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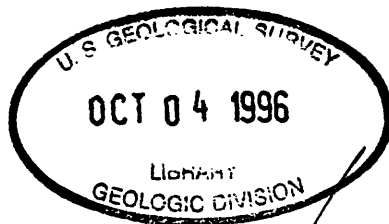
Hydrologic Data for Carson and Antelope Valleys, Douglas County, Nevada, and Alpine and Mono Counties, California, 1981-94

By Karen A. Mello

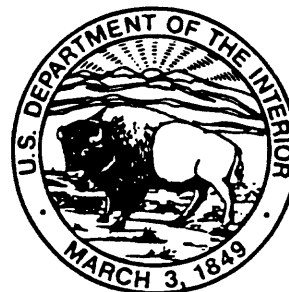
U.S. GEOLOGICAL SURVEY

Open-File Report 96-464

Prepared in cooperation with
DOUGLAS COUNTY COMMUNITY DEVELOPMENT DEPARTMENT



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Carson City, Nevada
1996

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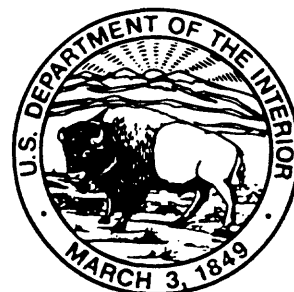
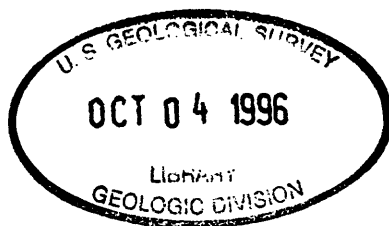
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Carson City, Nevada
1996

U.S. DEPARTMENT OF THE INTERIOR
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United States Department of the Interior

U.S. GEOLOGICAL SURVEY

WATER RESOURCES DIVISION

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PLEASE DO NOT RELEASE
BEFORE: September 15, 1996

FOR FURTHER INFORMATION
CONTACT: Karen A. Mello
Phone: (702) 887-7600, ext. 7672

WATER DATA AVAILABLE FOR DOUGLAS COUNTY

Data on surface water, ground water, and water quality in the Carson Valley and Topaz Lake areas of Douglas County, Nevada, have been published by the U.S. Geological Survey, Department of the Interior. The report is part of a study by the Geological Survey, made in cooperation with the Douglas County Community Development Department.

The report contains records of surface-water flow at 15 gaging stations and 10 miscellaneous sites, water-quality data for 6 surface-water sites and 168 wells, precipitation data at 3 sites, and water levels for 196 wells. Most of the information is contained on 3.5-inch diskettes in the report.

The 54-page report, titled "Hydrologic Data for Carson and Antelope Valleys, Douglas County, Nevada, and Alpine and Mono Counties, California, 1981-94," by Karen A. Mello, is U.S. Geological Survey Open-File Report 96-464. It is available for inspection in Minden at the Douglas County Community Development Department (1594 Esmeralda Ave.) and the Douglas County Public Library (1625 Library Lane), and in Carson City at the U.S. Geological Survey (333 W. Nye Lane). The report also may be inspected at the U.S. Geological Survey libraries in Menlo Park, Calif., Denver, Colo., and Reston, Va., and at the Geological Survey Earth Science Information Centers in Menlo Park, Calif., and Salt Lake City, Utah.

Paper copies can be purchased at cost (plus \$3.50 handling charge) from the U.S. Geological Survey, Branch of Information Services, Box 25286, Denver, CO 80225 (phone number is (303) 236-7476). Request must specify report number OFR 96-464 and include a check or money order payable to "U.S. Department of the Interior—Geological Survey."

* * * USGS * * *

DISKETTES

[In pocket at back of report]

High-density, double-sided, soft-sectored, 3-1/2-inch diskettes containing:

Table 6. Precipitation records for selected stations in Douglas County, Nev., operated by Natural Resource Conservation Service and National Oceanic and Atmospheric Administration

Table 7. Monthly streamflow statistics for selected gaging stations, Douglas County, Nev., and Alpine County, Calif.

Table 8. Streamflow data for selected miscellaneous sites, Douglas County, Nev., and Alpine County, Calif.

Table 9. Water-quality constituents and properties for selected surface-water sites, Douglas County, Nev., and Alpine and Mono Counties, Calif.

Table 10. Ground-water levels and well information for selected sites, Douglas County, Nev.

Table 11. Water-quality properties, nutrients, and major ions for selected wells, Douglas County, Nev.

Table 12. Trace elements and dissolved organic carbon for water from selected wells, Douglas County, Nev.

Table 13. Isotopes, volatile organic compounds, pesticides, radionuclides, and organic carbon for water from selected wells, Douglas County, Nev.

CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATIONS

Multiply	By	To obtain
acre	0.4047	square hectometer
acre-ft	0.001233	cubic hectometer
acre-foot per year (acre-ft/yr)	1,233	cubic meter per year
cubic foot per second (ft ³ /s)	0.02832	cubic meter per second
foot (ft)	0.3048	meter
inch (in.)	25.4	millimeter
mile (mi)	1.609	kilometer
square mile (mi ²)	2.590	square kilometer

Temperature: Degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) by using the formula °F = [1.8(°C)]+32.

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929, formerly called "Sea-Level Datum of 1929"), which is derived from a general adjustment of the first-order leveling networks of the United States and Canada.

Water-quality and related units used in this report:

mm	micrometer
mg/L	microgram per liter
mS/cm	microsiemens per centimeter at 25 degrees Celsius
mg/kg	milligram per kilogram
mg/L	milligram per liter
mL	milliliter
pCi/L	picocurie per liter

Hydrologic Data for Antelope and Carson Valleys, Douglas County, Nevada, and Alpine and Mono Counties, California, 1981-94

By Karen A. Mello

ABSTRACT

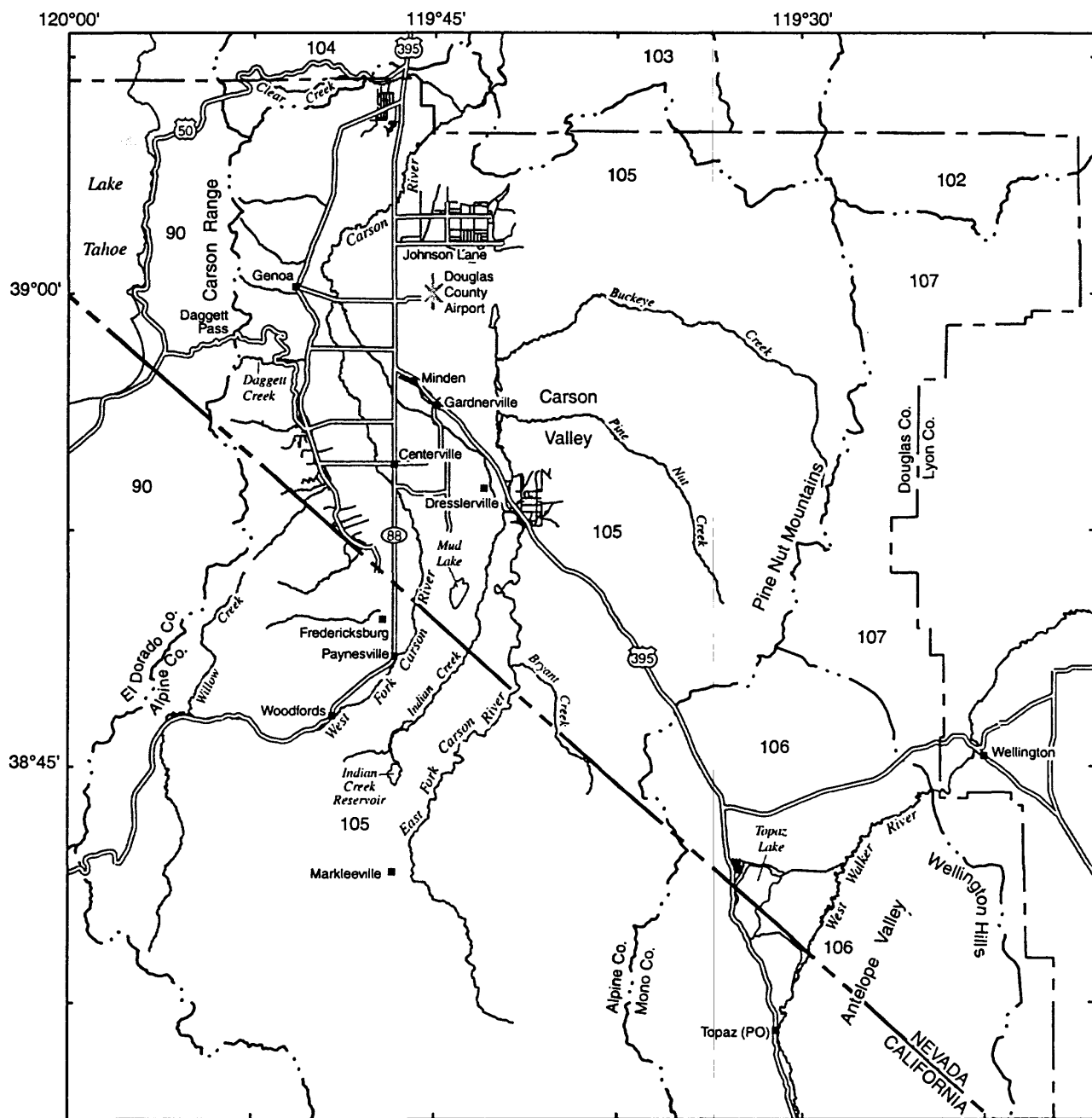
As land use in Douglas County changes from predominantly agricultural to urban and suburban, the availability and quality of water resources could be affected. The U.S. Geological Survey has been operating data-collection networks in Douglas County for more than 15 years to document ground-water levels, surface-water flow, and water-quality constituents. Heretofore, a comprehensive compilation of water-resource information did not exist. This report summarizes data on precipitation, surface-water flow, ground-water levels, water-quality constituents, and ground-water pumpage. Specifically, this report contains records of surface-water flow at 15 gaging stations and of miscellaneous measurements of surface-water flow at 10 sites, water-quality data for 6 surface-water sites and 168 wells and springs, precipitation data at 3 sites, and water levels for 196 wells. Most of the data are presented in American Standard Code for Information Interchange (ASCII) formatted tables on 3.5-inch diskettes. This compilation can assist Douglas County planners and managers, as well as the public, in determining trends or changes in ground-water levels, surface-water flow, and water chemistry and in delineating areas affected by development.

INTRODUCTION

Douglas County (fig. 1) is one of the fastest growing counties in the United States. Between 1980 and 1990, the county population increased 42 percent, from 19,421 to 27,637 (U.S. Bureau of the Census, 1983, p. 82; 1992). In July 1994, the population was estimated at 34,620 (Dean Judson, Nevada State Demographer, written commun., 1994), which is an increase of about 25 percent from 1990. The main population centers are Stateline at Lake Tahoe and the Minden-Gardnerville area in Carson Valley. Since 1980, an estimated 3,000 acres of agricultural land has been taken out of production for development purposes (Andrew Burnham, Vasey Engineering, oral commun., 1995). As land use in Douglas County changes from predominantly agricultural to urban and suburban, the availability and quality of water resources could be affected.

Water-resource information is needed by planners and managers to minimize and mitigate potential effects of land-use changes on water resources. The U.S. Geological Survey (USGS) has been operating data-collection networks in cooperation with Douglas County for more than 15 years to document ground-water levels, surface-water flow, and water-quality constituents. Previous USGS studies have shown areas in Douglas County with potential for ground-water-quality degradation (Nowlin, 1976, 1982; Garcia, 1989; Thodal, 1989, 1992a,b, 1995, 1996). In addition, measurements of ground-water levels and estimates of pumpage have been compiled (Berger, 1987, 1990). Ground-water-quality assessment of the Carson River Basin was completed through 1987 by the U.S. Geological Survey National Water-Quality Assessment (NAWQA) Program (Welch and others, 1989). Citations for these and additional USGS studies in the Carson Valley are listed in the "Selected References" section of this report.

Heretofore, a comprehensive summary of water-resource information did not exist. As a result, the U.S. Geological Survey, in cooperation with Douglas County, compiled existing data and augmented the existing data with additional data collection. This compilation can assist Douglas County planners and managers in determining trends or changes in ground-water levels, surface-water flow, and water quality and in delineating areas affected by development.



Base from U.S. Geological Survey digital data
1:100,000, 1979 and 1985; Universal Transverse
Mercator projection, Zone 11.

0 5 MILES
0 5 KILOMETERS



EXPLANATION

— · · — Hydrographic-area boundary—From Rush (1968)

- | | |
|----------------------|---------------------|
| 90 Lake Tahoe Basin | 105 Carson Valley |
| 102 Churchill Valley | 106 Antelope Valley |
| 103 Dayton Valley | 107 Smith Valley |
| 104 Eagle Valley | |

Figure 1. Location of study area, Douglas County, Nev., and Alpine and Mono Counties, Calif.

Purpose and Scope

The purpose of this report is to compile and summarize water-resources data collected in Carson and Antelope Valleys, Nevada and California, from 1981 through 1994. All the listed water wells and most of the surface-water sites are in Carson and Antelope Valleys, Douglas County, Nev.; some surface-water sites that provide information on inflow to Carson and Antelope Valleys are in two California counties. This information can be used by decision makers to manage and protect water resources by determining trends in the hydrologic information collected and by delineating areas affected by development. This report contains data on surface-water flow, ground-water levels, and water quality collected by the USGS in cooperation with Douglas County. In addition, pumpage data compiled by the USGS and Nevada Department of Water Resources and precipitation data collected by the Natural Resource Conservation Service (NRCS) and National Oceanic and Atmospheric Administration (NOAA) are presented. Specifically, this report contains records of flow at 15 gaging stations and of miscellaneous surface-water flow measurements at 10 sites, water-quality data for 6 surface-water sites and 168 wells and springs, precipitation data at 3 sites, and water levels for 196 wells. Most data are presented in ASCII formatted tables on 3.5-inch diskettes. The interpretation of the causes and effects of trends shown by the data is beyond the scope of this report.

Location and General Features of Study Area

The study area includes the Carson Valley hydrographic area¹ in Douglas County, Nev., and Alpine County, Calif. (420 mi²), and the Antelope Valley hydrographic area in Douglas County, Nev., and Mono County, Calif. (250 mi²), as shown in figure 1. The Carson Range on the west and the Pine Nut Mountains and Wellington Hills on the east border the study area. Two major rivers flow northward through the study area: the Carson River flows through Carson Valley and the West Walker River flows through Antelope Valley. Topaz Lake, which straddles the Nevada-California State line, is a water-storage reservoir created by diverting water from the West Walker River.

Unconsolidated basin-fill deposits in Carson and Antelope Valleys are the principal ground-water aquifers in Douglas County (Glancy, 1971; Maurer, 1986). These aquifers are the principal source of domestic and public water supplies for the rapidly growing population in these valleys, and are supplemental sources of irrigation supplies.

Numbering Systems for Hydrologic Data

The numbering systems used by the USGS to assign identification numbers for surface-water stations and for ground-water well sites differ, but all are based on geographic location.

Downstream Order System

An eight-digit number is used to identify each stream-gaging station. For example, station number 10311000 consists of a two-digit part number (10) followed by a six-digit downstream-order number (311000). The part number refers to a drainage area or group of areas that is generally regional in extent. Records in this report are for sites in Part 10 (the Great Basin). The downstream-order number is assigned according to the hydrographic location of the station in the drainage network; larger number stations are downstream from smaller number stations.

¹Formal hydrographic areas in Nevada were delineated systematically by the U.S. Geological Survey and Nevada Division of Water Resources in the late 1960's (Rush, 1968; Cardinalli and others, 1968) for scientific and administrative purposes. The official hydrographic-area names, numbers, and geographic boundaries continue to be used in Geological Survey scientific reports and Division of Water Resources administrative activities.

Standard Identification System

The standard site identification for wells and springs is based on the grid system of latitude and longitude. The number consists of 15 digits. The first six digits denote degrees, minutes, and seconds of latitude; the next seven digits denote degrees, minutes, and seconds of longitude; and the last two digits (assigned sequentially) identify the wells or other sites within a 1-second grid. For example, site 390619119471601 refers to 39°06'19" latitude and 119°47'16" longitude, and is the first site recorded in that 1-second grid. If a more precise latitude and longitude are later determined, the initially assigned number is nonetheless retained as the permanent identifier and the latitude and longitude are corrected.

Local Identification System

A local site designation is used in Nevada to identify a site by hydrographic area (Rush, 1968) and by the official rectangular subdivision of the public lands referenced to the Mount Diablo base line and meridian. Each site designation consists of four units: The first unit is the hydrographic area number. The second unit is the township, preceded by an N or S to indicate location north or south of the base line. The third unit is the range, preceded by an E to indicate location east of the meridian. The fourth unit consists of the section number and letters designating the quarter section, quarter-quarter section, and so on (A, B, C, and D indicate the northeast, northwest, southwest, and southeast quarters, respectively), followed by a number indicating the sequence in which the site was recorded. For example, site 105 N14 E20 34DBDB1 is in Carson Valley (hydrographic area 105). It is the first site recorded in the northwest quarter of the southeast quarter of the northwest quarter of the southeast quarter of section 34, Township 14 North, Range 20 East, Mount Diablo baseline and meridian.

