, 1999, 2004; Wilde 2008, 2009), and in the references for analytical methods listed in table A-1; only brief descriptions are given here. Samples for analyses of VOCs were collected in 40-milliliter (mL) glass baked-amber sample vials that were purged with three vial volumes of unfiltered groundwater before bottom-filling to minimize atmospheric contamination. One to one (1:1) hydrochloric acid to water ($HCl:H_2O$) solution was added as a preservative to the VOC samples. Each groundwater sample to be analyzed for perchlorate was collected in a 125-mL polystyrene bottle and then filtered in two or three 20-mL aliquots of water through a 0.20-micrometer (µm) pore-size Corning® syringe-tip disk filter into a sterilized 125-mL bottle. Samples for the analyses of tritium were collected in one 1-liter (L) polyethylene bottle and one 1-L glass bottle, both of which were purged with three volumes of unfiltered groundwater before bottom filling to avoid atmospheric contamination. Samples for analysis of stable isotopes of hydrogen and oxygen in water were collected in 60-mL clear-glass bottles filled with unfiltered groundwater, sealed with conical caps, and secured with electrical tape to prevent leakage and evaporation.

Groundwater samples for analysis of pesticides and pesticide degradates were collected in 1-L baked-amber glass bottles. These samples were filtered through a 0.7-µm nominal pore-size glass-fiber filter during collection.

Groundwater samples for trace elements, major and minor ions, silica, laboratory alkalinity and TDS analyses required filling one 250-mL polyethylene bottle with unfiltered groundwater and one 500-mL and one 250-mL polyethylene bottle with filtered groundwater (Wilde and others, 2004). Filtration was done by using a 0.45-µm pore-size PALL® unvented capsule filter that was pre-rinsed with 2 L of deionized water and then rinsed with 1 L of groundwater prior to sampling. Each 250-mL filtered sample then was preserved with 7.5-Normal (N) nitric acid. Nutrient samples were collected by filtering groundwater into 125-mL brown-polyethylene bottles. Samples analyzed for gross alpha and gross beta radioactivity were filtered into 1-L polyethylene bottles and acidified with 7.5-N nitric acid. Stable isotopes of carbon in dissolved inorganic carbon and carbon-14 abundance samples were collected in 500-mL glass bottles that were purged with three volumes of filtered groundwater before bottom-filling. These samples had no headspace and were sealed with conical caps to avoid atmospheric contamination.

For the collection of water samples for samples of radon-222, a stainless-steel and Teflon® valve assembly was attached to the hose bib at the well head (Wilde and others, 2004). The valve was partially closed to create back pressure, and a 10-mL groundwater sample was taken through a Teflon® septum on the valve assembly by using a stainless-steel needle attached to a glass syringe. The sample was then injected into a 25-mL vial partially filled with a scintillation mixture (mineral oil and 1,2,4-trimethylbenzene) and shaken. The vial then was placed in an insulated cardboard tube to protect the sample during shipping.

Dissolved noble gases were collected in three-eighths-inch-diameter copper tubes by using reinforced nylon tubing connected to the hose bib at the wellhead. Groundwater was flushed through the tubing to dislodge bubbles before the flow was restricted with a back-pressure valve. Clamps on either side of the copper tube were then tightened, trapping a sample of groundwater for analyses of dissolved noble gases (Kulongoski and Hilton, 2011).

Field alkalinity was measured in a mobile laboratory at the well site. Samples for field alkalinity titrations were collected by filtering groundwater into a 250-mL polyethylene bottle. Alkalinity was measured on filtered samples by using the Gran titration method (Gran, 1952). Titration data were entered directly into the PCFF and the concentrations of bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) were automatically calculated from the titration data by using the advanced speciation method (http://or.water.usgs.gov/alk/methods.html), where $pK_1 = 6.35$, $pK_2 = 10.33$, and $pK_W = 14$. Concentrations of HCO_3^- and CO_3^{2-} also were calculated from the laboratory alkalinity and laboratory pH measurements.

Seven laboratories performed chemical analyses for this study (table A-1), although most of the analyses were performed at the NWQL or by laboratories contracted by the NWQL. The NWQL maintains a rigorous QA program (Pirkey and Glodt, 1998; Maloney, 2005). Laboratory QC samples, including 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 tested continuously, and laboratory reporting levels are updated accordingly. The NWQL maintains the National Environmental Laboratory Accreditation Program (NELAP) and other certifications (http://www.nelac-institute.org/content/NELAP/accred-bodies.php). The USGS Branch of Quality Systems (BQS) maintains independent oversight of QA at the NWQL and laboratories contracted by the NWQL. The BQS also runs the National Field Quality Assurance Program (NFQA), which includes annual testing of all USGS field personnel for proficiency in making field water-quality measurements (https://bqs.usgs.gov/nfqa/). Results for analyses from the NWQL or from laboratories contracted by the NWQL were uploaded directly into NWIS. Results for analyses from other laboratories are compiled in a project database and, from there, uploaded to NWIS.

Data Reporting

The following section gives details for the laboratory reporting conventions and the constituents that are determined by multiple methods or by multiple laboratories.

Reporting Levels

The USGS NWQL uses two thresholds for reporting results: the long-term method detection level (LT-MDL) and the laboratory reporting level (LRL). The LT-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. The LT-MDL is statistically derived from concentrations in blank samples measured over an entire year (Childress and others, 1999; U.S. Environmental Protection Agency, 1999; Connor, 2012). The LRL is usually set at twice the LT-MDL for each constituent. The probability of reporting a false negative for a sample that contains a concentration of a constituent greater than or equal to the LRL is predicted to be less than or equal to 1 percent (Childress and others, 1999).

Since October 2010, value-qualifier codes are included with results in the USGS NWIS database for reported values less than the LRL. The value-qualifier code "n" indicates results between the LT-MDL and LRL, and "b" indicates results less than the lowest calibration standard. For organic constituents with mass spectrometric methods classified as "information rich," results less than the LT-MDL are often reported by the NWQL; these results are denoted with the value-qualifier "t" in the USGS NWIS database and are footnoted in the tables of results in this report. Values greater than the LRLs are sometimes reported as having a higher degree of uncertainty, which is coded by the letter "E" preceding the values in the tables and text. The E-coded values can result from detections outside the range of calibration standards, from detections that did not meet all laboratory QC criteria, and from samples that were diluted prior to analysis (Childress and others, 1999).

Non-detections are reported in the USGS NWIS database as less than (<) the reporting level for each constituent. The reporting level for organics is the LRL. For inorganic constituents, the reporting level is often the LT-MDL. Exceptions are bromide, nitrite, and nitrite plus nitrate, which are reported by using the method detection limit (MDL). Like the LT-MDL, the 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; however, the MDL is calculated from a small number of replicate analyses of a low-concentration spike sample (Childress and others, 1999; U.S. Environmental Protection Agency, 1999). Total dissolved solids, perchlorate, and NDMA are reported by using minimum reporting levels (MRLs). The MRL is the smallest measurable concentration of a constituent that can be reliably reported by using a given analytical method (Timme, 1995).

The USGS NWQL updates reporting levels regularly, and the values listed in this report were in effect during the period that groundwater samples from the MS-SA study unit were analyzed (October 2012 to May 2013).

Isotopes of hydrogen, oxygen, and carbon are reported by using method uncertainties (MUs). The MU generally indicates the precision of a particular analytical measurement; it gives a range of values wherein the true value will be found.

Results for most constituents are presented by using the LRL, LT-MDL, MDL, MRL, or MU values provided by the analyzing laboratories. Results for some organic and inorganic constituents are presented by using study reporting levels (SRLs) derived from assessment of data from QC samples associated with groundwater samples collected as part of the Groundwater Ambient Monitoring and Assessment-Priority Basin Project (GAMA-PBP; see "Assessment of Blank Results and SRLs" in this appendix).

The reporting limits for radiochemical constituents (carbon-14, tritium, radon-222, and gross-alpha and gross-beta radioactivity) were based on sample-specific critical levels (ssL_C; McCurdy and others, 2008). The critical level is analogous to the LT-MDL used for reporting results for organic and non-radioactive inorganic constituents. In this report, the critical level is defined as the minimum measured activity that indicates a positive detection of the radionuclide where there is less than a 5 percent probability of a false-positive detection. Sample-specific critical levels are used for radiochemical measurements because the critical level is sensitive to sample size and sample yield and is dependent on instrument background, counting times for the sample and background, and the characteristics of the instrument used and the nuclide being measured. The measured activity in the sample is compared to the ssL_C calculated for that sample. Measured activities less than the ssL_C are reported as non-detections with a dash (—) in the data tables.

The analytical uncertainties associated with measured activities are also sensitive to sample size and yield, counting times, and instrument characteristics. Therefore, measured activities of radioactive constituents are reported with sample-specific combined standard uncertainties. The combined standard uncertainty is reported at the 68 percent confidence level (1-sigma).

Notation

Stable isotopic compositions of oxygen, carbon, and hydrogen are reported as relative isotope ratios in units of per mil by using the standard delta notation (Coplen, 2011):

$$\delta^{i}E = \left[\frac{Rsample}{Rreference}\right] - 1 \quad (1)$$

where

i is the atomic mass of the heavier isotope of the element,

E is the element (H for hydrogen, O for oxygen, C for carbon),

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

Rreference is the ratio of the abundance of the heavier isotope of the element to the lighter isotope of the element in the reference material.

The reference material for oxygen and hydrogen is Vienna Standard Mean Ocean Water (VSMOW), which has assigned $\delta^{18}O$ and $\delta^{2}H$ values of 0 per mil (Coplen and others, 2002; Coplen, 2011). The reference material for carbon is Vienna Pee Dee Belemnite (VPDB), which has an assigned $\delta^{13}C$ value of 0 per mil (Coplen and others, 2002; Coplen, 2011). Positive values indicate enrichment of the heavier isotope, and negative values indicate depletion of the heavier isotope, compared to the ratios observed in the standard-reference material.

Constituents Measured in the Field and the Laboratory

Field water-quality indicators—pH, SC, and alkalinity—were measured in the field and at the NWQL. The field measurements are generally the preferred method for all three constituents, because field conditions are considered more representative of groundwater conditions (Hem, 1985). Laboratory values for all three constituents were significantly greater than field values (Wilcoxon signed-rank test, $p<0.001$ for all three tests). The increase in the pH of the groundwater samples between field and laboratory measurements (table 4) can be explained by equilibration of the samples with the atmosphere after collection and by analytical issues that can introduce bias to the laboratory values (Fram and others, 2009).

