Estimated Use of Water in the United States in 2000

By Susan S. Hutson, Nancy L. Barber, Joan F. Kenny, Kristin S. Linsey, Deborah S. Lumia, and Molly A. Maupin

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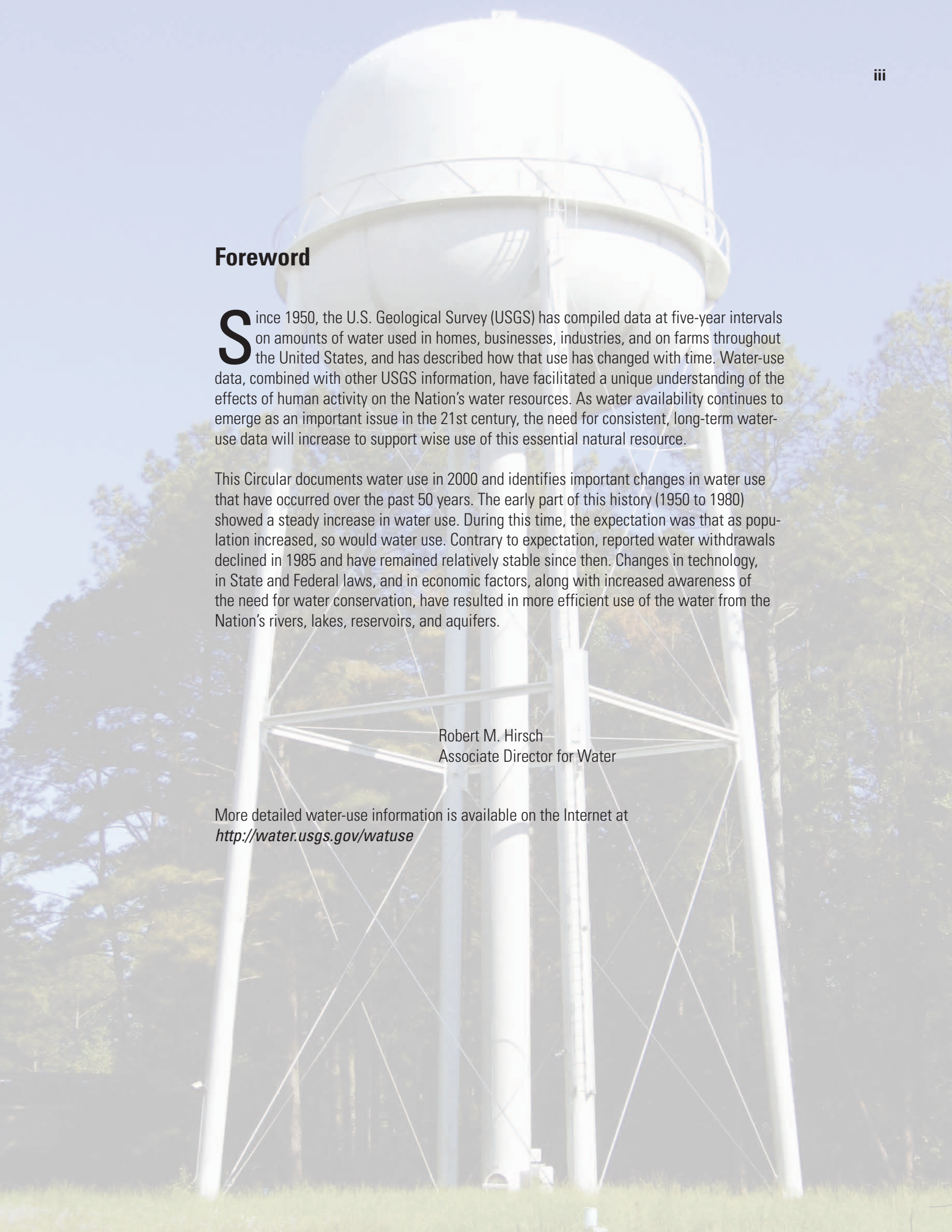

Foreword

Since 1950, the U.S. Geological Survey (USGS) has compiled data at five-year intervals on amounts of water used in homes, businesses, industries, and on farms throughout the United States, and has described how that use has changed with time. Water-use data, combined with other USGS information, have facilitated a unique understanding of the effects of human activity on the Nation's water resources. As water availability continues to emerge as an important issue in the 21st century, the need for consistent, long-term water-use data will increase to support wise use of this essential natural resource.

This Circular documents water use in 2000 and identifies important changes in water use that have occurred over the past 50 years. The early part of this history (1950 to 1980) showed a steady increase in water use. During this time, the expectation was that as population increased, so would water use. Contrary to expectation, reported water withdrawals declined in 1985 and have remained relatively stable since then. Changes in technology, in State and Federal laws, and in economic factors, along with increased awareness of the need for water conservation, have resulted in more efficient use of the water from the Nation's rivers, lakes, reservoirs, and aquifers.

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Associate Director for Water

More detailed water-use information is available on the Internet at
http://water.usgs.gov/watuse

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Conversion Factors

Multiply	By	To obtain
	Area	
acre	43,560	square foot (ft^2)
	4,047	square meter (m^2)
	0.001562	square mile (mi^2)
	Flow rate	
gallon per day (gal/d)	3.785	liter per day
million gallons per day (Mgal/d)	1.121	thousand acre-feet per year
	0.001547	thousand cubic feet per second
	0.6944	thousand gallons per minute
	0.003785	million cubic meters per day
	1.3815	million cubic meters per year
billion gallons per day (Bgal/d)	1.3815	billion cubic meters per year
thousand acre-feet day per year	0.8921	million gallons per day
	0.001380	thousand cubic feet per second
	0.6195	thousand gallons per minute
	0.003377	million cubic meters per day

Some water relations in inch-pound units are shown below	
1 gallon (gal)	8.34 pounds
1 million gallons (Mgal)	3.07 acre-feet
1 cubic foot (ft^3)	62.4 pounds
	7.48 gallons
1 acre-foot (acre-ft)	325,851 gallons
	43,450 cubic feet
1 inch of rain	17.4 million gallons per square mile
	27,200 gallons per acre
	100 tons per acre

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Abstract

Estimates of water use in the United States indicate that about 408 billion gallons per day (one thousand million gallons per day, abbreviated Bgal/d) were withdrawn for all uses during 2000. This total has varied less than 3 percent since 1985 as withdrawals have stabilized for the two largest uses—thermoelectric power and irrigation. Fresh groundwater withdrawals (83.3 Bgal/d) during 2000 were 14 percent more than during 1985. Fresh surface-water withdrawals for 2000 were 262 Bgal/d, varying less than 2 percent since 1985.

About 195 Bgal/d, or 48 percent of all freshwater and saline-water withdrawals for 2000, were used for thermoelectric power. Most of this water was derived from surface water and used for once-through cooling at power plants. About 52 percent of fresh surface-water withdrawals and about 96 percent of saline-water withdrawals were for thermoelectric-power use. Withdrawals for thermoelectric power have been relatively stable since 1985.

Irrigation remained the largest use of freshwater in the United States and totaled 137 Bgal/d for 2000. Since 1950, irrigation has accounted for about 65 percent of total water withdrawals, excluding those for thermoelectric power. Historically, more surface water than ground water has been used for irrigation. However, the percentage of total irrigation withdrawals from ground water has continued to increase, from 23 percent in 1950 to 42 percent in 2000. Total irrigation withdrawals were 2 percent more for 2000 than for 1995, because of a 16 percent increase in ground-water withdrawals and a small decrease in surface-water withdrawals. Irrigated acreage more than doubled between 1950 and 1980, then remained constant before increasing nearly 7 percent between 1995 and 2000. The number of acres irrigated with sprinkler and microirrigation systems has continued to increase and now comprises more than one-half the total irrigated acreage.

Public-supply withdrawals were more than 43 Bgal/d for 2000. Public-supply withdrawals during 1950 were 14 Bgal/d. During 2000, about 85 percent of the population in the United States obtained drinking water from public suppliers, compared to 62 percent during 1950. Surface water provided 63 percent of the total during 2000, whereas surface water provided 74 percent during 1950.

Self-supplied industrial withdrawals totaled nearly 20 Bgal/d in 2000, or 12 percent less than in 1995. Compared to 1985, industrial self-supplied withdrawals declined by 24 percent. Estimates of industrial water use in the United States were largest during the years from 1965 to 1980, but during 2000, estimates were at the lowest level since reporting began in 1950. Combined withdrawals for self-supplied domestic, livestock, aquaculture, and mining were less than 13 Bgal/d for 2000, and represented about 3 percent of total withdrawals.

California, Texas, and Florida accounted for one-fourth of all water withdrawals for 2000. States with the largest surface-water withdrawals were California, which had large withdrawals for irrigation and thermoelectric power, and Texas, which had large withdrawals for thermoelectric power. States with the largest ground-water withdrawals were California, Texas, and Nebraska, all of which had large withdrawals for irrigation.

INTRODUCTION

This report, "Estimated use of water in the United States in 2000," marks 50 years of water-use data compiled by the U.S. Geological Survey (USGS). Data on water withdrawals by State, source of water, and category of use have been compiled at 5-year intervals since 1950. Data from this Circular and other USGS water-use Circulars can be used along with information on the availability of ground water and surface water to assess water-resource management needs in the face of changing demands for water. Reliable water-use data are essential to many organizations and individuals in support of research and policy decisions.

Since 1950, water supplies and their uses have been affected by population growth, economic trends, legal decisions, and periodic droughts. In response to constraints on water supplies, communities have expanded their water-supply infrastructures or instituted water-conservation measures, farmers have changed crops or agricultural practices, and industries have reused or reclaimed process water. Population changes affecting water use during the time period from 1950 to 2000 include an overall growth of 90 percent, with a shift in the population of the United States from rural areas to urban areas and a continuing shift of the mean geographic center of population west and south (Hobbs and Stoops, 2002). In some geographic areas, the availability of water and improved technology have resulted in increases in irrigated acreage and irrigation water use. In other areas, increased costs and reduced water availability have led to more efficient irrigation practices and a reduction in irrigation water use. Changes in production, technology, and economic conditions have affected industrial water use. Periodic droughts have drawn attention to limits in the reliability of local and regional water supplies and influenced short-term water use for all users.

Climatic fluctuations affect water withdrawals, particularly for irrigation, power generation, public supply, and self-supplied domestic water use. However, effects of extremes in temperature and precipitation often are difficult to isolate from other factors that affect water use; thus, climatic effects cannot be identified readily based on the aggregated data contained in this report.

The year 2000 was one of climatic extremes. Weather in the Midwest and Northeast was characterized by prolonged periods of cooler and wetter than normal conditions. During the summer months (June–August), precipitation was above average in 15 States throughout this region. The South and West experienced severe drought as a result of below-normal precipitation and above-normal temperatures. Alabama, Florida, Georgia, Louisiana, and Mississippi had the driest May–October period on record during 2000. Streams and reservoirs dropped to record low levels, and some cities imposed drought restrictions. The driest July–September period was recorded in Arkansas, Kansas, Louisiana, Mississippi, Oklahoma, and Texas. Much of the western United States also was in severe drought—including Arizona, Colorado, Idaho, Montana, New Mexico, Utah, and Wyoming. By August 2000, 36 percent of the United States was in severe to extreme drought, leading to widespread wildfires and other drought-related damages (National Oceanic and Atmospheric Administration, 2001; U.S. Department of Agriculture, 2000).

Purpose and Scope

This report presents consistent and current water-use estimates by source and by State for the States, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands (referred to in the text as States or United States for brevity). The USGS has compiled similar national estimates every 5 years since 1950 (MacKichan, 1951, 1957; MacKichan and Kammerer, 1961; Murray, 1968; Murray and Reeves, 1972, 1977; and Solley and others, 1983, 1988, 1993, 1998). This series of water-use reports serves as one of the few sources of information about regional or national trends in water withdrawals. The report provides information on eight categories of water use—public supply, domestic, irrigation, livestock, aquaculture, industrial, mining, and thermoelectric power. This report contains a section on total water use for 2000, followed by more detailed discussions for each category. The final section presents a discussion on trends in water use from 1950 to 2000.

Terminology

The terms and units used in this report are similar to those used in previous USGS water-use Circulars and are defined in the Glossary (at the end of the report). For 2000, water use was defined as water withdrawals rather than as water withdrawals plus deliveries from public supplies. Saline water, defined as water that contains 1,000 milligrams per liter or more of dissolved solids, was tabulated for the industrial, mining, and thermoelectric-power categories. All public-supply, self-supplied domestic, irrigation, and livestock withdrawals were considered freshwater in this report. For aquaculture, only freshwater withdrawals were reported for 2000.

Annual water-use data are expressed in terms of million gallons per day (abbreviated as Mgal/d) and thousand acre-feet per year in this report. The term *billion gallons per day* (one-thousand million gallons per day, abbreviated as Bgal/d) is used in the Abstract and Trends sections of this report to more simply express large numbers. Units of million gallons per day or billion gallons per day are used to indicate an average daily rate of usage, and do not represent actual daily rates. For example, irrigation water is applied only part of each year and at variable rates; therefore, the actual rate of application at any given time during the growing season would be more than the average daily rate expressed as million gallons per day or as billion gallons per day.

The water-use data in this report are rounded to three significant figures. All values are rounded independently; therefore, the sums of individual rounded numbers may not equal

the totals. The percentage changes discussed in the text are calculated from the unrounded data and expressed as integers. All population data are rounded to three significant figures.

Changes for the 2000 Report

The number of reported categories and the data elements collected were reduced for 2000, and some States collected data for only certain core categories. Emphasis was placed on ensuring the quality of data that were collected, rather than attempting to provide all categories and data elements on a national scale. Additional water-use data were collected for some States as part of a broader water-use data-collection program.

For 2000, self-supplied water withdrawals for the core categories of public supply, domestic, irrigation, industrial, and thermoelectric power were compiled for all States. Self-supplied water withdrawals for livestock, aquaculture, and mining were compiled for selected States that represented most of the total water withdrawals for these categories during 1995. Data not reported for 2000 included self-supplied commercial withdrawals, deliveries from public supply for domestic, commercial, industrial, and thermoelectric-power purposes, and instream use for hydroelectric power. Also not reported were consumptive use, irrigation conveyance loss, reclaimed wastewater, number of wastewater facilities, and wastewater returns. The amount of power generated by thermoelectric- or hydroelectric-power plants was not reported for 2000.

Although some States did not compile data for some categories for 2000, most of the water withdrawals are likely to be accounted for in the water-use estimates in this report. During 1995, 97 percent of total water withdrawals were used for public supply, domestic, irrigation, industrial, and thermoelectric power. All States collected and reported data for these categories for 2000. The remaining 3 percent was used for livestock, animal specialties, mining, and commercial purposes. States that accounted for the majority of the water withdrawals for livestock, aquaculture, and mining uses for 1995 collected and reported data for 2000.

Other changes for 2000 involved the reclassification of data within the thermoelectric-power and livestock categories. Thermoelectric-power water use was subdivided by cooling type (once-through or closed-loop) rather than by fuel type as in previous reports. Cooling-system type is the primary determinant of consumptive use relative to withdrawals at power plants. Most of the water withdrawn for once-through cooling is returned to the source and, therefore, generally results in a relatively smaller consumptive use. Water withdrawn for closed-loop cooling is recirculated with a large part lost to evaporation, resulting in a larger consumptive use relative to withdrawals.

For 2000, the livestock category was no longer subdivided into livestock and animal specialties. Withdrawals for some animals that formerly were reported in the animal-specialties subcategory were included in the livestock category. The aquaculture category, new for 2000, combined withdrawals for fish farms, formerly reported in the animal-specialties category, and fish hatcheries, formerly reported as self-supplied withdrawals in the commercial category.

Sources of Data and Methods of Analysis

The USGS, in cooperation with State and local agencies, compiled water-use estimates for 2000 for each county in the United States, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands. The USGS National Water Use Information Program—implemented in 1978 to provide uniform, current, and reliable information on water use—coordinated the compilation effort. Water-use estimates and ancillary data were entered into a State aggregate water-use database in each USGS State office, and reviewed within the USGS and cooperating agencies. All water-use data compiled for this report are stored in the USGS Aggregate Water-Use Data System. Data collected for this report are available by county and State on the Internet at *http://water.usgs.gov/watuse/*.

Sources of information vary and are discussed for each category in subsequent parts of this report. Guidelines for preparing USGS water-use estimates for 2000 were developed and distributed to water-use study chiefs in each State office, and are available on the Internet site identified above. The following national data were available to each State: U.S. Environmental Protection Agency (USEPA) Safe Drinking Water Information System (SDWIS); U.S. Census Bureau, population; U.S. Department of Agriculture (USDA) Farm and Ranch Irrigation Survey; USDA Census of Agriculture; USDA, national agricultural statistics; and U.S. Department of Energy–Energy Information Administration (USDOE–EIA), steam-electric plant statistics. Each USGS study chief was responsible for determining the most reliable sources of information available for estimating water use for their State.

Each USGS study chief compiled and analyzed information from various sources, made estimates of missing data, and prepared documentation that identified the sources of water-use information and methods used to determine water use for their State. Many States published reports on water use as part of the National Water Use Information Program. A list of these publications is available on the Internet at *http://water.usgs.gov/watuse/*.

Acknowledgments

The authors gratefully acknowledge the USGS study chiefs in each State who compiled the data for this report and the assistance provided by the many State and local agencies that shared data and expertise with the USGS. In many States, personnel from cooperating agencies worked as full partners with the USGS in this compilation effort. Cooperators include State agencies that manage water resources, operate data-collection programs, and administer regulations on water use and natural resources. The USGS water-use points of contact for each State are identified on the Internet at *http://water.usgs.gov/watuse/*.

Total Water Use — 408,000 million gallons per day

Total water use in the United States for 2000 was determined from estimates of water withdrawals for the eight categories of public supply, domestic, irrigation, livestock, aquaculture, industrial, mining, and thermoelectric power (fig 1). Total freshwater and saline-water withdrawals for 2000 were estimated to be 408,000 Mgal/d, or 457,000 thousand acre-feet per year (table 1). Freshwater withdrawals were 85 percent of the total, and the remaining 15 percent was saline water. Estimates of withdrawals by source indicate that for 2000, total surface-water withdrawals were 323,000 Mgal/d, or 79 percent of the total withdrawals for all categories of use. About 81 percent of surface water withdrawn was freshwater. Total ground-water withdrawals were 84,500 Mgal/d, of which 99 percent was freshwater. Nearly all (98 percent) saline-water withdrawals were from surface water.

Total withdrawals by category and State are listed in table 2. For 2000, the largest water withdrawals were for thermoelectric power and irrigation. Most water (195,000 Mgal/d) was withdrawn for thermoelectric power, of which 30 percent (59,500 Mgal/d) was saline. Illinois used the largest amount of freshwater for thermoelectric power (8 percent of the freshwater withdrawals for thermoelectric power). The largest saline withdrawals for thermoelectric power (41 percent) were in California and Florida. The largest freshwater withdrawals were for irrigation (40 percent of the total freshwater, or 137,000 Mgal/d). California used the largest amount of irrigation water and accounted for nearly one-quarter of the total irrigation withdrawals.

For 2000, more surface water than ground water was used in all categories except domestic, livestock, and mining (considering saline water only) (table 3). About 52 percent of the fresh surface-water withdrawals were for thermoelectric power and 30 percent were for irrigation. The largest fresh and saline surface-water withdrawals were in California. California accounted for the largest fresh surface-water withdrawals for public-supply, self-supplied domestic, irrigation, and livestock uses and for the largest saline surface-water withdrawals for thermoelectric-power use.

Bull Run thermoelectric power plant, Anderson County, Tennessee. (Photo courtesy of Tennessee Valley Authority.)

For 2000, most of the fresh ground-water withdrawals, 68 percent, were for irrigation (table 4). About 52 percent of the fresh ground-water use nationwide was in California, Texas, Nebraska, Arkansas, and Florida. About three-fourths of ground-water withdrawals in California and Texas were for irrigation; in Nebraska and Arkansas, 94 percent of the ground-water withdrawals were for irrigation. Ground-water withdrawals for public supply and irrigation in Florida were nearly identical. Nationwide, ground-water withdrawals for irrigation were about 3.5 times larger than the withdrawals for public supply. Only 1 percent of ground-water withdrawals were saline. Nearly all of the saline ground-water withdrawals were for mining, of which 40 percent were in Texas.

Figure 1 shows that the largest category of water withdrawals for 2000 was thermoelectric power (48 percent of total withdrawals). Irrigation accounted for 34 percent of the total withdrawals; public supply, 11 percent of the total; self-supplied industrial, 5 percent of the total; and self-supplied domestic, livestock, aquaculture, and mining combined accounted for around 2 percent of the total withdrawals.

The geographic distribution of total, total surface-water, and total ground-water withdrawals is shown in figure 2. California, Texas, and Florida accounted for 25 percent of total withdrawals. California and Texas accounted for 17 percent of total surface-water withdrawals, and California accounted for 18 percent of total ground-water withdrawals. The geographic distribution of freshwater and saline-water withdrawals by State is shown in figure 3. California and Texas accounted for 18 percent of the total freshwater withdrawals, and California and Florida accounted for 40 percent of the total saline-water withdrawals.

A comparison of the intensity of freshwater withdrawals by State, in gallons per day per square mile, shows that some smaller- and medium-sized States in the eastern United States have a greater intensity of freshwater withdrawals per square mile compared to some larger-sized western States (fig. 4). California and Idaho also are high in water-use intensity; however, Texas, the State with the second largest total withdrawals, is relatively low in water-use intensity.

Public Supply, 11 percent

Richard L. Marella, USGS

Public supply water intake, Bay County, Florida

Irrigation, 34 percent

Courtesy of Jeff Vanuga, USDA NRCS

Gated-pipe flood irrigation, Fremont County, Wyoming

Aquaculture, less than 1 percent

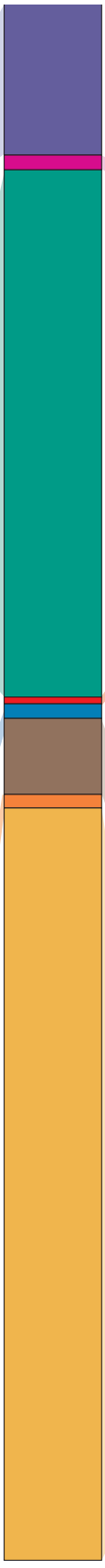
Courtesy of Clear Springs Foods, Inc.

World's largest trout farm, Buhl, Idaho

Mining, less than 1 percent

Nancy L. Barber, USGS

Spodumene pegmatite mine, Kings Mountain, North Carolina



Domestic, less than 1 percent

Alan M. Cressler, USGS

Domestic well, Early County, Georgia

Livestock, less than 1 percent

Courtesy of Jeff Vanuga, USDA NRCS

Livestock watering, Rio Arriba County, New Mexico

Industrial, 5 percent

Alan M. Cressler, USGS

Paper mill, Savannah, Georgia

Thermoelectric Power, 48 percent

Alan M. Cressler, USGS

Cooling towers, Burke County, Georgia

Figure 1. Total water withdrawals by category, 2000.

Table 1. Total water withdrawals by source and State, 2000.