Map Numbers

All sites have been given sequential map numbers (see pl. 1). These numbers were assigned in a generally north-to-south and west-to-east sequence.

Acknowledgments

The help of the following agencies and individuals is greatly appreciated. The Nevada Division of Water Resources provided pumpage data used in this report. The Douglas County Public Works Department provided house-meter counts. The Natural Resource Conservation Service and National Oceanic and Atmospheric Administration provided precipitation data collected in Douglas County. Sierra Pacific Resources provided agricultural kilowatt usage. Numerous residents of Douglas County permitted access to their wells for water-level measurements and water-quality sampling.

DATA COLLECTION METHODS

For flowing wells, measurements were made 10 minutes after flow had been shut off, with a standard pressure gauge that had been calibrated in units of inches of water. The gauge readings were then converted to feet above land surface. Minus signs preceding these measurements indicate water levels that were above land surface.

Samples for laboratory analysis were collected as follows. Water for major- and trace-constituent analyses was filtered through a 0.45- μ m membrane filter and collected in polyethylene bottles. Samples for cation and trace-constituent analyses were acidified to a pH of less than 3.0 with pure nitric acid (Wood, 1981, p. 7-9). Samples for nutrient analyses were collected in opaque polyethylene bottles, preserved with mercuric chloride, and kept at 4°C until the analysis were made (U.S. Geological Survey, 1990, p. 3-3). Dissolved-organic-carbon samples were filtered through a stainless-steel filter using a 0.45- μ m silver membrane filter and collected in a glass bottle that had been baked at 350°C. These samples were kept at 4°C from the time of collection to analysis.

(Wershaw and others, 1987, p. 7-8). Tritium samples were unfiltered water collected in glass bottles. The radon sample was collected in a liquid-scintillation vial containing mineral oil. Deuterium and oxygen-18 samples were unfiltered water collected in glass bottles. All samples were analyzed using standard methods (U.S. Geological Survey, 1990, p. 5-5 to 5-22) at the USGS laboratory in Arvada, Colo.

DESCRIPTION OF DATA

Surface-water-flow, water-level, and water-quality data for this report were extracted from the National Water-Information System data base maintained by the USGS. This report includes previously published data for Douglas County collected during water years 1981-89, and data from the current cooperative program for water years 1990-94¹. Data for this area that were collected for other USGS projects are not included, but are available upon request.

Primary and secondary drinking-water standards established by the U.S. Environmental Protection Agency, adopted and enforceable by the State of Nevada for public water supplies, and the sources and significance of water-quality constituents and properties presented in this report are listed in table 2.

Precipitation

Precipitation data for the Upper and Lower Pinenut sites (table 6 and pl. 1) were collected monthly at rain gages operated by Douglas County, and compiled by the NRCS. Precipitation data for the Daggett Pass site (table 6 and pl. 1), in the Lake Tahoe Basin just west of the Carson Valley drainage divide, are from a station operated by NOAA. Some values for monthly totals at the three sites are missing. Missing data are due to vandalism and leaking precipitation collectors, or access problems.

In Nevada, January 1980 to October 1986 had normal to above-normal precipitation. From October 1986 to September 1994, only the 1993 water year had above-normal precipitation. Below-normal precipitation results in surface-water supplies that are insufficient for the needs of agricultural water users. Users that normally rely on surface water for most of their supply have to rely on ground-water withdrawals to help augment the shortfall during dry years.

Surface-Water Flow

The location of surface-water gaging stations is shown on plate 1. A gaging station is a site on a stream, canal, lake, or reservoir, or at the orifice of a spring, where systematic measurements of hydrologic data are made. The station name, brief description of the station location, and period of record of gaging-station measurements presented for this study are given in table 1.

Data for the sites described in table 1 are presented in table 7 and provide an account of surface-water inflow to and outflow from Carson Valley. For water years 1981-94, annual mean flows at the East Fork Carson River near Gardnerville station ranged from 129 to 857 ft³/s; at the West Fork Carson River at Woodfords station, from 39.2 to 244 ft³/s; and at the Carson River at Carson City station, from 74.2 to 1,142 ft³/s. Additionally, quarterly measurements at miscellaneous streamflow sites² are presented in table 8 and locations of sites are shown on plate 1. The station name, brief description of station location, and period of record for miscellaneous flow sites measured for this study are given in table 1. Monitoring runoff is important for determining the quantity of surface water passing through Carson Valley and the potential for recharge to ground water. Such data are important in

¹A water year is the 12-month period from October 1 through September 30. The water year is designated by the calendar year in which it ends.

²A miscellaneous streamflow site is a location other than a gaging station where random streamflow measurements are made to give better areal coverage for defining conditions in the river basin.

documenting trends in changing streamflow caused by changes in climate (natural) or by changes in land use. In addition, a determination of flood-runoff magnitude and flood frequency associated with rapid snowmelt and summer thunderstorms can be assisted by such a network.

Surface-Water Quality

Water-quality data for surface-water sites are presented in table 9 and locations of the sites are shown on plate 1. Samples were measured for temperature, pH, and specific conductance in the field and analyzed at the USGS laboratory in Arvada, Colo. These data can be used to determine effects of surface-water/ground-water interactions on water quality, effects of land-use changes on stream-water quality, and trends in stream-water quality. Concentrations of constituents are generally higher at lower flows than at higher flows.

Ground-Water Levels

Ground-water monitoring includes weekly, seasonal, and annual water-level measurements. In 1994, wells in the northern part of the county were measured weekly during the irrigation season. The weekly network was modified during 1989-94, with wells being added and discontinued as irrigation use changed. Wells were added in the northwest part of Carson Valley; wells were discontinued in the central part. Wells were monitored weekly to document decreases in artesian flows and water-table declines that occurred in response to withdrawals from nearby wells. Wells measured seasonally and annually are in, or near, areas of irrigation and domestic use and also are in, or near, areas where water use is changing from irrigation to domestic or public supply.

Water-level data from these wells can be used to determine seasonal and long-term fluctuations resulting from changes in land use. To help detect long-term water-level changes, static water-level measurements were made annually at sites where large withdrawals were made. Temporal changes in ground-water levels are shown in figure 2. Most water levels shown in the graphs have declined since 1988. Net declines were more common on the east side of the valley; whereas annual water-level fluctuations were greater on the west side. Water-level measurements and general information on wells monitored in Douglas County since 1981 are presented in table 10. Well locations are shown on plate 1.

Ground-Water Quality

Ground-water samples in Douglas County for which drinking-water standards were exceeded are listed in table 3. Ground-water samples were collected using the existing pump at each monitoring well, or from the natural discharge of flowing (artesian) wells. Samples were commonly measured for temperature, pH, specific conductance, and alkalinity, in the field. Locations of ground-water-quality sampling sites are shown on plate 1. Chemical data are summarized in tables 11, 12, and 13. Table 11 includes properties, nutrients and major ions; table 12, trace constituents; and table 13, volatile organic compounds and pesticides. Graphs showing temporal changes in concentrations of dissolved solids and nitrite+nitrate are shown in figure 3.

Water was sampled quarterly at 18 wells for 2 years; thereafter, wells in those areas with observed changes were sampled quarterly (5 sites) and annually (12 sites). The data provide information that can be used to detect trends in water quality as development continues and document the effects of long-term drought and the response to wet years such as 1993.

Five study areas were intensively sampled during the 1990 and 1994 water years (pl. 1). Water was sampled for constituents that could indicate contamination from septic tanks. These samples were primarily from privately owned wells. Sample collection from this network was rotated throughout the county, so that areas were resampled at selected intervals. Sampling was intended to detect potential ground-water contamination from septic tanks and to help determine the extent of potential ground-water contamination in selected suburban and urban areas.

Boxplots, like those in figure 4, are used to display summary statistics showing the distribution of reported determinations for selected constituents and properties (Tukey, 1977). Statistical components are represented visually by features known as boxes and whiskers. The box defines the spread of the middle 50 percent of the data (observations that lie between the 25th and 75th percentiles—that is, within the interquartile range). The median value (the 50th percentile) is shown by a horizontal line within the box. The whiskers extend from the box to the last observation within one step (defined as 1.5 times the interquartile range) beyond either end of the box. The whiskers incorporate observations known as "adjacent values." Beyond the whiskers are "outside values"—observations between one and two steps (1.5 and 3 times the interquartile range) from the box in either direction. If present, these values are plotted individually as an X. Outside values occur fewer than once in 100 times for data from a normal distribution. Observations farther than two steps beyond the box, if present, are distinguished by plotting them as a small circle (these are known as "far-out values"). Such values occur fewer than once in 300,000 times for a normal distribution. The occurrence of outside or far-out values more frequently than expected gives a visual indication that the data may not originate from a normal distribution (Helsel and Hirsch, 1992, p. 25-26).

Ground-Water Pumpage

Total pumpage estimated by the USGS from 1981 to 1987 (table 4) was estimated using data collected from several subdivisions, public works departments, and industries in Carson Valley. Data on agricultural kilowatt usage was acquired from Sierra Pacific Resources, and ground-water pumpage was estimated therefrom using methods established by Maurer (1986, p. 61). Domestic pumpage was determined by multiplying house-meter counts by a conversion factor of 0.545 acre-ft/yr per domestic unit (Berger, 1987, p. 5). The house-meter counts were provided by the Douglas County Public Works Department. Meter readings of industrial pumpage were collected and then converted from gallons per month to acre-feet per year.

Total pumpage from 1988 to 1994 (table 4) was estimated by the Nevada Division of Water Resources. In addition to the water-use categories used by the USGS to estimate pumpage, the State subdivided agricultural use into two categories—irrigation and stock water. They also included a new category called "other use," which includes recreation, wildlife, environmental remediation, fire protection, and mining and milling in addition to the industrial category reported by Maurer (1986) and Berger (1987, 1990). Changes in annual average ground-water pumpage are shown in figure 5. Total pumpage was affected by annual runoff conditions. In dry years, agricultural pumpage increased to supplement low surface-water supplies. Pumpage during 1982-84 was less than in 1981 because these years were abnormally wet. Pumpage increased after 1984, in part because of below-normal precipitation and below-average runoff.

SPECIFICATIONS OF DATA ON DISKETTES

The original field data files and processed output files for the study were developed on a Prime computer, transferred to a microcomputer, and are contained on 3.5-inch diskettes at the back of this report. Files on the diskettes are the same as the original Prime computer files and are in American Standard Code for Information Interchange (ASCII) format. Table 5 shows the contents of the diskettes, sizes of the files, and descriptions of the data.

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(NOTE: **Bold type** emphasizes the references that are a result of USGS studies in Douglas County.)

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Summary Data

This section contains figures 2-5 and tables 1-5. Figure 2 shows temporal changes in water-level altitudes in Douglas County, Nev. Figure 3 shows temporal changes for selected ground-water sites in Douglas County, Nev. Figure 4 shows temporal changes in selected chemical constituents in Douglas County, Nev. Figure 5 shows estimated ground-water pumpage in Carson Valley, Nev.

Table 1 is a listing of selected surface-water stations for which data were collected. Table 2 is a listing of background information on constituents and properties of water. Table 3 is a listing of ground-water sampling sites for Douglas County, Nev., where drinking-water standards were exceeded. Table 4 is an inventory of estimated ground-water pumpage for Carson Valley, Nev. Table 5 is a listing of the size and description of data files on the enclosed diskettes.



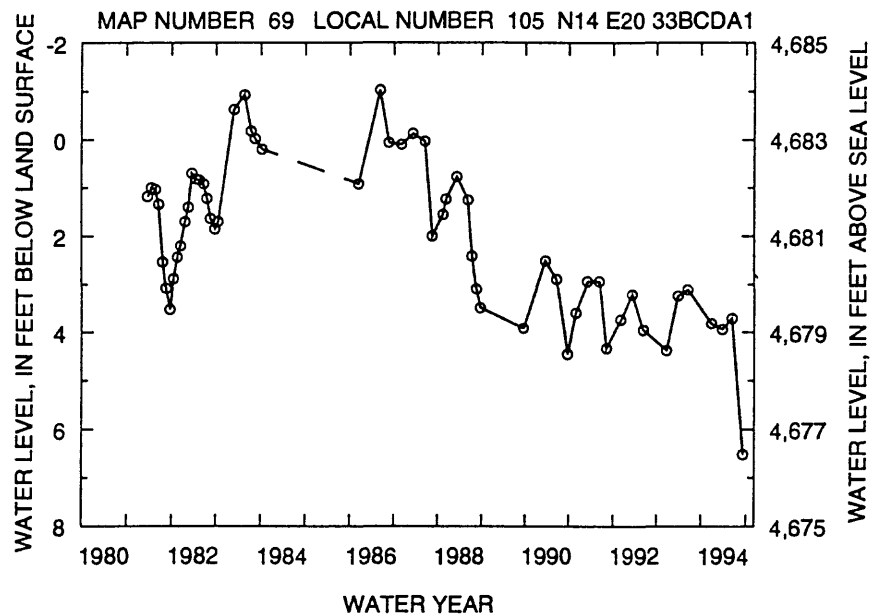
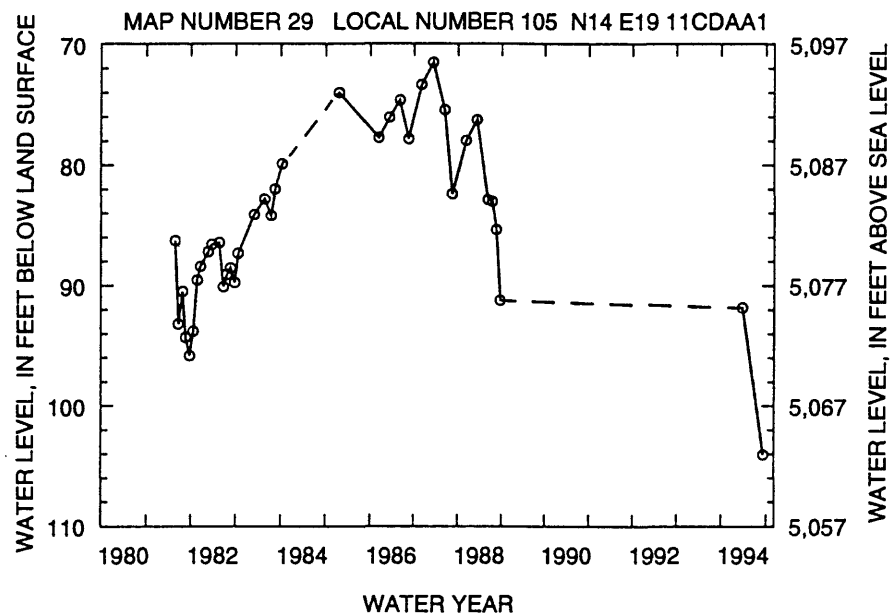


Figure 2. Temporal changes in water-level altitudes for selected ground-water sites in Douglas County, Nev. Dashed lines indicate data were not collected for more than a year.