The reason for the difference between field and laboratory SC values is unknown. The differences between the field and laboratory values were small; the percent relative standard deviation (percent RSD) was less than 1 percent for 53 percent of the samples and less than 10 percent (the criteria for acceptable replicate pairs) for 98 percent of the samples. One sample with a field SC value less than the upper benchmark had a laboratory SC value greater than the upper benchmark (S-MS-SV20).

The increase in alkalinity values between field and laboratory measurements (tables 4*A*, 4*B*) could be explained by differences among the methods used to measure alkalinity in the field and in the laboratory (Bennett and Fram, 2014). The importance of the systematic difference between the field and laboratory alkalinity values was evaluated by comparing cation-anion balances for major-on analyses for samples calculated with the field and laboratory alkalinity values (Bennett and Fram, 2014) and the differences are too small to disrupt the cation-anion balances.

Quality-Control Methods and Results

The purpose of QC is to identify which data best represent environmental conditions and which could have been affected by contamination or bias during sample collection, processing, storage, transportation, or laboratory analysis. Four types of QC measurements were evaluated in this study: (1) blank samples were collected to assess positive bias as a result of contamination during sample handling or analysis; (2) replicate samples were collected to assess variability; (3) matrix-spike tests were done to assess positive or negative bias; and (4) surrogate compounds were added to samples analyzed for organic constituents to assess potential bias of laboratory analytical methods. Two types of QC measurements were collected at shallow-well tap sites: blanks and replicates. Matrix-spike and surrogate analysis were not collected at wells sampled at the tap because samples for analysis of VOCs and pesticides were not collected at these sites. The QC measurements for the grid wells and the wells sampled at the tap were pooled together for assessment because the same equipment was used for sample collection, handling, and transport.

Assessment of Blank Results and Study Reporting Levels

The primary purposes of collecting blanks are to evaluate the potential contamination of samples by constituents of interest during sample handling or analysis and to identify and mitigate the sources of contamination. Results from blanks collected for the MS-SA study unit and for previous GAMA study units were used to establish SRLs for some constituents detected in blanks. Concentrations of SRLs can be higher than the reporting levels used by the laboratory. Detections reported by the laboratory with concentrations less than SRLs could have significant contamination bias. These data were flagged with appropriate remark codes (described in subsequent sections) and were rejected from subsequent use, including calculations of detection frequency.

Blank Collection and Analysis

Blanks were collected by using blank water certified by the NWQL to contain less than the reporting levels for selected constituents investigated in the study (James A. Lewis, National Water Quality Laboratory, written commun., 2013). Nitrogen-purged, organic-free blank water was used for blanks of organic constituents, and inorganic-free blank water was used for blanks of other constituents.

One source-solution blank was collected during MS-SA, because a new lot of blank water was released by NWQL, to assess potential contamination of samples during transport and analysis and potential contamination of the certified blank water obtained from the NWQL. A "lot" is a unique batch of blank water with defined production and expiration dates. The source-solution blank was collected in the field mobile laboratory by pouring blank water directly into sample containers that were preserved, shipped, and analyzed in the same manner as the groundwater samples. Source-solution blanks were analyzed for VOCs, NDMA, perchlorate, trace elements, major and minor ions, silica, and TDS. One additional source-solution blank was collected at a sampling site for perchlorate analysis.

Field blanks were collected to assess potential contamination of samples during collection, processing, transport, and analysis. To collect field blanks at the sampling sites, blank water was either pumped or poured through the sampling equipment (fittings and tubing) used to collect groundwater samples, then processed and transported by using the same protocols used for the groundwater samples. Four liters of blank water were pumped or poured through the sampling equipment before each field blank was collected. Field blanks were analyzed for VOCs, pesticides and pesticide degradates, NDMA, perchlorate, trace elements, nutrients, major and minor ions, silica, and TDS.

Field or source-solution blanks were not collected for gross alpha and gross beta radioactivity or radon because the laboratory determines an ssL_C value for each sample. The ssL_C is the minimum measured value that indicates a non-zero amount of the radionuclide in the sample; in other words, it is an amount of the radionuclide that is statistically greater than the amount in a blank. Blanks were not collected for tritium and dissolved noble gases. Tritium and dissolved noble gases are in the atmosphere and dissolve into any solution used to collect a blank, making it impractical to collect a blank for these analytes. Isotopic ratios of carbon, hydrogen, and oxygen are an intrinsic property of any of these elements; therefore, the concept of a blank does not apply to these ratios.

Determining Study Reporting Levels

The SRLs were determined for VOCs by Fram and others (2012) on the basis of statistical assessments of results from field blanks, source-solution blanks, laboratory instrument blanks, and groundwater samples collected for the first 32 GAMA-PBP study units (May 2004–September 2010). The SRLs were established for those VOCs that had evidence of potential contamination due to field or laboratory processes: 1,2,4-trimethylbenzene (0.56 micrograms per liter, µg/L), carbon disulfide (0.03 µg/L), chloroform (0.02 µg/L, which only applies to monitoring wells that were not sampled in this study), ethylbenzene (0.06 µg/L), toluene (0.69 µg/L), *m*- plus *p*-xylenes (0.33 µg/L), and *o*-xylene (0.12 µg/L). Three VOCs (acetone, 2-butanone, and tetrahydrofuran) had no upper limit on the concentrations that could be attributed to extrinsic contamination; detections of these constituents have been attributed to methanol used to clean field equipment or cement used to join polyvinyl chloride (PVC) piping (Fram and others, 2012). Detections of VOCs having concentrations less than the SRLs are reported as non-detections in table 5.

The SRLs were determined for trace elements on the basis of statistical assessments of results from field blanks, source-solution blanks, and laboratory blanks collected for the first 20 GAMA-PBP study units (May 2004–January 2008), as described by Olsen and others (2010), and for additional GAMA-PBP study units (March 2006 through March 2013) as described by Davis and others (2014). These assessments used order statistics and binomial probabilities to construct an upper confidence limit (Hahn and Meeker, 1991) for the maximum concentration of each constituent possibly introduced while groundwater samples were collected, handled, transported, and analyzed. The GAMA SRLs were used for copper (2.1 µg/L), iron (6 µg/L), lead (0.82 µg/L), manganese (0.66 µg/L), molybdenum (0.023 µg/L), nickel (0.21 µg/L), tungsten (0.023 µg/L), and zinc (6.2 µg/L). Detections of trace elements having concentrations less than the SRLs are marked with a less than or equal to (≤) symbol preceding the reported value on table 8 to indicate that the true value could be less than or equal to the reported value (including the possibility of being a non-detection). One additional trace element (cobalt) had no upper limit on the concentrations that could be attributed to extrinsic contamination; cobalt can be introduced by capsule filters used for processing water samples (Davis and others, 2014). All groundwater results for cobalt were coded as "reviewed and rejected" in the NWIS database and are not presented in this report.

Detections in Field Blanks and Application of Study Reporting Levels

Constituents were not detected in field blanks for the following constituent groups or constituents: pesticides and pesticide degradates (13 field blanks), perchlorate (14 field blanks), and TDS (19 field blanks).

Table A-2 presents a summary of detections in the field blanks and the SRLs applied for the MS-SA study unit. For VOCs and nutrients, 14 field blanks were collected; 12 field blanks were collected for NDMA; 19 field blanks for trace elements; and 21 field blanks for nitrate plus nitrite. Fewer field blanks were collected for VOCs and NDMA than for trace elements and nitrate, because samples for VOCs and NDMA were only collected at grid wells, whereas samples for trace elements and nitrate were collected at grid wells and at shallow-well tap sites. Two additional field blanks were not collected in accordance to GAMA protocols, and the results were reviewed and rejected. No constituents were detected in the source-solution blanks collected during the MS-SA study unit.

For the MS-SA study unit, VOCs were not detected in the field blanks (table A-2). Of the six VOCs with applicable SRLs defined by Fram and others (2012), three were detected in groundwater samples from the MS-SA study unit: carbon disulfide, toluene, and *m*- plus *p*-xylene. The current LRL for carbon disulfide (0.1 µg/L) is greater than the SRL, and the two groundwater detections were at concentrations greater than the SRL (tables 5, A-2). Two of the three detections of toluene (MS-SC-15 at 0.04 µg/L and MS-SV-30 at 0.02 µg/L) and the one detection of *m*- plus *p*-xylene (MS-SC-15 at 0.16 µg/L) were at concentrations less than their respective SRLs and were re-classified as non-detections. Additionally, all detections for acetone (two samples), 2-butanone (two samples), and tetrahydrofuran (three samples) were rejected because of their likely origination from extrinsic sources, such as methanol used to clean equipment or cement used on PVC piping that is sometimes connected to domestic wells, rather than from the groundwater (Fram and others, 2012). Although these VOCs had no upper limit for an SRL, none of the uncensored results in the MS-SA study for acetone or 2-butanone were greater than the benchmarks of 6,000 and 4,000 µg/L, respectively.

The special-interest constituent NDMA was detected in 1 out of 12 field blanks; the detected concentration (0.00254 µg/L) was below the range of concentrations observed in groundwater samples (tables A-2, 7). The low detection frequency and concentration of NDMA in the field blanks indicated that contamination bias did not likely affect groundwater results.

Seven of the eight trace elements with SRLs defined by Davis and others (2014) were detected in at least one MS-SA field blank, and most of the detections were at concentrations less than the updated SRLs (table A-2). Exceptions included one detection of molybdenum at 0.044 µg/L, one detection of tungsten at 0.03 µg/L, and one detection of zinc at 8.6 µg/L (table A-2). Three other trace elements were detected in MS-SA field blanks: antimony (0.139 µg/L), boron (32 µg/L), and thallium (0.02 µg/L). The SRLs were not defined for these constituents. It was determined from the low-detection frequency and concentration in field blanks of both antimony and thallium that contamination of samples for these constituents was unlikely to significantly affect groundwater results. For the field blank with a boron detection, the NWQL reported in the certificate of analysis for the blank water used to collect the field blank (NWQL Lot number 81202) that the water contained elevated concentrations of boron (James A. Lewis, NWQL, written commun., August 2013).