[Figures may not sum to totals because of independent rounding]

STATE	POPULATION (in thousands)	WITHDRAWALS (in million gallons per day) By source and type									WITHDRAWALS (in thousand acre-feet per year)		
		Ground water			Surface water			Total			Total		
		Fresh	Saline	Total	Fresh	Saline	Total	Fresh	Saline	Total	Fresh	Saline	Total
Alabama	4,450	440	0	440	9,550	0	9,550	9,990	0	9,990	11,200	0	11,200
Alaska	627	50.2	90.4	141	111	53.4	164	161	144	305	181	161	342
Arizona	5,130	3,420	8.17	3,430	3,300	0	3,300	6,720	8.17	6,730	7,530	9.16	7,540
Arkansas	2,670	6,920	.08	6,920	3,950	0	3,950	10,900	.08	10,900	12,200	.09	12,200
California	33,900	15,200	152	15,400	23,200	12,600	35,800	38,400	12,800	51,200	43,100	14,300	57,400
Colorado	4,300	2,320	0	2,320	10,300	0	10,300	12,600	0	12,600	14,200	0	14,200
Connecticut	3,410	143	0	143	565	3,440	4,010	708	3,440	4,150	794	3,860	4,650
Delaware	784	115	0	115	466	741	1,210	582	741	1,320	652	831	1,480
District of Columbia	572	0	0	0	9.87	0	9.87	9.87	0	9.87	11.1	0	11.1
Florida	16,000	5,020	0	5,020	3,110	12,000	15,100	8,140	12,000	20,100	9,120	13,400	22,500
Georgia	8,190	1,450	0	1,450	4,960	91.7	5,060	6,410	91.7	6,500	7,190	103	7,290
Hawaii	1,210	433	.85	434	208	0	208	640	.85	641	718	.95	719
Idaho	1,290	4,140	0	4,140	15,300	0	15,300	19,500	0	19,500	21,800	0	21,800
Illinois	12,400	813	0	813	12,900	0	12,900	13,700	0	13,700	15,400	0	15,400
Indiana	6,080	656	0	656	9,460	0	9,460	10,100	0	10,100	11,300	0	11,300
Iowa	2,930	679	0	679	2,680	0	2,680	3,360	0	3,360	3,770	0	3,770
Kansas	2,690	3,790	0	3,790	2,820	0	2,820	6,610	0	6,610	7,410	0	7,410
Kentucky	4,040	189	0	189	3,970	0	3,970	4,160	0	4,160	4,660	0	4,660
Louisiana	4,470	1,630	0	1,630	8,730	0	8,730	10,400	0	10,400	11,600	0	11,600
Maine	1,270	80.8	0	80.8	423	295	718	504	295	799	565	330	895
Maryland	5,300	225	0	225	1,200	6,490	7,690	1,430	6,490	7,910	1,600	7,270	8,870
Massachusetts	6,350	269	0	269	783	3,610	4,390	1,050	3,610	4,660	1,180	4,050	5,220
Michigan	9,940	734	0	734	9,260	0	9,260	10,000	0	10,000	11,200	0	11,200
Minnesota	4,920	720	0	720	3,150	0	3,150	3,870	0	3,870	4,340	0	4,340
Mississippi	2,840	2,180	0	2,180	632	148	781	2,810	148	2,960	3,150	166	3,320
Missouri	5,600	1,780	0	1,780	6,450	0	6,450	8,230	0	8,230	9,220	0	9,220
Montana	902	188	0	188	8,100	0	8,100	8,290	0	8,290	9,300	0	9,300
Nebraska	1,710	7,860	4.55	7,860	4,390	0	4,390	12,200	4.55	12,300	13,700	5.10	13,700
Nevada	2,000	757	0	757	2,050	0	2,050	2,810	0	2,810	3,140	0	3,140
New Hampshire	1,240	85.2	0	85.2	362	761	1,120	447	761	1,210	501	854	1,350
New Jersey	8,410	584	0	584	1,590	3,390	4,980	2,170	3,390	5,560	2,430	3,800	6,230
New Mexico	1,820	1,540	0	1,540	1,710	0	1,710	3,260	0	3,260	3,650	0	3,650
New York	19,000	893	0	893	6,190	5,010	11,200	7,080	5,010	12,100	7,940	5,610	13,600
North Carolina	8,050	580	0	580	9,150	1,620	10,800	9,730	1,620	11,400	10,900	1,810	12,700
North Dakota	642	123	0	123	1,020	0	1,020	1,140	0	1,140	1,280	0	1,280
Ohio	11,400	878	0	878	10,300	0	10,300	11,100	0	11,100	12,500	0	12,500
Oklahoma	3,450	771	256	1,030	990	0	990	1,760	256	2,020	1,970	287	2,260
Oregon	3,420	993	0	993	5,940	0	5,940	6,930	0	6,930	7,770	0	7,770
Pennsylvania	12,300	666	0	666	9,290	0	9,290	9,950	0	9,950	11,200	0	11,200
Rhode Island	1,050	28.6	0	28.6	110	290	400	138	290	429	155	326	481
South Carolina	4,010	330	0	330	6,840	0	6,840	7,170	0	7,170	8,040	0	8,040
South Dakota	755	222	0	222	306	0	306	528	0	528	592	0	592
Tennessee	5,690	417	0	417	10,400	0	10,400	10,800	0	10,800	12,100	0	12,100
Texas	20,900	8,470	504	8,970	16,300	4,350	20,700	24,800	4,850	29,600	27,800	5,440	33,200
Utah	2,230	1,020	26.5	1,050	3,740	177	3,920	4,760	203	4,970	5,340	228	5,570
Vermont	609	43.2	0	43.2	404	0	404	447	0	447	501	0	501
Virginia	7,080	314	0	314	4,880	3,640	8,520	5,200	3,640	8,830	5,830	4,080	9,900
Washington	5,890	1,470	0	1,470	3,800	39.9	3,840	5,270	39.9	5,310	5,910	44.7	5,960
West Virginia	1,810	90.9	0	90.9	5,060	0	5,060	5,150	0	5,150	5,770	0	5,770
Wisconsin	5,360	813	0	813	6,780	0	6,780	7,590	0	7,590	8,510	0	8,510
Wyoming	494	541	222	763	4,400	0	4,400	4,940	222	5,170	5,540	248	5,790
Puerto Rico	3,810	137	0	137	483	2,190	2,670	620	2,190	2,810	695	2,460	3,150
U.S. Virgin Islands	109	1.03	0	1.03	10.6	136	147	11.6	136	148	13.0	153	166
TOTAL	285,000	83,300	1,260	84,500	262,000	61,000	323,000	345,000	62,300	408,000	387,000	69,800	457,000

Table 2. Total water withdrawals by water-use category, 2000.

[Figures may not sum to totals because of independent rounding. All values are in million gallons per day. —, data not collected]

STATE	PUBLIC SUPPLY	DOMESTIC	IRRIGATION	LIVE-STOCK	AQUA-CULTURE	INDUSTRIAL		MINING		THERMOELECTRIC POWER		TOTAL		
	Fresh	Fresh	Fresh	Fresh	Fresh	Fresh	Saline	Fresh	Saline	Fresh	Saline	Fresh	Saline	Total
Alabama	834	78.9	43.1	—	10.4	833	0	—	—	8,190	0	9,990	0	9,990
Alaska	80.0	11.2	1.01	—	—	8.12	3.86	27.4	140	33.6	0	161	144	305
Arizona	1,080	28.9	5,400	—	—	19.8	0	85.7	8.17	100	0	6,720	8.17	6,730
Arkansas	421	28.5	7,910	—	198	134	.08	2.78	0	2,180	0	10,900	.08	10,900
California	6,120	286	30,500	409	537	188	13.6	23.7	153	352	12,600	38,400	12,800	51,200
Colorado	899	66.8	11,400	—	—	120	0	—	—	138	0	12,600	0	12,600
Connecticut	424	56.2	30.4	—	—	10.7	0	—	—	187	3,440	708	3,440	4,150
Delaware	94.9	13.3	43.5	3.92	.07	59.4	3.25	—	—	366	738	582	741	1,320
District of Columbia	0	0	.18	—	—	0	0	—	—	9.69	0	9.87	0	9.87
Florida	2,440	199	4,290	32.5	8.02	291	1.18	217	0	658	12,000	8,140	12,000	20,100
Georgia	1,250	110	1,140	19.4	15.4	622	30.0	9.80	0	3,250	61.7	6,410	91.7	6,500
Hawaii	250	12.0	364	—	—	14.5	.85	—	—	0	0	640	.85	641
Idaho	244	85.2	17,100	34.9	1,970	55.5	0	—	—	0	0	19,500	0	19,500
Illinois	1,760	135	154	37.6	—	391	0	—	—	11,300	0	13,700	0	13,700
Indiana	670	122	101	41.9	—	2,400	0	82.5	0	6,700	0	10,100	0	10,100
Iowa	383	33.2	21.5	109	—	237	0	32.8	0	2,540	0	3,360	0	3,360
Kansas	416	21.6	3,710	111	5.60	53.3	0	31.4	0	2,260	0	6,610	0	6,610
Kentucky	525	27.5	29.3	—	—	317	0	—	—	3,260	0	4,160	0	4,160
Louisiana	753	41.2	1,020	7.34	243	2,680	0	—	—	5,610	0	10,400	0	10,400
Maine	102	35.7	5.84	—	—	247	0	—	—	113	295	504	295	799
Maryland	824	77.1	42.4	10.4	19.6	65.8	227	8.31	.02	379	6,260	1,430	6,490	7,910
Massachusetts	739	42.2	126	—	—	36.8	0	—	—	108	3,610	1,050	3,610	4,660
Michigan	1,140	239	201	11.3	—	698	0	—	—	7,710	0	10,000	0	10,000
Minnesota	500	80.8	227	52.8	—	154	0	588	0	2,270	0	3,870	0	3,870
Mississippi	359	69.3	1,410	—	371	242	0	—	—	362	148	2,810	148	2,960
Missouri	872	53.6	1,430	72.4	83.3	62.7	0	16.9	0	5,640	0	8,230	0	8,230
Montana	149	18.6	7,950	—	—	61.3	0	—	—	110	0	8,290	0	8,290
Nebraska	330	48.4	8,790	93.4	—	38.1	0	128	4.55	2,820	0	12,200	4.55	12,300
Nevada	629	22.4	2,110	—	—	10.3	0	—	—	36.7	0	2,810	0	2,810
New Hampshire	97.1	41.0	4.75	—	16.3	44.9	0	6.80	0	236	761	447	761	1,210
New Jersey	1,050	79.7	140	1.68	6.46	132	0	110	0	650	3,390	2,170	3,390	5,560
New Mexico	296	31.4	2,860	—	—	10.5	0	—	—	56.4	0	3,260	0	3,260
New York	2,570	142	35.5	—	—	297	0	—	—	4,040	5,010	7,080	5,010	12,100
North Carolina	945	189	287	121	7.88	293	0	36.4	0	7,850	1,620	9,730	1,620	11,400
North Dakota	63.6	11.9	145	—	—	17.6	0	—	—	902	0	1,140	0	1,140
Ohio	1,470	134	31.7	25.3	1.36	807	0	88.5	0	8,590	0	11,100	0	11,100
Oklahoma	675	25.5	718	151	16.4	25.9	0	2.48	256	146	0	1,760	256	2,020
Oregon	566	76.2	6,080	—	—	195	0	—	—	15.3	0	6,930	0	6,930
Pennsylvania	1,460	132	13.9	—	—	1,190	0	182	0	6,980	0	9,950	0	9,950
Rhode Island	119	8.99	3.45	—	—	4.28	0	—	—	2.40	290	138	290	429
South Carolina	566	63.5	267	—	—	565	0	—	—	5,710	0	7,170	0	7,170
South Dakota	93.3	9.53	373	42.0	—	5.12	0	—	—	5.24	0	528	0	528
Tennessee	890	32.6	22.4	—	—	842	0	—	—	9,040	0	10,800	0	10,800
Texas	4,230	131	8,630	308	—	1,450	907	220	504	9,820	3,440	24,800	4,850	29,600
Utah	638	16.1	3,860	—	116	42.7	5.08	26.3	198	62.2	0	4,760	203	4,970
Vermont	60.1	21.0	3.78	—	—	6.91	0	—	—	355	0	447	0	447
Virginia	720	133	26.4	—	—	470	53.3	—	—	3,850	3,580	5,200	3,640	8,830
Washington	1,020	125	3,040	—	—	577	39.9	—	—	519	0	5,270	39.9	5,310
West Virginia	190	40.4	.04	—	—	968	0	—	—	3,950	0	5,150	0	5,150
Wisconsin	623	96.3	196	66.3	70.2	447	0	—	—	6,090	0	7,590	0	7,590
Wyoming	107	6.57	4,500	—	—	5.78	0	79.5	222	243	0	4,940	222	5,170
Puerto Rico	513	.88	94.5	—	—	11.2	0	—	—	0	2,190	620	2,190	2,810
U.S. Virgin Islands	6.09	1.69	.50	—	—	3.34	0	—	—	0	136	11.6	136	148
TOTAL	43,300	3,590	137,000	1,760	3,700	18,500	1,280	2,010	1,490	136,000	59,500	345,000	62,300	408,000

Table 3. Surface-water withdrawals by water-use category, 2000.

[Figures may not sum to totals because of independent rounding. All values are in million gallons per day. —, data not collected]

STATE	PUBLIC SUPPLY	DOMESTIC	IRRIGATION	LIVE-STOCK	AQUA-CULTURE	INDUSTRIAL		MINING		THERMOELECTRIC POWER		TOTAL		
	Fresh	Fresh	Fresh	Fresh	Fresh	Fresh	Saline	Fresh	Saline	Fresh	Saline	Fresh	Saline	Total
Alabama	553	0	28.7	—	1.44	777	0	—	—	8,190	0	9,550	0	9,550
Alaska	50.7	.25	.02	—	—	3.80	3.86	27.4	49.5	28.9	0	111	53.4	164
Arizona	613	0	2,660	—	—	0	0	4.43	0	26.2	0	3,300	0	3,300
Arkansas	289	0	1,410	—	10.4	66.8	0	2.57	0	2,170	0	3,950	0	3,950
California	3,320	28.6	18,900	227	380	5.65	13.6	2.71	.46	349	12,600	23,200	12,600	35,800
Colorado	846	0	9,260	—	—	96.4	0	—	—	122	0	10,300	0	10,300
Connecticut	358	0	13.4	—	—	6.61	0	—	—	186	3,440	565	3,440	4,010
Delaware	49.8	0	7.89	.22	0	42.5	3.25	—	—	366	738	466	741	1,210
District of Columbia	0	0	.18	—	—	0	0	—	—	9.69	0	9.87	0	9.87
Florida	237	0	2,110	1.51	.21	74.7	1.18	57.8	0	629	12,000	3,110	12,000	15,100
Georgia	968	0	392	17.7	7.72	333	30.0	2.05	0	3,240	61.7	4,960	91.7	5,060
Hawaii	7.60	7.22	193	—	—	0	0	—	—	0	0	208	0	208
Idaho	25.3	0	13,300	7.20	1,920	19.7	0	—	—	0	0	15,300	0	15,300
Illinois	1,410	0	4.25	0	—	259	0	—	—	11,300	0	12,900	0	12,900
Indiana	326	0	45.4	14.6	—	2,300	0	78.3	0	6,700	0	9,460	0	9,460
Iowa	79.8	0	1.08	27.1	—	11.7	0	30.3	0	2,530	0	2,680	0	2,680
Kansas	244	0	288	23.5	2.27	6.74	0	17.4	0	2,240	0	2,820	0	2,820
Kentucky	455	8.00	28.2	—	—	222	0	—	—	3,250	0	3,970	0	3,970
Louisiana	404	0	232	3.31	115	2,400	0	—	—	5,580	0	8,730	0	8,730
Maine	72.5	0	5.23	—	—	237	0	—	—	108	295	423	295	718
Maryland	740	0	12.6	3.18	14.8	49.9	227	4.10	.02	377	6,260	1,200	6,490	7,690
Massachusetts	542	0	106	—	—	26.2	0	—	—	108	3,610	783	3,610	4,390
Michigan	896	0	73.2	1.15	—	589	0	—	—	7,710	0	9,260	0	9,260
Minnesota	171	0	36.6	0	—	97.8	0	581	0	2,260	0	3,150	0	3,150
Mississippi	40.4	0	99.1	—	49.8	124	0	—	—	318	148	632	148	781
Missouri	594	0	48.1	54.1	81.3	33.5	0	12.8	0	5,620	0	6,450	0	6,450
Montana	92.4	1.29	7,870	—	—	29.3	0	—	—	110	0	8,100	0	8,100
Nebraska	63.8	0	1,370	17.4	—	2.60	0	122	0	2,810	0	4,390	0	4,390
Nevada	478	0	1,540	—	—	5.00	0	—	—	24.7	0	2,050	0	2,050
New Hampshire	64.1	.16	4.25	—	13.1	37.9	0	6.72	0	235	761	362	761	1,120
New Jersey	650	0	117	0	0	66.2	0	104	0	648	3,390	1,590	3,390	4,980
New Mexico	33.8	0	1,630	—	—	1.67	0	—	—	45.0	0	1,710	0	1,710
New York	1,980	0	12.1	—	—	152	0	—	—	4,040	5,010	6,190	5,010	11,200
North Carolina	779	0	221	32.3	0	267	0	0	0	7,850	1,620	9,150	1,620	10,800
North Dakota	31.2	0	73.2	—	—	10.7	0	—	—	902	0	1,020	0	1,020
Ohio	966	2.71	17.8	17.1	0	645	0	35.5	0	8,590	0	10,300	0	10,300
Oklahoma	562	0	151	97.2	16.1	19.1	0	.23	0	143	0	990	0	990
Oregon	447	7.97	5,290	—	—	183	0	—	—	12.8	0	5,940	0	5,940
Pennsylvania	1,250	0	12.5	—	—	1,030	0	20.9	0	6,970	0	9,290	0	9,290
Rhode Island	102	0	2.99	—	—	2.09	0	—	—	2.40	290	110	290	400
South Carolina	462	0	162	—	—	514	0	—	—	5,700	0	6,840	0	6,840
South Dakota	39.1	.01	236	25.2	—	1.96	0	—	—	4.01	0	306	0	306
Tennessee	569	0	15.1	—	—	785	0	—	—	9,040	0	10,400	0	10,400
Texas	2,970	0	2,130	172	—	1,200	906	91.5	0	9,760	3,440	16,300	4,350	20,700
Utah	274	0	3,390	—	0	8.38	0	17.7	177	49.2	0	3,740	177	3,920
Vermont	40.6	.25	3.45	—	—	4.86	0	—	—	355	0	404	0	404
Virginia	650	0	22.8	—	—	365	53.3	—	—	3,850	3,580	4,880	3,640	8,520
Washington	552	.02	2,290	—	—	439	39.9	—	—	518	0	3,800	39.9	3,840
West Virginia	149	.81	.02	—	—	958	0	—	—	3,950	0	5,060	0	5,060
Wisconsin	293	0	1.57	6.02	30.4	364	0	—	—	6,090	0	6,780	0	6,780
Wyoming	49.4	0	4,090	—	—	1.47	0	20.7	0	242	0	4,400	0	4,400
Puerto Rico	425	0	57.5	—	—	0	0	—	—	0	2,190	483	2,190	2,670
U.S. Virgin Islands	5.57	1.69	.21	—	—	3.12	0	—	—	0	136	10.6	136	147
TOTAL	27,300	58.9	80,000	747	2,640	14,900	1,280	1,240	227	135,000	59,500	262,000	61,000	323,000

Table 4. Ground-water withdrawals by water-use category, 2000.

[Figures may not sum to totals because of independent rounding. All values are in million gallons per day. —, data not collected]

STATE	PUBLIC SUPPLY	DOMESTIC	IRRIGATION	LIVE-STOCK	AQUA-CULTURE	INDUSTRIAL		MINING		THERMOELECTRIC POWER	TOTAL		
	Fresh	Fresh	Fresh	Fresh	Fresh	Fresh	Saline	Fresh	Saline	Fresh	Fresh	Saline	Total
Alabama	281	78.9	14.5	—	8.93	56.0	0	—	—	0	440	0	440
Alaska	29.3	10.9	.99	—	—	4.32	0	.01	90.4	4.65	50.2	90.4	141
Arizona	469	28.9	2,750	—	—	19.8	0	81.2	8.17	74.3	3,420	8.17	3,430
Arkansas	132	28.5	6,510	—	187	67.0	.08	.21	0	2.92	6,920	.08	6,920
California	2,800	257	11,600	182	158	183	0	21.0	152	3.23	15,200	152	15,400
Colorado	53.7	66.8	2,160	—	—	23.6	0	—	—	16.1	2,320	0	2,320
Connecticut	66.0	56.2	17.0	—	—	4.13	0	—	—	.08	143	0	143
Delaware	45.0	13.3	35.6	3.70	.07	17.0	0	—	—	.47	115	0	115
District of Columbia	0	0	0	—	—	0	0	—	—	0	0	0	0
Florida	2,200	199	2,180	31.0	7.81	216	0	160	0	29.5	5,020	0	5,020
Georgia	278	110	750	1.66	7.70	290	0	7.75	0	1.03	1,450	0	1,450
Hawaii	243	4.82	171	—	—	14.5	.85	—	—	0	433	.85	434
Idaho	219	85.2	3,720	27.7	51.5	35.8	0	—	—	0	4,140	0	4,140
Illinois	353	135	150	37.6	—	132	0	—	—	5.75	813	0	813
Indiana	345	122	55.5	27.3	—	99.7	0	4.20	0	2.58	656	0	656
Iowa	303	33.2	20.4	81.8	—	226	0	2.49	0	11.9	679	0	679
Kansas	172	21.6	3,430	87.2	3.33	46.6	0	14.0	0	14.9	3,790	0	3,790
Kentucky	71.0	19.5	1.14	—	—	95.2	0	—	—	2.71	189	0	189
Louisiana	349	41.2	791	4.03	128	285	0	—	—	28.4	1,630	0	1,630
Maine	29.6	35.7	.61	—	—	9.90	0	—	—	4.92	80.8	0	80.8
Maryland	84.6	77.1	29.8	7.18	4.81	15.9	0	4.21	0	1.80	225	0	225
Massachusetts	197	42.2	19.7	—	—	10.7	0	—	—	0	269	0	269
Michigan	247	239	128	10.2	—	110	0	—	—	0	734	0	734
Minnesota	329	80.8	190	52.8	—	56.3	0	6.90	0	4.17	720	0	720
Mississippi	319	69.3	1,310	—	321	118	0	—	—	43.5	2,180	0	2,180
Missouri	278	53.6	1,380	18.3	2.01	29.2	0	4.10	0	12.2	1,780	0	1,780
Montana	56.1	17.3	83.0	—	—	31.9	0	—	—	0	188	0	188
Nebraska	266	48.4	7,420	76.0	—	35.5	0	5.64	4.55	6.87	7,860	4.55	7,860
Nevada	151	22.4	567	—	—	5.29	0	—	—	12.0	757	0	757
New Hampshire	33.0	40.9	.50	—	3.12	6.95	0	.08	0	.71	85.2	0	85.2
New Jersey	400	79.7	22.8	1.68	6.46	65.3	0	6.12	0	2.24	584	0	584
New Mexico	262	31.4	1,230	—	—	8.80	0	—	—	11.4	1,540	0	1,540
New York	583	142	23.3	—	—	145	0	—	—	0	893	0	893
North Carolina	166	189	65.8	89.1	7.88	25.6	0	36.4	0	.09	580	0	580
North Dakota	32.4	11.9	72.2	—	—	6.88	0	—	—	0	123	0	123
Ohio	500	132	13.9	8.20	1.36	162	0	53.1	0	7.57	878	0	878
Oklahoma	113	25.5	566	53.6	.29	6.83	0	2.25	256	3.27	771	256	1,030
Oregon	118	68.3	792	—	—	12.1	0	—	—	2.47	993	0	993
Pennsylvania	212	132	1.38	—	—	155	0	162	0	3.98	666	0	666
Rhode Island	16.9	8.99	.46	—	—	2.19	0	—	—	0	28.6	0	28.6
South Carolina	105	63.5	106	—	—	50.9	0	—	—	5.83	330	0	330
South Dakota	54.2	9.52	137	16.9	—	3.16	0	—	—	1.23	222	0	222
Tennessee	321	32.6	7.33	—	—	56.3	0	—	—	0	417	0	417
Texas	1,260	131	6,500	137	—	244	.50	129	504	60.2	8,470	504	8,970
Utah	364	16.1	469	—	116	34.3	5.08	8.60	21.5	13.1	1,020	26.5	1,050
Vermont	19.5	20.7	.33	—	—	2.05	0	—	—	.66	43.2	0	43.2
Virginia	70.7	133	3.57	—	—	104	0	—	—	1.50	314	0	314
Washington	464	125	747	—	—	138	0	—	—	.92	1,470	0	1,470
West Virginia	41.6	39.6	.02	—	—	9.70	0	—	—	0	90.9	0	90.9
Wisconsin	330	96.3	195	60.3	39.8	83.0	0	—	—	8.99	813	0	813
Wyoming	57.2	6.57	413	—	—	4.31	0	58.8	222	1.13	541	222	763
Puerto Rico	88.5	.88	36.9	—	—	11.2	0	—	—	0	137	0	137
U.S. Virgin Islands	.52	0	.29	—	—	.22	0	—	—	0	1.03	0	1.03
TOTAL	16,000	3,530	56,900	1,010	1,060	3,570	6.51	767	1,260	409	83,300	1,260	84,500