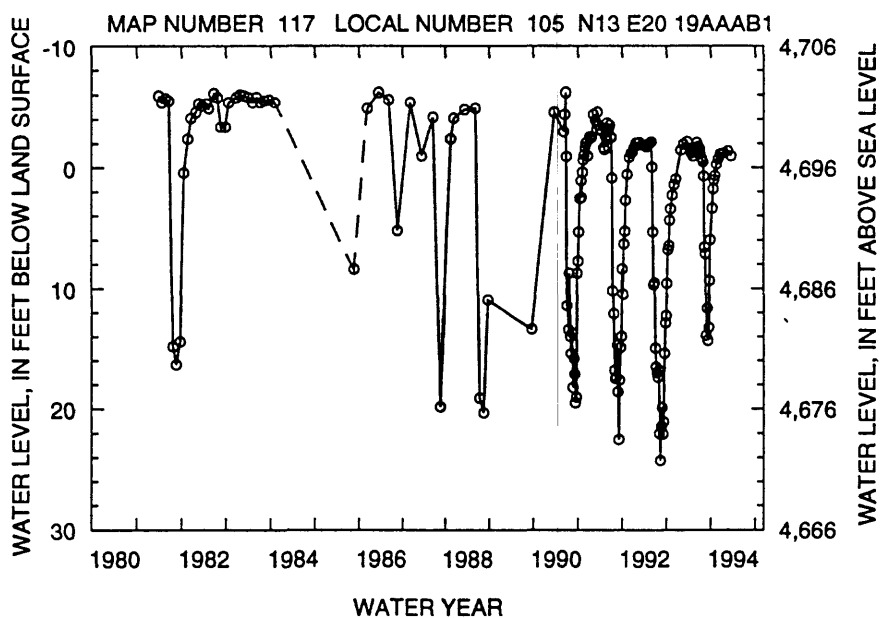
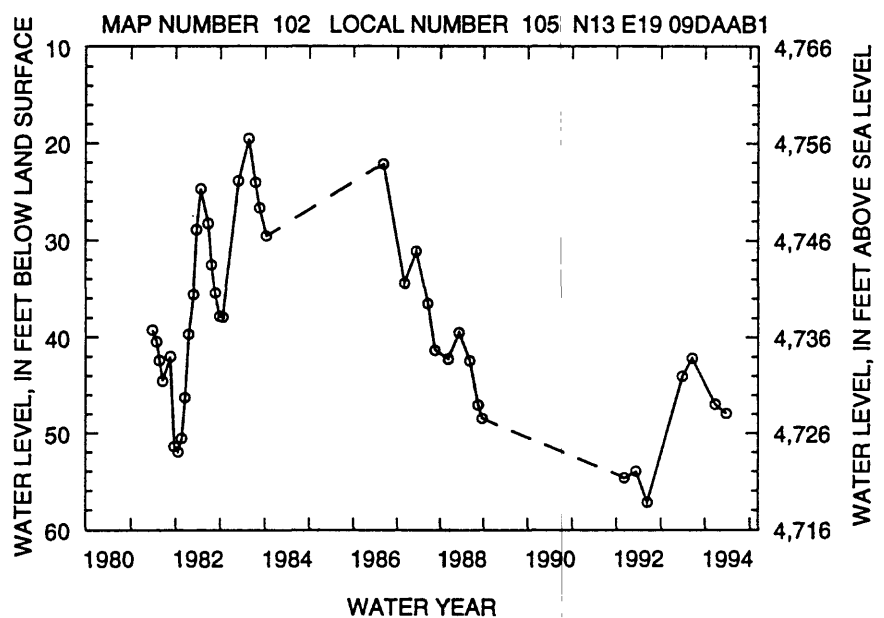


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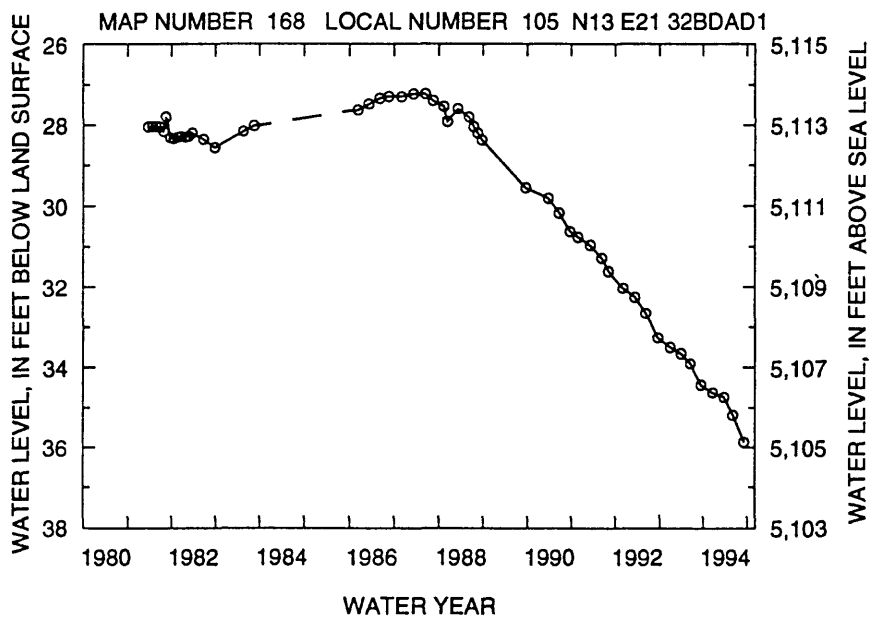
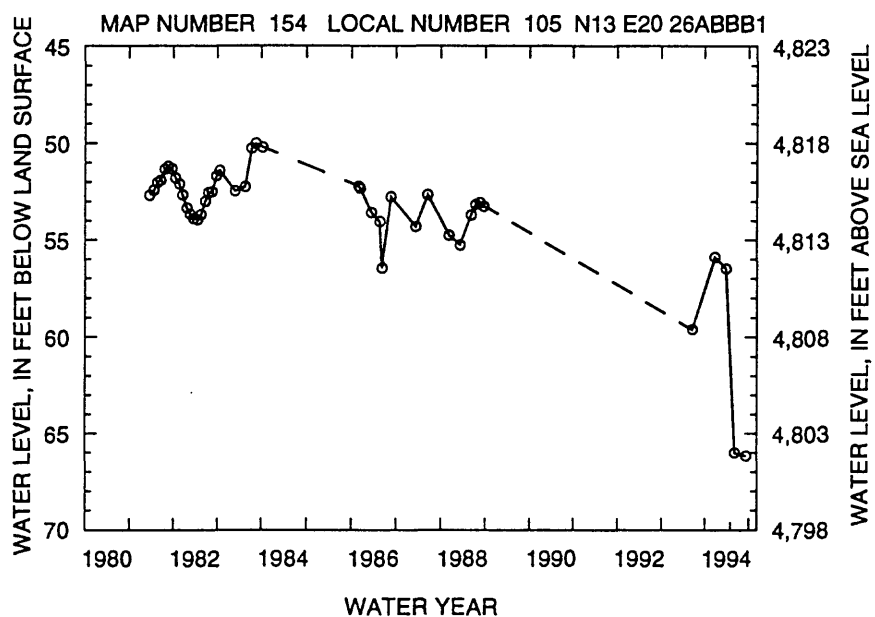


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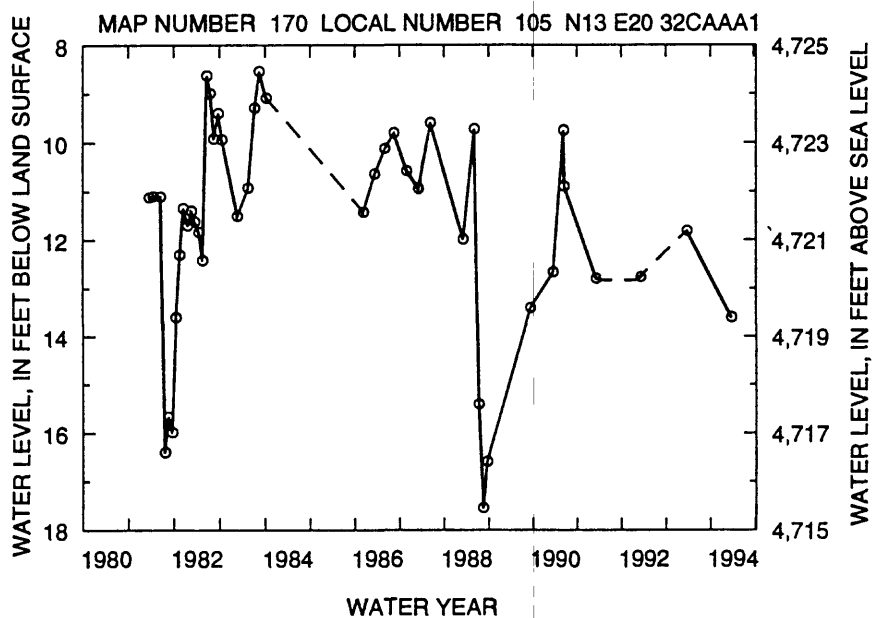
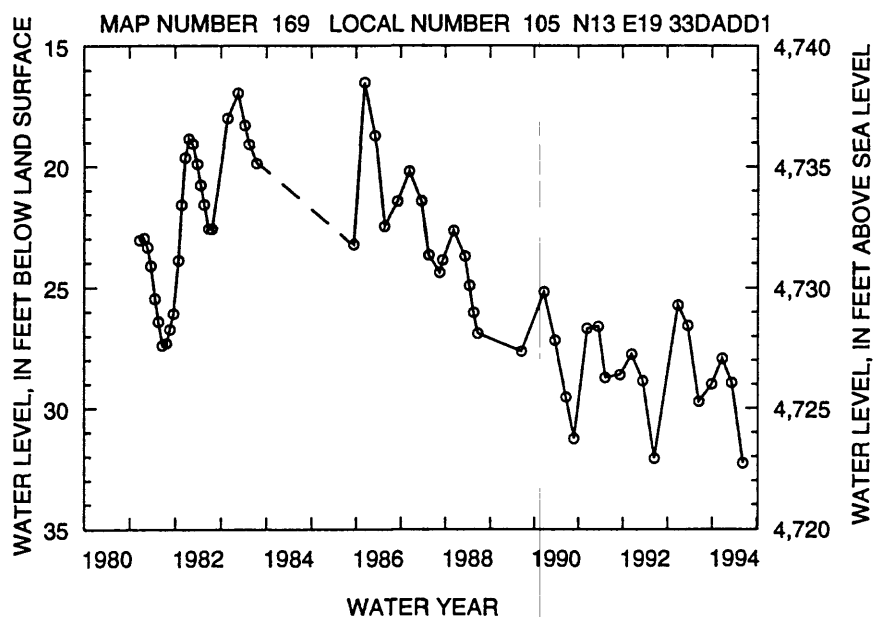


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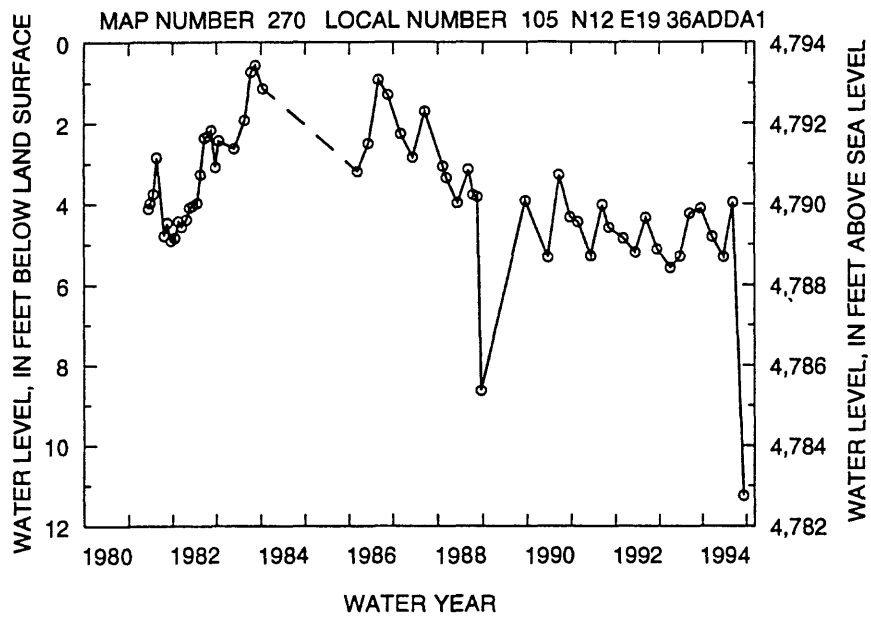
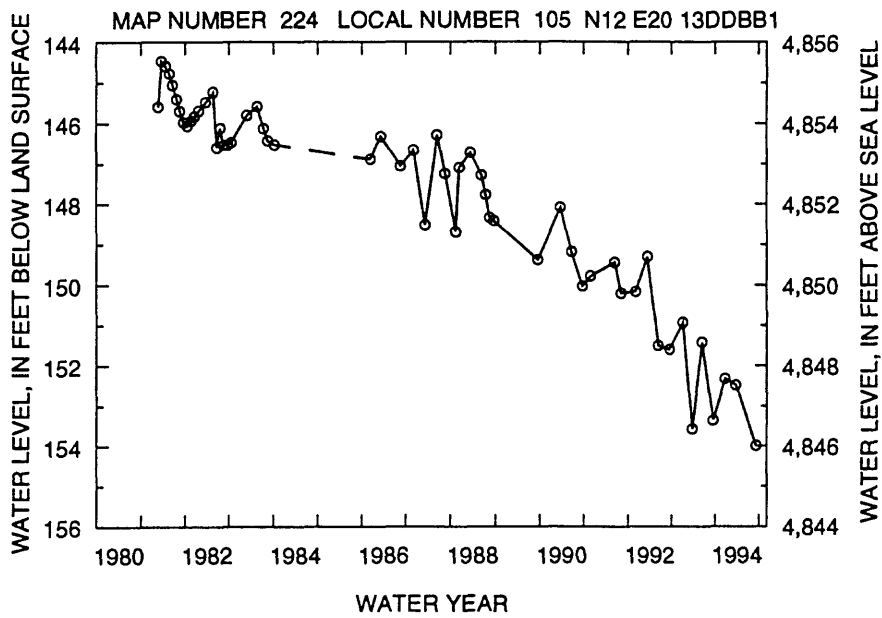


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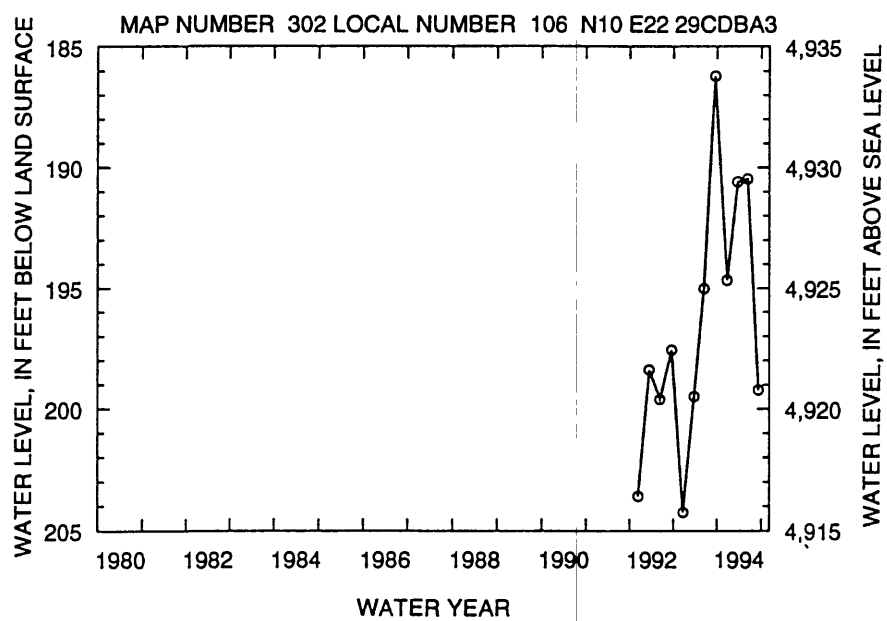


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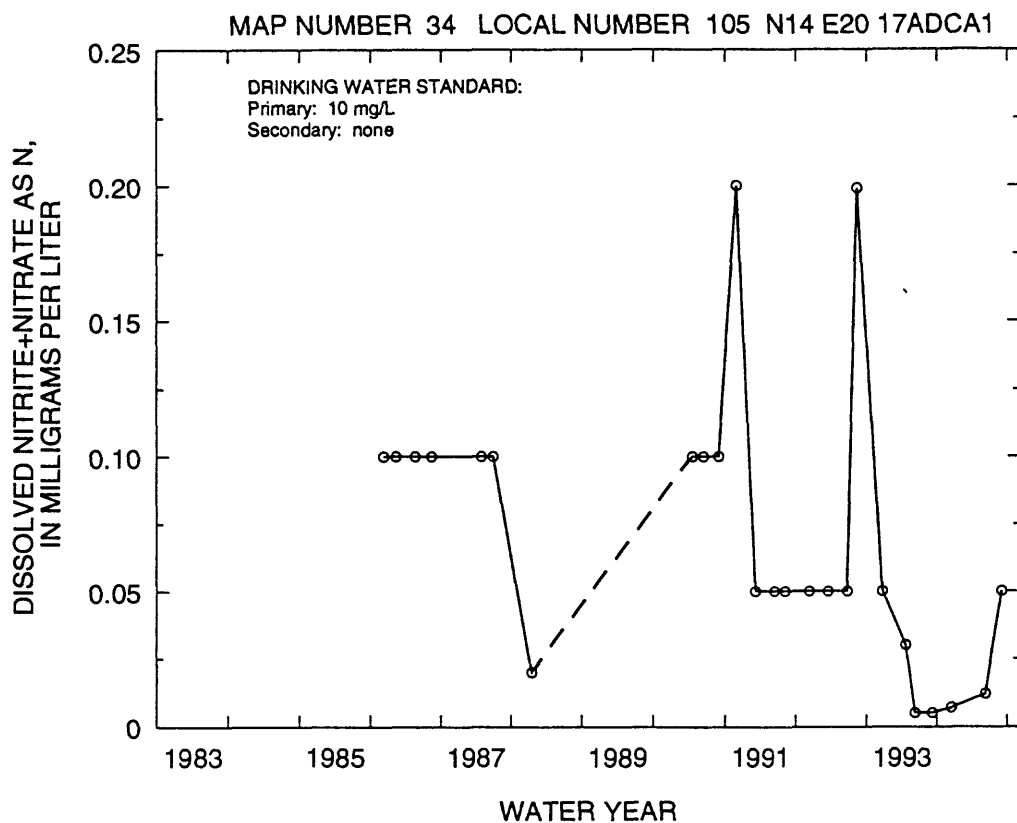
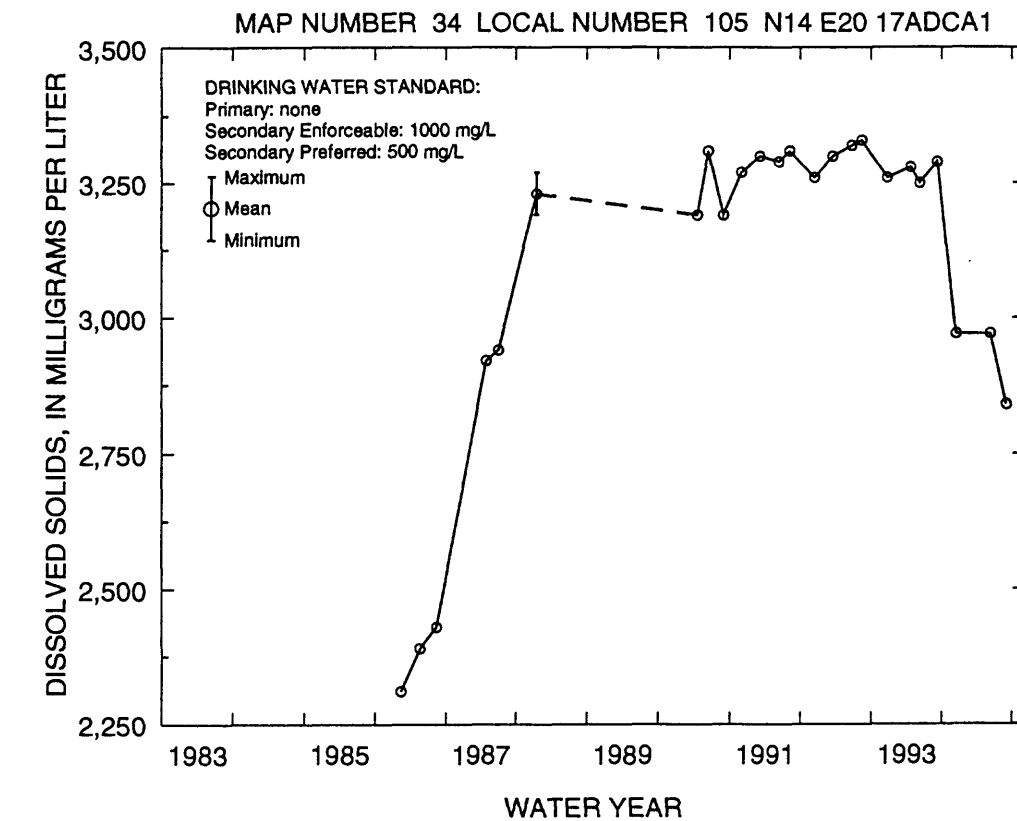


Figure 3. Temporal changes for selected ground-water sites in Douglas County, Nev. Dashed lines indicate data were not collected for more than a year. Abbreviation: N, nitrogen.