Nitrite and nitrite plus nitrate (as nitrogen) were each detected in one field blank at their respective detection levels: 0.001 mg/L for nitrite and 0.04 mg/L for nitrite plus nitrate (table A-2). It was not necessary to define SRLs for any nutrients, because of the low-detection frequency and concentration of the constituents in field blanks.

Replicates

Sequential replicate samples were collected to assess the precision of the water-quality data. Estimates of data precision are needed to assess whether differences between concentrations in samples reflect differences in groundwater quality or the variability that can result from collecting, processing, and analyzing the samples. Chemical constituents (tables A-3*A–B*) and radiochemical constituents (table A-3*C*) were assessed by using the different (but similar) approaches explained in following sections.

Assessment of Replicate Samples

Three methods for measuring variability were needed to adequately assess precision over the broad range of measured concentrations of most constituents. The variability between measured concentrations in the pairs of sequential replicate samples was represented by the standard deviation (SD) for low concentrations and by relative standard deviation (RSD) for high concentrations (Anderson, 1987; Mueller and Titus, 2005). The RSD is defined as the SD divided by the mean concentration for each replicate pair of samples expressed as a percentage. The boundary between concentrations for which variability is assessed with SD and concentrations for which variability was assessed with RSD was defined as five times the reporting level (RL) for each constituent. The RL can be the MDL or MRL for a constituent, as listed in tables 3*A–F*.

Replicate pairs of analyses of all constituents, except for radiochemical constituents, were evaluated as described in the following paragraphs.

If both values were reported as non-detections, the variability was considered acceptable. Values reported with the less than or equal to (≤) symbol were considered non-detections for this purpose. The less than or equal to (≤) code indicated that the reported value was less than the SRL, and the concentration had an unacceptable likelihood of being fully or partly attributed to contamination bias. If both values were reported as detections, the SD was calculated if the mean concentration was less than 5 RL for the constituent, and the RSD was calculated if the mean concentration was greater than or equal to 5 RL for the constituent. Acceptable precision was defined as having a SD less than or equal to the LT-MDL or having a RSD less than or equal to 10 percent. For comparison, a RSD of 10 percent is equivalent to a relative percent difference of 14 percent.

For organic and special-interest constituents, if one value was reported as a non-detection and the other value was reported as a detection greater than the LT-MDL (or MRL for special-interest constituents), the variability for the pair was considered unacceptable. For inorganics, if one value was a non-detection and the other value was greater than the LRL, the variability of the pair was considered unacceptable. If one value was coded as less than or equal to the reported value and the other value was a detection greater than the SRL, then the SD for the two reported values was calculated; acceptable precision was defined as having a SD less than or equal to one-half the SRL.

Replicate pairs of analyses of radiochemical constituents were evaluated by using the following equation (McCurdy and others, 2008) to calculate the normalized absolute difference (NAD):

$$NAD = \frac{\left|R_1 - R_2\right|}{\sqrt{\left(CSU_1^2 + CSU_2^2\right)}} \quad (2)$$

where

R_1 and R_2 are the results for the two samples in the replicate pair, and

CSU_1 and CSU_2 are the combined standard uncertainties associated with the results.

Values less than 1.65 for the normalized absolute difference correspond to a significance level (α) of 5 percent (α = 0.05), indicating differences that are acceptably small and not statistically significant.

If results from replicate sample pairs indicated that precision was unacceptable for a constituent and no specific reason could be identified, then this greater variability had to be considered when interpreting the data. If measured concentrations were slightly greater than a water-quality benchmark, then actual concentrations could be slightly less than that benchmark. Similarly, if measured concentrations were slightly less than a water-quality benchmark, then actual concentrations could be slightly greater than a benchmark. Also, if a constituent concentration showed high variability in replicate sample pairs, then a greater difference between concentrations measured in two samples was required to conclude that the two samples had significantly different concentrations.

Variability in Replicate Samples

Tables A-3*A–C* summarizes the results of replicate analyses for constituents detected in groundwater samples collected in the MS-SA study unit. Replicate analyses were made at 8 to 29 grid wells depending on constituent, representing approximately 30 percent of all the samples collected at grid-well sites. Replicate analyses were planned to be collected at seven of the wells sampled at the taps, but only two replicate analyses were able to be collected, representing approximately 3 percent of all wells sampled at taps.

Of the 5,575 replicate pairs of constituents collected, 1,027 pairs had a detection in one or both samples of the pair. Of these 1,027 pairs, 51 pairs had results outside of the limits for acceptable precision, including results for the organic and special-interest constituents bromodichloromethane, bromoform, chloroform, perchloroethylene, deethylatrazine, simazine, and NDMA and all the inorganic constituents, except aluminum, beryllium, lead, silver, thallium, vanadium, ammonia (as nitrogen), nitrate plus nitrate, calcium, chloride, sulfate, silica, and the stable isotopes of water and carbon-14. Results for replicate analyses for constituents that were not detected in groundwater samples are not reported in tables A-3*A*–*C*. All replicate pairs for perchlorate, isotopic tracers, and radioactive constituents were within acceptable precision.

For the each of the 85 VOCs, 29 replicate pairs of samples were analyzed. Of the 2,465 replicate pairs analyzed, the results of 1 replicate pair for perchloroethylene was composed of a non-detection and a detected concentration between the LT-MDL and LRL (table A-3*A*). One replicate pair each of bromodichloromethane, bromoform, and chloroform had an RSD greater than 10 percent. For the 63 pesticides compounds, 29 replicate pairs of samples were analyzed. Of the 1,827 replicate pairs, results from 1 pair of deethylatrazine and 1 pair of simazine were composed of a detected concentration between the LT-MDL and LRL and a non-detection (table A-3*A*). Of the 9 replicate pairs analyzed for NDMA, 1 pair was composed of a detected concentration between the LT-MDL and LRL and a non-detection (table A-3*A*).

Of the 1,170 replicate sample pairs analyzed for trace elements and major and minor ions, results for 43 pairs had unacceptable precision. Of these 43 pairs of results, 13 pairs involved 1 replicate pair of samples collected at grid-well site S-MS-H22 (table A-3*B*), indicating that the poor precision for these 13 pairs could be the result of an inadvertent sample switch at the laboratory or in the field. The sample is annotated in tables 8 and 10.

Thirty-one replicate pairs of samples were analyzed for nitrate, and twenty-nine replicate pairs of samples were analyzed for the other nutrient constituents. Replicate pairs of nitrate were within acceptable precision. Replicate pairs for nitrite, total nitrogen and orthophosphate each had one or two pairs outside of acceptable precision (table A-3*B*).

Eight to nine replicate pairs were analyzed for isotopic tracers. All pairs were within acceptable precision (table A-3*B*).

Nine replicate pairs of samples were analyzed for gross alpha and gross beta radioactivities, and ten replicate pairs of samples were analyzed for radon-222. All pairs were within acceptable precision (table A-3*C*).

Detected concentrations in environmental samples were not modified on the basis of the replicate analyses.

Matrix Spikes

The addition of a known concentration of a constituent (spike) to a replicate sample from the environment enables the laboratory to determine the effect of the matrix, in this case groundwater, on the analytical technique used to measure the constituent. The known compounds added in matrix spikes are the same as those analyzed in the environmental samples. This enables an analysis of matrix interferences on a compound-by-compound basis. For this study, matrix spikes were added by the laboratory performing the analysis rather than in the field. Low matrix-spike recovery can indicate that the compound might not be detected in some samples if it was present at very low concentrations. Low and high matrix-spike recoveries can be a potential concern if the concentration of a compound in a groundwater sample is close to the health-based benchmark; a low recovery could result in a falsely measured concentration less than the health-based benchmark, whereas a high recovery could result in a falsely measured concentration greater than the health-based benchmark.

Assessment of Matrix Spikes

Matrix spikes were assessed for VOCs, NDMA, and pesticides and pesticide degradates, because the analytical methods for these constituents could be susceptible to matrix interferences. The GAMA-PBP defined the data-quality objective range for acceptable median matrix-spike recoveries as 70 to 130 percent, with recovery, R, for each constituent defined as follows:

$$R(percent) = \frac{C_S - C_U}{C_{EXP}} \times 100\ percent \quad (3)$$

where

C_S is the concentration measured in the spiked sample,

C_U is the concentration measured in the unspiked sample, and

C_{EXP} is the expected concentration added through spiking.

Only constituents that had median matrix-spike recoveries outside of this range were flagged as having unacceptable recoveries. For some constituents, the range of 70 to 130 percent for median matrix-spike recovery was more restrictive than the control limits used by the laboratory for recoveries in set spikes composed of laboratory blank water.

Matrix-Spike Recoveries

Tables A-4*A–B* present a summary of matrix-spike recoveries for the MS-SA study unit. Replicate samples for spike additions of organic constituents were collected at 12 of the 100 grid wells for VOCs and pesticides and pesticide degradates (12 percent of all the wells sampled). Samples for spike additions of NDMA were collected at 12 of the 100 grid wells, but 2 sample sets were not analyzed within the laboratory hold time and were excluded, leaving 10 spiked samples (10 percent of all the wells sampled). Groundwater from the 70 wells sampled at the taps was not analyzed for these constituents.

Groundwater samples were spiked with 85 VOCs to calculate matrix-spike recoveries. Median matrix-spike recoveries were between 70 and 130 percent for all VOCs (table A-4*A*). The special-interest constituent NDMA was analyzed at Weck Laboratories Inc., and matrix-spike results were within the acceptable range and are presented in table A-4*A*.

Groundwater samples were spiked with 63 pesticides and pesticide degradates to calculate matrix-spike recoveries. Median matrix-spike recoveries were less than 70 percent for 23 compounds, of which, 10 were detected in groundwater samples (table A-4*B*). Low matrix-spike recoveries could indicate the compound was not detected in some samples, if it was present at very low concentrations.

Detected concentrations in environmental samples were not modified on the basis of the matrix-spike recovery analysis.

Surrogate Compound Recoveries

Table A-5 presents a summary of the surrogate recoveries for the MS-SA study unit. The table lists the surrogates, the analytical schedule for which each surrogate was used, the number of analyses for field blanks and environmental samples, the number of surrogate recoveries less than 70 percent, and the number of surrogate recoveries greater than 130 percent for the blank and environmental samples. Field blanks and environmental samples were considered separately to assess whether or not the matrices present in environmental samples affected surrogate recoveries.