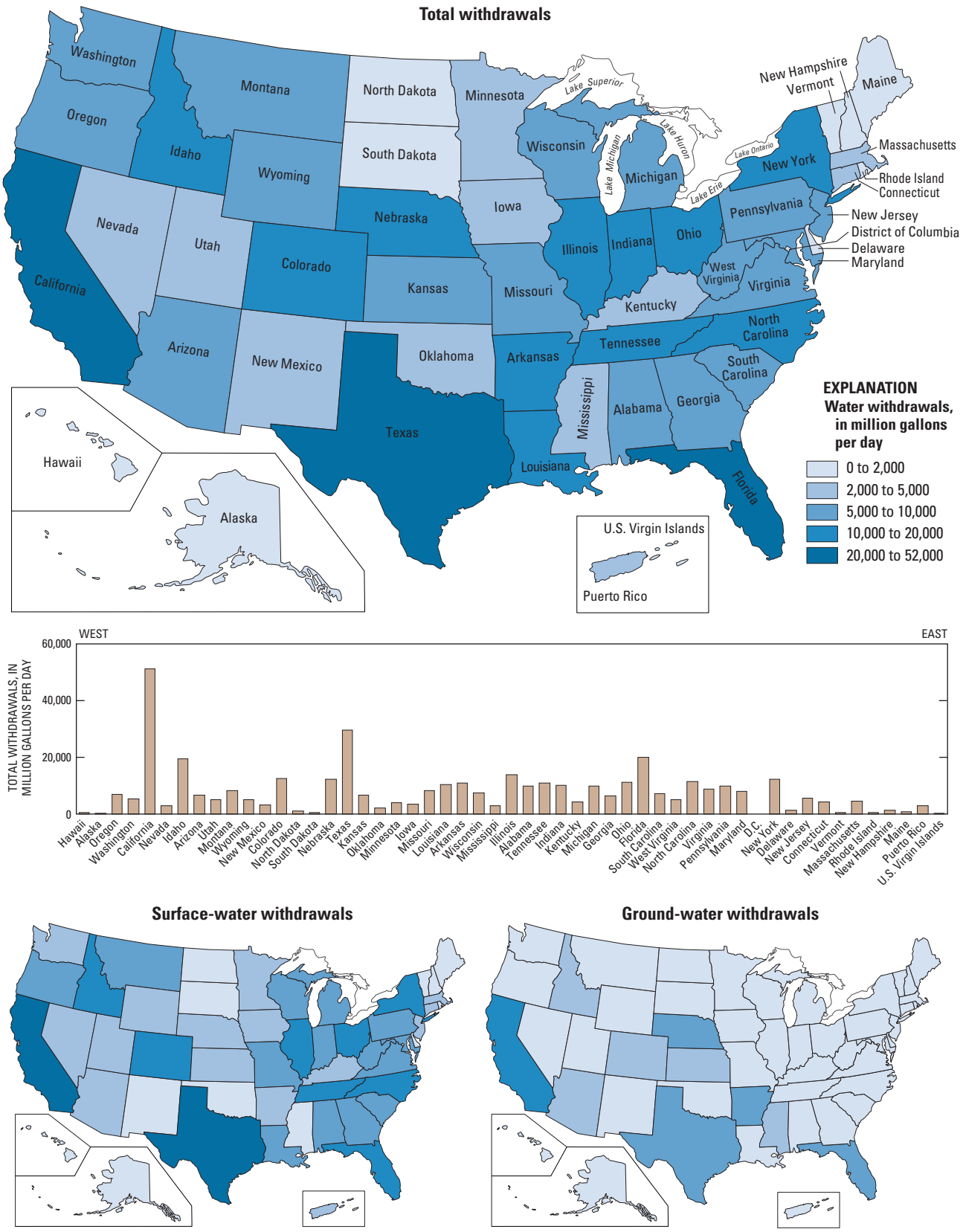


Figure 2. Total, surface-water, and ground-water withdrawals, 2000.

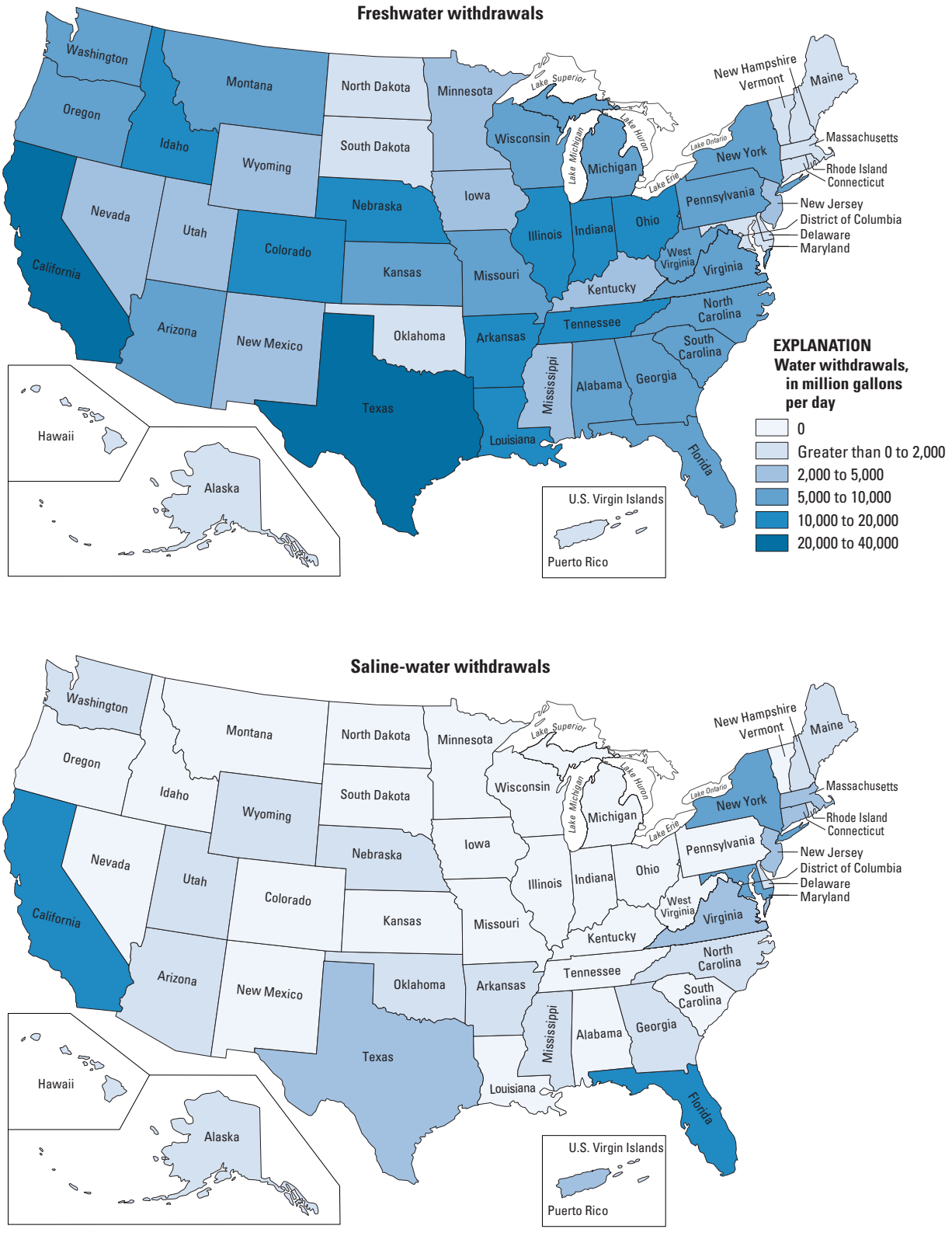


Figure 3. Fresh and saline water withdrawals, 2000.

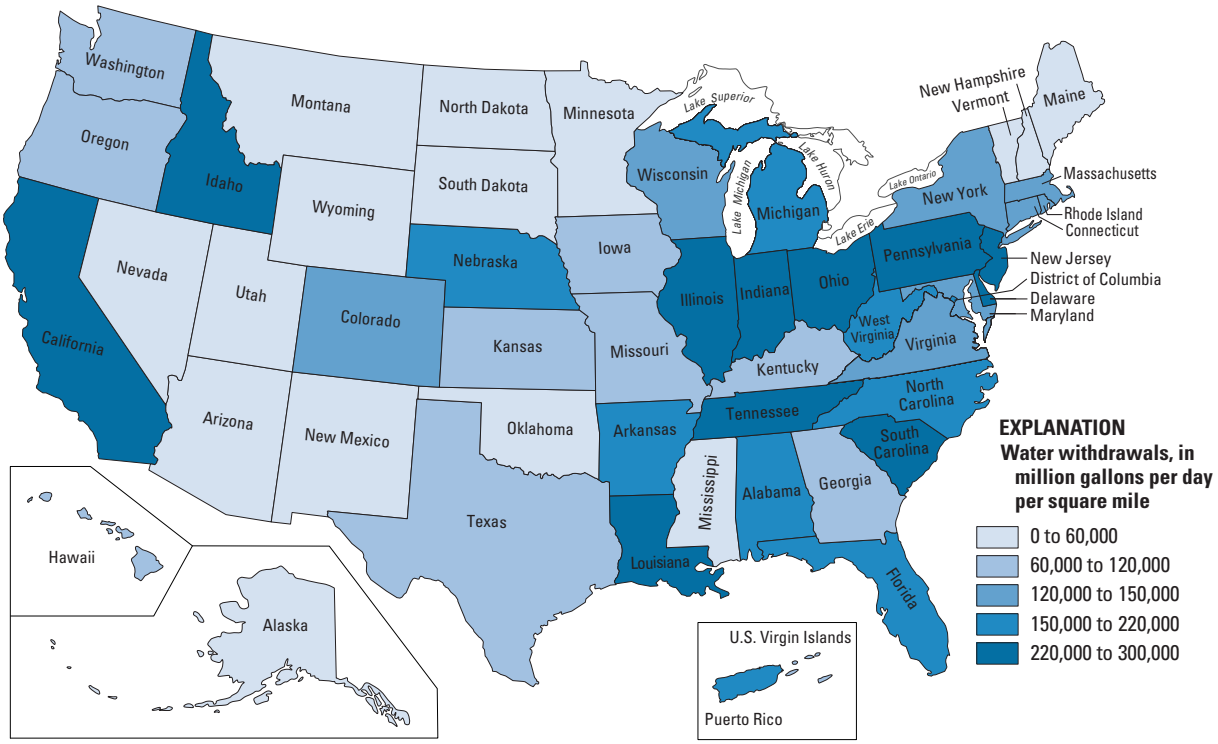


Figure 4. Intensity of freshwater withdrawals, 2000.

A sprinkler irrigation system in Colorado. Efficient irrigation systems help save water and decrease leaching of salts. (Photo courtesy of Gene Alexander, USDA Natural Resources Conservation Services.)

PUBLIC SUPPLY

43,300 million gallons per day

Public supply refers to water withdrawn by public and private water suppliers that furnish water to at least 25 people or have a minimum of 15 connections. Public-supply water may be delivered to users for domestic, commercial, industrial, or thermoelectric-power purposes. Some public-supply water may be delivered to other public suppliers or used in the processes of water and wastewater treatment. Public-supply water is used for such public services (public uses) as pools, parks, and public buildings; or be unaccounted for (losses) because of system leaks or such nonmetered services as firefighting or the flushing of water lines. Some public suppliers treat saline water before it is distributed. However, all public-supply withdrawals in this report are considered freshwater. Estimates for water deliveries, public use, and losses were not reported for 2000 for public supply.

Public-supply withdrawals and population are listed by State in table 5. For 2000, withdrawals were an estimated 43,300 Mgal/d, or 48,500 thousand acre-feet per year. Public-supply withdrawals were about 13 percent of total freshwater withdrawals and nearly 21 percent of total freshwater withdrawals for all categories excluding thermoelectric power. About 242 million people depended on water from public suppliers. The majority of the water for public supply (63 percent) was withdrawn from surface sources. Between 1995 and 2000, public-supply withdrawals and the population served increased 8 percent. The population served as a percentage of the total U.S. population was about 85 percent in 2000.

The geographic distribution of total, surface-water, and ground-water withdrawals for public supply is shown in figure 5. States with the largest populations withdrew the largest quantities of water. California, Texas, New York, Florida, and Illinois accounted for 40 percent of total public-supply withdrawals and 38 percent of the total population served by public suppliers. The largest surface-water withdrawals were in California and Texas, and the largest ground-water withdrawals were in California and Florida.

The source of data used for estimating public-supply water withdrawals by source of supply and population served varied by State. Public suppliers; State health, environmental, or water-permitting agencies; and the USEPA SDWIS database were the primary sources of information.

Fairmont Water Works (1815–1911), Philadelphia, Pa.
(Photo courtesy of Philadelphia Water Department.)

Table 5. Public-supply water withdrawals, 2000.

[Figures may not sum to totals because of independent rounding]

STATE	POPULATION (in thousands)			WITHDRAWALS (in million gallons per day)			WITHDRAWALS (in thousand acre-feet per year)		
		Served by public supply		By source			By source		
	Total	Population	Population (in percent)	Ground water	Surface water	Total	Ground water	Surface water	Total
Alabama	4,450	3,580	80	281	553	834	315	620	935
Alaska	627	421	67	29.3	50.7	80.0	32.9	56.9	89.7
Arizona	5,130	4,870	95	469	613	1,080	526	688	1,210
Arkansas	2,670	2,320	87	132	289	421	148	324	472
California	33,900	30,100	89	2,800	3,320	6,120	3,140	3,730	6,860
Colorado	4,300	3,750	87	53.7	846	899	60.2	948	1,010
Connecticut	3,410	2,660	78	66.0	358	424	74.0	402	476
Delaware	784	617	79	45.0	49.8	94.9	50.5	55.9	106
District of Columbia	572	572	100	0	0	0	0	0	0
Florida	16,000	14,000	88	2,200	237	2,440	2,470	266	2,730
Georgia	8,190	6,730	82	278	968	1,250	311	1,090	1,400
Hawaii	1,210	1,140	94	243	7.60	250	272	8.52	281
Idaho	1,290	928	72	219	25.3	244	245	28.3	274
Illinois	12,400	10,900	88	353	1,410	1,760	396	1,580	1,970
Indiana	6,080	4,480	74	345	326	670	386	365	751
Iowa	2,930	2,410	83	303	79.8	383	340	89.5	429
Kansas	2,690	2,500	93	172	244	416	193	273	466
Kentucky	4,040	3,490	86	71.0	455	525	79.5	510	589
Louisiana	4,470	3,950	88	349	404	753	392	453	844
Maine	1,270	726	57	29.6	72.5	102	33.2	81.3	115
Maryland	5,300	4,360	82	84.6	740	824	94.8	829	924
Massachusetts	6,350	5,880	93	197	542	739	220	608	828
Michigan	9,940	7,170	72	247	896	1,140	277	1,000	1,280
Minnesota	4,920	3,770	77	329	171	500	369	192	561
Mississippi	2,840	2,190	77	319	40.4	359	357	45.3	402
Missouri	5,600	4,770	85	278	594	872	311	666	978
Montana	902	664	74	56.1	92.4	149	62.9	104	167
Nebraska	1,710	1,390	81	266	63.8	330	299	71.6	370
Nevada	2,000	1,870	94	151	478	629	169	536	705
New Hampshire	1,240	756	61	33.0	64.1	97.1	37.0	71.9	109
New Jersey	8,410	7,460	89	400	650	1,050	449	729	1,180
New Mexico	1,820	1,460	80	262	33.8	296	294	37.9	332
New York	19,000	17,100	90	583	1,980	2,570	653	2,220	2,880
North Carolina	8,050	5,350	66	166	779	945	186	873	1,060
North Dakota	642	493	77	32.4	31.2	63.6	36.3	35.0	71.3
Ohio	11,400	9,570	84	500	966	1,470	560	1,080	1,640
Oklahoma	3,450	3,150	91	113	562	675	127	631	757
Oregon	3,420	2,730	80	118	447	566	133	501	634
Pennsylvania	12,300	10,100	82	212	1,250	1,460	237	1,400	1,640
Rhode Island	1,050	922	88	16.9	102	119	19.0	115	134
South Carolina	4,010	3,160	79	105	462	566	117	517	635
South Dakota	755	625	83	54.2	39.1	93.3	60.7	43.9	105
Tennessee	5,690	5,240	92	321	569	890	360	638	997
Texas	20,900	19,700	94	1,260	2,970	4,230	1,420	3,330	4,740
Utah	2,230	2,180	97	364	274	638	408	307	715
Vermont	609	362	59	19.5	40.6	60.1	21.8	45.6	67.4
Virginia	7,080	5,310	75	70.7	650	720	79.3	728	808
Washington	5,890	4,900	83	464	552	1,020	520	619	1,140
West Virginia	1,810	1,300	72	41.6	149	190	46.6	167	213
Wisconsin	5,360	3,620	67	330	293	623	370	329	699
Wyoming	494	406	82	57.2	49.4	107	64.1	55.3	119
Puerto Rico	3,810	3,800	100	88.5	425	513	99.2	476	576
U.S. Virgin Islands	109	53.4	49	.52	5.57	6.09	.58	6.24	6.83
TOTAL	285,000	242,000	85	16,000	27,300	43,300	17,900	30,600	48,500

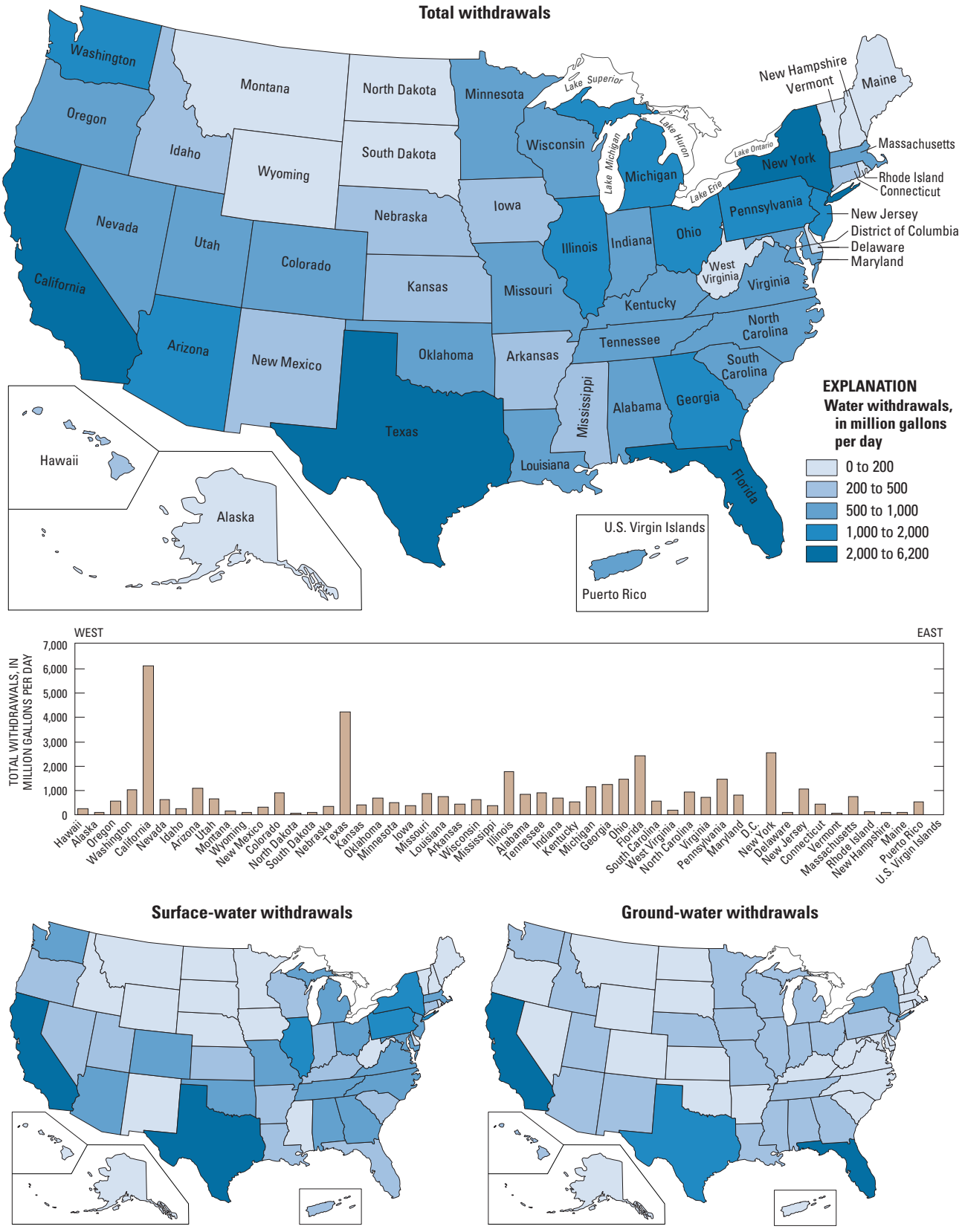
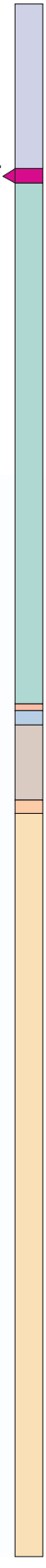


Figure 5. Public-supply withdrawals by source and State, 2000.