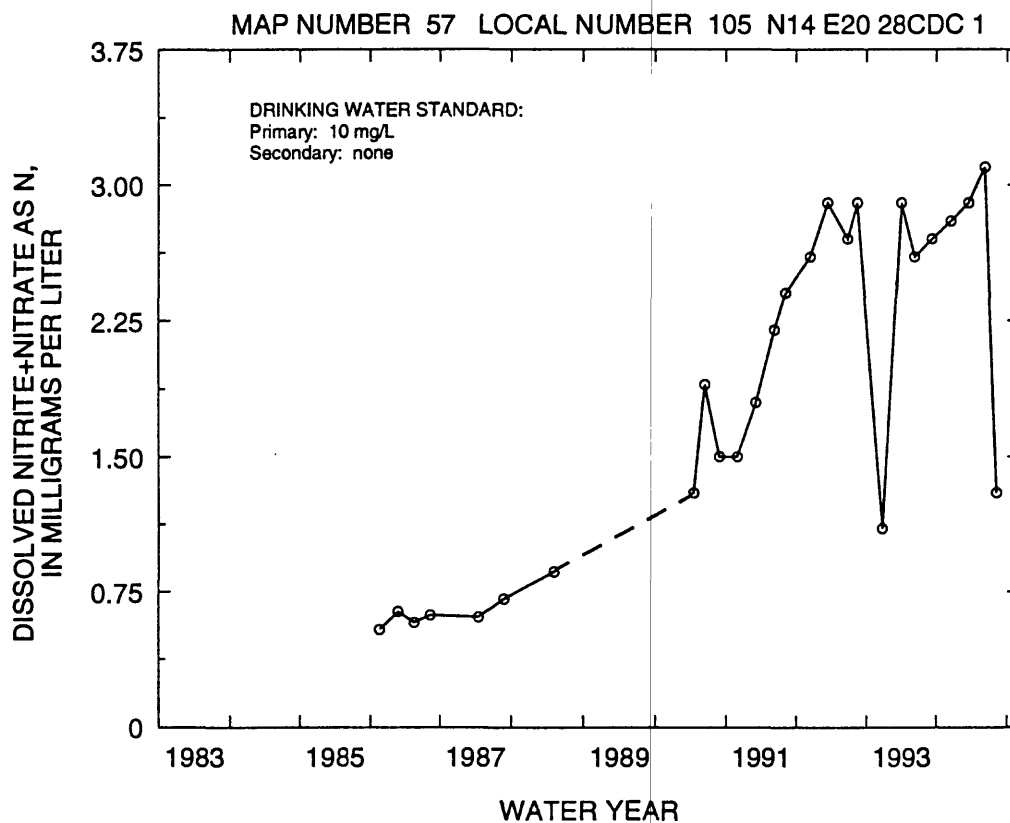
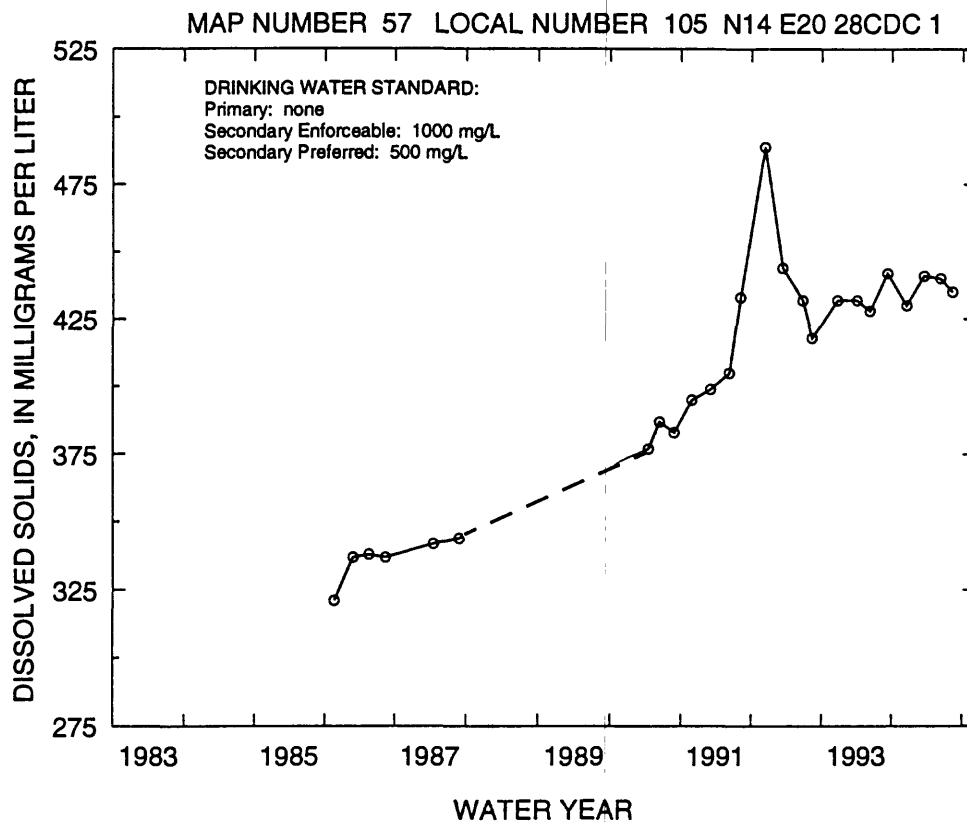


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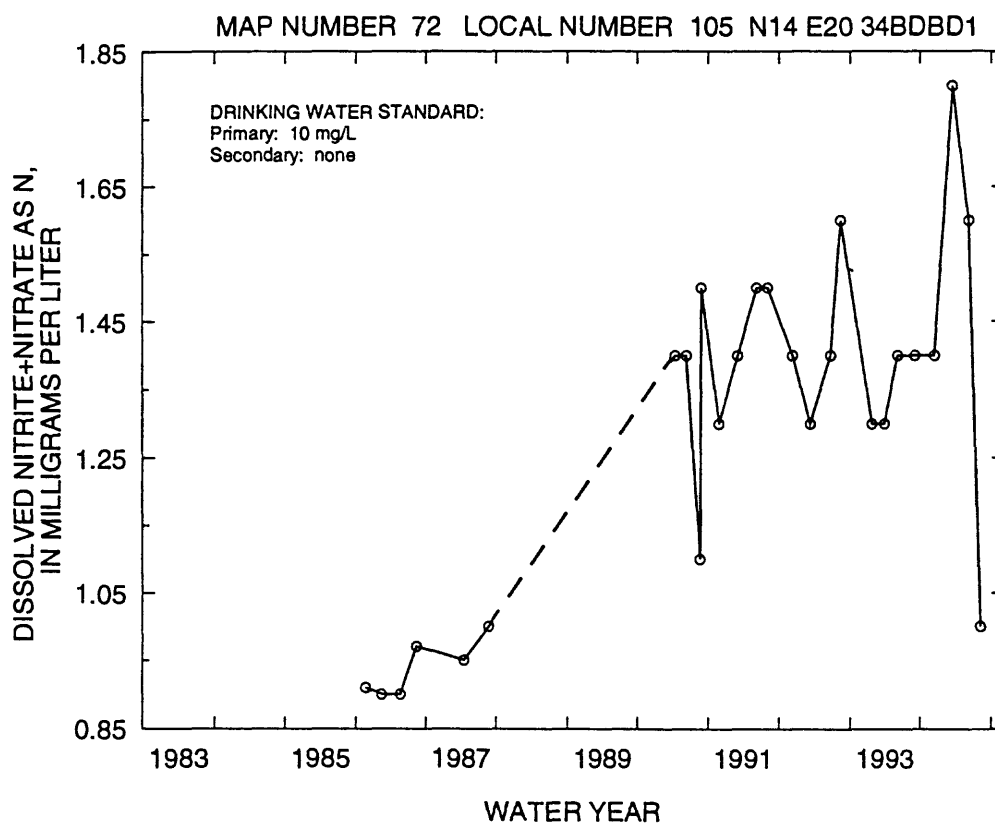
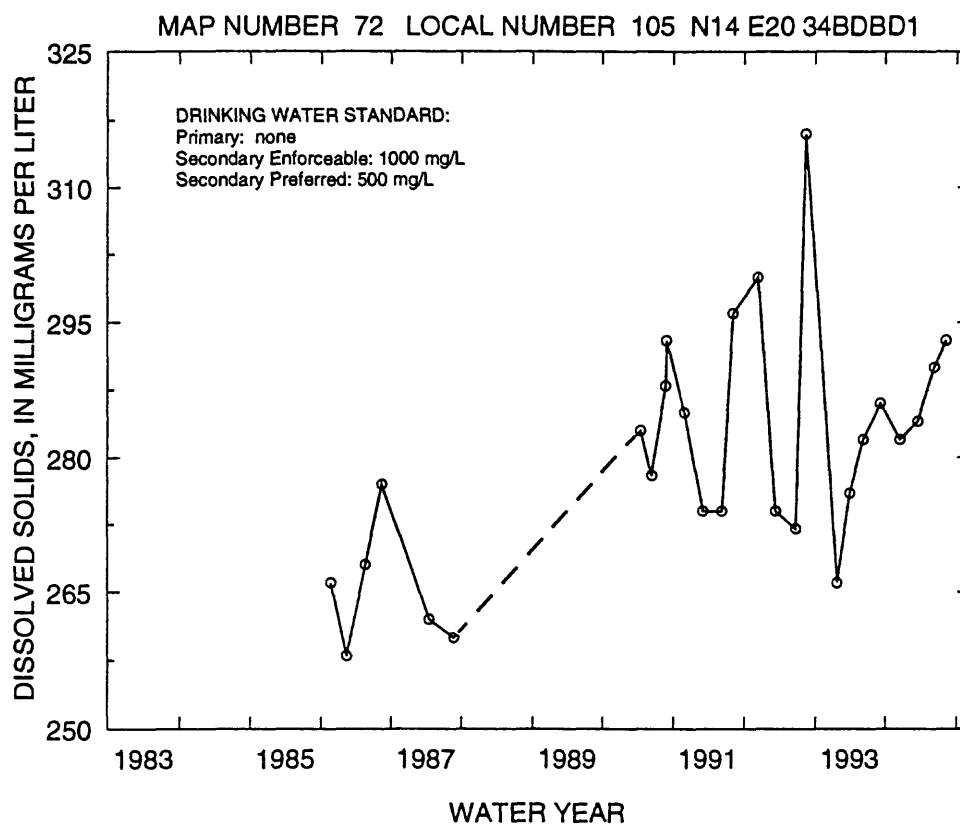


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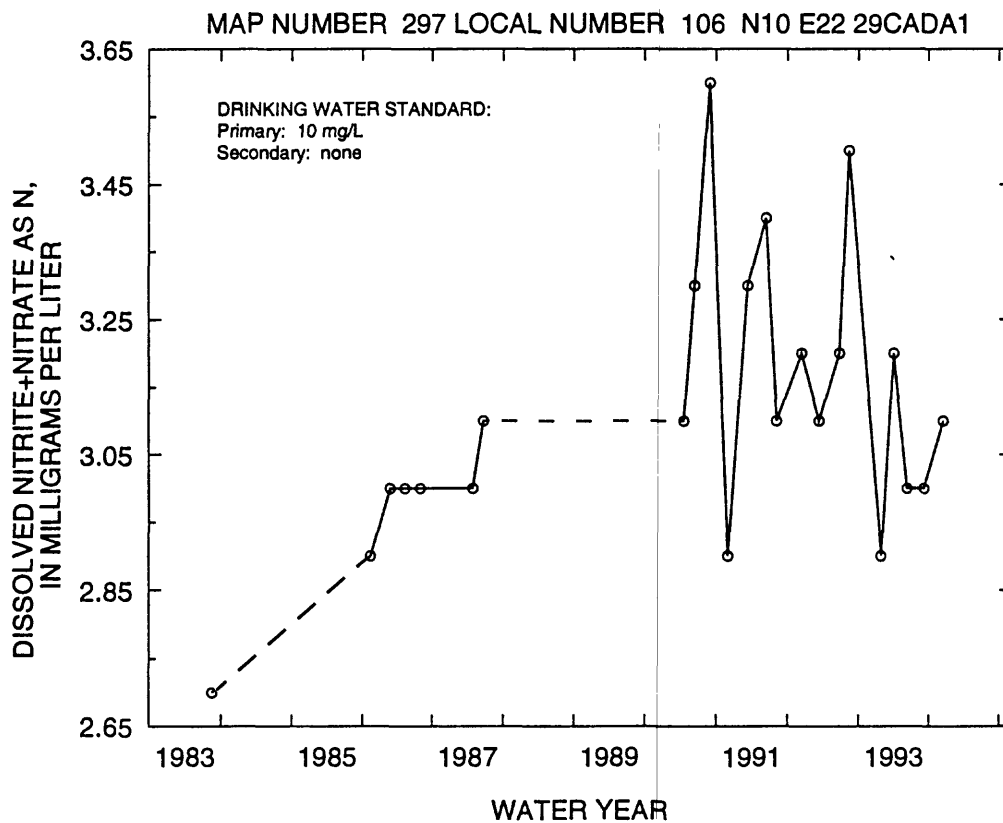
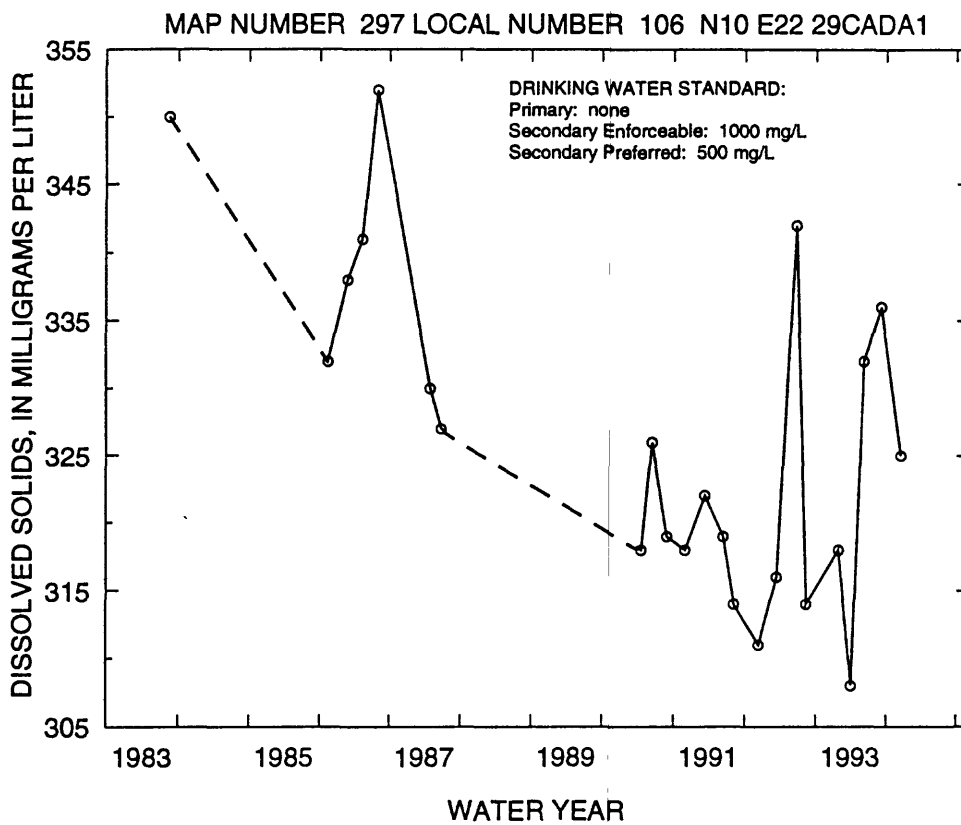