Most surrogate recoveries for the field blanks and environmental samples were within the acceptable range of 70 percent to 130 percent. For VOC analyses, about 30 percent of field blanks and about 47 percent of environmental samples had surrogate recoveries for 1, 2-dichloroethane-*d*4 greater than 130 percent. All other VOC surrogates were within the acceptable range. For pesticides and pesticide degradates, the diazinon-*d*10 surrogate recoveries were less than 70 percent in 62 percent of the field blanks and 58 percent of the environmental samples. The α-HCH-*d*6 surrogate recoveries were less than 70 percent in one field blank sample and greater than 130 percent in one field blank sample. The recoveries for all environmental samples were within the acceptable range.

Detected concentrations in environmental samples were not modified on the basis of the surrogate-recovery analysis.

Other Quality-Control Results

Two other laboratory QC issues arose during the analysis of samples collected for the MS-SA study unit: holding times were exceeded for the analyses of NDMA, radon, and gross alpha and gross beta radioactivity samples, and laboratory QC tests indicated bias in the results of some of the trace elements.

Holding time refers to the time in calendar days from sample collection to the analysis of the sample. Analyses for some samples in the MS-SA study unit were completed after the recommended maximum holding time because of a scheduling error at the laboratory or shipping error. A delay in the analysis at the laboratory can result in different measured concentrations than what was in the sample. Two spiked samples for NDMA were analyzed past the U.S. Environmental Protection Agency (USEPA) recommended holding time, and the results were omitted from the total count of spiked samples (table A-4*A*). No environmental samples for NDMA were analyzed past the holding time.

The gross alpha and beta radioactivity reported results are the amounts measured in the samples. Radioactive decay between the time of sample collection and measurement can change the gross alpha and gross beta radioactivity of a sample (Arndt, 2010). At least one sample for the analysis of gross alpha and gross beta radioactivity (72-hour counts) was analyzed 4 to 6 days after sample collection for every 15 grid-well samples. These samples are noted in the results table.

The results for gross alpha radioactivity were reviewed, and results for one grid-well sample (S-MS-H14) were rejected. The combined standard uncertainties for the raw gross alpha radioactivity 72-hour and 30-day counts results were 10 and 11 picocuries per liter (pCi/L), respectively, and the sample specific critical levels were 16 and 17 pCi/L, respectively. Because of the high uncertainty of the results, and because the detection levels were greater than the MCL-US for gross alpha radioactivity, the results were considered inconclusive for the purpose of this report. The results were not coded by the laboratory as analyzed after the holding time, and the reason for the high uncertainty is unknown.

Results for one grid-well sample (S-MS-P15) for radon was analyzed after the radon half-life of 3.92 days. The combined standard uncertainty for the raw radon radioactivity result was 34 pCi/L, and the sample specific critical level was 27.6 pCi/L. The result was well below the MCL-US and is noted as analyzed after the radon half-life in the results table 11.

Potential bias indicated from laboratory QC tests is an issue that must be investigated to determine whether or not the environmental sample data are affected. The BQS operates independent, quality-assurance projects called the Inorganic Blind Sample Project (IBSP) and Blind Blank Program (BBP) to monitor and evaluate the quality of results for analyses of trace elements, nutrients, major and minor ions, silica, and TDS by the NWQL. The IBSP submits standard-reference samples consisting of natural-matrix water samples spiked with known concentrations of the inorganic constituents (Farrar and Long, 1997). The IBSP samples are disguised as regular environmental samples for submission to the NWQL; the BBP samples are disguised as regular field blanks. The BQS uses results from the IBSP and BBP samples to evaluate potential bias in the results reported by the NWQL.

The BQS summaries from October 2012 to May 2013 were examined. The BQS reported that eight inorganic constituents showed evidence of bias during this period: there was a positive bias for chromium (approximately 4 percent), barium (approximately 7 percent), cadmium (approximately 6 percent), lead (approximately 5 percent), molybdenum (approximately 6 percent), thallium (approximately 3 percent), and zinc (approximately 4 percent), and there was a negative bias for ammonia (approximately 1 percent). Examination of the results for the IBSP samples for these eight constituents indicated that the analytical biases reported by the BQS were not high or low enough relative to the constituent benchmarks to warrant adding or subtracting the biases from sample results for the data collected for the MS-SA study unit.

References Cited

American Public Health Association, 1998, Standard methods for the examination of water and wastewater (20th ed.): Washington, D.C., American Public Health Association, American Water Works Association, and Water Environment Federation, p. 3-37–3-43.

American Society for Testing and Materials International, 1998, Water and environmental technology, Volume 11.02 Water (II), *in* Annual Book of ASTM Standards, Section 11: Philadelphia, Pa., American Society for Testing and Materials, p. 664–666.

Anderson, R.L., 1987, Practical statistics for analytical chemists: New York, N.Y., Van Nostrand Reinhold Company, Inc., 316 p.

Arndt, M.F., 2010, Evaluation of gross alpha and uranium measurements for MCL compliance: Water Research Foundation, 299 p., http://www.waterrf.org/PublicReportLibrary/3028.pdf.

Bennett, G.L.,V, and Fram, M.S., 2014, Groundwater-quality data in the North San Francisco Bay Shallow Aquifer study unit, 2012—Results from the California GAMA Program: U.S. Geological Survey Data Series 865, 94 p., http://dx.doi.org/10.3133/ds865.

Childress, C.J.O., Foreman, W.T., Connor, B.F., and Maloney, T.J., 1999, New reporting procedures based on long-term method detection levels and some considerations for interpretations of water-quality data provided by the U.S. Geological Survey National Water Quality Laboratory: U.S. Geological Survey Open-File Report 99–193, 19 p., https://pubs.er.usgs.gov/publication/ofr99193.

Connor, B.F., Rose, D.L., Noriega, M.C., Murtagh, L.K., and Abney, S.R., 1998, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of 86 volatile organic compounds in water by gas chromatography/mass spectrometry, including detections less than reporting limits: U.S. Geological Survey Open-File Report 97–829, 78 p., https://pubs.er.usgs.gov/publication/ofr97829.

Connor, B.F., 2012, Long Term-Method Detection Levels (LT-MDL) for the U.S. Geological Survey, National Water Quality Laboratory: U.S. Geological Survey Branch of Quality Systems LT-MDL Project, accessed January 2, 2015, at http://bqs.usgs.gov/ltmdl.

Coplen, T.B., 1994, Reporting of stable hydrogen, carbon, and oxygen isotopic abundances: Pure and Applied Chemistry, v. 66, no. 2, p. 273–276, http://www.iupac.org/publications/pac/1994/pdf/6602x0273.pdf.

Coplen, T.B., 2011, Guidelines and recommended terms for expression of stable-isotope-ratio and gas-ratio measurement results: Rapid Communications in Mass Spectrometry, v. 25, p. 2538–2560, http://dx.doi.org/10.1002/rcm.5129.

Coplen, T.B., Wildman, J.D., and Chen, Julie, 1991, Improvements in the gaseous hydrogen-water equilibrium technique for hydrogen isotope-ratio analysis: Analytical Chemistry, v. 63, no. 9, p. 910–912, http://dx.doi.org/10.1021/ac00009a014.

Coplen, T.B., Hopple, J.A., Böhlke, J.K., Peiser, H.S., Rieder, S.E., Krouse, H.R., Rosman, K.J.R., Ding, T., Vocke, R.D., Jr., Revesz, K.M., Lamberty, A., Taylor, P., and DeBievre, P., 2002, Compilation of minimum and maximum isotope ratios of selected elements in naturally occurring terrestrial materials and reagents: U.S. Geological Survey Water-Resources Investigations Report 2001–4222, 98 p., https://pubs.er.usgs.gov/publication/wri014222.

Davis, T.A., Olsen, L.D., Fram, M.S., and Belitz, Kenneth, 2014, Updated study reporting levels (SRLs) for trace-element data collected for the California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2009–March 2013: U.S. Geological Survey Scientific Investigations Report 2014–5105, 52 p., http://dx.doi.org/10.3133/sir20145105.

Donahue, D.J., Linick, T.W., and Jull, A.J.T., 1990, Isotope-ratio and background corrections for accelerator mass spectrometry radiocarbon measurements: Radiocarbon, v. 32, no. 2, p. 135–142, https://journals.uair.arizona.edu/index.php/radiocarbon/article/view/1261.

Eaton, G.F., Hudson, G.B., and Moran, J.E., 2003, Tritium-helium-3 age-dating of groundwater in the Livermore Valley of California: American Chemical Society (ACS) Symposium Series, v. 868, chap. 16, p. 235–245, http://dx.doi.org/10.1021/bk-2004-0868.ch016.

Epstein, Samuel, and Mayeda, T.K., 1953, Variation of O^{18} content of water from natural sources: Geochimica et Cosmochimica Acta, v. 4, no. 5, p. 213–224, http://dx.doi.org/10.1016/0016-7037(53)90051-9.

Faires, L.M., 1993, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of metals in water by inductively coupled plasma-mass spectrometry: U.S. Geological Survey Open-File Report 92–634, 28 p., https://pubs.er.usgs.gov/publication/ofr92634.

Fishman, M.J., ed., 1993, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of inorganic and organic constituents in water and fluvial sediments: U.S. Geological Survey Open-File Report 93–125, 217 p., https://pubs.er.usgs.gov/publication/ofr93125.

Fishman, M.J., ed., and Friedman, L.C., 1989, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, 545 p., https://pubs.er.usgs.gov/publication/twri05A1.

Farrar, J.W., and Long, H.K., 1997, Report on the U.S. Geological Survey's evaluation program for standard reference samples distributed in September 1996—T-143 (trace constituents), T-145 (trace constituents), M-140 (major constituents), N-51 (nutrient constituents), N-52 (nutrient constituents), P-27 (low ionic strength constituents), and Hg-23 (mercury): U.S. Geological Survey Open-File Report 97–20, 145 p., https://pubs.er.usgs.gov/publication/ofr9720.

Fram, M.S., Munday, Cathy, and Belitz, Kenneth, 2009, Groundwater quality data for the Tahoe–Martis study unit, 2007—Results from the California GAMA Program: U.S. Geological Survey Data Series 432, 89 p., https://pubs.er.usgs.gov/publication/ds432.

Fram, M.S., Olsen, L.D., and Belitz, Kenneth, 2012, Evaluation of volatile organic compound (VOC) blank data and application of study reporting levels to groundwater data collected for the California GAMA Priority Basin Project, May 2004 through September 2010: U.S. Geological Survey Scientific Investigations Report 2012–5139, 94 p., https://pubs.er.usgs.gov/publication/sir20125139.