DOMESTIC

3,590 million gallons per day

Domestic water use is water used for indoor and outdoor household purposes. Common indoor uses include drinking, preparing food, bathing, washing clothes and dishes, and flushing toilets. The major outdoor uses are watering lawns and gardens. Water for domestic use may be delivered from a public supplier or be self-supplied. In this report, domestic use refers to self-supplied withdrawals only. For self-supplied domestic water, the source usually is a well. All self-supplied domestic withdrawals were considered freshwater. Self-supplied domestic population was defined as the difference between the total population for 2000, as determined by the U.S. Census Bureau, and the population served by public suppliers. Public-supply deliveries to domestic users and consumptive use were not reported for 2000.

Self-supplied domestic withdrawals and population are listed by State in table 6. For 2000, withdrawals were an estimated 3,590 Mgal/d or 4,030 thousand acre-feet per year. Self-supplied domestic withdrawals were about 1 percent of total freshwater withdrawals and about 2 percent of total freshwater withdrawals for all categories excluding thermoelectric power. About 43.5 million people were self-supplied. Ground water was the primary source of the water (98 percent). Between 1995 and 2000, self-supplied domestic withdrawals increased about 6 percent and the self-supplied domestic population increased about 2 percent. The self-supplied domestic population was 15 percent of the total U.S. population.

The geographic distribution of total withdrawals for self-supplied domestic use, self-supplied domestic population, and self-supplied domestic population as a percentage of the State total population is shown in figures 6a and 6b, respectively. The largest self-supplied domestic withdrawals and self-supplied populations were in California and Michigan. These two States represented 15 percent of the total self-supplied domestic withdrawals and 15 percent of the total self-supplied domestic population. Some States, such as the U.S. Virgin Islands, Maine, and Vermont, had large percentages of the total State population that were self-supplied.

Self-supplied domestic withdrawals are rarely measured or reported. Therefore, self-supplied domestic withdrawals were estimated using self-supplied domestic population and per capita use coefficients. Coefficients varied from one geographic region to another. Domestic per capita use coefficients were either derived using public-supply delivery data for domestic use, or were obtained from a State agency, a planning or research organization, or were obtained from published values in the technical literature.

(Photo courtesy of Glenn Phillips, IMEC.)

Table 6. Self-supplied domestic water withdrawals, 2000.

[Figures may not sum to totals because of independent rounding]

STATE	POPULATION (in thousands)				WITHDRAWALS (in million gallons per day)			WITHDRAWALS (in thousand acre-feet per year)		
			Self-supplied domestic		By source			By source		
	Total	Served by public supply	Population	Population (in percent)	Ground water	Surface water	Total	Ground water	Surface water	Total
Alabama	4,450	3,580	868	20	78.9	0	78.9	88.4	0	88.4
Alaska	627	421	206	33	10.9	.25	11.2	12.2	.28	12.5
Arizona	5,130	4,870	265	5	28.9	0	28.9	32.4	0	32.4
Arkansas	2,670	2,320	351	13	28.5	0	28.5	31.9	0	31.9
California	33,900	30,100	3,810	11	257	28.6	286	288	32.0	320
Colorado	4,300	3,750	555	13	66.8	0	66.8	74.9	0	74.9
Connecticut	3,410	2,660	749	22	56.2	0	56.2	63.0	0	63.0
Delaware	784	617	166	21	13.3	0	13.3	14.9	0	14.9
District of Columbia	572	572	0	0	0	0	0	0	0	0
Florida	16,000	14,000	1,950	12	199	0	199	223	0	223
Georgia	8,190	6,730	1,450	18	110	0	110	123	0	123
Hawaii	1,210	1,140	72.9	6	4.82	7.22	12.0	5.40	8.09	13.5
Idaho	1,290	928	366	28	85.2	0	85.2	95.6	0	95.6
Illinois	12,400	10,900	1,500	12	135	0	135	152	0	152
Indiana	6,080	4,480	1,600	26	122	0	122	137	0	137
Iowa	2,930	2,410	511	17	33.2	0	33.2	37.2	0	37.2
Kansas	2,690	2,500	193	7	21.6	0	21.6	24.2	0	24.2
Kentucky	4,040	3,490	552	14	19.5	8.00	27.5	21.9	8.97	30.8
Louisiana	4,470	3,950	523	12	41.2	0	41.2	46.2	0	46.2
Maine	1,270	726	549	43	35.7	0	35.7	40.0	0	40.0
Maryland	5,300	4,360	932	18	77.1	0	77.1	86.4	0	86.4
Massachusetts	6,350	5,880	473	7	42.2	0	42.2	47.2	0	47.2
Michigan	9,940	7,170	2,770	28	239	0	239	268	0	268
Minnesota	4,920	3,770	1,150	23	80.8	0	80.8	90.6	0	90.6
Mississippi	2,840	2,190	654	23	69.3	0	69.3	77.7	0	77.7
Missouri	5,600	4,770	824	15	53.6	0	53.6	60.1	0	60.1
Montana	902	664	238	26	17.3	1.29	18.6	19.4	1.45	20.8
Nebraska	1,710	1,390	324	19	48.4	0	48.4	54.3	0	54.3
Nevada	2,000	1,870	124	6	22.4	0	22.4	25.2	0	25.2
New Hampshire	1,240	756	479	39	40.9	.16	41.0	45.8	.18	46.0
New Jersey	8,410	7,460	952	11	79.7	0	79.7	89.3	0	89.3
New Mexico	1,820	1,460	360	20	31.4	0	31.4	35.2	0	35.2
New York	19,000	17,100	1,890	10	142	0	142	159	0	159
North Carolina	8,050	5,350	2,700	34	189	0	189	212	0	212
North Dakota	642	493	149	23	11.9	0	11.9	13.3	0	13.3
Ohio	11,400	9,570	1,790	16	132	2.71	134	148	3.04	151
Oklahoma	3,450	3,150	299	9	25.5	0	25.5	28.5	0	28.5
Oregon	3,420	2,730	692	20	68.3	7.97	76.2	76.5	8.93	85.5
Pennsylvania	12,300	10,100	2,190	18	132	0	132	148	0	148
Rhode Island	1,050	922	127	12	8.99	0	8.99	10.1	0	10.1
South Carolina	4,010	3,160	847	21	63.5	0	63.5	71.2	0	71.2
South Dakota	755	625	129	17	9.52	.01	9.53	10.7	.01	10.7
Tennessee	5,690	5,240	453	8	32.6	0	32.6	36.6	0	36.6
Texas	20,900	19,700	1,190	6	131	0	131	147	0	147
Utah	2,230	2,180	56.2	3	16.1	0	16.1	18.0	0	18.0
Vermont	609	362	247	41	20.7	.25	21.0	23.2	.28	23.5
Virginia	7,080	5,310	1,770	25	133	0	133	150	0	150
Washington	5,890	4,900	993	17	125	.02	125	140	.02	140
West Virginia	1,810	1,300	505	28	39.6	.81	40.4	44.4	.91	45.3
Wisconsin	5,360	3,620	1,750	33	96.3	0	96.3	108	0	108
Wyoming	494	406	87.5	18	6.57	0	6.57	7.36	0	7.36
Puerto Rico	3,810	3,800	12.8	0	.88	0	.88	.99	0	.99
U.S. Virgin Islands	109	53.4	55.2	51	0	1.69	1.69	0	1.89	1.89
TOTAL	285,000	242,000	43,500	15	3,530	58.9	3,590	3,960	66.1	4,030

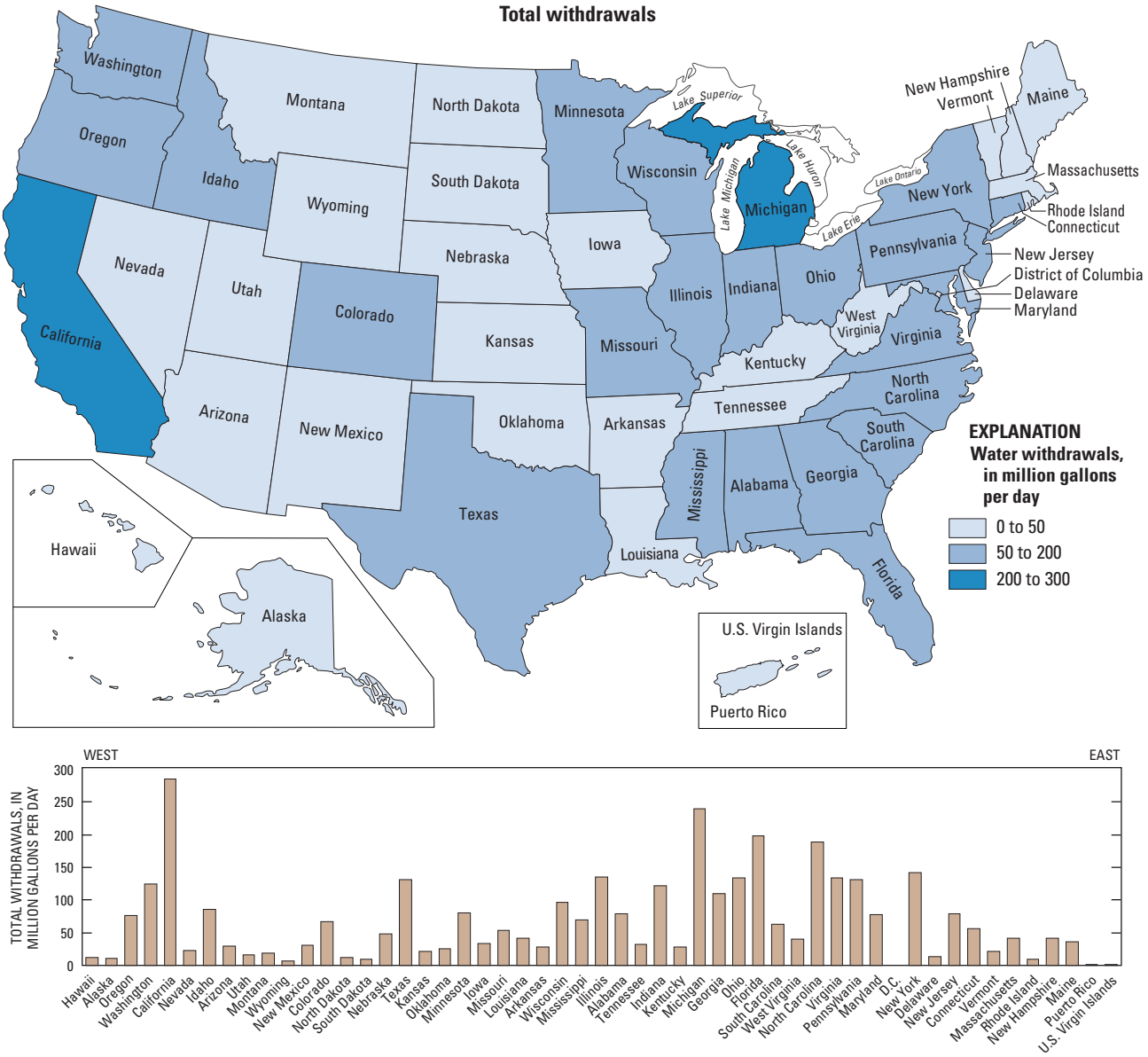
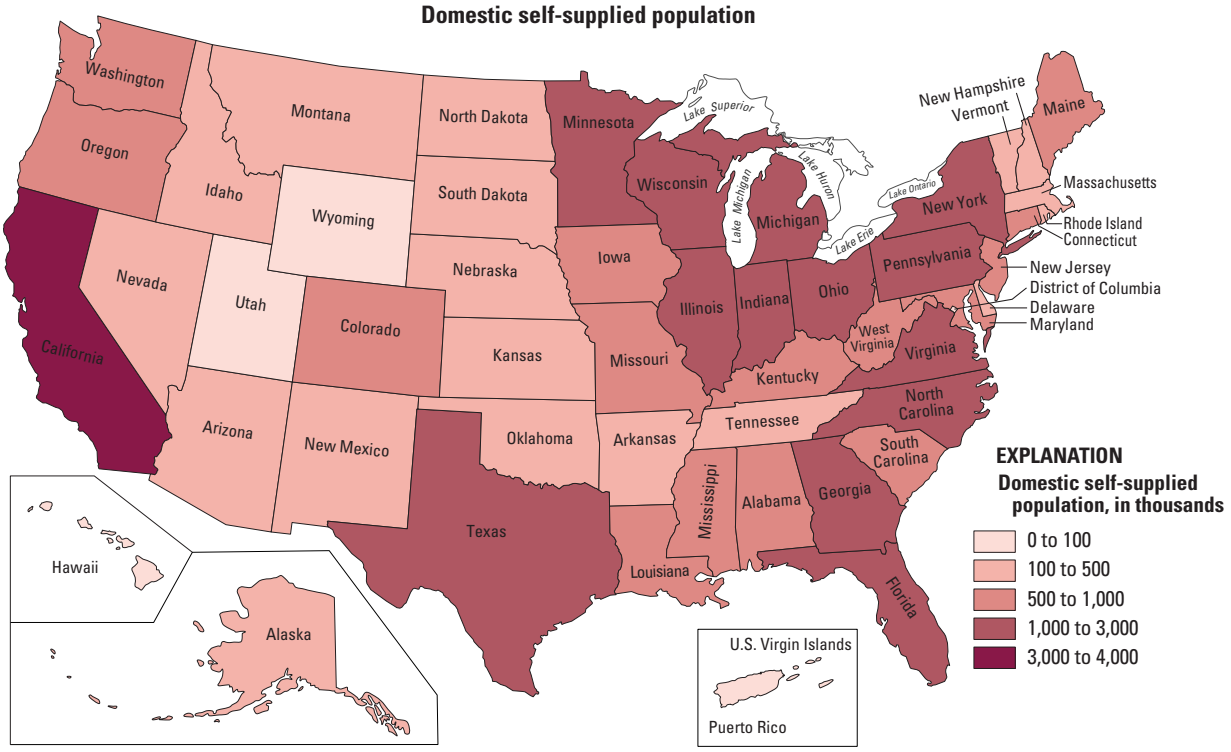


Figure 6a. Self-supplied domestic withdrawals by State, 2000.



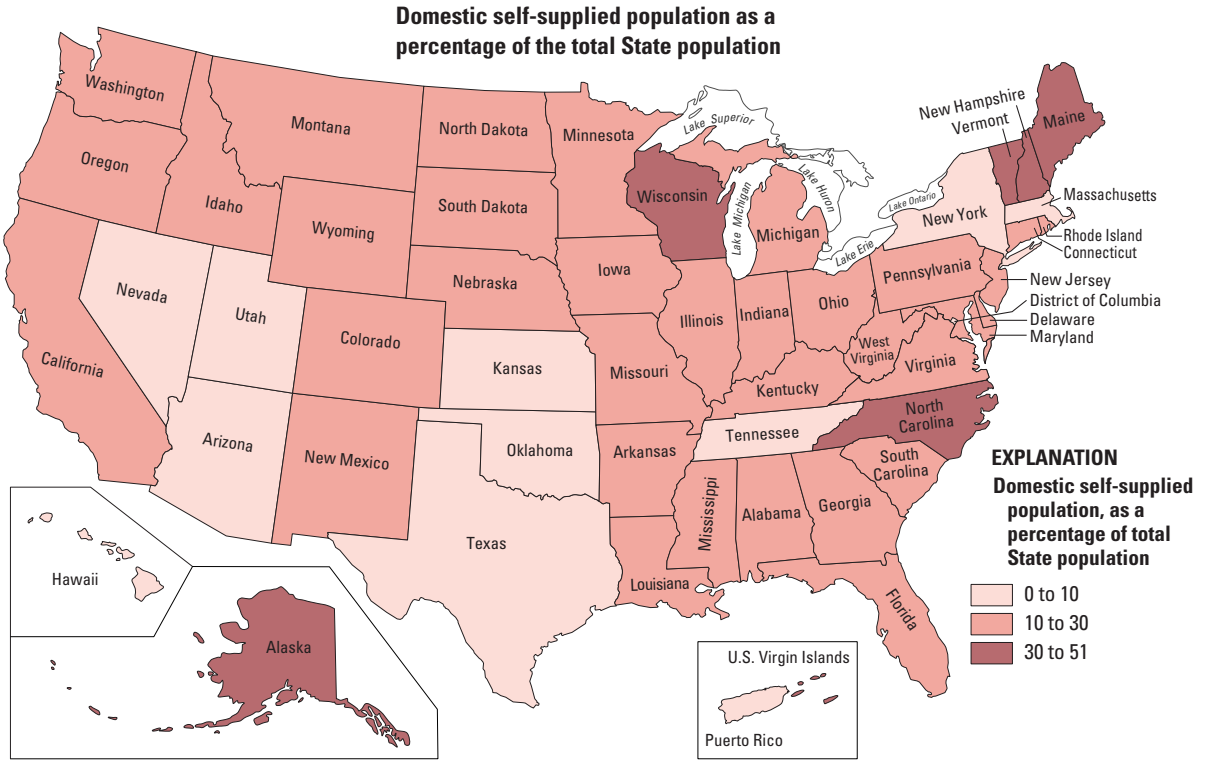
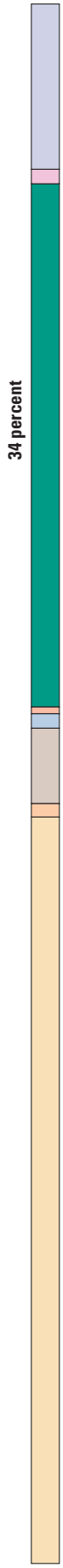


Figure 6b. Self-supplied domestic population and self-supplied domestic population as a percentage of total population, 2000.



IRRIGATION — 137,000 million gallons per day

Irrigation water use includes water that is applied by an irrigation system to sustain plant growth in all agricultural and horticultural practices. Irrigation also includes water that is applied for pre-irrigation, frost protection, application of chemicals, weed control, field preparation, crop cooling, harvesting, dust suppression, leaching salts from the root zone, and water lost in conveyance. Irrigation of golf courses, parks, nurseries, turf farms, cemeteries, and other self-supplied landscape-watering uses also are included. Irrigation water use includes self-supplied withdrawals and deliveries from irrigation companies, irrigation districts, cooperatives, or governmental entities. All irrigation withdrawals were considered freshwater. Irrigated acres were reported by three types of irrigation methods: sprinkler, microirrigation, and surface (flood). For 2000, reclaimed wastewater, conveyances losses, and consumptive use were not reported separately for irrigation.

Irrigation withdrawals and irrigated acres by irrigation system are listed by State in table 7. For 2000, withdrawals were an estimated 137,000 Mgal/d, or 153,000 thousand acre-feet per year. Irrigation withdrawals were 40 percent of total freshwater withdrawals and 65 percent of total freshwater withdrawals for all categories excluding thermoelectric power. Surface water accounted for 58 percent of the total irrigation withdrawals. About 61,900 thousand acres were irrigated in 2000. Of this total acreage, about 29,400 thousand acres were irrigated with surface (flood) systems; 28,300 thousand acres with sprinkler systems; and 4,180 thousand acres with microirrigation systems. Application rates were calculated by dividing total withdrawals by irrigated acres. The average application rate was 2.48 acre-feet per acre for the United States.

Side-wheel sprinkler systems irrigate alfalfa in Utah. (Photo courtesy of Ron Nichols, USDA Natural Resources Conservation Service.)

The geographic distribution of total, surface-water, and ground-water withdrawals for irrigation is shown in figure 7. The majority of withdrawals (86 percent) and irrigated acres (75 percent) were in the 17 conterminous western States. Irrigated acreage in these States were located in areas where average annual precipitation typically is less than 20 inches and is insufficient to support crops without supplemental water. Surface water was the primary source of water in the arid West and the Mountain States. Ground water was the primary source of water in the Central States. California, Idaho, Colorado, and Nebraska combined accounted for one-half of the total irrigation withdrawals. California and Idaho accounted for 40 percent of surface-water withdrawals. California and Nebraska accounted for one-third of ground-water withdrawals.

California, Nebraska, Texas, Arkansas, and Idaho accounted for 53 percent of total irrigated acreage. California, Nebraska, and Texas accounted for 40 percent of the irrigated acreage using sprinkler and microirrigation systems. California alone accounted for 72 percent of the irrigated acreage by microirrigation systems. Sprinkler and microirrigation systems were associated with slightly more than 50 percent of total irrigated acreage.

Application rates were greatest in the arid West and the Mountain States where surface water was available and surface (flood) application was the predominant method of irrigation. In Arizona, Montana, and Idaho, application rates exceeded 5 acre-feet per acre. States that utilized the High Plains aquifer (Nebraska, Texas, Kansas, and Oklahoma) or the Mississippi River alluvium (Arkansas, Missouri, Mississippi, and Louisiana) for irrigation relied mostly on ground water and had application rates ranging between 1 and 2 acre-feet per acre. Sprinkler irrigation was the predominant application method in the Central Plains States of Kansas, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas. Surface irrigation was the predominant application method in Arkansas, Louisiana, Mississippi, and Missouri.

Estimates of total irrigation withdrawals for 2000 were about 2 percent more than during 1995. Surface-water withdrawals were about 5 percent less for 2000 compared to 1995, but ground-water withdrawals were 16 percent more. The estimated number of irrigated acres was about 7 percent more, which resulted in a slightly lower average application rate for 2000. The number of acres irrigated for 2000 using sprinkler or microirrigation systems was 25 percent more than during 1995.

Sources of data for irrigation withdrawals and irrigated acres included State and Federal crop reporting programs. Withdrawals also were estimated using information on irrigated crop acreages along with specific crop water-consumption coefficients or irrigation-system application rates. Estimation methods varied from one geographic area to another. Estimation methods ideally included adjustments for climatic variables, system efficiencies, conveyance losses, and other irrigation practices such as pre-irrigation. Other methods of estimating irrigation withdrawals included extrapolation of sample data on crop water-application rates or power-consumption coefficients.

Table 7. Irrigation water withdrawals, 2000.