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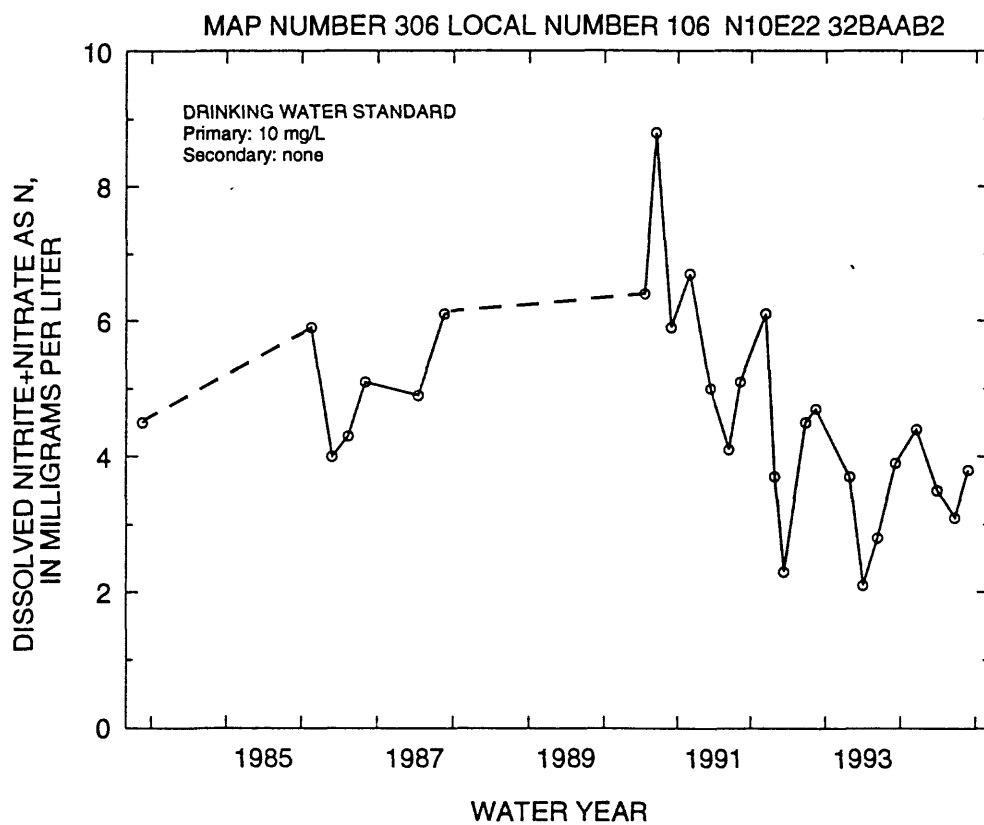
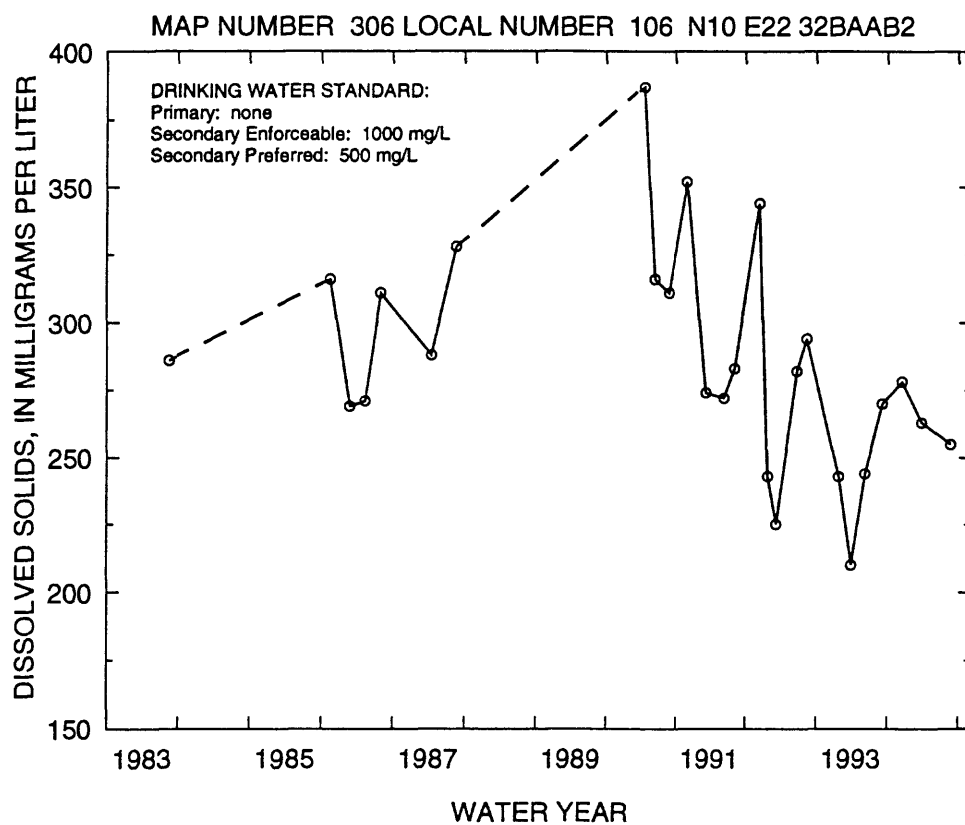
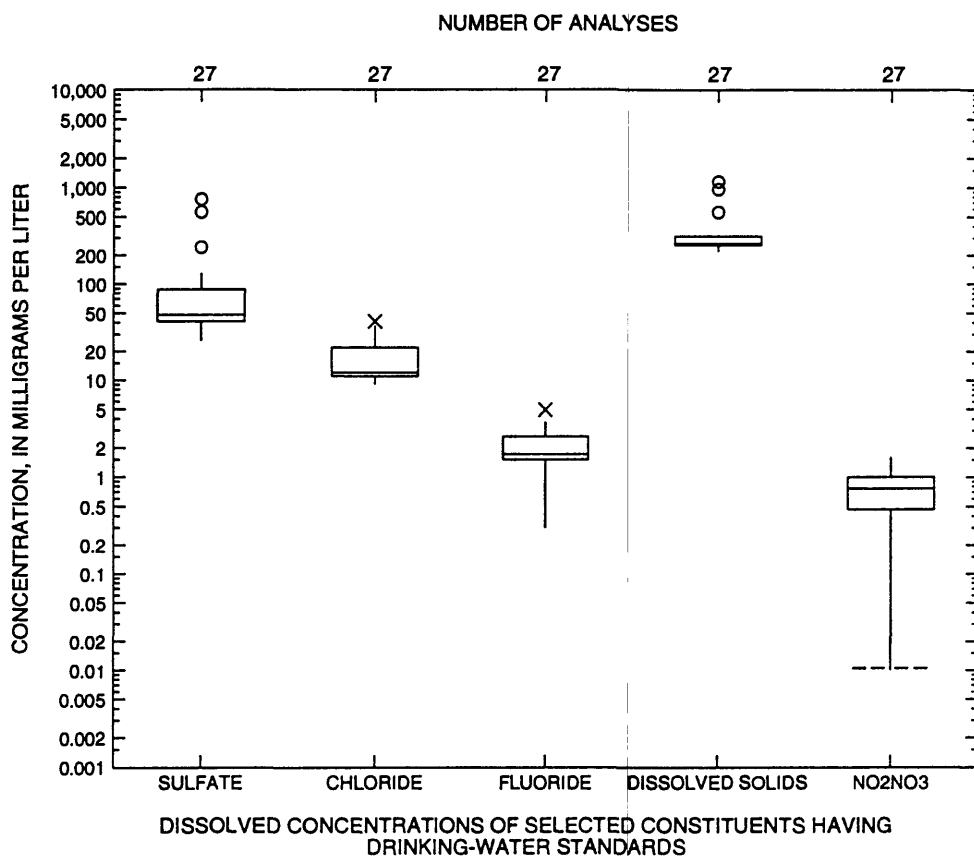


Figure 3. Continued.

A. 1990 JOHNSON LANE STUDY AREA



EXPLANATION

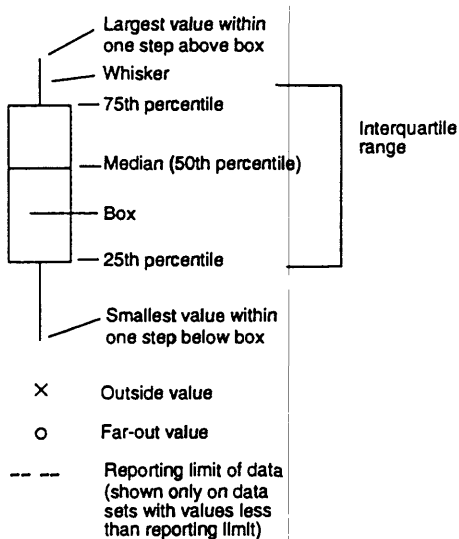
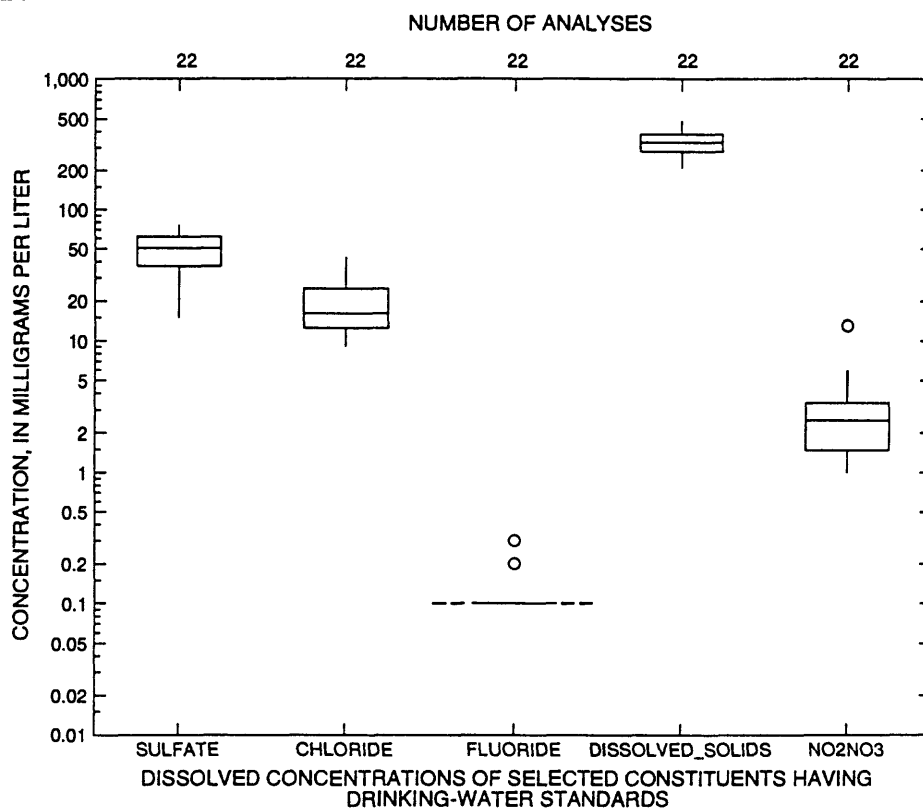


Figure 4. Temporal changes in concentrations of selected chemical constituents in ground water where intensive sampling occurred in Douglas County, Nev. The study areas are (A) Johnson Lane, (B) Ruhenstroth, (C) Jacks Valley-Indian Hills, (D) Foothill, and (E) Topaz Lake. Drinking-water standards are given in table 2. Abbreviation: NO₂NO₃, nitrite plus nitrate, as nitrogen.

B. 1991 RUHENSTROTH STUDY AREA



C. 1992 JACKS VALLEY-INDIAN HILLS STUDY AREA

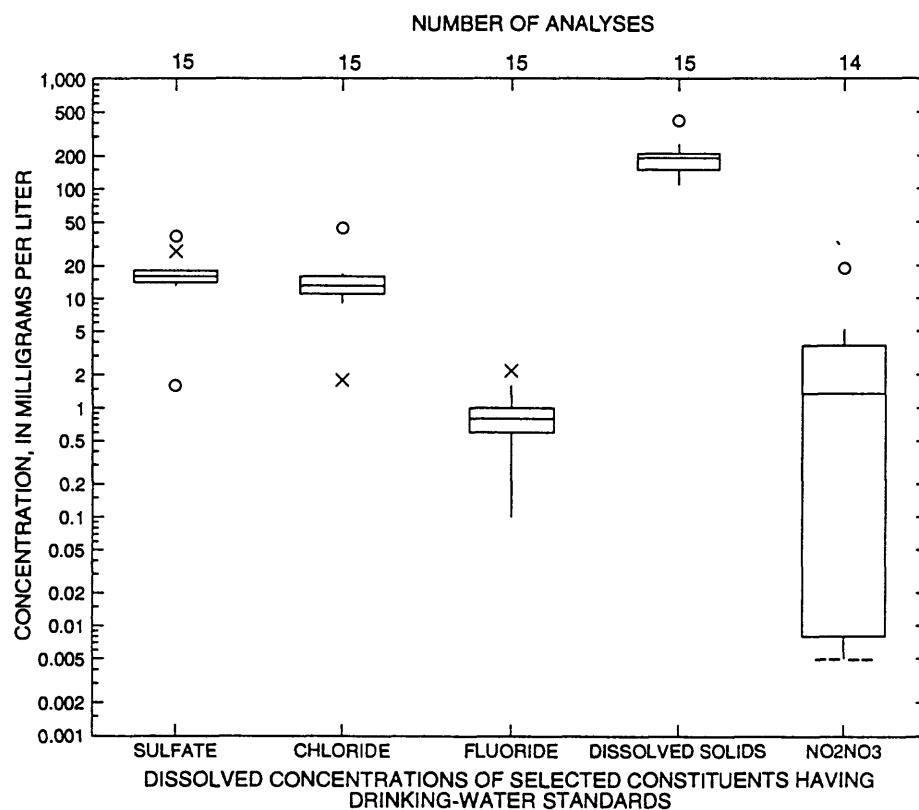
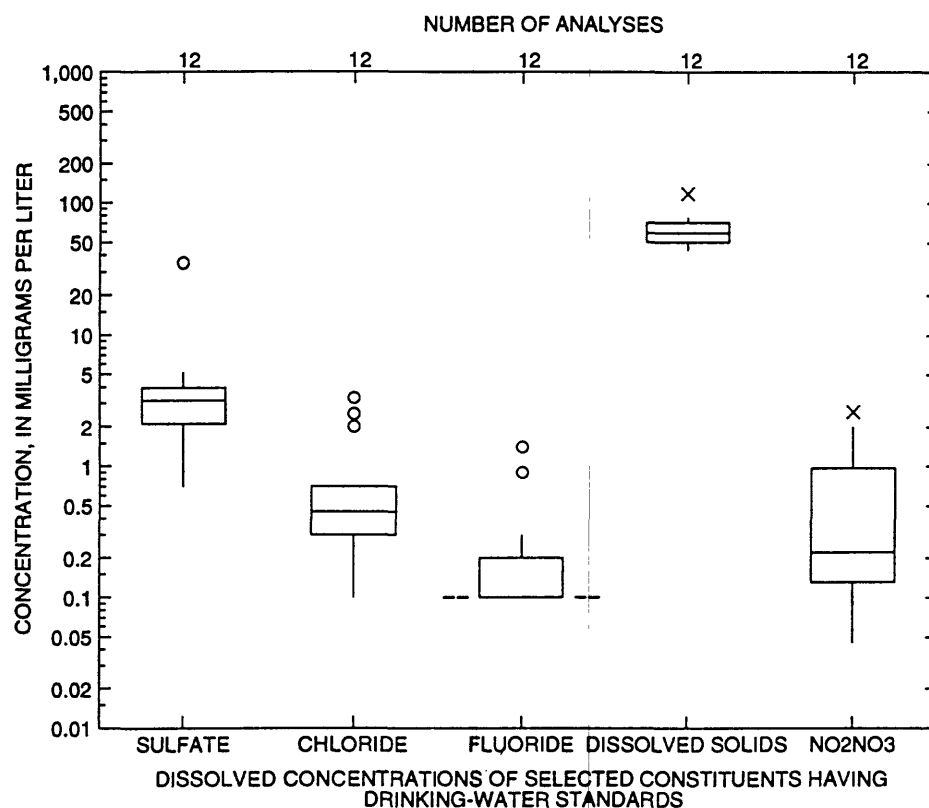


Figure 4. Continued.