Gagnon, A.R., and Jones, G.A., 1993, AMS-graphite target production methods at the Woods Hole Oceanographic Institution during 1986–1991: Radiocarbon, v. 35, no. 2, p. 301–310, https://journals.uair.arizona.edu/index.php/radiocarbon/article/viewFile/18070/17800#page=65.

Garbarino, J.R., 1999, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of dissolved arsenic, boron, lithium, selenium, strontium, thallium, and vanadium using inductively coupled plasma-mass spectrometry: U.S. Geological Survey Open-File Report 99–93, 31 p., https://pubs.er.usgs.gov/publication/ofr9993.

Garbarino, J.R., Kanagy, L.K., and Cree, M.E., 2006, Determination of elements in natural-water, biota, sediment, and soil samples using collision/reaction cell inductively coupled plasma-mass spectrometry: U.S. Geological Survey Techniques and Methods, book 5, chap. B1, 87 p., https://pubs.er.usgs.gov/publication/tm5B1.

Gran, Gunnar, 1952, Determination of the equivalence point in potentiometric titrations, Part II: Analyst, v. 77, p. 661–671, http://dx.doi.org/10.1039/AN9527700661.

Hahn, G.J., and Meeker W.Q., 1991, Statistical intervals—A guide for practitioners: New York, N.Y., John Wiley and Sons, 392 p.

Hem, J.D., 1985, Study and interpretation of the chemical characteristics of natural water: U.S. Geological Survey Water Supply Paper 2254, 264 p., https://pubs.er.usgs.gov/publication/wsp2254.

Koterba, M.T., Wilde, F.D., and Lapham, W.W., 1995, Ground-water data-collection protocols and procedures for the National Water-Quality Assessment Program—Collection and documentation of water-quality samples and related data: U.S. Geological Survey Open-File Report 95–399, 114 p., https://pubs.er.usgs.gov/publication/ofr95399.

Krieger, H.L., and Whittaker, E.L., 1980, Prescribed procedures for measurement of radioactivity in drinking water: U.S. Environmental Protection Agency EPA-600/4-80-032, 132 p., available as PB80-224744 at http://www.ntis.gov.

Kulongoski, J.T., and Hilton, D.R., 2011, Applications of groundwater helium, Chapter 15 *in* Baskaran, M. (ed.), Handbook of environmental isotope geochemistry, Vol. I, Part II: Springer-Verlag Berlin Heidelberg, p. 285–304, http://dx.doi.org/10.1007/978-3-642-10637-8_15.

Lane, S.L., Flanagan, Sarah, and Wilde, F.D., 2003, Selection of equipment for water sampling (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A2, accessed October 1, 2012, at http://pubs.water.usgs.gov/twri9A2/.

Lewis, M.E., 2006, Dissolved oxygen (ver. 2.1): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6.2, accessed October 27, 2011, at http://pubs.water.usgs.gov/twri9A6.2/.

Lindley, C.E., Stewart, J.T., and Sandstrom, M.W., 1996, Determination of low concentrations of acetochlor in water by automated solid-phase extraction and gas chromatography with mass-selective detection: Journal of AOAC International, v. 79, no. 4, p. 962–966, https://pubs.er.usgs.gov/publication/70018563.

Madsen, J.E., Sandstrom, M.W., and Zaugg, S.D., 2002, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—A method supplement for the determination of fipronil and degradates in water by gas chromatography/mass spectrometry: U.S. Geological Survey Open-File Report 2002–462, 11 p., https://pubs.er.usgs.gov/publication/ofr02462.

Maloney, T.J., ed., 2005, Quality management system, U.S. Geological Survey National Water Quality Laboratory: U.S. Geological Survey Open-File Report 2005–1263, accessed October 27, 2011, at http://pubs.usgs.gov/of/2005/1263/.

McCurdy, D.E., Garbarino, J.R., and Mullin, A.H., 2008, Interpreting and reporting radiological water-quality data: U.S. Geological Survey Techniques and Methods, book 5, chap. B6, 33 p., https://pubs.er.usgs.gov/publication/tm5B6.

McLain, B.J., 1993, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of chromium in water by graphite furnace atomic absorption spectrophotometry: U.S. Geological Survey Open-File Report 93–449, 16 p., https://pubs.er.usgs.gov/publication/ofr93449.

McNichol, A.P., Gagnon, A.R., Jones, G.A., and Osborne, E.A., 1992, Illumination of a black box—Analysis of gas composition during graphite target preparation: Radiocarbon, v. 34, no. 3, p. 321–329, https://journals.uair.arizona.edu/index.php/radiocarbon/article/view/1471.

McNichol, A.P., Jones, G.A., Hutton, D.L., and Gagnon, A.R., 1994, The rapid preparation of seawater $\sum CO_2$ for radiocarbon analysis at the National Ocean Sciences AMS Facility: Radiocarbon, v. 36, no. 2, p. 237–246, https://journals.uair.arizona.edu/index.php/radiocarbon/article/view/1621/1625.

Moran, J.E., Hudson, G.B., Eaton, G.F., and Leif, R., 2002, A contamination vulnerability assessment for the Livermore–Amador and Niles Cone groundwater basins: Lawrence Livermore National Laboratory internal report UCRL-AR-148831, 25 p.

Mueller, D.K., and Titus, C.J., 2005, Quality of nutrient data from streams and ground water sampled during water years 1992–2001: U.S. Geological Survey Scientific Investigations Report 2005–5106, 27 p., http://pubs.usgs.gov/sir/2005/5106/.

Olsen, L.D., Fram, M.S., and Belitz, Kenneth, 2010, Review of trace-element field-blank data collected for the California Groundwater Ambient Monitoring and Assessment (GAMA) Program, May 2004–January 2008: U.S. Geological Survey Scientific Investigations Report 2009–5220, 47 p., http://pubs.usgs.gov/sir/2009/5220/.

Patton, C.J., and Kryskalla, J.R., 2003, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Evaluation of alkaline persulfate digestion as an alternative to Kjeldahl digestion for determination of total and dissolved nitrogen and phosphorous in water: U.S. Geological Survey Water-Resources Investigations Report 03–4174, 33 p., http://nwql.usgs.gov/pubs/WRIR/WRIR-03-4174.pdf.

Patton, C.J., and Kryskalla, J.R., 2011, Colorimetric determination of nitrate plus nitrite in water by enzymatic reduction, automated discrete analyzer methods: U.S. Geological Survey Techniques and Methods, book 5, chap. B8, 34 p., https://pubs.usgs.gov/tm/05b08/contents/TM5-B8.pdf.

Pirkey, K.D., and Glodt, S.R., 1998, Quality control at the U.S. Geological Survey National Water Quality Laboratory: U.S. Geological Survey Fact Sheet 026–98, 4 p., accessed October 27, 2011, at http://pubs.er.usgs.gov/usgspubs/fs/fs02698.

Plomley, J.B., Koester, C.J., and March, R.E., 1994, Determination of *N*-Nitrosodimethylamine in complex environmental matrices by quadrupole ion storage tandem mass spectrometry enhanced by unidirectional ion ejection: Analytical Chemistry, v. 66, no. 24, p. 4437–4443, http://dx.doi.org/10.1021/ac00096a008.

Radtke, D.B., Davis, J.V., and Wilde, F.D., 2005, Specific electrical conductance (ver. 1.2): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6.3, accessed October 27, 2011, at http://pubs.water.usgs.gov/twri9A6.3/.

Ritz, G.F., and Collins, J.A., 2008, pH (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6.4, accessed January 18, 2013, at http://pubs.water.usgs.gov/twri9A6.4/.

Sandstrom, M.W., Stroppel, M.E., Foreman, W.T., and Schroeder, M.P., 2001, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of moderate-use pesticides and selected degradates in water by C-18 solid-phase extraction and gas chromatography/mass spectrometry: U.S. Geological Survey Water-Resources Investigations Report 01–4098, 70 p., http://nwql.usgs.gov/rpt.shtml?WRIR-01-4098.

Schneider, R.J., Jones, G.A., McNichol, A.P., von Reden, K.F., Elder, K.L., Huang, Kelan, and Kessel, E.D., 1994, Methods for data screening, flagging, and error analysis at the National Ocean Sciences AMS Facility: Nuclear Instruments and Methods in Physics Research, Section B: Beam interations with materials and atoms, v. 92, no. 1–4, p. 172–175, http://dx.doi.org/10.1016/0168-583X(94)96000-3.

Shelton, J.L., Burow, K.R., Belitz, Kenneth, Dubrovsky, N.M., Land, Michael, and Gronberg, JoAnn, 2001, Low-level volatile organic compounds in active public supply wells as ground-water tracers in the Los Angeles physiographic basin, California, 2000: U.S. Geological Survey Water-Resources Investigations Report 01–4188, 29 p., http://pubs.usgs.gov/wri/2001/wri014188/pdf/wri014188.pdf.

Thatcher, L.L., Janzer, V.J., and Edwards, K.W., 1977, Methods for the determination of radioactive substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A5, 95 p., https://pubs.usgs.gov/twri/twri5a5/.

Timme, P.J., 1995, National Water Quality Laboratory 1995 services catalog: U.S. Geological Survey Open-File Report 95–352, 120 p., https://pubs.usgs.gov/of/1995/0352/report.pdf.

U.S. Environmental Protection Agency, 1989, 1,2,3-Trichloropropane—Drinking water health advisory: Office of Water, 15 p., accessed February 18, 2014, at http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=60001XkV.txt.

U.S. Environmental Protection Agency, 1999, National primary drinking water regulations, Radon-222: Federal Register, v. 64, no. 211, p. 59, 245–59, 294.

U.S. Environmental Protection Agency, 2005, Method 331.0—Determination of perchlorate in drinking water by liquid chromatography electrospray ionization mass spectrometry (Revision 1.0, January 2005): Office of Groundwater and Drinking Water, EPA Document #815-R-05-007, 34 p., accessed October 27, 2011, at https://yosemite.epa.gov/water/owrccatalog.nsf/9da204a4b4406ef885256ae0007a79c7/6a2d2a74f222c69a8525701f0063939a!OpenDocument.

U.S. Geological Survey, [variously dated], National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A1–A9, accessed October 27, 2011, at http://water.usgs.gov/owq/FieldManual/.