[Figures may not sum to totals because of independent rounding]

STATE	IRRIGATED LAND (in thousand acres)				WITHDRAWALS (in million gallons per day)			WITHDRAWALS (in thousand acre-feet per year)			APPLICATION RATE (in acre-feet per acre)
	By type of irrigation				By source			By source			
	Sprinkler	Micro-irrigation	Surface	Total	Ground water	Surface water	Total	Ground water	Surface water	Total	
Alabama	68.7	1.30	0	70.0	14.5	28.7	43.1	16.2	32.2	48.4	0.69
Alaska	2.43	0	.07	2.50	.99	.02	1.01	1.11	.02	1.13	.45
Arizona	183	14.0	779	976	2,750	2,660	5,400	3,080	2,980	6,060	6.21
Arkansas	631	0	3,880	4,510	6,510	1,410	7,910	7,290	1,580	8,870	1.97
California	1,660	3,010	5,470	10,100	11,600	18,900	30,500	13,100	21,100	34,200	3.37
Colorado	1,190	1.16	2,220	3,400	2,160	9,260	11,400	2,420	10,400	12,800	3.76
Connecticut	20.6	.39	0	21.0	17.0	13.4	30.4	19.0	15.0	34.0	1.62
Delaware	81.1	.71	0	81.8	35.6	7.89	43.5	39.9	8.84	48.7	.60
District of Columbia	.32	0	0	.32	0	.18	.18	0	.20	.20	.63
Florida	515	704	839	2,060	2,180	2,110	4,290	2,450	2,370	4,810	2.34
Georgia	1,470	73.8	0	1,540	750	392	1,140	841	439	1,280	.83
Hawaii	16.7	105	0	122	171	193	364	191	216	407	3.35
Idaho	2,440	4.70	1,300	3,750	3,720	13,300	17,100	4,170	15,000	19,100	5.10
Illinois	365	0	0	365	150	4.25	154	168	4.76	173	.47
Indiana	250	0	0	250	55.5	45.4	101	62.2	51.0	113	.45
Iowa	84.5	0	0	84.5	20.4	1.08	21.5	22.9	1.21	24.1	.28
Kansas	2,660	2.14	647	3,310	3,430	288	3,710	3,840	323	4,160	1.26
Kentucky	66.6	0	0	66.6	1.14	28.2	29.3	1.28	31.6	32.9	.49
Louisiana	110	0	830	940	791	232	1,020	887	261	1,150	1.22
Maine	35.0	.95	.03	36.0	.61	5.23	5.84	.68	5.86	6.55	.18
Maryland	57.3	3.32	0	60.6	29.8	12.6	42.4	33.4	14.1	47.6	.78
Massachusetts	26.6	2.35	0	29.0	19.7	106	126	22.1	119	141	4.88
Michigan	401	8.67	4.87	415	128	73.2	201	144	82.0	226	.54
Minnesota	546	0	26.9	573	190	36.6	227	213	41.1	254	.44
Mississippi	455	0	966	1,420	1,310	99.1	1,410	1,470	111	1,580	1.11
Missouri	532	1.43	792	1,330	1,380	48.1	1,430	1,550	53.9	1,600	1.21
Montana	506	0	1,220	1,720	83.0	7,870	7,950	93.0	8,820	8,920	5.18
Nebraska	4,110	0	3,710	7,820	7,420	1,370	8,790	8,320	1,540	9,860	1.26
Nevada	192	0	456	647	567	1,540	2,110	635	1,730	2,360	3.65
New Hampshire	6.08	0	0	6.08	.50	4.25	4.75	.56	4.76	5.32	.88
New Jersey	109	15.7	3.70	128	22.8	117	140	25.5	131	156	1.22
New Mexico	461	7.17	530	998	1,230	1,630	2,860	1,380	1,830	3,210	3.22
New York	70.0	8.73	1.84	80.6	23.3	12.1	35.5	26.1	13.6	39.8	.49
North Carolina	193	3.70	0	196	65.8	221	287	73.8	248	322	1.64
North Dakota	200	0	26.7	227	72.2	73.2	145	80.9	82.1	163	.72
Ohio	61.0	0	0	61.0	13.9	17.8	31.7	15.6	19.9	35.5	.58
Oklahoma	392	1.50	113	507	566	151	718	635	170	804	1.59
Oregon	1,160	4.02	1,000	2,170	792	5,290	6,080	887	5,920	6,810	3.14
Pennsylvania	28.9	7.17	0	36.0	1.38	12.5	13.9	1.55	14.0	15.6	.43
Rhode Island	4.48	.29	.05	4.82	.46	2.99	3.45	.52	3.35	3.87	.80
South Carolina	166	3.66	17.5	187	106	162	267	118	181	300	1.60
South Dakota	276	0	78.3	354	137	236	373	153	264	418	1.18
Tennessee	51.2	5.35	3.96	60.5	7.33	15.1	22.4	8.22	16.9	25.1	.41
Texas	4,010	89.4	2,390	6,490	6,500	2,130	8,630	7,290	2,390	9,680	1.49
Utah	526	1.68	880	1,410	469	3,390	3,860	526	3,800	4,330	3.08
Vermont	4.95	0	0	4.95	.33	3.45	3.78	.37	3.87	4.24	.86
Virginia	64.3	13.9	0	78.2	3.57	22.8	26.4	4.00	25.6	29.6	.38
Washington	1,270	49.9	252	1,570	747	2,290	3,040	837	2,570	3,400	2.16
West Virginia	2.21	0	.98	3.19	.02	.02	.04	.02	.02	.04	.01
Wisconsin	355	0	0	355	195	1.57	196	218	1.76	220	.62
Wyoming	190	4.73	964	1,160	413	4,090	4,500	463	4,580	5,050	4.36
Puerto Rico	15.5	33.0	5.35	53.8	36.9	57.5	94.5	41.4	64.5	106	1.97
U.S. Virgin Islands	.20	0	0	.20	.29	.21	.50	.33	.24	.56	2.80
TOTAL	28,300	4,180	29,400	61,900	56,900	80,000	137,000	63,800	89,700	153,000	2.48

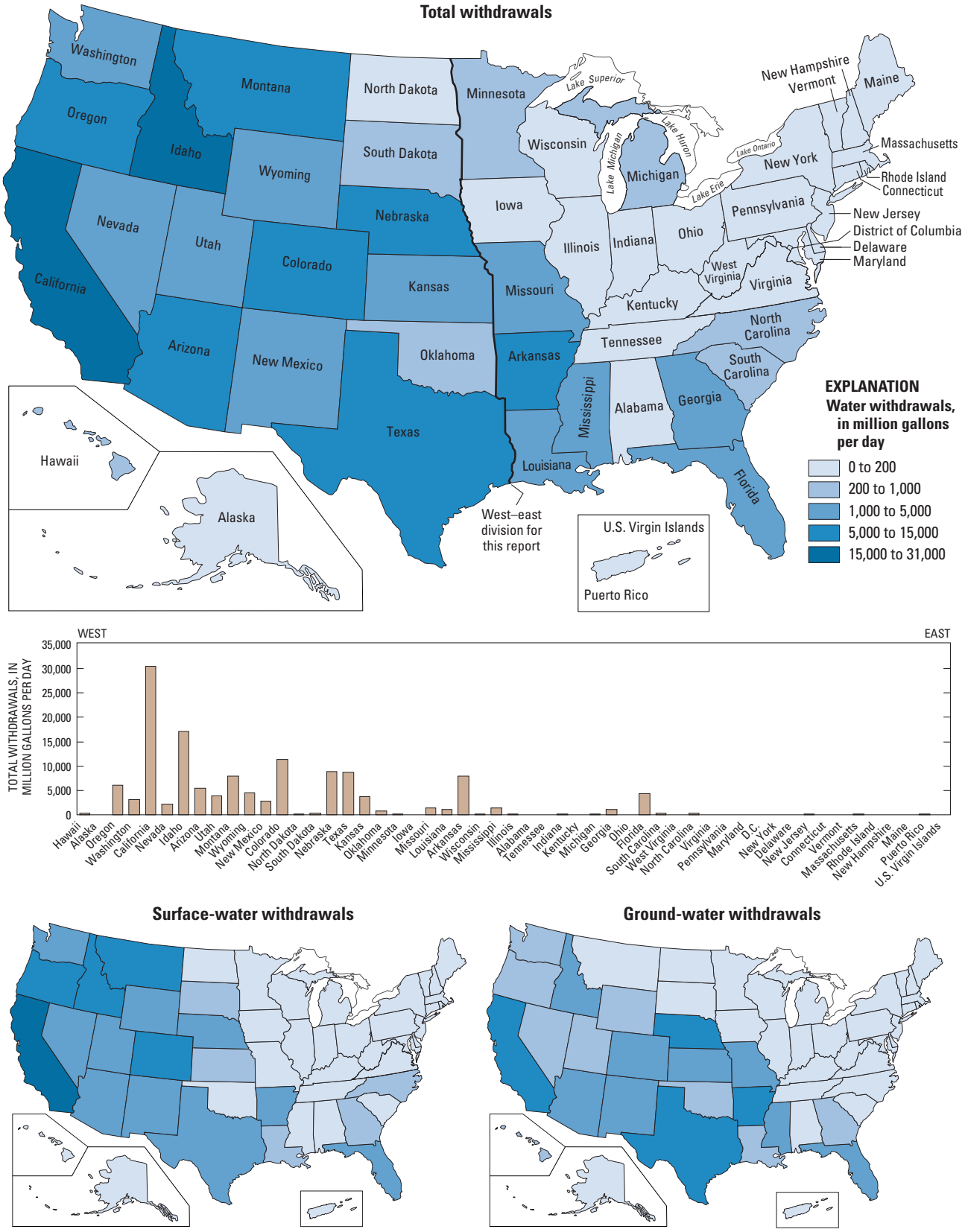


Figure 7. Irrigation withdrawals by source and State, 2000.

LIVESTOCK

1,760 million gallons per day

Livestock water use is water associated with livestock watering, feedlots, dairy operations, and other on-farm needs. Livestock includes dairy cows and heifers, beef cattle and calves, sheep and lambs, goats, hogs and pigs, horses, and poultry. Other livestock water uses include cooling of facilities for the animals and products, dairy sanitation and wash down of facilities, animal waste-disposal systems, and incidental water losses. All withdrawals were considered freshwater and self-supplied. The livestock category excludes on-farm domestic use, lawn and garden watering, and irrigation water use. For 2000, consumptive use was not reported for livestock.

In the 1990 and 1995 USGS water-use Circulars (Solley and others, 1993, 1998, respectively), the livestock category was split into the subcategories of livestock and animal specialties as specified in the 1987 Standard Industrial Classification manual (Office of Management and Budget, 1987). In the 1990 and 1995 Circulars, withdrawals for fish farms and watering horses were included in animal specialties; withdrawals for fish hatcheries were included in the commercial category. For 2000, the livestock category includes the types of animals formerly included in animal specialties. Fish farms and fish hatcheries comprised the aquaculture category for 2000.

Ponds to deliver water to cattle are important to ranches in South Dakota. (Photo courtesy of USDA Natural Resources Conservation Service.)

For 2000, the estimate of livestock water use for the United States was based on estimates of total freshwater withdrawals for livestock in 22 States, rather than on estimates from all States. These 22 States included the 10 States with the largest withdrawals for the livestock subcategory during 1995, and 12 other States in which livestock water-use data were collected as part of a broader State water-use program. The 22 States reporting for 2000 accounted for 75 percent of the livestock subcategory water use during 1995. During 1995, water withdrawals for the livestock subcategory accounted for a small percentage of the total, less than 1 percent of the total water withdrawals for all categories.

Livestock withdrawals for 2000 are listed by State in table 8. During 2000, withdrawals were an estimated 1,760 Mgal/d, or 1,980 thousand acre-feet per year. Livestock withdrawals were less than 1 percent of total freshwater withdrawals and nearly 1 percent of total freshwater withdrawals for all categories excluding thermoelectric power. Ground water was the source for 58 percent of total livestock withdrawals. Total withdrawals for livestock increased slightly for the 22 States that reported data for both 1995 and 2000. However, withdrawals actually increased only in 8 of the 22 reporting States.

The geographic distribution of total, surface-water, and ground-water withdrawals for livestock is shown in figure 8. California, Texas, and Oklahoma accounted for 49 percent of total livestock withdrawals for States that reported for 2000. California, Texas, North Carolina, and Kansas accounted for nearly one-half of ground-water withdrawals. California, Texas, and Oklahoma accounted for two-thirds of surface-water withdrawals. The areas of major water withdrawals for livestock (as shown in figure 8), for the most part, correspond to the major areas where corn, hay, and alfalfa are grown. For example, the major hog- and pig-producing States of Iowa, Minnesota, and Illinois also are major corn-growing States; the major cattle- and calf-producing States of Texas, Kansas, and Nebraska also are major hay and alfalfa growing States (U.S. Department of Agriculture, May 1999).

Few State agencies require livestock operations to report water withdrawals; therefore, most estimates of withdrawals for livestock typically were derived using animal population counts (most often from the USDA National Agricultural Statistics Service) and a coefficient for gallons of water per animal per day. Coefficients vary by State and, for most States, were provided by agricultural extension agents or water-permitting agencies. Coefficients may reflect both the effect of climate on animal watering and facility maintenance needs.

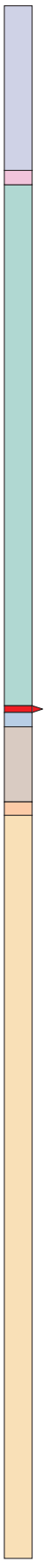


Table 8. Livestock water withdrawals, 2000.

[Figures may not sum to totals because of independent rounding. —, data not collected]

STATE	WITHDRAWALS (in million gallons per day)			WITHDRAWALS (in thousand acre-feet per year)		
	By source			By source		
	Ground water	Surface water	Total	Ground water	Surface water	Total
Alabama	—	—	—	—	—	—
Alaska	—	—	—	—	—	—
Arizona	—	—	—	—	—	—
Arkansas	—	—	—	—	—	—
California	182	227	409	204	255	458
Colorado	—	—	—	—	—	—
Connecticut	—	—	—	—	—	—
Delaware	3.70	.22	3.92	4.15	.25	4.39
District of Columbia	—	—	—	—	—	—
Florida	31.0	1.51	32.5	34.7	1.69	36.4
Georgia	1.66	17.7	19.4	1.86	19.9	21.7
Hawaii	—	—	—	—	—	—
Idaho	27.7	7.20	34.9	31.0	8.07	39.1
Illinois	37.6	0	37.6	42.1	0	42.1
Indiana	27.3	14.6	41.9	30.6	16.4	47.0
Iowa	81.8	27.1	109	91.8	30.4	122
Kansas	87.2	23.5	111	97.7	26.3	124
Kentucky	—	—	—	—	—	—
Louisiana	4.03	3.31	7.34	4.52	3.71	8.23
Maine	—	—	—	—	—	—
Maryland	7.18	3.18	10.4	8.05	3.56	11.6
Massachusetts	—	—	—	—	—	—
Michigan	10.2	1.15	11.3	11.4	1.29	12.7
Minnesota	52.8	0	52.8	59.2	0	59.2
Mississippi	—	—	—	—	—	—
Missouri	18.3	54.1	72.4	20.5	60.6	81.1
Montana	—	—	—	—	—	—
Nebraska	76.0	17.4	93.4	85.2	19.5	105
Nevada	—	—	—	—	—	—
New Hampshire	—	—	—	—	—	—
New Jersey	1.68	0	1.68	1.88	0	1.88
New Mexico	—	—	—	—	—	—
New York	—	—	—	—	—	—
North Carolina	89.1	32.3	121	99.9	36.2	136
North Dakota	—	—	—	—	—	—
Ohio	8.20	17.1	25.3	9.19	19.2	28.4
Oklahoma	53.6	97.2	151	60.0	109	169
Oregon	—	—	—	—	—	—
Pennsylvania	—	—	—	—	—	—
Rhode Island	—	—	—	—	—	—
South Carolina	—	—	—	—	—	—
South Dakota	16.9	25.2	42.0	18.9	28.2	47.1
Tennessee	—	—	—	—	—	—
Texas	137	172	308	153	192	346
Utah	—	—	—	—	—	—
Vermont	—	—	—	—	—	—
Virginia	—	—	—	—	—	—
Washington	—	—	—	—	—	—
West Virginia	—	—	—	—	—	—
Wisconsin	60.3	6.02	66.3	67.6	6.75	74.4
Wyoming	—	—	—	—	—	—
Puerto Rico	—	—	—	—	—	—
U.S. Virgin Islands	—	—	—	—	—	—
TOTAL	1,010	747	1,760	1,140	838	1,980

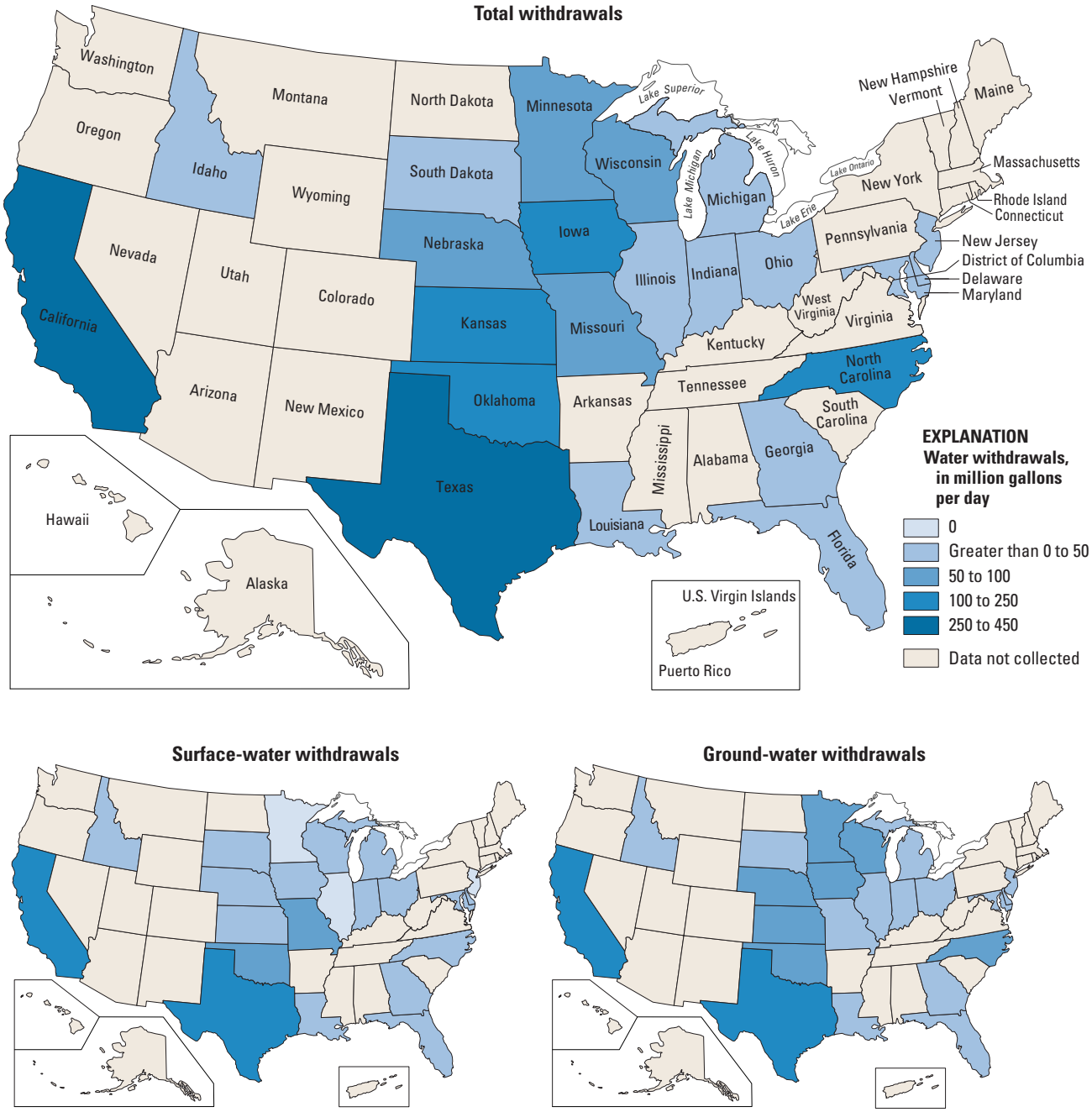


Figure 8. Livestock withdrawals by source and State, 2000.

AQUACULTURE — 3,700 million gallons per day

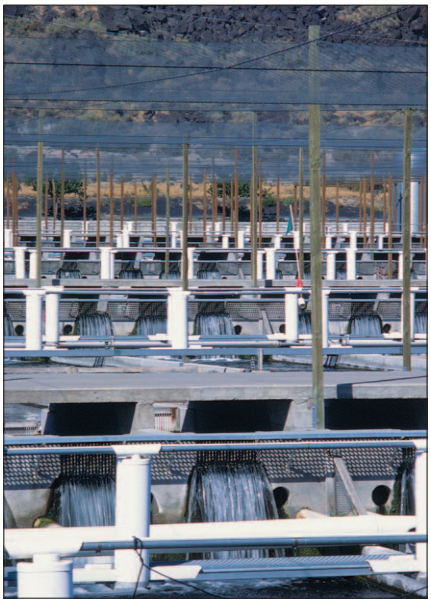
Aquaculture water use is water associated with raising organisms that live in water—such as finfish and shellfish—for food, restoration, conservation, or sport. Aquaculture production occurs under controlled feeding, sanitation, and harvesting procedures primarily in ponds, flow-through raceways, and, to a lesser extent, cages, net pens, and closed-recirculation tanks. All withdrawals were considered self-supplied. Only freshwater withdrawals were compiled as part of the total. Aquaculture combines the fish-farming activities of the former livestock subcategory animal specialties and the fish-hatchery activities of the commercial category that were reported during 1990 and 1995 (Solley and others, 1993, 1998, respectively). For 2000, consumptive use was not reported for aquaculture.

For 2000, the estimate of aquaculture water use for the United States was based on estimates of freshwater withdrawals for aquaculture in 19 States, rather than on estimates from all States. These 19 States included the 8 States with the largest water withdrawals for animal specialties in 1995, and 11 other States in which aquaculture water-use data were collected as part of a broader State water-use program for 2000. Most of the water withdrawals for animal specialties during 1995 were for aquaculture, with a small amount of water primarily used for watering horses. The 19 States that reported for 2000 accounted for 94 percent of the total withdrawals for animal-specialties water use during 1995. During 1995, withdrawals for animal specialties accounted for a small percentage of the total water use, less than 1 percent of the total withdrawals for all categories.

Freshwater withdrawals for aquaculture for 2000 are listed by State in table 9. For 2000, the quantity of freshwater withdrawn for aquaculture was an estimated 3,700 Mgal/d, or 4,150 thousand acre-feet per year. Maryland reported saline withdrawals of 3.09 Mgal/d, which are not listed in the tables or included in the totals. Surface water was the source for about 71 percent of the withdrawals for this category. Aquaculture withdrawals were nearly 1 percent of total water withdrawals and nearly 2 percent of total withdrawals for all categories excluding thermoelectric power.

The geographic distribution of total, surface-water, and ground-water withdrawals for aquaculture is shown in figure 9. Idaho used the most water for aquaculture, about one-half of the total reported. Idaho's source of water was almost exclusively surface water, and represented 73 percent of the total surface-water withdrawals for aquaculture. Mississippi, Arkansas, California, Louisiana, and Utah combined accounted for 86 percent of the ground-water withdrawals for aquaculture.

Several sources of information were used to estimate withdrawals for aquaculture. Some estimates of aquaculture water use were derived from State permits that reported water withdrawals or return flows for aquaculture facilities. The USEPA Permit Compliance System database also was a source of return-flow data that were used to estimate water withdrawals. The State Offices of the USDA National Agricultural Statistics Service or the Cooperative Extension Service sometimes maintained records for a State on pond acreage for fish farms and sometimes on the rate of water lost to evaporation for the ponds.