D.1993 FOOTHILL STUDY AREA



E.1994 TOPAZ LAKE STUDY AREA

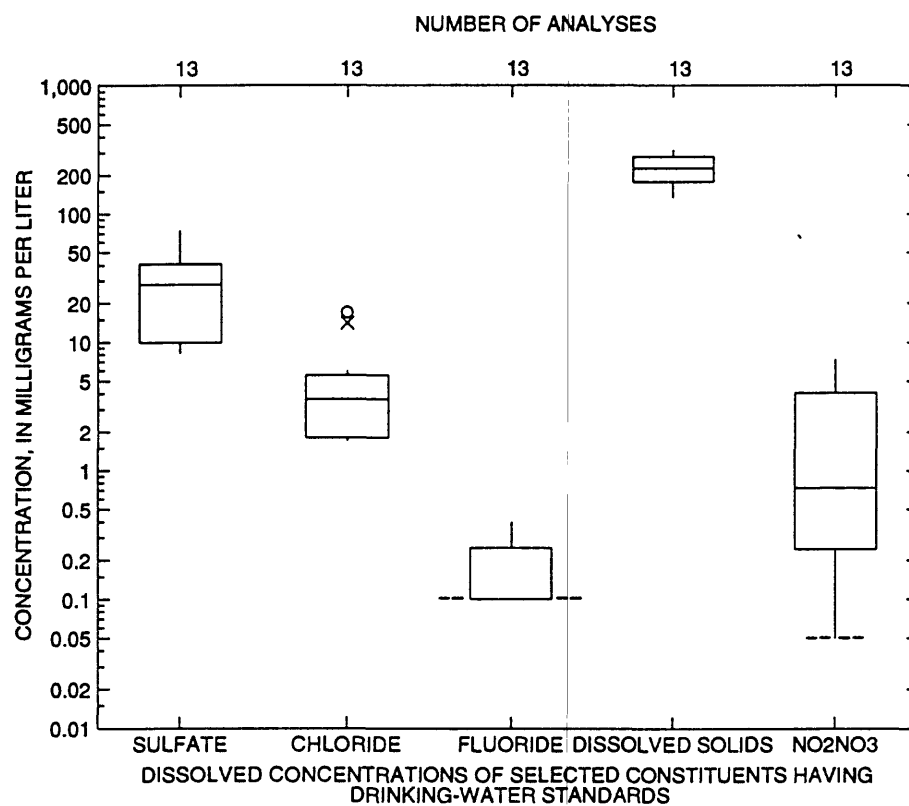


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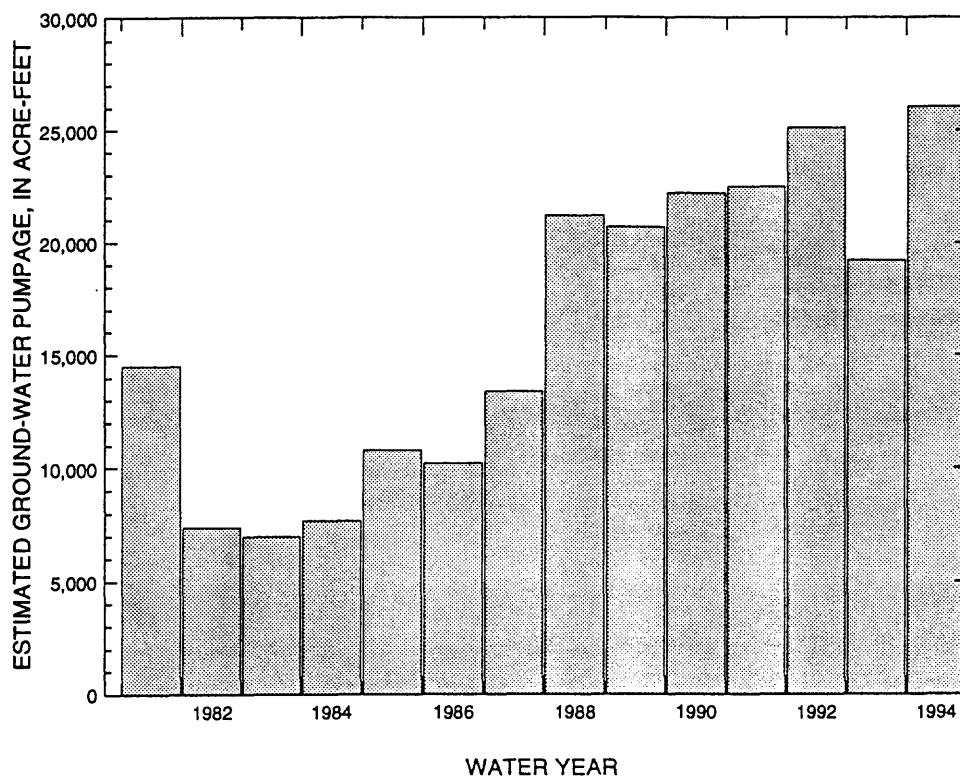


Figure 5. Estimated ground-water pumpage in Carson Valley, Nev., water years 1981-94. Data for water years 1981-83 from Maurer (1986, table 10), for water years 1984-87 from Berger (1990, p. 9), and for water years 1988-94 from Nevada Division of Water Resources (1989-95).

Table 1. Name, number, location, and period of record for selected gaging stations and miscellaneous flow sites from which data were collected

Station number	Station name	Map number (pl. 1)	Location	Period of record (water year)
Gaging stations				
10297500	West Walker River at Hoyer Bridge, near Wellington, NV	289	On left bank, 20 feet upstream from Hoyer Bridge, 2 miles upstream from head of Saroni Canal, and 4 miles southwest of Wellington.	1910, 1920-23, 1924-25, 1926-32, 1958-94
10308200	East Fork Carson River below Markleeville Creek, near Markleeville, CA	291	On right bank, 0.5 mile downstream from Markleeville Creek, and 1.5 miles northeast of Markleeville.	1960-94
10308800	Bryant Creek near Gardnerville, NV	284	On right bank, 500 feet upstream from Doud Springs, 1.7 miles upstream from mouth, and 11 miles southeast of Gardnerville.	1961-69, 1978-80, 1994
10309000	East Fork Carson River near Gardnerville, NV	279	On left bank, 0.1 mile downstream from Horseshoe Bend, 2 miles east of Mud Lake Reservoir, 4.5 miles downstream from Bryant Creek, and 7 miles southeast of Gardnerville.	1890-94, 1901-07, 1908-11, 1917-18, 1925-28, 1929, 1936-38, 1939-94
10309025	Indian Creek near Woodfords, CA	315	On right bank, 2 miles south of Woodfords.	1987-91
10309030	Indian Creek at Diamond Valley near Paynesville, CA	314	On left bank, 1 mile southwest of Paynesville.	1987-91
10309050	Pine Nut Creek near Gardnerville, NV	277	On right bank, 11.5 miles southeast of Gardnerville.	1980-94
10309070	Buckeye Creek near Minden, NV	120	On left bank, 10.5 miles east of Minden.	1980-94
10309100	East Fork Carson River at Minden, NV	167	On left bank, 0.25 mile above bridge at State Highway 88, and 1.0 mile south of Minden.	1974-84, 1994
10310000	West Fork Carson River at Woodfords, CA	286	On left bank, 0.3 mile downstream from bridge on State Highway 88, 0.6 mile southwest of Woodfords, and 3.8 miles downstream from Willow Creek.	1901-07, 1910-11, 1938-94
10310300	Fredericksburg Canyon Creek near Fredericksburg, CA	281	On left bank, 1 mile west of Fredericksburg, and 6 miles north of Woodfords.	1972-73, 1976-77, 1981-83, 1988-94
10310350	Miller Spring near Sheridan, NV	262	On left bank, 1.25 miles south of Sheridan, 3 miles southwest of Centerville, and 6 miles southwest of Minden.	1982-83, 1989-94
10310400	Daggett Creek near Genoa, NV	153	On left bank in Haines Canyon, 0.55 mile upstream from Foothill Road, and 3.5 miles southwest of Genoa.	1964, 1965, 1966-83, 1989-94
10310500	Clear Creek near Carson City, NV	1	On left bank, 3 miles upstream from mouth, and 3.5 miles southwest of Carson City.	1948-62, 1963-88, 1989-94
10311000	Carson River near Carson City, NV	2	On left bank, 2 miles downstream from Clear Creek, 3 mile upstream from Lloyds Bridge on road to Mexican Dam, and 5 miles southeast of Carson City Post Office.	1939-94

Table 1. Name, number, location, and period of record for selected gaging stations and miscellaneous flow sites from which data were collected

Station number	Station name	Map number (pl. 1)	Location	Period of record (water year)
Miscellaneous flow sites				
10310330	Luther Creek near Fredericksburg, CA	271	0.6 mile upstream from Foothill Road and 2.4 miles northwest of Fredricksburg.	1976-77, 1981-83, 1989-94
--	Benson Spring	319	3.5 mile northwest of Fredricksburg.	1981-83
10310360	Jobs Canyon Creek near Minden, Nev	238	1.2 mile upstream from Foothill Road and 3.6 miles southwest of Centerville.	1976, 1981-83, 1989-94
--	Barber Creek	318	0.6 mile upstream from confluence of Sheridan Creek and 3.6 miles southwest of Centerville.	1981-83
10310370	Sheridan Creek near Minden, Nev.	220	1.3 miles upstream from Foothill Road and 3.8 miles west of Centerville.	1981-83, 1989-94
--	Stutler Canyon Creek	317	0.7 mile upstream from Foothill Road and 3.5 miles west of Centerville.	1981-83
38550311 9504501	Monument Creek	316	0.6 mile upstream from Foothill Road and 3.7 miles northwest of Centerville.	1981-82
10310385	Mott Canyon Creek near Minden, Nev.	185	0.8 mile upstream from Foothill Road, and 5.5 miles southwest of Minden.	1969, 1972, 1976-77, 1981-82, 1987-94
10310410	Genoa Canyon Creek at Genoa, Nev.	109	0.3 mile upstream from Foothill Road and 0.5 mile southwest of Genoa.	1969, 1971-73, 1976-77, 1981-83, 1987-94
10310415	Sierra Canyon Creek near Genoa, Nev.	99	0.5 mile upstream from Foothill Road and 0.9 mile north of Genoa.	1969, 1972, 1976-77, 1981-83, 1989-94

Table 2. Background information on constituents and properties of water

[Modified from Nowlin (1982, table 2) and Garcia and Jacoboni (1991, table 1). Abbreviations: °C, degrees Celsius; µg/L, micrograms per liter; mg/kg, milligrams per kilogram; mg/L, milligrams per liter; mL, milliliter; NBCHPS, Nevada Bureau of Consumer Health Protection Services (1980); pCi/L, picocuries per liter; USEPA, U.S. Environmental Protection Agency; --, no data available.]

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Specific conductance	Capability of water to conduct electric current at specified temperature of 25°C. Presence of charged ionic species dissolved in water makes solution conductive, whereas pure liquid water (without dissolved ions) has low electrical conductance. As ion concentrations increase, conductance of solution increases; therefore, specific conductance is indication of ion concentrations (Hem, 1985, p. 66).	Generally less than 1,000 microsiemens per centimeter at 25°C for potable water (Hem, 1985, p. 67).	No enforceable standard.	Provides field estimate of ion concentration and quality control for associated laboratory analysis.
pH	A measure of acidity (pH value less than 7.0) or alkalinity (pH greater than 7.0) of water, which is based on effective concentration (also called "activity") of dissolved hydrogen ions. Primary source of hydrogen ions in most natural groundwater systems is from reaction of water with carbon dioxide that is produced by soil microorganisms; this reaction forms dissolved bicarbonate and hydrogen ions (Hem, 1985, p. 61-63).	The pH of pure water at 25°C is 7.00 (which is termed a neutral pH). Typical ground-water values range from about 6.0 to about 8.5 (Hem, 1985, p. 63-64).	Secondary standard: range of acceptable pH is from 6.5 to 8.5 (NBCHPS).	Toxicity of certain compounds (such as hydrogen cyanide or ammonia), solubility of metal compounds, and corrosiveness of water are affected by pH (USEPA, 1976, p. 178-179). The pH is also a controlling factor in geochemical equilibrium.
Turbidity	Semiquantitative measure of light scattering due to suspended inorganic and organic particles, precipitates, colloids, and phytoplankton. May be derived from soil erosion, algal blooms, industrial wastes, sewage, or chemical reactions such as oxidation of dissolved iron.	--	Secondary standard: 1 to 5 standard turbidity units, depending upon population served by water-supply system (NBCHPS).	Esthetically objectionable in drinking water.

Table 2. Background information on constituents and properties of water—Continued.

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Fecal coliform bacteria	Bacteria that are present in intestine or feces of warm-blooded animals. Are widely used as indicators of sanitary quality of water. Technically defined for laboratory purposes as all organisms that produce blue colonies within 24 hours when incubated at 44.5°C ± 0.2°C on M-FC medium (nutrient medium for bacterial growth). Fecal-coliform abundance expressed as number of colonies per 100 mL of sample (Britton and Greeson, 1989, p. 37).	Not expected in potable ground water; however, some species of <i>E. coli</i> bacteria have been found to survive and multiply on organic matter introduced to ground water through artificially recharged lake water. (Canter and Knox, 1985, p. 72).	Primary drinking water standards: (1) one colony per 100 mL of sample as the arithmetic mean of all samples examined per compliance period; (2) 4 colonies per 100 mL when less than 20 samples are examined per month; (3) 4 colonies per 100 mL in more than 5 percent of the samples when 20 or more are examined per month (NBCHPS).	Some nonfecal coliform organisms can survive and multiply on organic substrates and may produce slimes inside pipes. Fecal-coliform membrane-filter procedure used in this investigation is considered to have 93 percent accuracy in differentiating between coliforms from warm-blooded animals and those of other sources (American Public Health Association and others, 1985, p. 896). Presence of fecal-coliform bacteria in ground water suggests presence of other micro-organisms, some pathogenic; however, such contamination is generally due to ineffective surface seal at individual well, rather than extensive aquifer contamination.
Fecal streptococcal bacteria	Bacteria found in intestine or feces of warm-blooded animals. Their presence in water is considered to verify fecal pollution. Technically defined for laboratory purposes as gram-positive cocci bacteria that produce red or pink colonies within 48 hours at 35°C ± 0.5°C on KF-streptococcus medium (nutrient medium for bacterial growth). Abundance expressed as number of colonies per 100 mL of sample (Britton and Greeson, 1989, p. 47).	Not expected in potable ground water; however, some species of <i>E. coli</i> bacteria have been found to survive and multiply on organic matter introduced to ground water through artificially recharged lake water (Canter and Knox, 1985, p. 72).	No enforceable standard.	Intestines of humans and animals are normal habitat for fecal streptococci; thus, these organisms are indicators of fecal pollution. Limited survival outside normal habitat makes these organisms poor choice for sole indicator of contamination; but combined with fecal coliform data, inferences about pollution source may be made (American Public Health Association and others, 1985, p. 903).

Table 2. Background information on constituents and properties of water—Continued.

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Hardness (as CaCO ₃)	Derived principally from dissolved calcium and magnesium.	Commonly 200 to 300 mg/L in carbonate ground water.	No enforceable standard.	Consumes soap and detergents before lather will form, resulting in soap curds depositing on sinks and bathtubs. Hard water forms scales in pipes, boilers, and water heaters. Water-hardness classification: 0-60 mg/L, soft; 61-120 mg/L, moderately hard; 121-180 mg/L, hard; more than 180 mg/L, very hard. Soft water is corrosive to metal pipes and fixtures.
Calcium (Ca) and magnesium (Mg)	Dissolved from rocks and soils, especially those containing limestone, dolomite, and gypsum.	Calcium: 1 to more than 1,000 mg/L. Magnesium: Normally much less than calcium and usually less than sodium (Hem, 1985, p. 89-100).	Secondary standards for magnesium: 125 mg/L unless alternative supply unavailable, then 150 mg/L (NBCHPS).	Impart hardness and scale-forming properties to water (see hardness). High concentrations unsuitable for laundries, steam plants, textile processing, dyeing, and electroplating. Small amounts desirable to prevent corrosion.
Sodium (Na) and potassium (K)	Dissolved from most rocks and soils. High concentrations may be found in natural brines, industrial waste, and sewage.	Sodium: Generally 1 to 1,000 mg/L. Potassium: Commonly 0.1 to 0.5 times sodium; generally less than 10 mg/L (Hem, 1985, p. 100-105).	No enforceable standard.	Concentrations greater than 50 mg/L may cause foaming in boilers. Combine with chloride to impart salty taste. Sodium may contribute to hypertension and cardiovascular diseases. Sodium may be objectionable in irrigation water at concentrations that depend on type of crop and soil.
Bicarbonate (HCO ₃) and carbonate (CO ₃)	Dissolved from most rocks and soils by carbon dioxide reacting with carbonate minerals such as limestone and dolomite. Carbonate ion can exist at greater-than-trace concentrations only if the pH is about 8.3 or more.	Bicarbonate: Generally less than 200 mg/L in surface water and 500 mg/L in ground water. Carbonate: Generally less than 10 mg/L (Hem, 1985, p. 105-109).	No enforceable standard.	Increases alkalinity and, usually, pH of water. In combination with calcium and magnesium, causes scales in pipes and, upon heating, may release corrosive carbon dioxide.

Table 2. Background information on constituents and properties of water—Continued.