Vogel, J.S., Nelson, D.E., and Southon, J.R., 1987, ^{14}C background levels in an accelerator mass spectrometry system: Radiocarbon, v. 29, no. 3, p. 323–333, https://journals.uair.arizona.edu/index.php/radiocarbon/article/view/1055/1060.

Wilde, F.D., ed., 2004, Cleaning of equipment for water sampling (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A3, accessed June 1, 2013, at http://pubs.water.usgs.gov/twri9A3/.

Wilde, F.D., 2006, Temperature (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6.1, accessed January 28, 2015, at http://pubs.water.usgs.gov/twri9A6.1/.

Wilde, F.D., 2008, Guidelines for field-measured water-quality properties (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6.0, accessed January 18, 2013, at http://pubs.water.usgs.gov/twri9A6.0/.

Wilde, F.D., ed., 2009, Processing of water samples (ver. 2.2): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A5, accessed January 18, 2013, at http://pubs.water.usgs.gov/twri9A5/.

Wilde, F.D., and Radtke, D.B., 2005, General information and guidelines (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6.0, accessed January 28, 2015, at http://pubs.water.usgs.gov/twri9A6.0/.

Wilde, F.D., Radtke, D.B., Gibs, Jacob, and Iwatsubo, R.T., 1999, Collection of water samples: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A4, accessed January 28, 2015, at http://pubs.water.usgs.gov/twri9A4/.

Wilde, F.D., Radtke, D.B., Gibs, Jaacob, and Iwatsubo, R.T., 2004, Processing of water samples (ver. 2.2): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A5, accessed January 28, 2015, at http://pubs.water.usgs.gov/twri9A5/.

Wright, M.T., Belitz, Kenneth, and Burton, C.A., 2005, California GAMA program—Ground-water quality data in the San Diego drainages hydrogeologic province, California, 2004: U.S. Geological Survey Data Series 129, 91 p., at http://pubs.usgs.gov/ds/2005/129.

Zaugg, S.D., Sandstrom, M.W., Smith, S.G., and Fehlberg, K.M., 1995, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of pesticides in water by C-18 solid-phase extraction and capillary-column gas chromatography/mass spectrometry with selected-ion monitoring: U.S. Geological Survey Open-File Report 95–181, 60 p., http://nwql.usgs.gov/OFR-95-181.shtml.

Table A–1. Analytical methods used for the determination of organic and inorganic constituents by the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL) and contract laboratories.

[Laboratory entity codes in the USGS National Water Information System (NWIS) for laboratories other than the USGS National Water Quality Laboratory (NWQL) are given in parentheses after the laboratory names. **Abbreviations**: USEPA, U.S. Environmental Protection Agency]

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
		Organic constituents	
Volatile organic compounds	Purge and trap capillary gas chromatography/mass spectrometry	NWQL, Schedule 2020	Connor and others, 1998
Pesticides and pesticide degradates	Solid-phase extraction and gas chromatography/mass spectrometry	NWQL, Schedule 2003	Zaugg and others, 1995; Lindley and others, 1996; Sandstrom and others, 2001; Madsen and others, 2003
		Constituents of special interest	
Perchlorate	Liquid chromatography with mass spectrometry/mass spectrometry (USEPA Method 331.0)	Weck Laboratories, Inc., City of Industry, California (CA-WECK), standard operating procedure ORG099.R01	U.S. Environmental Protection Agency, 2005
N-Nitrosodimethylamine (NDMA)	Isotopic dilution with gas chromatography and chemical-ionization mass spectrometry (USEPA Method 1625 *modified*)	Weck Laboratories, Inc., City of Industry, California (CA-WECK), standard operating procedure ORG065.R10	U.S. Environmental Protection Agency, 1989; Plomley and others, 1994
		Inorganic constituents	
Major and minor ions and trace elements	Atomic absorption spectrometry, colorimetry, ion-exchange chromatography, inductively-coupled plasma atomic emission spectrometry, and mass spectrometry	NWQL, Schedule 1948	Fishman and Friedman, 1989; Faires, 1993; Fishman, 1993; McLain, 1993; Garbarino, 1999; American Public Health Association, 1998; Garbarino and others, 2006
Nutrients	Alkaline persulfate digestion, Kjedahl digestion	NWQL, Schedule 2755	Fishman, 1993; Patton and Kryskalla, 2003, 2011
		Isotopic tracers	
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 (USGSSIVA), NWQL Schedule 1142	Epstein and Mayeda, 1953; Coplen and others, 1991; Coplen, 1994
Stable isotopes of carbon in dissolved inorganic carbon and carbon-14 abundance	Accelerator mass spectrometry	Woods Hole Oceanographic Institution, National Ocean Sciences Accelerator Mass Spectrometry Facility [NOSAMS], Woods Hole, Massachusetts (MA-WHAMS), NWQL Schedule 2255	Vogel and others, 1987; Donahue and others, 1990; McNichol and others, 1992; Gagnon and Jones, 1993; McNichol and others, 1994; Schneider and others, 1994
Tritium	Electrolytic enrichment-liquid scintillation	USGS Stable Isotope and Tritium Laboratory [SITL], Menlo Park, California (USGSH3CA), NWQL Schedule 1565	Thatcher and others, 1977

Table A–1. Analytical methods used for the determination of organic and inorganic constituents by the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL) and contract laboratories.—Continued

[Laboratory entity codes in the USGS National Water Information System (NWIS) for laboratories other than the USGS National Water Quality Laboratory (NWQL) are given in parentheses after the laboratory names. **Abbreviations**: USEPA, U.S. Environmental Protection Agency]

Analyte	Analytical method	Laboratory and analytical schedule	Citation(s)
		Radioactive constituents	
Radon-222	Liquid scintillation counting	NWQL, Schedule 1369	American Society for Testing and Materials, 1998
Gross alpha and gross beta radioactivity (72-hour and 30-day count)	Alpha and beta activity counting (USEPA Method 900.0)	Eberline Analytical Services, Richmond, California (CA-EBERL), NWQL Schedule 1792	Krieger and Whittaker, 1980
		Noble gases	
Noble gases	Helium-3 in-growth and mass spectrometry	Lawrence Livermore National Laboratory [LLNL], Livermore, California (CA LLNL)	Moran and others, 2002; Eaton and others, 2004

Table A–2. Constituents detected in field blanks and study reporting levels (SRLs) used for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[mg/L, milligrams per liter; na, not applicable; nv, no value in category; RL, reporting level; USGS, U.S. Geological Survey; VOC, volatile organic compound; µg/L, micrograms per liter; —, not detected; ≤, less than or equal to]

Constituent	Number of field blank detections / total number of field blank samples	RL	Concentration(s) detected in field blank sample(s)	SRL	Source of SRL	Number of groundwater results≤-coded / total number of groundwater detections	Number of groundwater results coded as "reviewed and rejected"
Volatile organic compounds (VOCs) (µg/L)							
Acetone	0/14	3.4	—	nv[1]	Fram and others, 2012	na	2
Carbon disulfide	0/14	0.1	—	0.03	Fram and others, 2012	0/2	na
Methyl ethyl ketone (2-butanone)	0/14	1.6	—	nv[1]	na	na	2
Tetrahydrofuran	0/14	1.4	—	nv[1]	na	na	4
Toluene	0/14	0.02	—	0.69	Fram and others, 2012	2/3	na
m- plus *p*-Xylene	0/14	0.08	—	0.33	Fram and others, 2012	1/1	na
Constituents of special interest (µg/L)							
N-Nitrosodimethyl-amine (NDMA)	1/12	0.002	0.0025	nv	na	0/8	na
Trace elements (µg/L)							
Antimony	1/19	0.135	0.139	nv	na	0/113	na
Boron	1/19	3	[1]32	nv	na	0/170	na
Cobalt	18/19	0.023	0.034 to 0.243	nv[1]	Davis and others, 2014	na	all
Copper	4/19	0.08	0.8 to 1.8	2.1	Davis and others, 2014	63/112	na
Iron	0/19	4	—	6	Davis and others, 2014	10/48	na
Lead	5/19	0.025	0.03 to 0.21	0.82	Davis and others, 2014	132/154	na
Manganese	6/19	0.15	0.15 to 0.41	0.66	Davis and others, 2014	31/149	na
Molybdenum	2/19	0.014	0.044, 0.022	0.023	Davis and others, 2014	0/170	na
Nickel	1/19	0.09	0.11	0.21	Davis and others, 2014	7/167	na
Thallium	1/19	0.01	0.02	nv	na	0/14	na
Tungsten	1/19	0.01	0.03	0.023	Davis and others, 2014	79/110	na
Zinc	7/19	1.4	1.7 to 8.6	6.2	Davis and others, 2014	57/155	na
Nutrients (mg/L)							
Nitrite (as nitrogen)	1/14	0.001	0.001	nv	na	na	na
Nitrite plus nitrate (as nitrogen)	1/21	0.04	0.04	nv	na	na	na

[1]All detections of the three VOCs acetone, 2-butanone, and tetrahydrofuran and all results for cobalt were coded as "reviewed and rejected" in the USGS National Water Information System database and are not presented in tables 5 and 8.

[2]The blank water used to collect the field blank with a boron detection was reported by the U.S. Geological Survey National Water Quality Laboratory to have elevated concentrations of boron.