Flow-through raceways are used to raise fish for commercial sale in Idaho. (Photo courtesy of Clear Springs Foods, Inc.)

Harvesting hybrid striped bass at a fish farm in Mississippi. (Photo courtesy of Matthew Craig, The Commercial Appeal.)

Nine-hundred acres of fish ponds fed by ground water from the Mississippi River alluvial aquifer in Mississippi. (Photo courtesy of Nature's Catch.)

Table 9. Aquaculture water withdrawals, 2000.

[Figures may not sum to totals because of independent rounding. —, data not collected]

STATE	WITHDRAWALS (in million gallons per day)			WITHDRAWALS (in thousand acre-feet per year)		
	By source			By source		
	Ground water	Surface water	Total	Ground water	Surface water	Total
Alabama	8.93	1.44	10.4	10.0	1.61	11.6
Alaska	—	—	—	—	—	—
Arizona	—	—	—	—	—	—
Arkansas	187	10.4	198	210	11.6	222
California	158	380	537	177	426	603
Colorado	—	—	—	—	—	—
Connecticut	—	—	—	—	—	—
Delaware	.07	0	.07	.08	0	.08
District of Columbia	—	—	—	—	—	—
Florida	7.81	.21	8.02	8.76	.24	8.99
Georgia	7.70	7.72	15.4	8.63	8.65	17.3
Hawaii	—	—	—	—	—	—
Idaho	51.5	1,920	1,970	57.7	2,150	2,210
Illinois	—	—	—	—	—	—
Indiana	—	—	—	—	—	—
Iowa	—	—	—	—	—	—
Kansas	3.33	2.27	5.60	3.73	2.54	6.28
Kentucky	—	—	—	—	—	—
Louisiana	128	115	243	144	129	273
Maine	—	—	—	—	—	—
Maryland	4.81	14.8	19.6	5.39	16.6	22.0
Massachusetts	—	—	—	—	—	—
Michigan	—	—	—	—	—	—
Minnesota	—	—	—	—	—	—
Mississippi	321	49.8	371	360	55.9	416
Missouri	2.01	81.3	83.3	2.25	91.2	93.4
Montana	—	—	—	—	—	—
Nebraska	—	—	—	—	—	—
Nevada	—	—	—	—	—	—
New Hampshire	3.12	13.1	16.3	3.50	14.7	18.2
New Jersey	6.46	0	6.46	7.24	0	7.24
New Mexico	—	—	—	—	—	—
New York	—	—	—	—	—	—
North Carolina	7.88	0	7.88	8.83	0	8.83
North Dakota	—	—	—	—	—	—
Ohio	1.36	0	1.36	1.52	0	1.52
Oklahoma	.29	16.1	16.4	.33	18.1	18.4
Oregon	—	—	—	—	—	—
Pennsylvania	—	—	—	—	—	—
Rhode Island	—	—	—	—	—	—
South Carolina	—	—	—	—	—	—
South Dakota	—	—	—	—	—	—
Tennessee	—	—	—	—	—	—
Texas	—	—	—	—	—	—
Utah	116	0	116	130	0	130
Vermont	—	—	—	—	—	—
Virginia	—	—	—	—	—	—
Washington	—	—	—	—	—	—
West Virginia	—	—	—	—	—	—
Wisconsin	39.8	30.4	70.2	44.6	34.1	78.7
Wyoming	—	—	—	—	—	—
Puerto Rico	—	—	—	—	—	—
U.S. Virgin Islands	—	—	—	—	—	—
TOTAL	1,060	2,640	3,700	1,180	2,960	4,150

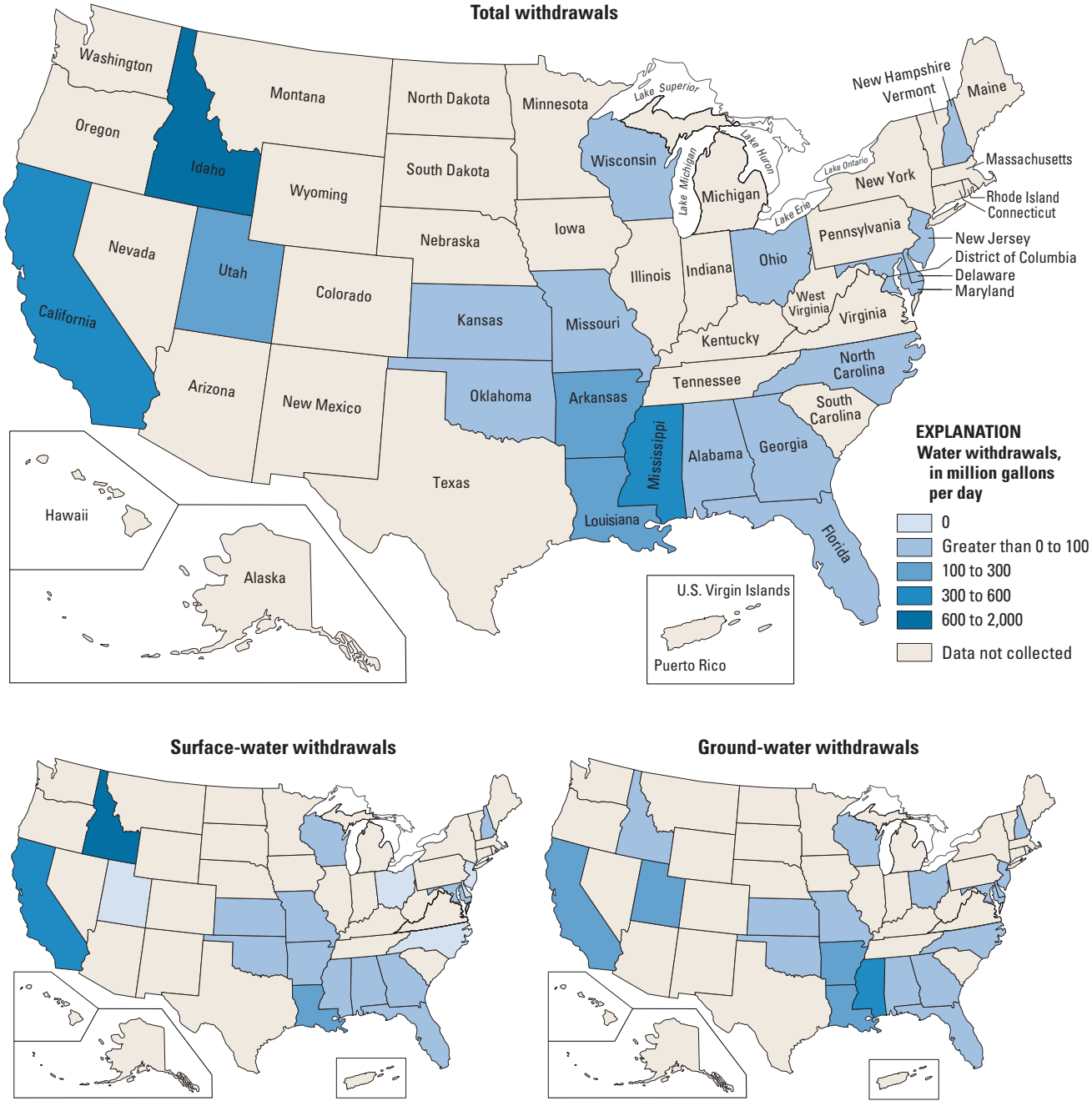


Figure 9. Aquaculture withdrawals by source and State, 2000.

INDUSTRIAL — 19,700 million gallons per day

Industrial water use includes water used for such purposes as fabricating, processing, washing, diluting, cooling, or transporting a product; incorporating water into a product; or for sanitation needs within the manufacturing facility. Some industries that use large amounts of water produce such commodities as food, paper, chemicals, refined petroleum, or primary metals. Water for industrial use may be delivered from a public supplier or be self-supplied. In this report, industrial use refers to self-supplied industrial withdrawals only. Withdrawals were reported as freshwater or saline water. Public-supply deliveries to industrial users and consumptive use were not reported for 2000.

Industrial withdrawals are listed by State in table 10. For 2000, withdrawals were an estimated 19,700 Mgal/d, or 22,100 thousand acre-feet per year. Industrial withdrawals were about 5 percent of total withdrawals and about 9 percent of total withdrawals for all categories excluding thermoelectric power. Surface water was the source for 82 percent of total industrial withdrawals. Nearly all (92 percent) of the surface-water withdrawals and nearly all (99 percent) of the ground-water withdrawals for industrial use were freshwater. For 2000, total industrial withdrawals were 11 percent less than during 1995.

The geographic distribution of total, total surface-water, and total ground-water withdrawals for industrial use is shown in figure 10. Louisiana, Indiana, and Texas accounted for almost 38 percent of total industrial withdrawals. The largest fresh surface-water withdrawals were in Louisiana and Indiana, which together accounted for 32 percent of the total fresh surface-water withdrawals. The largest fresh ground-water withdrawals were in Georgia, Louisiana, and Texas, which together accounted for 23 percent of the total fresh ground-water withdrawals. Texas accounted for 71 percent of the saline surface-water withdrawals for industry.

Sources of data for industrial water use included individual facilities and State or Federal permit programs that require reporting of industrial withdrawals or return flows. Industrial withdrawals also were estimated using employment numbers classified by industry group and per employee water-use coefficients.

Pulp and paper mill, St. Marys, Georgia (Alan M. Cressler, USGS).

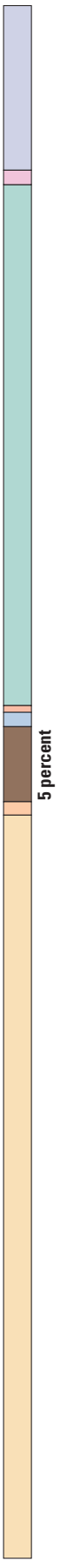


Table 10. Industrial self-supplied water withdrawals, 2000.

[Figures may not sum to totals because of independent rounding]

STATE	WITHDRAWALS (in million gallons per day)									WITHDRAWALS (in thousand acre-feet per year)		
	By source and type									By type		
	Ground water			Surface water			Total					
	Fresh	Saline	Total	Fresh	Saline	Total	Fresh	Saline	Total	Fresh	Saline	Total
Alabama	56.0	0	56.0	777	0	777	833	0	833	934	0	934
Alaska	4.32	0	4.32	3.80	3.86	7.66	8.12	3.86	12.0	9.10	4.33	13.4
Arizona	19.8	0	19.8	0	0	0	19.8	0	19.8	22.2	0	22.2
Arkansas	67.0	.08	67.1	66.8	0	66.8	134	.08	134	150	.09	150
California	183	0	183	5.65	13.6	19.3	188	13.6	202	211	15.3	226
Colorado	23.6	0	23.6	96.4	0	96.4	120	0	120	135	0	135
Connecticut	4.13	0	4.13	6.61	0	6.61	10.7	0	10.7	12.0	0	12.0
Delaware	17.0	0	17.0	42.5	3.25	45.7	59.4	3.25	62.7	66.6	3.64	70.3
District of Columbia	0	0	0	0	0	0	0	0	0	0	0	0
Florida	216	0	216	74.7	1.18	75.9	291	1.18	292	326	1.32	328
Georgia	290	0	290	333	30.0	363	622	30.0	652	698	33.6	731
Hawaii	14.5	.85	15.4	0	0	0	14.5	.85	15.4	16.2	.95	17.2
Idaho	35.8	0	35.8	19.7	0	19.7	55.5	0	55.5	62.2	0	62.2
Illinois	132	0	132	259	0	259	391	0	391	438	0	438
Indiana	99.7	0	99.7	2,300	0	2,300	2,400	0	2,400	2,690	0	2,690
Iowa	226	0	226	11.7	0	11.7	237	0	237	266	0	266
Kansas	46.6	0	46.6	6.74	0	6.74	53.3	0	53.3	59.8	0	59.8
Kentucky	95.2	0	95.2	222	0	222	317	0	317	356	0	356
Louisiana	285	0	285	2,400	0	2,400	2,680	0	2,680	3,010	0	3,010
Maine	9.90	0	9.90	237	0	237	247	0	247	277	0	277
Maryland	15.9	0	15.9	49.9	227	277	65.8	227	292	73.8	254	328
Massachusetts	10.7	0	10.7	26.2	0	26.2	36.8	0	36.8	41.3	0	41.3
Michigan	110	0	110	589	0	589	698	0	698	782	0	782
Minnesota	56.3	0	56.3	97.8	0	97.8	154	0	154	173	0	173
Mississippi	118	0	118	124	0	124	242	0	242	271	0	271
Missouri	29.2	0	29.2	33.5	0	33.5	62.7	0	62.7	70.3	0	70.3
Montana	31.9	0	31.9	29.3	0	29.3	61.3	0	61.3	68.7	0	68.7
Nebraska	35.5	0	35.5	2.60	0	2.60	38.1	0	38.1	42.7	0	42.7
Nevada	5.29	0	5.29	5.00	0	5.00	10.3	0	10.3	11.5	0	11.5
New Hampshire	6.95	0	6.95	37.9	0	37.9	44.9	0	44.9	50.3	0	50.3
New Jersey	65.3	0	65.3	66.2	0	66.2	132	0	132	147	0	147
New Mexico	8.80	0	8.80	1.67	0	1.67	10.5	0	10.5	11.7	0	11.7
New York	145	0	145	152	0	152	297	0	297	333	0	333
North Carolina	25.6	0	25.6	267	0	267	293	0	293	329	0	329
North Dakota	6.88	0	6.88	10.7	0	10.7	17.6	0	17.6	19.7	0	19.7
Ohio	162	0	162	645	0	645	807	0	807	905	0	905
Oklahoma	6.83	0	6.83	19.1	0	19.1	25.9	0	25.9	29.1	0	29.1
Oregon	12.1	0	12.1	183	0	183	195	0	195	218	0	218
Pennsylvania	155	0	155	1,030	0	1,030	1,190	0	1,190	1,330	0	1,330
Rhode Island	2.19	0	2.19	2.09	0	2.09	4.28	0	4.28	4.80	0	4.80
South Carolina	50.9	0	50.9	514	0	514	565	0	565	633	0	633
South Dakota	3.16	0	3.16	1.96	0	1.96	5.12	0	5.12	5.74	0	5.74
Tennessee	56.3	0	56.3	785	0	785	842	0	842	944	0	944
Texas	244	.50	244	1,200	906	2,110	1,450	907	2,350	1,620	1,020	2,640
Utah	34.3	5.08	39.4	8.38	0	8.38	42.7	5.08	47.8	47.8	5.69	53.5
Vermont	2.05	0	2.05	4.86	0	4.86	6.91	0	6.91	7.75	0	7.75
Virginia	104	0	104	365	53.3	419	470	53.3	523	526	59.7	586
Washington	138	0	138	439	39.9	479	577	39.9	617	647	44.7	692
West Virginia	9.70	0	9.70	958	0	958	968	0	968	1,090	0	1,090
Wisconsin	83.0	0	83.0	364	0	364	447	0	447	501	0	501
Wyoming	4.31	0	4.31	1.47	0	1.47	5.78	0	5.78	6.48	0	6.48
Puerto Rico	11.2	0	11.2	0	0	0	11.2	0	11.2	12.5	0	12.5
U.S. Virgin Islands	.22	0	.22	3.12	0	3.12	3.34	0	3.34	3.74	0	3.74
TOTAL	3,570	6.51	3,580	14,900	1,280	16,200	18,500	1,280	19,700	20,700	1,440	22,100

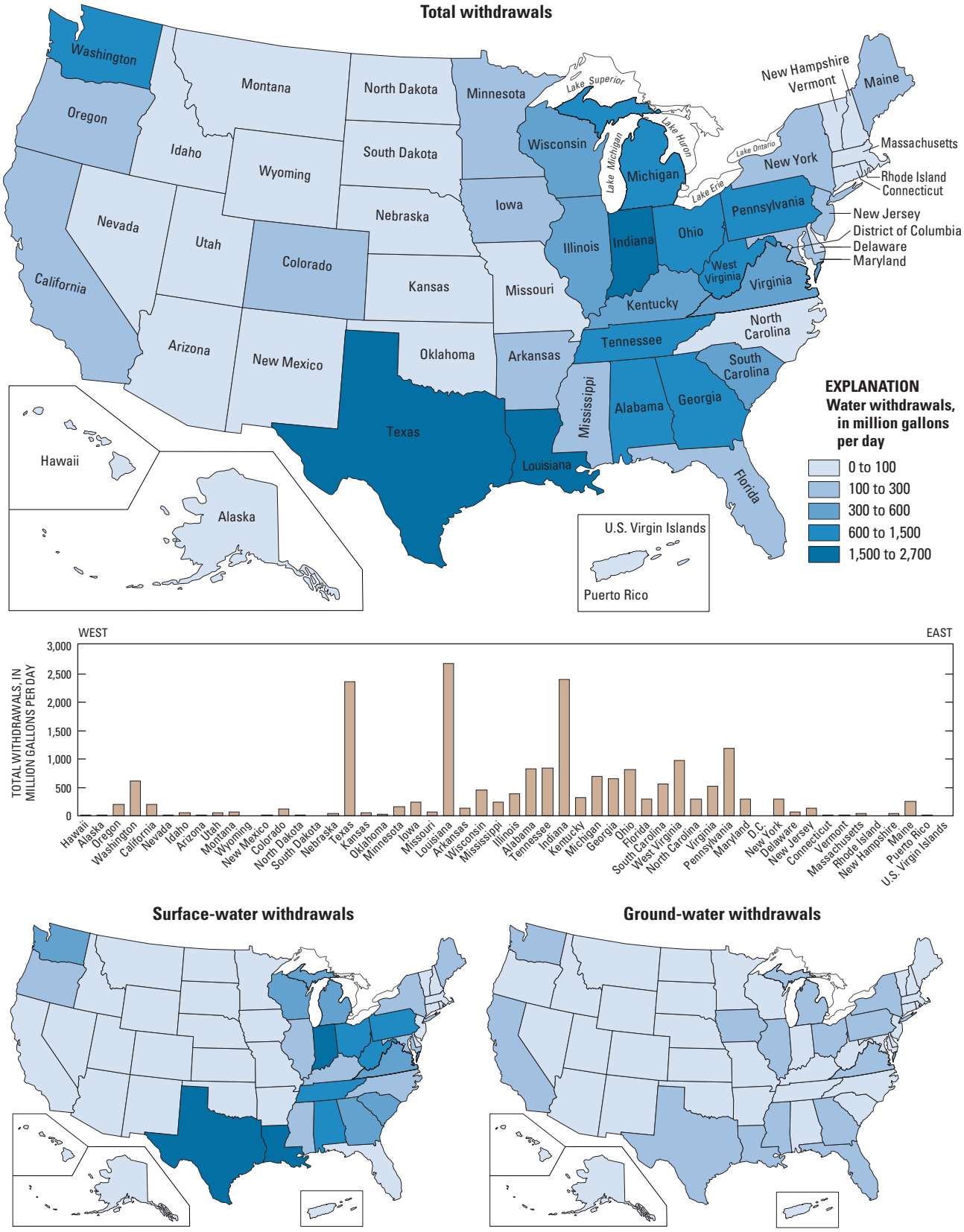


Figure 10. Industrial withdrawals by source and State, 2000.

MINING

3,490 million gallons per day

Mining water use is water for the extraction of minerals that may be in the form of such solids as coal, iron, sand, and gravel; such liquids as crude petroleum; and such gases as natural gas. The category includes quarrying, milling (crushing, screening, washing, and flotation of mined materials), re-injecting extracted water for secondary oil recovery, and other operations associated with mining activities. All mining withdrawals were considered self-supplied. Water withdrawals were reported as freshwater or saline water. Dewatering was not reported as a mining withdrawal unless the water was used beneficially, such as dampening roads for dust control. For 2000, consumptive use was not reported for mining.

For 2000, the estimate of mining water use for the United States was based on estimates of total withdrawals for mining in 22 States, rather than on estimates from all States. These 22 States included the 12 States with the largest mining withdrawals during 1995, and 10 other States in which mining water-use data had been collected as part of a broader State water-use program for 2000. The 22 States that reported for 2000 accounted for 83 percent of the total mining water withdrawals during 1995. During 1995, withdrawals for mining accounted for a small percentage of the total water use, less than 1 percent of the total water withdrawals for all categories.

Mining withdrawals for 2000 are listed by State in table 11. For 2000, an estimated 3,490 Mgal/d, or 3,920 thousand acre-feet per year, were used. Mining withdrawals were nearly 1 percent of total withdrawals and less than 2 percent of total withdrawals for all categories excluding thermoelectric power. Ground water was the source for 58 percent of total withdrawals for mining. Most of the ground-water withdrawals for mining (62 percent) were saline, and most of the surface-water withdrawals (85 percent) were freshwater. Saline ground-water withdrawals and fresh surface-water withdrawals each represented 36 percent of the total withdrawals for mining.

Total withdrawals for mining for the 22 States that reported data during both 1995 and 2000 increased about 11 percent during this time period; ground-water withdrawals increased about 15 percent; and surface-water withdrawals increased 7 percent. Saline-water withdrawals increased 32 percent. Freshwater withdrawals remained about the same for 2000.

The geographic distribution of total, total freshwater, and total saline-water withdrawals is shown in figure 11. Texas, Minnesota, and Wyoming accounted for 46 percent of the total withdrawals for mining. Iron ore mining in Minnesota, sand and gravel operations in Nebraska, and sand operations in New Jersey accounted for the largest fresh surface-water withdrawals. Gas and oil operations in Alaska, California, Oklahoma, Texas, and Wyoming were responsible for the large saline ground-water withdrawals in those States. Mineral salt extraction from the Great Salt Lake in Utah accounted for the largest saline surface-water withdrawals in the United States.

Blunger in kaolin pit, Freeport Kaolin, Gordon, Georgia (Nancy L. Barber, USGS).

Sources of data for water use for mining included surveys of mining operations or State and Federal agencies that collect water withdrawal or discharge data for mining sites or mineral tonnages and associated coefficients. A determination of water withdrawals that are put to beneficial use in mining operations can be difficult to determine, especially when dewatering is necessary for extraction of the mineral. Water produced from dewatering varies in quality from fresh to saline, and generally is disposed of through surface discharge, ponding, or re-injection. Some of the less-mineralized water may be re-used for irrigation or livestock.

Table 11. Mining water withdrawals, 2000.