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Sulfate (SO ₄)	Dissolved from rocks and soils containing gypsum and sulfate minerals. Commonly associated with coal deposits, metallic ore deposits, and geothermal areas. May be derived from industrial wastes and atmospheric pollution.	Generally ranges from 1 to 1,000 mg/L (Hem, 1985, p. 116-117).	Secondary standards: 250 mg/L unless alternate supply unavailable, then 500 mg/L (NBCHPS).	Forms boiler scale in combination with calcium. Causes bitter taste when combined in high concentrations with other ions and may have laxative effects when ingested in higher concentrations than an individual is accustomed to. Combines with hydrogen ions in low-pH water to form sulfuric acid.
Chloride (Cl)	Dissolved in differing amounts from all rocks and soils. High concentrations may be derived from marine and desert evaporites and brines. Commonly present in sewage and industrial wastes. May be derived from salts used for control of ice on streets and highways.	Commonly less than 100 mg/L in potable water (Hem, 1985, p. 117-120).	Secondary standards: 250 mg/L unless alternate supply unavailable, then 400 mg/L (NBCHPS).	May contribute to corrosiveness of water. Imparts salty taste in concentrations as low as 100 mg/L. The chloride ion is very stable in ground water and is often used as a tracer of ground-water movement in aquifers.
Fluoride (F)	Dissolved in small amounts from most rocks and soils. Added to many public water supplies to inhibit tooth decay.	Commonly less than 1.0 mg/L in potable natural water (Hem, 1985, p. 120-123).	Primary standard, 4.0 mg/L; secondary standard, 2.0 mg/L (USEPA, 1986b).	Concentrations between 0.6 and 1.7 mg/L may have beneficial effects on the structure and resistance to decay of children's teeth. Concentrations in excess of 6.0 mg/L may cause mottling and disfigurement of teeth (National Academy of Sciences and National Academy of Engineering, 1973, p. 66).
Bromide (Br)	Similar in chemical behavior to chloride, but much less abundant (Hem, 1985, p. 146)	Normal range, 5-150 µg/L in precipitation; geothermal water may have >20 mg/L (Hem, 1985, p. 146).	None.	Gasoline additive, fumigants, fire-retardant agents (Hem, 1985, p. 46).
Silica (SiO ₂)	Dissolved in most natural water in hydrated form [Si(OH) ₄] from rocks and soils containing minerals such as quartz, kaolinite, or potassium feldspar (Hem, 1985, p. 69-73).	Commonly 1 to 30 mg/L with concentrations up to 100 mg/L occurring frequently (Hem, 1985, p. 73).	No enforceable standard.	Silica solubility is controlled by temperature and pH, and changes in these properties may cause precipitation of silicate minerals from solution.

Table 2. Background information on constituents and properties of water—Continued.

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Dissolved solids	Sum of all minerals dissolved in water. Concentrations may be increased by industrial wastes, sewage, or agricultural drainage.	Ground water is generally in the range of 25 to 1,000 mg/L (Hem, 1985, p. 31).	Secondary standards: 500 mg/L unless alternate supply not available, then 1,000 mg/L (NBCHPS).	Specific effects upon water uses depend upon individual constituents present.
Nitrogen (N)	Derived from atmosphere by nitrogen fixation or leached from decaying organic matter, fertilizer, sewage, or industrial, agricultural, and domestic wastes. Nitrogen generally occurs in ground water as nitrate (NO ₃), nitrite (NO ₂), ammonium (NH ₄), ammonia (NH ₃), and organic nitrogen. Cyanide (CN) also may be introduced to ground water through improper waste disposal (Hem, 1985, p. 124-126).	Nitrate, less than 10 mg/L; nitrite, ammonium, ammonia, and organic nitrogen, all less than 1 mg/L (Hem, 1985, p. 124-126).	Primary standard: Nitrate, 10 mg/L as N or 44 mg/L as NO ₃ ; no enforceable standards for other nitrogen species (NBCHPS).	Nitrate concentrations in excess of 10 mg/L (as N) may cause methemoglobinemia (infant cyanosis, or "blue-baby" syndrome). Nitrogen is also an essential nutrient that may promote plant and algal growth in lakes and streams. High concentrations of dissolved nitrogen may indicate contamination from agricultural, domestic, or industrial wastes, or from fertilizer.
Nitrate (NO ₃)	Derived naturally from atmosphere or leached from decaying organic matter. Man-caused contamination reported from fertilizers, sewage and industrial wastes, feedlots, and internal-combustion engines, and combustion of fossil fuels (Hem, 1985, p. 124-125).	Generally 0-10 mg/L.	Primary standard: 10 mg/L as N or 44 mg/L as NO ₃ (NBCHPS).	Nitrogen is essential nutrient to all life, and nitrate is form most readily assimilated by most green plants. Bioassay experiments indicate that nitrate is primary nutrient controlling algal growth in Lake Tahoe (Goldman, 1974, p. 6-7). Concentrations in excess of 10 mg/L as N may cause methemoglobinemia (infant cyanosis or "blue-baby" syndrome). Nitrate may be internally reduced to form nitrite compounds, which are suspected to be carcinogenic (Hem, 1985, p. 125).
Nitrite (NO ₂)	Intermediate nitrogen compound resulting from biological oxidation of ammonium (nitrification) or biological reduction of nitrate (denitrification). Unstable in aerated water; converted rapidly to nitrate (Hem, 1985, p. 124).	Less than 0.1 mg/L.	No enforceable standard.	Generally considered indicator of pollution from sewage or organic waste, or of anaerobic or reducing conditions. In most situations, nitrite rapidly oxidizes to nitrate (Hem, 1985, p. 124).

Table 2. Background information on constituents and properties of water—Continued.

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Ammonium (NH ₄)	Derived naturally by hydrolysis of organic matter (ammonification). Reported as contaminant due to fertilizer application, sewage and industrial waste, and feedlots (Hem, 1985, p. 124).	--	No enforceable standard. National criteria for "protection of aquatic organisms and their uses" have been established for freshwater organisms as function of water temperatures and pH (USEPA, 1986b).	Ammonium cations are strongly adsorbed on mineral surfaces. At pH above 9.2, most ammonium ions are converted to uncharged ammonium hydroxide ion, which is not impeded by adsorption. Ammonium is readily oxidized (nitrification) to nitrite and nitrate (Hem, 1985, p. 126); it thus contributes to nitrogen load.
Organic nitrogen	Derived from decaying organic matter, primarily as amides, amines, amino acids, and proteins.	--	No enforceable standard.	Typically converted by soil bacteria into ammonium, nitrite, and nitrate. Elevated concentrations in ground water may indicate contamination by improper disposal of nitrogenous waste (Hem, 1985, p. 125). Complex molecular structure and electrostatic charge limit transport of organic nitrogen in ground-water systems.
Phosphorus (P), phosphate (PO ₄)	Derived from phosphate minerals (notably apatite) common in many rocks and soils. May be present in sewage from human or animal wastes and from additives to synthetic detergents.	--	No enforceable standard. Criterion for freshwater aquatic life: 0.025 to 0.05 mg/L as P (USEPA, 1986b).	Stimulates growth of nuisance algae in lakes and streams where phosphorus is a limiting nutrient.
Dissolved organic carbon (DOC)	Dissolved in moderate amounts from land-surface organic matter and from fossilized organic matter (kerogen; Thurman, 1985, p. 14-15).	From 0.2 to 15 mg/L; commonly less than 2 mg/L (Thurman, 1985, p. 8-9).	No enforceable standard.	Normal concentrations of dissolved organic carbon play significant role in aqueous geochemistry and can facilitate the movement of charged molecules and ions through an aquifer. High concentrations may indicate contamination from landfill leachate.

Table 2. Background information on constituents and properties of water—Continued.

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Aluminum (Al)	Found in silicate rocks. Low- and high-pH waters may contain high concentrations (Hem, 1985, p. 73-75).	Generally 30 to 300 µg/L (Hem, 1985, p. 73)	None.	Gastrointestinal irritation can occur from large oral doses. Aluminum is used as building material and in industry.
Antimony (Sb)	Derived mainly from the mineral stibnite (Hem, 1985, p. 145).	Concentrations can be expected to be very small in most natural waters; thermal waters may contain a few hundred micrograms per liter (Hem, 1985, p. 145)	Criteria: 146 µg/L through ingestion of water and contaminated organisms (USEPA, 1986b)	Acute poisoning may result from ingestion of antimony. Used with lead alloys in storage batteries and in rubber and textile industries.
Arsenic (As)	Associated with volcanic minerals and metallic ore deposits. Common in thermal ground water.	--	Primary standard: 50 µg/L (NBCHPS).	Trivalent arsenic (arsenite) is more toxic than pentavalent arsenic (arsenate). Epidemiologic studies by U.S. Public Health Service suggest that elevated concentrations in drinking water may be related to increased incidence of skin cancer (Hammond and Beliles, 1980, p. 437-438).
Barium (Ba)	Dissolved in small amounts from rocks and soils containing soluble barium salts. Higher concentrations have been reported associated with certain oil-field waters and other brines. Common minerals are barite and witherite (Hem, 1985, p. 135-137). Uses: metallurgy, paint, glass, electronics, and medicine.	Reported median concentration in public water supplies: 43 µg/L (Hem, 1985, p. 137).	Primary standard: 1,000 µg/L (NBCHPS).	May affect the central nervous system and gastrointestinal system and may act as muscle stimulant, especially of heart muscle (USEPA, 1986b).
Beryllium (Be)	Rare element found in crustal rocks. Can be found in higher concentrations in acid water (Hem, 1985, p. 135)	Generally less than a few tenths of a microgram per liter in river water (Hem, 1985, p. 135)	None.	Coal combustion contributes beryllium to environment (Hammond and Beliles, 1980, p. 438).
Boron (B)	Dissolved in small to moderate amounts from soils and rocks containing sodium or calcium borate salts. Higher concentrations have been associated with volcanic areas and geothermal spring water (Hem, 1985, p. 129). Uses: fire retardants, glass, leather tanning and finishing, cosmetics, photography, metallurgy, and high-energy rocket fuels.	Commonly a few tenths of a milligram per liter (Hem, 1985, p. 129).	No enforceable standard. Criterion: 750 µg/L for long-term irrigation of sensitive crops (USEPA, 1986b).	Essential element for plant growth, but sensitive crops have shown toxic effects at concentrations less than 1,000 µg/L. No evidence exists that it is required by animals (USEPA, 1986b).

Table 2. Background information on constituents and properties of water—Continued.

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Cadmium (Cd)	Dissolved in small amounts from rocks and soils containing minerals such as sphalerite, commonly associated with zinc and copper ores. High concentrations may be found in landfill leachate (Hem, 1985, p. 142). Uses: electroplating, paint, printing inks, plastics, electrical batteries, and fluorescent and video tubes.	Commonly less than 10 µg/L (Hem, 1985, p. 142).	Primary standard: 10 µg/L (NBCHPS). Criteria: 10 µg/L for irrigation water; for aquatic life, criterion is related to water-hardness concentration (USEPA, 1986b).	Causes deterioration of bones in humans. Irrigation-water criteria established on basis of human toxicity and tendency of accumulation in plants. Acute toxicity to aquatic life is buffered by hardness and salinity.
Chromium (Cr)	Dissolved in small amounts from rocks and soils containing minerals, such as chromite, and is found in greater relative abundance in magnesium- and iron-rich igneous rocks. High concentrations may indicate contamination from waste-disposal leachate (Hem, 1985, p. 138). Ground-water pollution from industrial application of chromium has occurred in many places. Plating processes are the primary industrial application of chromium.	Commonly less than 10 µg/L (Hem, 1985, p. 138).	Primary standard: 50 µg/L (NBCHPS).	Trivalent chromium is essential element in animal metabolism of glucose and lipids. Occupational exposure to hexavalent chromium compounds causes dermatitis, penetrating ulcers on hands and forearms, perforation of nasal septum, and inflammation of larynx and liver. Epidemiological studies estimate relative risk of chromate plant workers for respiratory cancer is 20 times greater than that of general population. Laboratory mice, given 5 mg/L hexavalent chromium in drinking water, had a slightly higher incidence of malignant tumors than control mice (Hammond and Beliles, 1980, p. 441-442).
Cobalt (Co)	More common in ultrabasic igneous rocks (Rankama and Sahama, 1950, p. 684)	Generally waters have less than 1.0 µg/L (Hem, 1985, p. 139)	None.	Increased levels of cobalt in water may cause goiter. Essential for plant and animal nutrition but in small amounts.

Table 2. Background information on constituents and properties of water—Continued.

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Copper (Cu)	Dissolved in small amounts from rocks and soils containing minerals such as chalcocite and malachite. Also leached from water pipes and plumbing fixtures by water with less than neutral pH (Hem, 1985, p. 141). High concentrations are associated with acid drainage from mines.	Commonly less than 10 µg/L (Hem, 1985, p. 141).	Secondary standard: 1,000 µg/L. Criteria: 500 µg/L for livestock water; 200 µg/L for long-term irrigation (USEPA, 1986b).	Copper is essential to plant and animal metabolism, but range between deficiency and toxicity is low for organisms such as algae, fungi, some invertebrates, and fish, which lack effective barriers to control absorption. Monogastric mammals, including humans, are less sensitive to copper than ruminants, and excessive copper exposure in normal persons is not thought to result in chronic disease. Acute poisoning resulting from excessive ingestion of copper salts may cause death (Hammond and Beliles, 1980, p. 443).
Iron (Fe)	Dissolved from iron-bearing minerals present in most rocks and soils. Found in some industrial wastes, and can be corroded from pipes, well casings, pumps, and other equipment. Also can be concentrated in wells and springs by certain bacteria.	Concentrations in ground water as high as 1,000 to 10,000 µg/L may be common in some aquifers. Areal distribution is commonly erratic (Hem, 1985, p. 83).	Secondary standards: 300 µg/L unless alternate supply is unavailable, then 600 µg/L (NBCHPS).	Oxidizes to reddish-brown sediment. Stains utensils, enamelware, clothing, and plumbing fixtures. May cause taste and odor problems objectionable for food and beverage processing. Iron is an essential element in metabolism of plants and animals (Hem, 1985, p. 77). Bioassay experiments by Goldman (1974, p. 6-7) suggest that dissolved iron is a more significant nutrient to Lake Tahoe algae than phosphorus.

Table 2. Background information on constituents and properties of water—Continued.

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Lead (Pb)	Dissolved in small amounts from soils and rocks containing minerals such as galena (principal ore of lead). Lead minerals are most abundant in sedimentary rock. "Leaded" gasoline and lead water pipes also can increase concentrations of lead (Hem, 1985, p. 143-144). Uses: paints, batteries, and in sport-hunting and fishing industry.	Less than 10 µg/L in potable water (Hem, 1985, p. 143-144).	Primary standard: 50 µg/L (NBCHPS).	Lead adversely affects the central nervous system, peripheral nerves, kidney, and hematopoietic system. Chronic or subchronic exposure to high concentrations of inorganic lead may lead to commonly fatal condition referred to as lead encephalopathy, whereas toxic effects of alkyl lead compounds on central nervous system result in hallucinations, delusions, and excitement, progressing to delirium in fatal cases. Other effects of lead exposure include colic, chromosomal aberrations, and abnormal sperm morphology. Inhalation is principal mode of exposure (Hammond and Beliles, 1980, p. 418-421).
Lithium (Li)	Found in pegmatite minerals and natural brines (Hem, 1985, p. 134)	Generally range from 1 to 3 µg/L in dilute natural water (Hem, 1985, p. 134).	None.	Lithium is used in alloys and in medicine.
Manganese (Mn)	Dissolved from some rocks, soils, and lake-bottom sediments. Generally associated with iron; often associated with acid drainage from mines (Hem, 1985, p. 86).	Generally less than 1,000 µg/L; usually less than iron (Hem, 1985, p. 89).	Secondary standards: 50 µg/L unless alternate supply is unavailable, then 100 µg/L (NBCHPS).	Oxidizes to dark brown or black sediment. Problems similar to those of iron.

Table 2. Background information on constituents and properties of water—Continued.

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Mercury (Hg)	Dissolved in very small amounts from soils and rocks containing minerals such as cinnabar (principal ore of mercury). Use as amalgam for gold and silver extraction may have increased its abundance in vicinity of pre-1900 mining operations. Other uses: electrical, electrolytic preparation of chlorine and caustic soda, thermometers, pharmaceuticals, dentistry, and as agricultural and industrial biocide.	Less than 1.0 µg/L in potable water (Hem, 1985, p. 142-143).	Primary standard: 2 µg/L (NBCHPS).	Mercury is a highly poisonous element that is known to accumulate in aquatic organisms. Adverse effects of mercury are principally manifested in kidney and central nervous system. Neurotoxicity of mercury poisoning occurs due to disruption of integrity of blood-brain barrier, inhibition of protein synthesis, and blocked synaptic and neuromuscular transmission. Mercury nephrotoxicity results only from exposure to inorganic mercury, and pathogenetic mechanism is not well understood. Other effects include: stomatitis, gingivitis, and inflammation of intestinal mucosa (Hammond and Beliles, 1980, p. 424-426). Also accumulates in organs of animals and humans.
Molybdenum (Mo)	Accessory element in many metal ores and fossil fuels (Hem, 1985, p. 140)	Generally less than 1 µg/L in surface water unaffected by pollution. Concentrations near 4 mg/L have been found in stream affected by molybdenum mining (Hem, 1985, p. 140)	No enforceable standard.	Used in steel alloys and in ceramics.
Nickel (Ni)	Found in crustal rocks (Hem, 1985, p. 139)	Uncontaminated natural waters should have a few micrograms per liter (Hem, 1985, p. 139)	Standard: 0.013 mg/L for drinking water (USEPA, 1986b)	Important industrial metal. Used in stainless steel.
Selenium (Se)	Dissolved in very small amounts from rocks and soils containing minerals such as clausthalite, ferroselite, or chalcocite (Fairbridge, 1972, p. 1080). Also may be leached from soils containing detritus of selenium-accumulating vegetation (organic selenium) or selenium salts [for example, ferric selenite or calcium selenate (Wigget and Alfors, 1986, p. 105)].	Rarely exceeds 1 µg/L in potable water. Up to 3,000 µg/L in drainage water from seleniferous irrigated soils (Hem, 1985, p. 145-146).	Primary standard: 10 µg/L (NBCHPS).	Selenium is essential nutrient for animals, and its deficiency in livestock diet is common. However, when intake becomes excessive, selenium toxicity ("blind staggers") can result.