Table A–3*A*. Quality-control summary for replicate pair analyses of organic constituents and special-interest constituents in samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[Constituents for which all replicate pairs were non-detections are not listed. Replicate pairs with one value reported as a non-detection and the other value reported at a concentration greater than the LT-MDL are included with the number of replicate pairs with standard deviations (SDs) greater than the LT-MDL. **Abbreviations**: LRL, laboratory reporting level; LT-MDL, long-term method detection level; nv, no value; RL, reporting level; RSD, relative standard deviation; USGS, U.S. Geological Survey; µg/L, micrograms per liter; —, not detected; >, greater than]

Constituent	Number of non-detections / number of replicate pairs	Number of SDs > LT-MDL / number of replicate pairs with concentration less than 5 times the RL	Concentrations of replicates with SDs greater than ½ LRL (environmental, replicate)	Number of RSDs greater than 10 percent/ number of replicates with concentration greater than 5 times the LRL	Concentrations of replicates with RSDs greater than 10 percent (environmental, replicate)	
Volatile organic compounds (VOCs) (µg/L)						
Bromodichloromethane	28/29	nv	nv, —	1/1	0.258, 0.205	—
Bromoform (Tribromomethane)	27/29	0/1	nv, —	1/1	[1]0.998, 0.708	—
Chloroform (Trichloromethane)	24/29	0/3	nv, —	2/2	0.874, 0.695	0.612, 0.776
Dibromochloromethane	28/29	0/1	nv, —	nv	nv	—
Dichlorodifluoro-methane	28/29	0/1	nv, —	nv	nv	—
1,1,2-Trichloro-1,2,2-trifluoroethane	27/29	0/1	nv, —	0/1	nv	—
Methyl *tert*-butyl ether (MTBE)	28/29	nv	nv, —	0/1	nv	—
Perchloroethene (PCE)	24/29	1/5	—, 0.033	nv	nv	—
Trichlorofluoromethane	27/29	0/2	nv, —	nv	nv	—
Pesticides and pesticide degradates (µg/L)						
Atrazine	26/29	0/3	nv, —	nv	nv	—
Deethylatrazine	23/29	1/5	0.003, —	0/1	nv	—
Hexazinone	28/29	0/1	nv, —	nv	nv	—
Simazine	24/29	1/5	0.004, —	nv	nv	—
Constituents of special interest (µg/L)						
Perchlorate	3/9	0/3	nv, —	0/3	nv	—
N-Nitrosodimethyl-amine (NDMA)	8/9	1/1	0.003, —	nv	nv	—

[1]Reported values were E-coded by the USGS National Water Quality Laboratory (NWQL) for having greater uncertainty.

Table A–3*B*. Quality-control summary for replicate pair analyses of inorganic constituents in samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[Constituents for which all replicate pairs were non-detections are not listed. **Abbreviations**: C, carbon; H, hydrogen; LRL, laboratory reporting level; LT-MDL, long-term method detection level; mg/L, milligrams per liter; nv, no value; O, oxygen; RL, reporting level; RSD, relative standard deviation in percent; SD, standard deviation; µg/L, micrograms per liter; —, not detected; ≤, less than or equal to]

Constituent	Number of non-detect or ≤-coded replicates/ number of replicates	Number of SDs greater than LT-MDL / number of replicates with concentration less than 5 times the RL	Concentrations of replicates with SDs greater than ½ LRL (environmental, replicate)		Number of RSDs greater than 10 percent/ number of replicates with concentration greater than 5 times the RL	Concentrations of replicates with RSDs greater than 10 percent (environmental, replicate)		
Trace elements (µg/L)								
Aluminum	17/31	0/14	nv	—	nv	nv	—	—
Antimony	9/31	1/22	0.113, —	—	nv	nv	—	—
Arsenic	0/31	0/2	nv	—	1/29	[1]0.119, 0.323	—	—
Barium	0/31	nv	nv	—	1/31	[1]25.7, 20.9	—	—
Beryllium	15/31	0/15	nv	—	0/1	nv	—	—
Boron	0/31	nv	nv	—	2/31	25.4, 29.5	106, 164	—
Cadmium	8/31	0/15	nv	—	2/8	0.700, 0.590	0.072, 0.102	—
Chromium	5/31	1/5	[1]—, 0.277	—	1/21	4.68, 3.88	—	—
Copper	23/31	1/7	11.19, 7.43	—	0/1	nv	—	—
Iron	12/31	2/17	33.6, ≤5.68	[1]34.6, 21.5	1/2	60.9, 40.5	—	—
Lead	27/31	0/4	nv	—	nv	nv	—	—
Lithium	0/31	nv	nv	—	1/31	12.36, 14.67	—	—
Manganese	13/31	2/10	1.41, 0.90	1.6, 0.86	2/8	29.1, 35.2	[1]133, 92.9	—
Molybdenum	0/31	0/1	nv	—	2/30	0.543, 0.637	5.47, 4.49	—
Nickel	3/31	1/23	[1]0.361, 0.689	—	0/5	nv	—	—
Selenium	1/31	0/4	nv	—	3/26	6.28, 5.41	0.60, 0.51	[1]0.59, 4.02
Silver	22/31	0/8	nv	—	0/1	nv	—	—
Strontium	0/31	nv	nv	—	1/31	[1]1,100, 868	—	—
Thallium	30/31	0/1	nv	—	nv	nv	—	—
Tungsten	13/31	0/15	nv	—	1/3	0.506, 0.594	—	—
Uranium	0/31	nv	nv	—	3/31	7.13, 8.54	4.42, 3.71	[1]0.81, 5.48
Vanadium	0/31	1/2	[1]—, 0.265	—	0/29	nv	—	—
Zinc	13/31	1/11	25.8, 20.9	—	1/7	[1]97.4, 73.7	—	—

Table A–3*B*. Quality-control summary for replicate pair analyses of inorganic constituents in samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[Constituents for which all replicate pairs were non-detections are not listed. **Abbreviations**: C, carbon; H, hydrogen; LRL, laboratory reporting level; LT-MDL, long-term method detection level; mg/L, milligrams per liter; nv, no value; O, oxygen; RL, reporting level; RSD, relative standard deviation in percent; SD, standard deviation; µg/L, micrograms per liter; —, not detected; ≤, less than or equal to]

Constituent	Number of non-detect or ≤-coded replicates/ number of replicates	Number of SDs greater than LT-MDL / number of replicates with concentration less than 5 times the RL	Concentrations of replicates with SDs greater than ½ LRL (environmental, replicate)		Number of RSDs greater than 10 percent/ number of replicates with concentration greater than 5 times the RL	Concentrations of replicates with RSDs greater than 10 percent (environmental, replicate)		
Nutrients (mg/L)								
Ammonia (as nitrogen)	24/29	0/1	nv	—	0/4	nv	—	—
Nitrite plus nitrate (as nitrogen)[2]	1/31	nv	nv	—	0/30	nv	—	—
Nitrite (as nitrogen)	22/29	1/5	0.0029, —	—	0/2	nv	—	—
Total nitrogen (ammonia + nitrite + nitrate + organic nitrogen)	0/29	0/3	nv	—	2/26	1.12, 1.96	3.13, 2.50	—
Orthophosphate (as phosphorus)	0/29	0/8	nv	—	1/21	0.064, 0.050	—	—
Major and minor ions, silica, and total dissolved solids (TDS) (mg/L)								
Calcium	0/31	nv	nv	—	0/31	nv	—	—
Chloride	0/31	nv	nv	—	0/31	nv	—	—
Fluoride	0/31	0/15	nv	—	0/16	nv	—	—
Magnesium	0/31	nv	nv	—	1/31	24.7, 29.0	—	—
Potassium	0/31	nv	nv	—	2/31	3.88, 4.50	[1]5.12, 3.96	—
Sodium	0/31	nv	nv	—	2/31	48.9, 68.3	[1]58.1, 47.5	—
Bromide	2/31	nv	nv	—	2/31	2.9, 0.29	2.0, 0.19	—
Sulfate	0/31	nv	nv	—	0/31	nv	—	—
Silica (as SiO_2)	0/31	nv	nv	—	0/31	nv	—	—
TDS	0/31	nv	nv	—	1/31	368, 313	—	—
Isotope tracers								
δ^2H of water (per mil)	0/9	nv	nv	—	0/9	nv	—	—
$\delta^{18}O$ of water (per mil)	0/9	nv	nv	—	0/9	nv	—	—
$\delta^{13}C$ of dissolved inorganic carbon (per mil)	0/8	nv	nv	—	0/8	nv	—	—
C-14 of water (percent modern)	0/8	nv	nv	—	0/8	nv	—	—

[1]One replicate pair had precision outside the acceptable limits for 13 inorganic constituents, possibly indicating a sample collection or analysis error. Results for the environmental sample were annotated in tables 8 and 10.

[2]Nitrite plus nitrate (as nitrogen) is referred to as nitrate in the text for clarity.

[3]Two replicate pairs of bromide were outside the limits of acceptable precision. Reported concentrations may have been affected by dilution calculation errors; however, the USGS National Water Quality Laboratory (NWQL) verified results for both replicate pairs. Results for the environmental samples were annotated in table 10.

Table A–3*C*. Quality-control summary for replicate pair analyses of radioactive constituents in samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[For activities of radioactive constituents, a replicate pair analyses is defined as acceptable if the p-value for the normalized absolute difference is less than the significance level, α = 0.05. **Abbreviations**: nv, no values; >, greater than]

Constituent	Number of non-detections / number of replicate pairs	Number of detections paired with non-detections	Number of replicate pairs with p > 0.05 / number of replicate pairs	Activities for replicate pairs with p > 0.05 (environmental sample, replicate sample)
Gross alpha radioactivity, 72-hour count	1/9	0	0/9	nv
Gross alpha radioactivity, 30-day count	3/9	1	0/9	nv
Gross beta radioactivity, 72-hour count	0/9	0	0/9	nv
Gross beta radioactivity, 30-day count	1/9	0	0/9	nv
Radon-222	0/10	0	0/10	nv

Table A–4*A*. Quality-control summary for matrix-spike recoveries of volatile organic compounds (VOCs) and the special interest constituent *N*-nitrosodimethylamine (NDMA) in samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[Acceptable recovery range is between 70 and 130 percent]

Constituent (synonym or abbreviation)	Number of matrix-spike samples collected	Minimum recovery (percent)	Maximum recovery (percent)	Median recovery (percent)
Acetone	12	100	125	117
Acrylonitrile	12	100	120	109
tert-Amyl methyl ether (TAME)[1]	12	94	104	101
Benzene	12	94	107	102
Bromobenzene	12	89	98	95
Bromochloromethane	12	93	107	98
Bromodichloromethane[1]	12	85	108	88
Bromoform (Tribromomethane)[1]	12	82	104	86
Bromomethane (Methyl bromide)	12	64	118	99
n-Butylbenzene	12	76	101	91
sec-Butylbenzene	12	86	107	97
tert-Butylbenzene	12	95	109	100
Carbon disulfide[1]	12	75	102	87
Carbon tetrachloride (Tetrachloromethane)[1]	12	85	108	92
Chlorobenzene	12	86	102	97
Chloroethane	12	81	125	100
Chloroform (Trichloromethane) [1]	12	84	104	97
Chloromethane	12	95	139	108
3-Chloropropene	12	90	110	103
2-Chlorotoluene	12	94	108	104
4-Chlorotoluene	12	90	110	103
Dibromochloromethane[1]	12	81	105	88
1,2-Dibromo-3-chloropropane (DBCP)	12	80	104	91
1,2-Dibromoethane (EDB)	12	76	105	96
Dibromomethane[1]	12	90	113	94
1,2-Dichlorobenzene	12	88	114	106