[Figures may not sum to totals because of independent rounding. —, data not collected]

STATE	WITHDRAWALS (in million gallons per day)									WITHDRAWALS (in thousand acre-feet per year)		
	By source and type									By type		
	Ground water			Surface water			Total					
	Fresh	Saline	Total	Fresh	Saline	Total	Fresh	Saline	Total	Fresh	Saline	Total
Alabama	—	—	—	—	—	—	—	—	—	—	—	—
Alaska	0.01	90.4	90.4	27.4	49.5	76.9	27.4	140	167	30.7	157	188
Arizona	81.2	8.17	89.4	4.43	0	4.43	85.7	8.17	93.8	96.0	9.16	105
Arkansas	.21	0	.21	2.57	0	2.57	2.78	0	2.78	3.12	0	3.12
California	21.0	152	173	2.71	.46	3.17	23.7	153	177	26.6	171	198
Colorado	—	—	—	—	—	—	—	—	—	—	—	—
Connecticut	—	—	—	—	—	—	—	—	—	—	—	—
Delaware	—	—	—	—	—	—	—	—	—	—	—	—
District of Columbia	—	—	—	—	—	—	—	—	—	—	—	—
Florida	160	0	160	57.8	0	57.8	217	0	217	244	0	244
Georgia	7.75	0	7.75	2.05	0	2.05	9.80	0	9.80	11.0	0	11.0
Hawaii	—	—	—	—	—	—	—	—	—	—	—	—
Idaho	—	—	—	—	—	—	—	—	—	—	—	—
Illinois	—	—	—	—	—	—	—	—	—	—	—	—
Indiana	4.20	0	4.20	78.3	0	78.3	82.5	0	82.5	92.5	0	92.5
Iowa	2.49	0	2.49	30.3	0	30.3	32.8	0	32.8	36.8	0	36.8
Kansas	14.0	0	14.0	17.4	0	17.4	31.4	0	31.4	35.2	0	35.2
Kentucky	—	—	—	—	—	—	—	—	—	—	—	—
Louisiana	—	—	—	—	—	—	—	—	—	—	—	—
Maine	—	—	—	—	—	—	—	—	—	—	—	—
Maryland	4.21	0	4.21	4.10	.02	4.12	8.31	.02	8.33	9.32	.02	9.34
Massachusetts	—	—	—	—	—	—	—	—	—	—	—	—
Michigan	—	—	—	—	—	—	—	—	—	—	—	—
Minnesota	6.90	0	6.90	581	0	581	588	0	588	659	0	659
Mississippi	—	—	—	—	—	—	—	—	—	—	—	—
Missouri	4.10	0	4.10	12.8	0	12.8	16.9	0	16.9	19.0	0	19.0
Montana	—	—	—	—	—	—	—	—	—	—	—	—
Nebraska	5.64	4.55	10.2	122	0	122	128	4.55	132	143	5.10	148
Nevada	—	—	—	—	—	—	—	—	—	—	—	—
New Hampshire	.08	0	.08	6.72	0	6.72	6.80	0	6.80	7.62	0	7.62
New Jersey	6.12	0	6.12	104	0	104	110	0	110	124	0	124
New Mexico	—	—	—	—	—	—	—	—	—	—	—	—
New York	—	—	—	—	—	—	—	—	—	—	—	—
North Carolina	36.4	0	36.4	0	0	0	36.4	0	36.4	40.8	0	40.8
North Dakota	—	—	—	—	—	—	—	—	—	—	—	—
Ohio	53.1	0	53.1	35.5	0	35.5	88.5	0	88.5	99.2	0	99.2
Oklahoma	2.25	256	258	.23	0	.23	2.48	256	258	2.78	287	290
Oregon	—	—	—	—	—	—	—	—	—	—	—	—
Pennsylvania	162	0	162	20.9	0	20.9	182	0	182	205	0	205
Rhode Island	—	—	—	—	—	—	—	—	—	—	—	—
South Carolina	—	—	—	—	—	—	—	—	—	—	—	—
South Dakota	—	—	—	—	—	—	—	—	—	—	—	—
Tennessee	—	—	—	—	—	—	—	—	—	—	—	—
Texas	129	504	633	91.5	0	91.5	220	504	724	247	565	812
Utah	8.60	21.5	30.1	17.7	177	194	26.3	198	225	29.4	222	252
Vermont	—	—	—	—	—	—	—	—	—	—	—	—
Virginia	—	—	—	—	—	—	—	—	—	—	—	—
Washington	—	—	—	—	—	—	—	—	—	—	—	—
West Virginia	—	—	—	—	—	—	—	—	—	—	—	—
Wisconsin	—	—	—	—	—	—	—	—	—	—	—	—
Wyoming	58.8	222	280	20.7	0	20.7	79.5	222	301	89.1	248	338
Puerto Rico	—	—	—	—	—	—	—	—	—	—	—	—
U.S. Virgin Islands	—	—	—	—	—	—	—	—	—	—	—	—
TOTAL	767	1,260	2,030	1,240	227	1,470	2,010	1,490	3,490	2,250	1,660	3,920

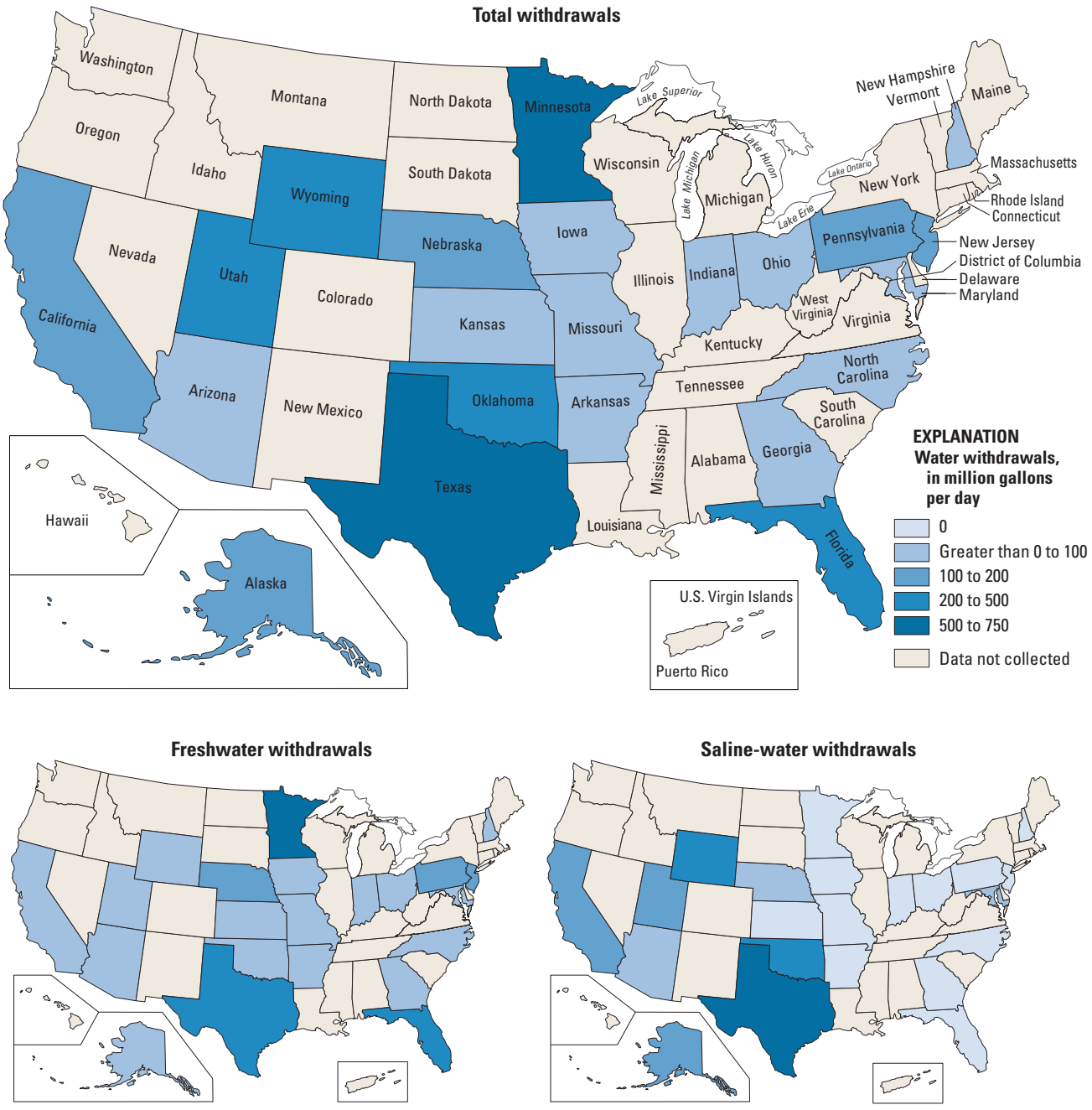


Figure 11. Mining withdrawals by water quality and State, 2000.

Thermoelectric Power

195,000 million gallons per day

Water for thermoelectric power is used in generating electricity with steam-driven turbine generators. For 2000, thermoelectric-power water withdrawals were compiled by cooling-system type because cooling-system type is the primary determinant for the amount of consumptive use relative to withdrawals. Once-through cooling refers to cooling systems in which water is withdrawn from a source, circulated through the heat exchangers, and then returned to a surface-water body. Closed-loop cooling refers to cooling systems in which water is withdrawn from a source, circulated through heat exchangers, cooled, and then recycled. Subsequent water withdrawals for a closed-loop system are used to replace water lost to evaporation, blowdown, drift, and leakage. Closed-loop cooling results in larger consumptive-use values relative to withdrawals. Water withdrawals were reported as freshwater or saline water. For 2000, public-supply deliveries to thermoelectric-power plants, water use by fuel type, consumptive use, and the amount of power generated were not reported.

Thermoelectric-power withdrawals are listed by State in table 12. The total quantity of water withdrawn for thermoelectric power for 2000 was an estimated 195,000 Mgal/d, or 219,000 thousand acre-feet per year. Surface water was the source for more than 99 percent of total thermoelectric-power withdrawals. Nearly one-third of the surface water was saline. Saline withdrawals from surface water sources accounted for 96 percent of the total saline withdrawals for all categories. Thermoelectric-power withdrawals accounted for 48 percent of total water use, 39 percent of total freshwater withdrawals for all categories, and 52 percent of fresh surface-water withdrawals. Estimates of freshwater and saline-water withdrawals were each about 3 percent more for 2000 than for 1995.

The geographic distribution of total, total freshwater, and total saline-water withdrawals for thermoelectric power is shown in figure 12. The largest total water withdrawals were in Texas, where both freshwater and saline water were utilized for cooling purposes. Illinois, Texas, and Tennessee combined accounted for 22 percent of total freshwater withdrawals. California and Florida accounted for 41 percent of saline surface-water withdrawals. Freshwater and saline-water withdrawals in the eastern States were 83 percent of total water withdrawals. This pattern of withdrawals exists partly because the power-production infrastructure was established in the eastern States to take advantage of the plentiful water supply in the Great Lakes, along major rivers, and along the coast in order to meet electricity demand from large urban and industrial centers.

In contrast, the Pacific Northwest utilizes hydroelectric-power generation to supply a substantial part of the regional demand for electricity. For example, in Idaho, power is supplied primarily by hydroelectric-power generation, and, therefore, Idaho reported no withdrawals for thermoelectric power. Hydroelectric power, an instream use, is not included in this report.

Thermoelectric-power withdrawals are listed by cooling-system type and by State in table 13. Power plants equipped with once-through cooling systems accounted for 91 percent of water withdrawals for thermoelectric power. Plants equipped with closed-loop cooling systems withdrew the remaining 9 percent of the water. Cooling technologies that require less water also allow for the production of thermoelectric power in areas where water is scarce or strictly managed (Michelletti and Burns, 2002). Such water-scarce States as Arizona, Nevada, and New Mexico utilized closed-loop cooling systems rather than the more water-intensive once-through cooling systems during 2000. During 2000, about 75 percent of the generating units using closed-loop cooling systems reported rates of consumptive use greater than 50 percent (U.S. Department of Energy, Energy Information Administration, 2003a, 2003b).

In coastal areas, the use of saline water instead of freshwater expands the overall available water supply. More than 90 percent of the thermoelectric-power withdrawals were saline in Puerto Rico (100 percent), U.S. Virgin Islands (100 percent), Rhode Island, California, Massachusetts, Connecticut, Florida, and Maryland. Saline ground-water use by geothermal power plants in Nevada (78.7 Mgal/d), California (32.9 Mgal/d), and Utah (0.87 Mgal/d) was compiled, but excluded from the total water withdrawals and tables in this report. Thermoelectric-power withdrawals for Hawaii were all ground water for once-through cooling systems (1,200 Mgal/d). Saline ground-water withdrawals supplied 96 percent (1,150 Mgal/d) of the total. Hawaii's thermoelectric-power data were excluded from the total water withdrawals and tables in this report.

Sources of data for thermoelectric-power water use included individual facilities, State permitting or regulatory agencies, or the USDOE–EIA. Generally, relatively complete files on water withdrawals and power generation were maintained by these entities for 2000.

Table 12. Thermoelectric-power water withdrawals, 2000.

[Figures may not sum to totals because of independent rounding]

STATE	WITHDRAWALS (in million gallons per day)							WITHDRAWALS (in thousand acre-feet per year)		
	By source and type				Total			By type		
	Ground water	Surface water								
	Fresh	Fresh	Saline	Total	Fresh	Saline	Total	Fresh	Saline	Total
Alabama	0	8,190	0	8,190	8,190	0	8,190	9,180	0	9,180
Alaska	4.65	28.9	0	28.9	33.6	0	33.6	37.6	0	37.6
Arizona	74.3	26.2	0	26.2	100	0	100	113	0	113
Arkansas	2.92	2,170	0	2,170	2,180	0	2,180	2,440	0	2,440
California	3.23	349	12,600	12,900	352	12,600	12,900	395	14,100	14,500
Colorado	16.1	122	0	122	138	0	138	155	0	155
Connecticut	.08	186	3,440	3,630	187	3,440	3,630	209	3,860	4,070
Delaware	.47	366	738	1,100	366	738	1,100	411	827	1,240
District of Columbia	0	9.69	0	9.69	9.69	0	9.69	10.9	0	10.9
Florida	29.5	629	12,000	12,600	658	12,000	12,600	738	13,400	14,100
Georgia	1.03	3,240	61.7	3,310	3,250	61.7	3,310	3,640	69.2	3,710
Hawaii	0	0	0	0	0	0	0	0	0	0
Idaho	0	0	0	0	0	0	0	0	0	0
Illinois	5.75	11,300	0	11,300	11,300	0	11,300	12,600	0	12,600
Indiana	2.58	6,700	0	6,700	6,700	0	6,700	7,510	0	7,510
Iowa	11.9	2,530	0	2,530	2,540	0	2,540	2,850	0	2,850
Kansas	14.9	2,240	0	2,240	2,260	0	2,260	2,530	0	2,530
Kentucky	2.71	3,250	0	3,250	3,260	0	3,260	3,650	0	3,650
Louisiana	28.4	5,580	0	5,580	5,610	0	5,610	6,290	0	6,290
Maine	4.92	108	295	403	113	295	408	127	330	457
Maryland	1.80	377	6,260	6,640	379	6,260	6,640	425	7,020	7,440
Massachusetts	0	108	3,610	3,720	108	3,610	3,720	121	4,050	4,170
Michigan	0	7,710	0	7,710	7,710	0	7,710	8,640	0	8,640
Minnesota	4.17	2,260	0	2,260	2,270	0	2,270	2,540	0	2,540
Mississippi	43.5	318	148	467	362	148	510	406	166	572
Missouri	12.2	5,620	0	5,620	5,640	0	5,640	6,320	0	6,320
Montana	0	110	0	110	110	0	110	123	0	123
Nebraska	6.87	2,810	0	2,810	2,820	0	2,820	3,160	0	3,160
Nevada	12.0	24.7	0	24.7	36.7	0	36.7	41.1	0	41.1
New Hampshire	.71	235	761	997	236	761	997	265	854	1,120
New Jersey	2.24	648	3,390	4,040	650	3,390	4,040	729	3,800	4,530
New Mexico	11.4	45.0	0	45.0	56.4	0	56.4	63.2	0	63.2
New York	0	4,040	5,010	9,050	4,040	5,010	9,050	4,530	5,610	10,100
North Carolina	.09	7,850	1,620	9,470	7,850	1,620	9,470	8,800	1,810	10,600
North Dakota	0	902	0	902	902	0	902	1,010	0	1,010
Ohio	7.57	8,590	0	8,590	8,590	0	8,590	9,630	0	9,630
Oklahoma	3.27	143	0	143	146	0	146	164	0	164
Oregon	2.47	12.8	0	12.8	15.3	0	15.3	17.2	0	17.2
Pennsylvania	3.98	6,970	0	6,970	6,980	0	6,980	7,820	0	7,820
Rhode Island	0	2.40	290	293	2.40	290	293	2.69	326	328
South Carolina	5.83	5,700	0	5,700	5,710	0	5,710	6,400	0	6,400
South Dakota	1.23	4.01	0	4.01	5.24	0	5.24	5.87	0	5.87
Tennessee	0	9,040	0	9,040	9,040	0	9,040	10,100	0	10,100
Texas	60.2	9,760	3,440	13,200	9,820	3,440	13,300	11,000	3,860	14,900
Utah	13.1	49.2	0	49.2	62.2	0	62.2	69.8	0	69.8
Vermont	.66	355	0	355	355	0	355	398	0	398
Virginia	1.50	3,850	3,580	7,430	3,850	3,580	7,430	4,310	4,020	8,330
Washington	.92	518	0	518	519	0	519	582	0	582
West Virginia	0	3,950	0	3,950	3,950	0	3,950	4,430	0	4,430
Wisconsin	8.99	6,090	0	6,090	6,090	0	6,090	6,830	0	6,830
Wyoming	1.13	242	0	242	243	0	243	273	0	273
Puerto Rico	0	0	2,190	2,190	0	2,190	2,190	0	2,460	2,460
U.S. Virgin Islands	0	0	136	136	0	136	136	0	153	153
TOTAL	409	135,000	59,500	195,000	136,000	59,500	195,000	152,000	66,700	219,000

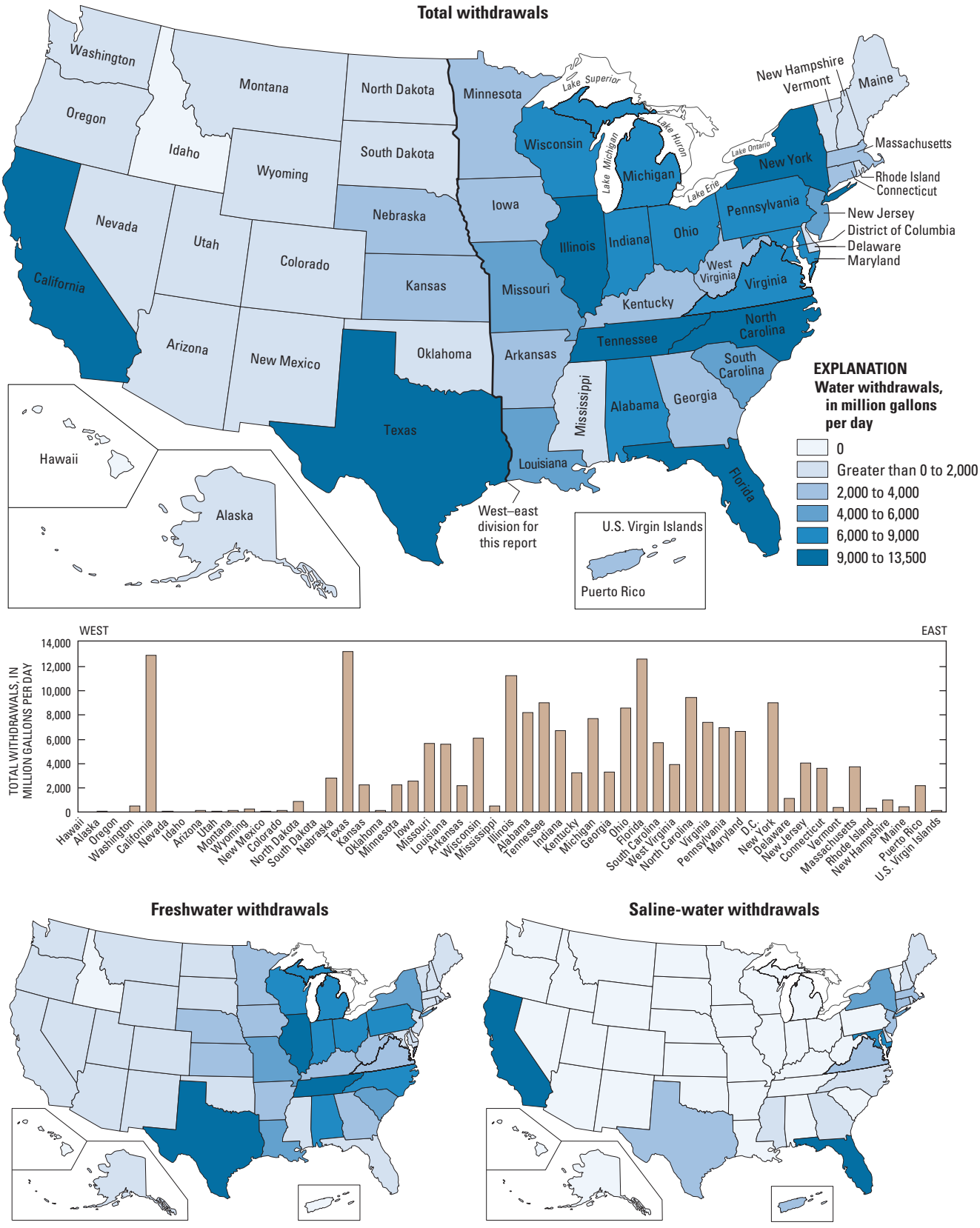


Figure 12. Thermoelectric-power withdrawals by water quality and State, 2000.

Table 13. Thermoelectric-power water withdrawals by cooling type, 2000.