Table 2. Background information on constituents and properties of water—Continued.

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Silver (Ag)	Dissolved in small amounts from rocks and soils containing minerals such as argentite or cerargyrite (Fairbridge, 1972, p. 1092). Limited solubility and distribution of silver suggests its occurrence in ground water may indicate contamination from silver mining/milling operations or improper disposal of photographic-processing wastes. Uses: jewelry and coinage, photography, and electronics; silver iodide has been used in "cloud seeding" for weather modification (Hem, 1985, p. 141).	Much less than 10 µg/L in most natural water (Hem, 1985, p. 141).	Primary standard: 50 µg/L (NBCHPS).	Elemental silver is not considered toxic (although it does cause skin discoloration—argyria), but most silver salts are toxic due to associated anions.
Strontium (Sr)	Fairly common element in igneous-rock minerals (Hem, 1985, p. 135).	Median content for larger U.S. public water supplies, 0.11 mg/L. Concentrations above 1 mg/L have been found in some U.S. ground waters (Hem, 1985, p. 135).	None.	Used in small amounts in lead and tin alloys.
Vanadium (V)	Present in fossil fuels and volcanic rocks (Hem, 1985, p. 135).	Ground and surface waters rarely have more than 10 µg/L (Hem, 1985, p. 138)	None.	A byproduct of petroleum refinement. Found in many foods.
Zinc (Zn)	Dissolved in small amounts from rocks or soils containing minerals such as sphalerite, willemite, or zinc-rich magnetite (Fairbridge, 1972, p. 1293). Uses: metallurgy, paint, rubber, and paper products.	Less than 100 µg/L in potable water (Hem, 1985, p. 142).	Secondary standard: 5,000 µg/L (NBCHPS).	Zinc is considered essential element to plant and animal life, but water is not normally a significant dietary source. Human dwarfism and lack of sexual development have been related to zinc deficiency. Consumption of acidic food or beverages from galvanized containers has caused accidental poisoning, with symptoms such as fever, vomiting, stomach cramps, and diarrhea (Hammond and Beliles, 1980, p. 460-462).

Table 2. Background information on constituents and properties of water—Continued.

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Methyl chloride	Synthetic halomethane; colorless gas, only slightly soluble in water. Other names include chloromethane. Used as refrigerant and local anesthetic (Windholz, 1976, p. 789). Occurrence in ground water may result from improper disposal of refrigerants.	Not expected in natural water.	No enforceable standard. Lifetime cancer-risk criteria for total halomethanes (USEPA, 1986b): Criterion (mg/L) Estimated risk 0.019 1:10,000,000 0.19 1:1,000,000 1.9 1:100,000	One of seven halomethanes listed by USEPA as a potential carcinogen (USEPA, 1986b). Poisonous; may injure liver, kidneys, and central nervous system (Windholz, 1976, p. 789).
Phorate	Synthetic, organophosphorus insecticide. Solubility in water, 50 mg/L at 20°C. Other names include Thimet, American Cyanamid 3911, phosphorodithioteic acid O, O-diethyl S-[(ethylthio) methyl] ester. Use: systemic pesticide (Windholz, 1976, p. 954). In Nevada, applied to alfalfa hay crops at rates less than 10 pounds per acre for alfalfa weevil control (Robbin E. Rose, Nevada Department of Agriculture, written commun., 1987). Classified as immobile in soils (Helling and others, 1971, p. 163).	Not expected in natural water.	No enforceable standard.	Inhibits enzyme cholinesterase, which normally hydrolyzes acetylcholine to acetic acid and choline; an essential metabolic pathway (Windholz, 1976, p. 954). Acute oral dosage lethal to 50 percent of test population of laboratory rats is 1.6-4 mg/kg (Verschuere, 1983, p. 996). Relatively nonpersistent in environment; oxidized or hydrolyzed to non-toxic breakdown products by soil micro-organisms and chemical reactions (Kaufman, 1974, p. 144).
Tetrachloroethylene (PCE)	Synthetic, colorless, halogenated organic liquid. Solubility in water, at 25°C is 150 mg/L. About 550 million pounds produced in 1982 (USEPA, 1987, p. 305). Other names include perchloroethylene, ethylene tetrachloride, tetrachloroethylene, Nema, Tetracup, Tetropil, Percelene, Ankilostin, Didakene Perc. Uses: dry cleaning; degreasing metals; as a solvent, and as an anthelmintic (hook worm eliminator) in the 1920's (Windholz, 1976, p. 1184). Occurrence in ground water is common, and it may remain for months or years (USEPA, 1987, p. 306).	Not expected in natural water.	No enforceable standard. Lifetime cancer-risk criteria (USEPA, 1986b): Criterion (mg/L) Estimated risk 0.08 1:10,000,000 0.8 1:1,000,000 8 1:100,000	Narcotic at high dosages (Windholz, 1976, p. 1184). Clinical data suggest ingestion to be relatively nontoxic, but liver, kidney, and central-nervous-system effects reportedly have resulted from occupational exposure. Is very mobile in soils, and under specific conditions may degrade to trichloroethylene, then to dichloroethylene, and to vinyl chloride. USEPA estimates that 3 percent of all public water supplies contain 0.5 mg/L or more (USEPA, 1987, p. 306).

Table 2. Background information on constituents and properties of water—Continued.

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Toluene	Naturally occurring in tar oil; clear, colorless liquid. Solubility in water, 535 mg/L at 25°C. About 5 billion pounds produced in 1981. Other names include methylbenzene, phenylmethane, toluol, methylbenzol, and methacide. Uses: production of benzene and other organic solvents and compounds, solvent, gasoline additive. Toluene migrates slowly through soil and aquifer material and under specific conditions is readily biodegraded to carbon dioxide (USEPA, 1987, p. 325).	Not expected in natural water.	No enforceable standard. Ambient-water criterion: 14,300 mg/L (USEPA, 1986b).	Human exposure primarily through occupational inhalation. Oral toxicity is relatively low, resulting in inhibition of central nervous system. Limited data from experiments with pregnant laboratory mice suggest adverse developmental effects (USEPA, 1987, p. 327-328).
Trichloroethylene (TCE)	Synthetic, colorless, halogenated organic liquid. Solubility in water, 1,000 mg/L at 20°C. About 200 million pounds produced in 1982. Other names include: trichloroethene, acetylene trichloride, Tri, Trilene. Uses: industrial solvent, dry cleaning, and degreaser for metal. TCE migrates readily through soil and may reside in ground-water systems for months to years. May form also in ground water from degradation of tetrachloroethylene (USEPA, 1987, p. 356).	Not expected in natural water.	Primary standard: 5 mg/L (NBCHPS).	Most reported exposure is by inhalation, resulting in narcotic effect and death due to ventricular fibrillation (Verschuere, 1983, p. 1135). Surveys of drinking-water supplies suggest that 3 percent of all ground-water public supply sources in the U.S. contain at least 0.5 mg/L (USEPA, 1987, p. 356).

Table 2. Background information on constituents and properties of water—Continued.

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Vinyl chloride	<p>Synthetic, colorless gas that polymerizes to polyvinyl chloride (PVC) in light or in the presence of a catalyst. Solubility in water, 1,100 mg/L at 28°C. Other names include chlorethylene, chloroethene, and monochloroethylene (Windholz, 1976, p. 1283). Uses: raw material in the plastics, rubber, paper, glass, and automotive industries; electrical pipe insulation, piping; medical supplies; food packaging; and construction. In excess of 7 billion pounds have been produced since 1979. Occurrence in ground water is relatively rare due to its rapid degradation to carbon dioxide and chloride. Less than 2 percent of all public-supply systems derived from ground water contain levels exceeding 1 mg/L. Movement through soil is not retarded by adsorption; once in ground water, vinyl chloride is expected to remain for months to years. Vinyl chloride is reported to be a degradation product of trichloroethylene and tetrachloroethylene. Contaminated water is believed to be a major source of exposure (USEPA, 1987, p. 368-369).</p>	Not expected in natural water.	Primary standard: 2 mg/L (NBCHPS).	Classified by USEPA as human carcinogen; linked to increased occurrence of liver angio-sarcomas and brain and lung tumors associated with long-term occupational exposure. Short-term toxicity requires relatively high-level exposure (100,000 parts of vinyl chloride per million parts of air by inhalation) to induce narcosis and death (USEPA, 1987, p. 371-372). Concentrations of vinyl chloride found in PVC-bottled liquids range from 0 to 400 mg/L, depending on the time of storage and quality of PVC (Verschuere, 1983, p. 1185).

Table 2. Background information on constituents and properties of water—Continued.

Constituent or property	Source or cause of occurrence	Normal range of values in natural waters	Standards or criteria for water use ¹	Remarks
Xylene	Colorless, mobile, flammable liquid. Other names include dimethylbenzene, xylois. First isolated from wood distillate; also present in petroleum oil and in coal tar (primary raw material for xylene manufacture). Estimated production in 1982 was 5 billion pounds. Commercial xylene is mixture of three isomers: ortho-xylene, meta-xylene, and para-xylene; meta-xylene predominates. Solubility in water: ortho-xylene, 175 mg/L at 20°C; meta-xylene, 160 mg/L at 20°C; and para-xylene, 198 mg/L at 25°C. Uses: solvent for paints, inks, and adhesives; manufacture of aviation gasoline, polyester, and protective coatings; component of petroleum and asphalt. Movement with ground water retarded by moderate binding to soil; readily biodegraded, but expected stable in ground water. About 3 percent of all public water supplies derived from ground water contain levels greater than 0.5 mg/L, with a maximum reported concentration of 2.5 mg/L (USEPA, 1987, p. 384-385).	Not expected in potable water.	No enforceable standard. Carcinogenic potential has not been evaluated. Suggested-no-adverse-response-levels (SNARL's) calculated by National Academy of Science: 21,000 mg/L for 1-day exposure and 11,200 mg/L for 7-day exposure (USEPA, 1987, p. 393).	Environmental exposure primarily to air, with release to water due to spills and leaks of gasoline and other petroleum products. Occurrence in ground water also may indicate improper disposal of paints, inks, or industrial products (USEPA, 1987, p. 385).

¹ Primary drinking-water standards specify maximum contaminant levels that are health-related and Federally mandated; secondary drinking-water standards are based on esthetic qualities and are enforceable by the State of Nevada (Jeffrey A. Fontaine, Nevada Bureau of Consumer Health Protection Agency Services, oral commun., 1989). Criteria are recommended limits for specific water uses, based on current scientific knowledge. Some standards and criteria for trace elements and organic compounds are expressed in milligrams per liter in the cited references; these values are herein converted to micrograms per liter to maintain consistency with units of measure used in the accompanying water-quality data tabulations.

Table 3. Ground-water sampling sites in Douglas County, Nev., where drinking-water standards for selected constituents were exceeded

Map number (plate 1)	Station number	Date	Fluoride, dissolved (mg/L as F) ¹	Solids, residue at 180°C dissolved (mg/L)	Nitrogen, NO ₂ +NO ₃ dissolved (mg/L as N)	Arsenic, dissolved (µg/L as As)	Cadmium, dissolved (µg/L as Cd)
4	390623119470501	06-30-87	--	--	12	--	--
		08-27-87	--	--	12	--	--
18	390602119471201	06-22-90	--	--	19	--	--
		09-08-92	2.2	--	--	--	--
34	390446119451401	02-10-86	5.2	2,310	--	--	--
		05-19-86	5.4	2,390	--	--	10
		08-13-86	5.2	2,430	--	--	--
		07-01-87	6.8	2,940	--	--	--
		04-29-87	5.6	2,920	--	--	--
		01-14-88	5.1	3,220	--	--	--
		01-14-88	5.2	3,190	--	--	--
		01-14-88	5.1	3,230	--	--	--
		01-14-88	5.2	3,220	--	--	--
		01-14-88	5.0	3,270	--	--	--
		01-14-88	5.0	3,250	--	--	--
		04-18-90	--	3,190	--	--	--
		06-13-90	--	3,310	--	--	--
		08-29-90	--	3,190	--	--	--
		11-28-90	5.3	3,270	--	--	--
		03-06-91	5.5	3,300	--	--	--
		06-12-91	5.6	3,290	--	--	--
		08-07-91	5.5	3,310	--	--	--
		12-11-91	5.5	3,260	--	--	--
		03-17-92	5.7	3,300	--	--	--
		06-23-92	5.2	3,320	--	--	--
		08-13-92	5.6	3,330	--	--	--
		12-22-92	5.2	3,260	--	--	--
		04-22-93	5.3	3,280	--	--	--
		06-09-93	5.7	3,250	--	--	--
		09-08-93	5.6	3,290	--	--	--
		12-15-93	5.2	2,970	--	--	--
		06-09-94	6.3	2,970	--	--	--
		09-01-94	6.5	2,840	--	--	--
37	390407119464901	08-24-83	2.0	--	--	--	--
38	390407119451901	08-29-83	2.9	--	--	--	--
39	390343119450501	08-26-83	5.1	--	--	--	--
45	390303119473701	09-06-94	2.8	--	--	--	--
48	390258119441501	08-21-90	3.5	1,150	--	--	--
51	390243119442801	08-24-90	3.7	--	--	--	--
54	390241119424701	08-24-90	2.5	--	--	--	--
56	390233119443501	08-21-90	2.4	--	--	--	--
58	390234119431501	08-24-90	2.2	--	--	--	--
62	390224119424201	08-22-90	3.6	--	--	--	--
64	390222119423001	08-22-90	4.9	--	--	--	--
68	390212119423701	08-22-90	4.9	--	--	--	--
76	390156119435801	08-21-90	2.6	--	--	--	--
79	390152119435801	08-21-90	2.2	--	--	--	--
80	390152119434601	08-21-90	2.6	--	--	--	--
85	390137119453601	08-26-86	--	--	--	55	--
		08-29-94	--	--	--	79	--
86	390138119433701	08-22-90	2.8	--	--	--	--
256	385308119405401	08-07-91	--	--	13	--	--
292	384222119325401	06-23-94	--	--	--	64	--
311	384123119324701	06-23-94	--	--	--	92	--

¹ Primary standard of 4.0 mg/L and secondary standard of 2.0 mg/L since December 1, 1988. Prior to that, standards ranged from 1.4 to 2.4 mg/L depending upon average air temperature (Nevada Bureau of Consumer Health Protection Services, oral commun., 1996).

Table 4. Inventory of estimated ground-water pumpage for Carson Valley, Nev., water years 1981-94. Data for water years 1981-83 from Maurer (1986, table 10), for water years 1984-87 from Berger (1990, p. 9), and for water years 1988-94 from Nevada Division of Water Resources (1989-95) ¹

[--, data not tabulated or not available for specific pumpage category]

Water year	Pumpage (rounded to nearest 100 acre-feet)								Total
	Agricultural	Commercial	Domestic	Industrial	Irrigation	Municipal	Other	Stockwater	
1981	--	--	--	--	--	--	--	--	14,500
1982	--	--	--	--	--	--	--	--	7,400
1983	--	--	--	--	--	--	--	--	7,000
1984	2,800	--	1,300	200	--	3,400	--	--	7,700
1985	5,700	--	1,400	200	--	3,500	--	--	10,800
1986	3,400	--	1,400	1,900	--	3,500	--	--	10,200
1987	6,500	--	1,500	1,800	--	3,600	--	--	13,400
1988	--	100	2,100	--	10,100	5,300	3,200	400	21,200
1989	--	100	2,300	--	9,600	5,400	3,000	400	20,700
1990	--	200	2,500	--	10,400	5,600	3,100	400	22,200
1991	--	100	2,600	--	10,000	6,000	3,300	500	22,500
1992	--	200	2,700	--	11,800	7,000	3,200	200	25,100
1993	--	200	2,800	--	7,200	6,300	2,600	200	19,200
1994	--	200	3,000	--	12,500	7,000	3,300	100	26,100

¹ Agricultural pumpage for 1988-94 can be calculated by summing irrigation and stockwater quantities. "Other" category for 1988-94 includes industrial pumpage.

Table 5. Size and description of processed data files on diskettes

File	Size (bytes)	Description
README.FIL	1,297	Contains table 5, which lists the size and description of processed data files on diskettes
Table6.asc	19,631	Precipitation records for selected stations in Douglas County, Nev., operated by Natural Resource Conservation Service and National Oceanic and Atmospheric Administration
Table7.asc	100,378	Monthly streamflow statistics for selected gaging stations, Douglas County, Nev., and Alpine County, Calif.
Table8.asc	9,755	Streamflow data for selected miscellaneous sites, Douglas County, Nev., and Alpine County, Calif.
Table9.asc	96,106	Water-quality constituents and properties for selected surface-water sites, Douglas County, Nev., and Alpine and Mono Counties, Calif.
Table10.asc	127,314	Ground-water levels and well information for selected sites, Douglas County, Nev.
Table11.asc	372,448	Water-quality properties, nutrients, and major ions for water from selected wells, Douglas County, Nev.
Table12.asc	166,603	Trace elements and dissolved organic carbon for water from selected wells, Douglas County, Nev.
Table13.asc	330,050	Isotopes, volatile organic compounds, pesticides, radionuclides, and organic carbon in water from selected wells, Douglas County, Nev.

2 Disks kept on USGS file

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