Table A–4*A*. Quality-control summary for matrix-spike recoveries of volatile organic compounds (VOCs) and the special interest constituent *N*-nitrosodimethylamine (NDMA) in samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[Acceptable recovery range is between 70 and 130 percent]

Constituent (synonym or abbreviation)	Number of matrix-spike samples collected	Minimum recovery (percent)	Maximum recovery (percent)	Median recovery (percent)
1,3-Dichlorobenzene	12	89	101	96
1,4-Dichlorobenzene	12	90	113	101
trans-1,4-Dichloro-2-butene	12	87	122	99
Dichlorodifluoromethane (CFC-12)[1]	12	80	128	109
1,1-Dichloroethane (1,1-DCA)	12	92	118	100
1,2-Dichloroethane (1,2-DCA)	12	94	121	99
1,1-Dichloroethene (1,1-DCE)	12	92	112	97
cis-1,2-Dichloroethene (*cis*-1,2-DCE)	12	93	101	98
trans-1,2-Dichloroethene (*trans*-1,2-DCE)	12	92	106	97
1,2-Dichloropropane[1]	12	77	104	94
1,3-Dichloropropane	12	85	111	99
2,2-Dichloropropane	12	78	95	84
1,1-Dichloropropene	12	84	98	94
cis-1,3-Dichloropropene	12	88	97	91
trans-1,3-Dichloropropene	12	75	90	85
Diethyl ether	12	98	113	108
Diisopropyl ether (DIPE)	12	93	113	105
Ethylbenzene	12	88	102	95
Ethyl *tert*-butyl ether (ETBE)	12	96	111	104
Ethyl methacrylate	12	85	100	96
o-Ethyl toluene (1-Ethyl-2-methyl benzene)	12	94	108	99
Hexachlorobutadiene	12	70	103	89
Hexachloroethane	12	76	103	89
2-Hexanone (*n*-Butyl methyl ketone)	12	81	111	104
Iodomethane (Methyl iodide)	12	99	119	107
Isopropylbenzene	12	88	104	94
4-Isopropyl-1-methyl benzene	12	83	103	92
Methyl acrylate	12	95	116	107
Methyl acrylonitrile	12	97	118	107
Methyl *tert*-butyl ether (MTBE)[1]	12	97	114	107
Methyl *iso*-butyl ketone (MIBK)	12	89	114	102
Methylene chloride (Dichloromethane)	12	95	119	99
Methyl ethyl ketone (2-butanone, MEK)	12	82	119	105
Methyl methacrylate	12	82	103	95
Naphthalene	12	83	103	92
N-Nitrosodimethylamine (NDMA)[1, 2]	[3]10	83	139	102
Perchloroethene (PCE, Tetrachloroethene)[1]	12	82	157	92
n-Propylbenzene	12	87	105	97
Styrene	12	35	102	94
1,1,1,2-Tetrachloroethane	12	86	103	92
1,1,2,2-Tetrachloroethane	12	85	112	95

Table A–4*A*. Quality-control summary for matrix-spike recoveries of volatile organic compounds (VOCs) and the special interest constituent *N*-nitrosodimethylamine (NDMA) in samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[Acceptable recovery range is between 70 and 130 percent]

Constituent (synonym or abbreviation)	Number of matrix-spike samples collected	Minimum recovery (percent)	Maximum recovery (percent)	Median recovery (percent)
Tetrahydrofuran	12	[4]0	125	107
1,2,3,4-Tetramethylbenzene	12	84	108	95
1,2,3,5-Tetramethylbenzene	12	88	114	99
Toluene[1]	12	96	125	103
1,2,3-Trichlorobenzene	12	85	109	99
1,2,4-Trichlorobenzene	12	77	97	93
1,1,1-Trichloroethane (1,1,1-TCA)	12	86	114	98
1,1,2-Trichloroethane (1,1,2-TCA)	12	88	111	96
Trichloroethene (TCE)	12	90	100	94
Trichlorofluoromethane (CFC-11)[1]	12	90	117	107
1,2,3-Trichloropropane (1,2,3-TCP)	12	91	111	97
Trichlorotrifluoroethane (CFC-113)[1]	12	88	108	95
1,2,3-Trimethylbenzene	12	94	116	103
1,2,4-Trimethylbenzene	12	92	116	105
1,3,5-Trimethylbenzene	12	90	107	98
Vinyl bromide (Bromoethene)	12	82	118	101
Vinyl chloride (Chloroethene)	12	87	124	100
m- plus *p*-Xylene	12	94	109	99
o-Xylene	12	87	105	97

[1]Constituent detected in groundwater sample(s).

[2]Spike results from Weck Laboratories, Inc.

[3]Twelve spike samples were collected; however two samples were not analyzed within the holding time for NDMA and were not included in the assessment of matrix spike results.

[4]Tetrahydrofuran was detected in the matrix spike sample and the associated groundwater sample at concentrations five to six times the expected spike fortification concentration, resulting in an unusually low spike recovery.

Table A–4*B*. Quality-control summary for matrix-spike recoveries of pesticides and pesticide degradates in samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[Acceptable recovery range is between 70 and 130 percent]

Constituent (synonym or abbreviation)	Number of matrix-spike samples collected	Minimum recovery (percent)	Maximum recovery (percent)	Median recovery (percent)
Acetochlor	12	64	135	79
Alachlor	12	71	132	85
Atrazine[1]	12	74	108	86
Azinphos-methyl	12	63	103	82
Azinphos-methyl oxon	12	30	112	63
Benfluralin[1]	12	42	100	57
Carbaryl	12	76	141	92
2-Chloro-2,6-diethylacetanilide	12	74	127	84
4-Chloro-2-methylphenol	12	57	90	74
Chlorpyrifos[1]	12	59	101	72
Chlorpyrifos oxon	12	16	81	77
Cyfluthrin	12	45	89	54
Cypermethrin[1]	12	49	88	55
DCPA (Dacthal)[1]	12	76	110	91
Deethylatrazine (2-Chloro-4-isopropylamino-6-amino-*s*-triazine, CIAT)[1]	12	41	122	57
Desulfinylfipronil[1]	12	74	120	96
Desulfinylfipronil amide	12	77	189	106
Diazinon[1]	12	78	110	87
3,4-Dichloroaniline[1]	12	69	105	82
Dichlorvos	12	12	39	16
Dicrotophos	12	9	78	22
Dieldrin[1]	12	62	91	79
2,6-Diethylaniline	12	77	98	91
Dimethoate[1]	12	32	74	55
Ethion[1]	12	57	102	69
Ethion monoxon	12	63	115	76
2-Ethyl-6-methylaniline	12	82	94	89
Fenamiphos	12	61	178	78
Fenamiphos sulfone	12	52	115	77
Fenamiphos sulfoxide	12	7	77	26
Fipronil[1]	12	76	161	88
Fipronil sulfide[1]	12	51	119	73
Fipronil sulfone[1]	12	47	112	68
Fonofos	12	65	94	79
Hexazinone[1]	12	37	97	49
Iprodione	12	43	91	63
Isofenphos[1]	12	69	140	82
Malaoxon	12	63	131	73
Malathion	12	64	120	79
Metalaxyl	12	76	142	90

Table A–4*B*. Quality-control summary for matrix-spike recoveries of pesticides and pesticide degradates in samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.—Continued

[Acceptable recovery range is between 70 and 130 percent]

Constituent (synonym or abbreviation)	Number of matrix-spike samples collected	Minimum recovery (percent)	Maximum recovery (percent)	Median recovery (percent)
Methidathion	12	65	114	78
Metolachlor[1]	12	61	123	72
Metribuzin	12	69	114	83
Myclobutanil	12	58	126	74
1-Naphthol	12	10	58	30
Paraoxon-methyl	12	36	111	53
Parathion-methyl	12	72	159	80
Pendimethalin[1]	12	55	134	69
cis-Permethrin[1]	12	45	84	53
Phorate	12	43	81	56
Phorate oxon	12	51	137	74
Phosmet	12	6	78	75
Phosmet oxon	12	45	50	49
Prometon	12	27	123	83
Prometryn[1]	12	67	121	80
Pronamide	12	49	123	81
Simazine[1]	12	68	107	81
Tebuthiuron	12	101	211	116
Terbufos	12	51	82	67
Terbufos oxon sulfone	12	51	129	61
Terbuthylazine	12	79	110	89
Tribufos[1]	12	38	84	50
Trifluralin[1]	12	43	105	59

[1]Constituent detected in groundwater sample(s).

Table A–5. Quality-control summary for surrogate compound recoveries of volatile organic compounds (VOCs) and pesticides and pesticide degradates in samples collected for the Monterey–Salinas Shallow Aquifer (MS-SA) study unit, California Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project, October 2012 to May 2013.

[NWQL, U.S. Geological Survey National Water Quality Laboratory; VOC, volitile organic compound; <, less than; >, greater than]

Surrogate compound	NWQL analytical schedule	Constituent class analyzed	Number of blanks analyzed	Median recovery in blanks (percent)	Number of surrogate recoveries <70 percent in blanks	Number of surrogate recoveries >130 percent in blanks	Number of groundwater samples analyzed	Median recovery in groundwater samples (percent)	Number of surrogate recoveries <70 percent in groundwater samples	Number of surrogate recoveries >130 percent in groundwater samples
1-Bromo-4-fluorobenzene	2020	VOC	13	89	0	0	100	88	0	0
1,2-Dichloroethane-*d*4	2020	VOC	13	126	0	4	100	127	0	47
Toluene-*d*8	2020	VOC	13	98	0	0	100	96	0	0
Diazinon-*d*10	2003	Pesticide	13	66	8	0	102	68	59	0
α-HCH-*d*6	2003	Pesticide	13	89	1	1	102	89	0	0

Prepared by the Sacramento Publishing Service Center.

For more information concerning this report, contact:

Director
U.S. Geological Survey
California Water Science Center
6000 J Street, Placer Hall
Sacramento, CA 95819
dc_ca@usgs.gov

or visit our Web site at:
http://ca.water.usgs.gov

ISSN 2327-638X (online)
http://dx.doi.org/10.3133/DS987