[Totals may not sum because of independent rounding. All values are in million gallons per day]

STATE	WITHDRAWALS FOR ONCE-THROUGH COOLING			WITHDRAWALS FOR CLOSED-LOOP COOLING						
				By source and type						
	Surface water			Ground water	Surface water			Total		
	Fresh	Saline	Total	Fresh	Fresh	Saline	Total	Fresh	Saline	Total
Alabama	8,020	0	8,020	0	167	0	167	167	0	167
Alaska	28.9	0	28.9	4.65	0	0	0	4.65	0	4.65
Arizona	0	0	0	74.3	26.2	0	26.2	100	0	100
Arkansas	1,690	0	1,690	2.92	478	0	478	481	0	481
California	344	12,600	12,900	3.23	5.41	0	5.41	8.64	0	8.64
Colorado	90.2	0	90.2	16.1	31.8	0	31.8	48.0	0	48.0
Connecticut	115	3,440	3,560	.08	71.7	0	71.7	71.8	0	71.8
Delaware	0	0	0	.47	366	738	1,100	366	738	1,100
District of Columbia	0	0	0	0	9.69	0	9.69	9.69	0	9.69
Florida	559	11,800	12,400	29.5	69.8	150	219	99.3	150	249
Georgia	2,800	61.7	2,860	1.03	444	0	444	445	0	445
Hawaii	0	0	0	0	0	0	0	0	0	0
Idaho	0	0	0	0	0	0	0	0	0	0
Illinois	11,000	0	11,000	5.75	239	0	239	245	0	245
Indiana	6,450	0	6,450	2.58	252	0	252	254	0	254
Iowa	2,510	0	2,510	11.9	15.6	0	15.6	27.6	0	27.6
Kansas	2,210	0	2,210	14.9	29.1	0	29.1	44.0	0	44.0
Kentucky	824	0	824	2.71	2,430	0	2,430	2,430	0	2,430
Louisiana	4,500	0	4,500	28.4	1,080	0	1,080	1,110	0	1,110
Maine	90.8	295	385	4.92	17.2	0	17.2	22.2	0	22.2
Maryland	377	5,670	6,050	1.80	0	589	589	1.80	589	591
Massachusetts	108	3,610	3,720	0	.45	0	.45	.45	0	.45
Michigan	7,710	0	7,710	0	0	0	0	0	0	0
Minnesota	1,330	0	1,330	4.17	935	0	935	939	0	939
Mississippi	307	148	456	43.5	11.2	0	11.2	54.7	0	54.7
Missouri	5,200	0	5,200	12.2	422	0	422	434	0	434
Montana	84.4	0	84.4	0	25.6	0	25.6	25.6	0	25.6
Nebraska	2,390	0	2,390	6.87	418	0	418	424	0	424
Nevada	0	0	0	12.0	24.7	0	24.7	36.7	0	36.7
New Hampshire	234	761	995	.71	1.37	0	1.37	2.08	0	2.08
New Jersey	648	3,330	3,980	2.24	0	57.6	57.6	2.24	57.6	59.9
New Mexico	0	0	0	11.4	45.0	0	45.0	56.4	0	56.4
New York	4,040	5,010	9,050	0	0	0	0	0	0	0
North Carolina	7,850	1,620	9,470	.09	0	0	0	.09	0	.09
North Dakota	887	0	887	0	14.5	0	14.5	14.5	0	14.5
Ohio	7,790	0	7,790	7.57	799	0	799	806	0	806
Oklahoma	37.9	0	37.9	3.27	105	0	105	109	0	109
Oregon	0	0	0	2.47	12.8	0	12.8	15.3	0	15.3
Pennsylvania	4,330	0	4,330	3.98	2,650	0	2,650	2,650	0	2,650
Rhode Island	0	290	290	0	2.40	0	2.40	2.40	0	2.40
South Carolina	3,860	0	3,860	5.83	1,850	0	1,850	1,850	0	1,850
South Dakota	0	0	0	1.23	4.01	0	4.01	5.24	0	5.24
Tennessee	8,860	0	8,860	0	174	0	174	174	0	174
Texas	6,990	3,440	10,400	60.2	2,770	0	2,770	2,830	0	2,830
Utah	0	0	0	13.1	49.2	0	49.2	62.2	0	62.2
Vermont	354	0	354	.66	.55	0	.55	1.21	0	1.21
Virginia	3,850	3,580	7,430	1.50	0	0	0	1.50	0	1.50
Washington	444	0	444	.92	74.2	0	74.2	75.1	0	75.1
West Virginia	3,790	0	3,790	0	163	0	163	163	0	163
Wisconsin	6,090	0	6,090	8.99	0	0	0	8.99	0	8.99
Wyoming	179	0	179	1.13	63.4	0	63.4	64.6	0	64.6
Puerto Rico	0	2,190	2,190	0	0	0	0	0	0	0
U.S. Virgin Islands	0	136	136	0	0	0	0	0	0	0
TOTAL	119,000	58,000	177,000	409	16,300	1,530	17,900	16,800	1,530	18,300

Trends in Water Use, 1950–2000

The USGS first conducted the water-use compilations for 1950 and has published them every 5 years since. Groupings of categories and data elements have changed through the years. Water-use categories were combined in some compilations and were published as separate categories in others. Summaries of withdrawal estimates from 1950 to 2000 are shown in table 14 and shown graphically in figures 13 and 14. Self-supplied domestic withdrawals are shown separately from livestock and aquaculture withdrawals in table 14, although these uses were combined in the rural domestic and livestock category in previous water-use Circulars and are shown together in figure 14.

The livestock category represents water use for farm animals (or stock) from 1950 through 1980. The livestock and aquaculture withdrawal estimates in table 14 include fish farms from 1985 through 2000. For 2000, this category includes water use for stock, fish farms and fish hatcheries in table 14.

The industrial category also has been treated differently in various compilation years. The industrial water-use data for 1960 through 1980 represented withdrawals for facilities traditionally considered industrial as well as water use by commercial and mining facilities, fish farms, and fish hatcheries. This combined category was called "other industrial use" to distinguish these uses from thermoelectric-power generation water use. For the years 1985, 1990 and 1995, water-use data for industrial, commercial, and mining uses were published as separate categories. For 2000, industrial and mining withdrawals were compiled and published as separate categories, and commercial use was not compiled nationally. In table 14, commercial and mining withdrawals have been added to the industrial withdrawals for 1985 through 1995 so that the data are comparable to the "other industrial use" category in previous water-use Circulars. The "other industrial use" category cannot be calculated for 2000 because an estimate of commercial withdrawals was not compiled for 2000.

Estimates of withdrawals are summarized in table 14 at 5-year intervals from 1950 through 2000. The percentage change in withdrawals for each category (or category combination) is shown between 1995 and 2000. Estimates of total, ground-water, and surface-water withdrawals and total population are shown in figure 13. Figure 14 illustrates total freshwater and saline-water withdrawals by category.

Estimates in table 14 and figure 13 show total withdrawals increased steadily from 1950 to 1980, declined more than 9 percent from 1980 to 1985, and have varied less than 3 percent between the 5-year intervals since 1985. Total withdrawals peaked during 1980, although total U.S. population has increased steadily since 1950. Estimates of water use peaked during 1980 because of large industrial, irrigation, and thermoelectric-power withdrawals. Total withdrawals for 2000 were similar to the 1990 total withdrawals, although population had increased 13 percent since 1990.

Works Progress Administration Federal Art Project poster by Vera Bock (Library of Congress, Prints and Photographs Division, WPA Poster Collection, LC-USZC2-836 DLC).

Total withdrawals have remained about 80 percent surface water and 20 percent ground water during the 50-year period. The portion of surface-water withdrawals that was saline increased from 7 percent for 1950 to 20 percent for 1975 and has remained about 20 percent since. The percentage of ground water that was saline never exceeded about 2 percent. The percentage of total withdrawals that was saline water increased from a minor amount in 1950 to as much as 17 percent during 1975 and 1990.

Estimated withdrawals for public supply increased continually since 1950 (fig. 14) along with population served by public suppliers. Public-supply withdrawals more than tripled during this 50-year period and increased about 8 percent from 1995 to 2000. The percentage of population served by public suppliers increased from 62 percent for 1950 to 85 percent for 2000. Public-supply withdrawals represented about 8 percent of total withdrawals for 1950 and about 11 percent for 2000. The percentage of ground-water use for public supply increased from 26 percent for 1950 to 40 percent for 1985 and has remained at slightly less than 40 percent since.

Estimated withdrawals for self-supplied domestic use increased by 71 percent between 1950 and 2000. The self-supplied domestic population was 57.5 million people for 1950, or 38 percent of the total population. For 2000, 43.5 million people, or 15 percent of the total population, were self-supplied.

Table 14. Trends in estimated water use in the United States, 1950–2000.

[Data for 1995 and earlier from Solley and others (1998). The water-use data are in billion gallons per day (thousand million gallons per day) and are rounded to two significant figures for 1950–80, and to three significant figures for 1985–2000; percentage change is calculated from unrounded numbers. —, not available]

	YEAR											PERCENTAGE CHANGE
	[1] 1950	[2] 1955	[3] 1960	[4] 1965	[4] 1970	[3] 1975	[3] 1980	[3] 1985	[3] 1990	[3] 1995	[3] 2000	1995–2000
Population, in millions	150.7	164.0	179.3	193.8	205.9	216.4	229.6	242.4	252.3	267.1	285.3	+7
Offstream use:												
Total withdrawals	180	240	270	310	370	420	440	399	408	402	408	+2
Public supply	14	17	21	24	27	29	34	36.5	38.5	40.2	43.2	+8
Rural domestic and livestock:												
Self-supplied domestic	2.1	2.1	2.0	2.3	2.6	2.8	3.4	3.32	3.39	3.39	3.59	+6
Livestock and aquaculture	1.5	1.5	1.6	1.7	1.9	2.1	2.2	[5] 4.47	4.50	5.49	([6])	—
Irrigation	89	110	110	120	130	140	150	137	137	134	137	+2
Industrial:												
Thermoelectric-power use	40	72	100	130	170	200	210	187	195	190	195	+3
Other industrial use	37	39	38	46	47	45	45	30.5	29.9	29.1	([7])	—
Source of water:												
Ground:												
Fresh	34	47	50	60	68	82	83	73.2	79.4	76.4	83.3	+9
Saline	([8])	.6	.4	.5	1.0	1.0	.9	.65	1.22	1.11	1.26	+14
Surface:												
Fresh	140	180	190	210	250	260	290	265	259	264	262	–1
Saline	10	18	31	43	53	69	71	59.6	68.2	59.7	61.0	+2

[1] 48 States and District of Columbia, and Hawaii
[2] 48 States and District of Columbia
[3] 50 States and District of Columbia, Puerto Rico, and U.S. Virgin Islands
[4] 50 States and District of Columbia, and Puerto Rico
[5] From 1985 to present this category includes water use for fish farms
[6] Data not available for all States; partial total was 5.46
[7] Commercial use not available; industrial and mining use totaled 23.2
[8] Data not available

Withdrawals for livestock and aquaculture use increased from 1.5 Bgal/d during 1950 to 5.49 Bgal/d during 1995. The use for these categories during 2000 was 5.46 Bgal/d. The livestock and aquaculture estimate includes fish farms from 1985 through 2000. The water-use estimate for 2000 also includes fish hatcheries. Livestock water-use estimates for 2000 were not required from all States.

Since 1950, irrigation has represented about 65 percent of total withdrawals, excluding those for thermoelectric power. Withdrawals for irrigation increased by more than 68 percent from 1950 to 1980 (from 89 to 150 Bgal/d). Withdrawals have decreased since 1980 and have stabilized at between 134 and 137 Bgal/d between 1985 and 2000. Depending on the geographic area of the United States, this overall decrease can be attributed to climate, crop type, advances in irrigation efficiency, and higher energy costs.

Surface water historically has been the primary source for irrigation, although data show an increasing usage of ground water since 1950. During 1950, 77 percent of all irrigation withdrawals were surface water, most of which was used in the western States. By 2000, surface-water withdrawals comprised only 58 percent of the total. Ground-water withdrawals for irrigation during 2000 were more than three times larger than during 1950. Most of this increase occurred from 1965 through 1980.

The total number of acres irrigated in the United States steadily increased from 25,000 thousand acres for 1950 to 58,000 thousand acres for 1980. The estimated number of acres irrigated remained relatively constant from 1980 to 1995, and then increased to 61,900 thousand acres during 2000. The increase in irrigated acreage during the 1960s and 1970s was related to the expansion of irrigation in the western States. The number of acres irrigated in 2000 increased in some States in response to drought.

Since 1985, when USGS first collected data on irrigated acres by system type, more acres were irrigated using sprinkler and microirrigation systems than were irrigated with flood systems. The proportion of total acres irrigated using

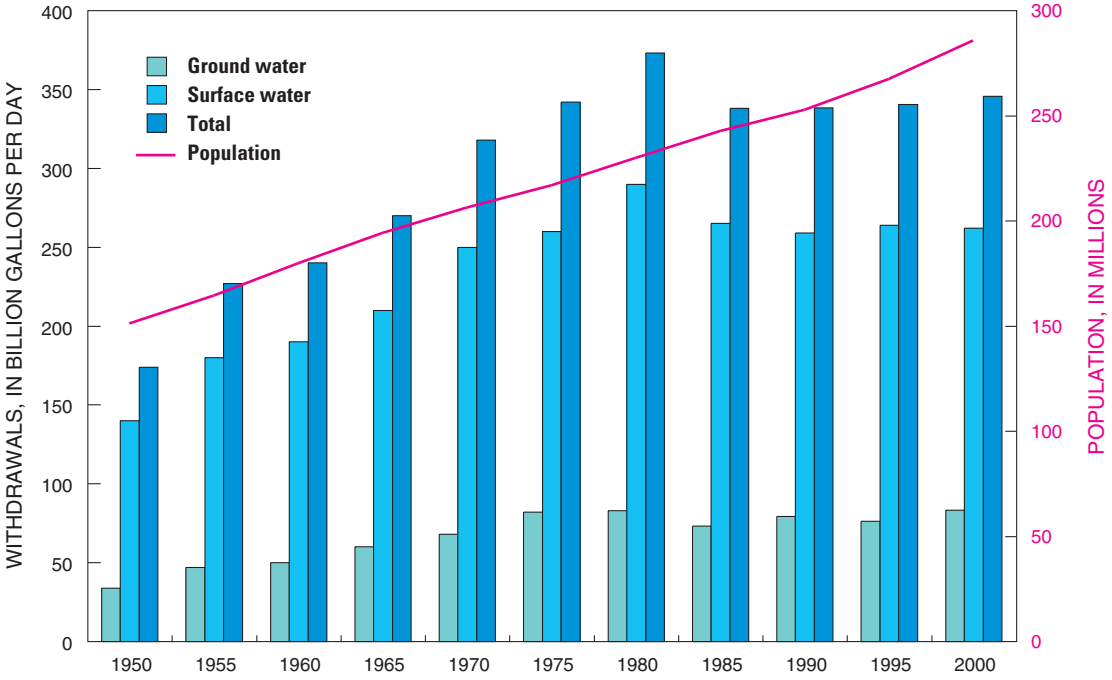


Figure 13. Trends in population and freshwater withdrawals by source, 1950–2000.

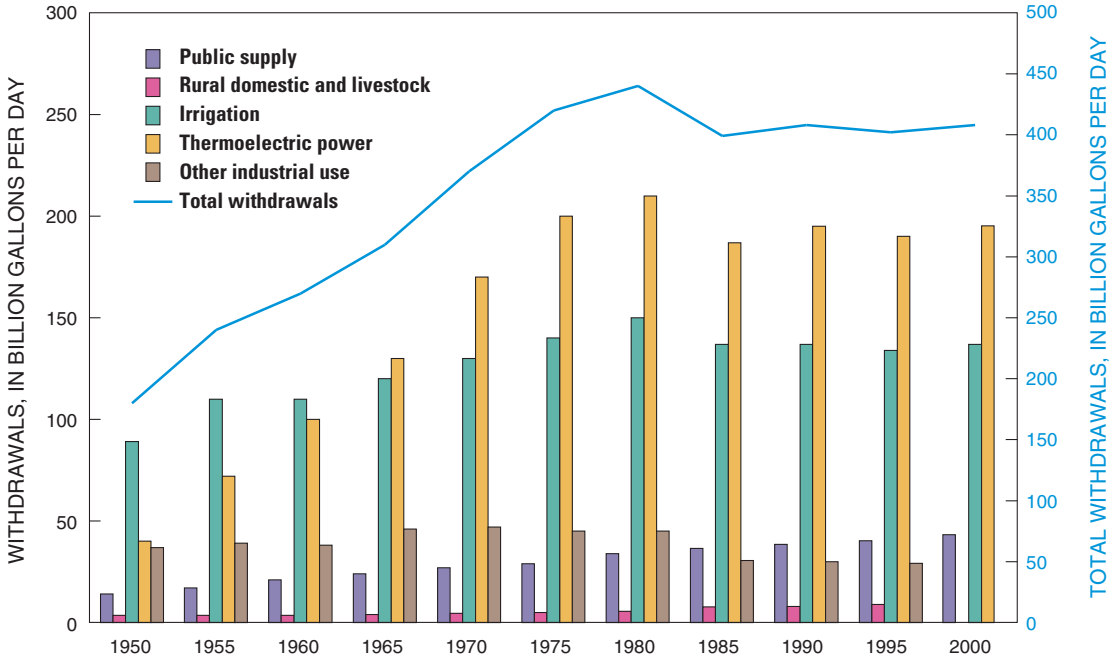


Figure 14. Trends in total water withdrawals by water-use category, 1950–2000. (Total withdrawals for rural domestic and livestock and for "other industrial use" are not available for 2000.)

sprinkler and microirrigation systems increased from less than 40 percent in 1985 to 52 percent for 2000. The average irrigation application rate declined about 30 percent, from 3.55 acre-feet per acre during 1950 to 2.48 acre-feet per acre during 2000. The largest declines in application rates occurred after 1980.

Thermoelectric power has been the category with the largest water withdrawals since 1965, and for 2000 comprised 48 percent of total withdrawals. The largest total and fresh and saline surface-water withdrawals were during 1980. Withdrawals by thermoelectric-power plants increased from 40 Bgal/d during 1950 to 210 Bgal/d during 1980. Withdrawals for thermoelectric power declined and then stabilized since 1980; the total withdrawal of 195 Bgal/d for 2000 is the same as the total withdrawal for 1990.

Thermoelectric-power water withdrawals primarily were affected by the Federal legislation that required stricter water-quality standards for return flow and by limited water supplies in some areas of the United States (U.S. Congress, Amendments to the Federal Pollution Control Act of 1972 and 1977; Micheletti and Burns, 2002). Consequently, since the 1970s, power plants increasingly were built with or converted to closed-loop cooling systems or air-cooled systems instead of using once-through cooling systems. By 2000, an alternative to once-through cooling was used in about 60 percent of the installed steam-generation capacity in the power plants (Bozek, 2002).

Use of recirculated water for cooling in a closed-loop system reduces the water requirement at the power plant, resulting in reduced water withdrawals. The increasing influence over time of these technologies that require less water can be observed in the historical USGS water-use record. The trend showing the increase, decline, then stabilization of water withdrawals for thermoelectric power from 1950 to 2000 occurred as net electricity generated increased almost 15-fold to 3,450 billion kilowatt-hours (kWh) during this same period (U.S. Department of Energy, Energy Information Administration, 2003c). Overall, significantly less water was required to generate a kilowatt-hour of electricity for 2000. The average gallons of water used to produce one kilowatt-hour (gal/kWh) decreased from 63 gal/kWh during 1950 to 21 gal/kWh during 2000 (Solley and others, 1998).

The industrial category has been treated differently in various compilation years. The industrial water-use data for 1960 through 1980 represented use for facilities traditionally considered as industrial as well as water use for commercial and mining facilities, fish farms, and fish hatcheries. For the years 1985, 1990, and 1995, water-use data were published as the separate categories of industrial, commercial, and mining. For 2000, withdrawal data were compiled for industrial and mining uses but not commercial use. In table 14, commercial and mining withdrawals were added to the industrial withdrawals to correspond to the "other industrial use" category of previous water-use Circulars. Because commercial data were not available for 2000, a percentage change for 1995 to 2000 cannot be calculated for this combined category.

Withdrawals for "other industrial uses" were between 37 and 39 Bgal/d between 1950 and 1960, and then increased to the range of 45 and 47 Bgal/d for the years reported from 1965 to 1980. Withdrawals declined by about 32 percent to 30 Bgal/d between 1980 and 1985; the decline continued to about 29 Bgal/d in 1995. Because data were not classified separately from 1955 to 1980, it is not known how much of the "other industrial use" was attributable to commercial and mining withdrawals. However, it is evident that by 2000 the "other industrial use" category was at its lowest level since data were first reported for 1950. For the industrial withdrawals not to be at the lowest level since 1950, commercial water use, which was not reported for 2000, would have had to more than double between 1995 and 2000. That scenario for commercial water use is improbable.

Because withdrawal data were compiled independently for the industrial category for 1985 through 2000, the changes in the industrial category may be compared for those years. Total industrial withdrawals decreased by 24 percent from about 26 Bgal/d during 1985 to less than 20 Bgal/d during 2000. Ground water provided 15 percent of the total industrial withdrawals during 1985 and 18 percent of the total during 1990, 1995, and 2000. Almost all of the ground water withdrawn for industrial uses was freshwater. The percentage of surface water that is fresh has increased from about 84 percent during 1985 to about 92 percent during 2000.

Two factors have affected the industrial water-use withdrawals. Passage of the Amendments to the Federal Pollution Control Act of 1972 and 1977 required stricter water-quality standards for water discharges, which in turn, encouraged conservation, greater efficiency, and lower water-using technologies. Decline in the number of manufacturing facilities during more recent years also has reduced industrial withdrawals. Employment in two of the major water-using industries declined from 1985 to 2000. Employment in the petroleum and coal products industries declined by 26 percent, and employment in the primary metal industries declined by 13 percent (U.S. Department of Commerce, Bureau of Economic Analysis, 2003).

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Glossary

Water-use terminology has changed in this series of water-use Circulars prepared at 5-year intervals. The term water use as initially used for 1950 in the USGS water-use Circulars meant withdrawals of water; in the report for 1960, the term was redefined to include consumptive use of water as well as withdrawals. With the beginning of the USGS National Water Use Information Program in 1978, the term was again redefined to include return flow and offstream and instream uses. In the report for 1985, the term was redefined to include withdrawals plus deliveries from public suppliers. In the water-use Circular for 2000, water use is defined as initially used in 1950 as withdrawals of water. The following terms are referenced in the text and are part of the water-use Circular series.

animal-specialties water use–water use associated with the production of fish in captivity, except for fish hatcheries, and the raising of horses and such fur-bearing animals as rabbits and pets. Animal-specialties water use estimates were included in some previous water-use Circulars, but were combined with the livestock categories or aquaculture categories for 2000. *See also* aquaculture water use, fish-farm water use, livestock water use, and rural water use.

aquaculture water use–water use associated with the farming of organisms that live in water—such as finfish and shellfish — and offstream water use associated with fish hatcheries. *See also* fish-farm water use, fish-hatchery water use, animal-specialties water use, and livestock water use.

closed-loop cooling system–cooling systems where water is withdrawn from a source, circulated through heat exchangers, then cooled, and recycled. Subsequent water withdrawals are used to replace water lost to evaporation, blowdown, drift, and leakage and, accordingly, results in a much smaller return flow than once-through cooling. *See also* cooling system, cooling-system type, industrial water use, and thermoelectric-power water use.

commercial water use–water for motels, hotels, restaurants, office buildings, other commercial facilities, military and nonmilitary institutions—and for 1990 and 1995, water for offstream fish hatcheries. Water may be obtained from a public-supply system or may be self-supplied. Commercial water-use estimates were included in some previous water-use Circulars but were omitted for 2000. *See also* fish-hatchery water use, public-supply water use, public-supply deliveries, and self-supplied water use.

consumptive use–the part of water withdrawn that is evaporated, transpired, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment. Consumptive-use estimates were included in some previous water-use Circulars but were omitted for 2000. Also referred to as water consumed.

conveyance loss–water that is lost in transit from a pipe, canal, conduit, or ditch by leakage or evaporation. Generally, the water is not available for further use; however, leakage from an irrigation ditch, for example, may percolate to a ground-water source and be available for further use. Conveyance-loss estimates were included in some previous water-use Circulars but were omitted for 2000. *See also* irrigation water use.

cooling system–an equipment system that provides water for cooling purposes, such as to condensers at power plants or at factories, and includes water intakes and outlets; cooling towers; and ponds, pumps, and pipes. *See also* cooling-system type, industrial water use, and thermoelectric-power water use.

cooling-system type–*See* closed-loop cooling system and once-through cooling system.

domestic water use–water used for all such indoor household purposes as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and such outdoor purposes as watering lawns and gardens. The term used in previous water-use Circulars described the combined public supply deliveries to residential users and self-supplied domestic withdrawals. For 2000, domestic water use refers only to self-supplied domestic withdrawals. *See also* public-supply deliveries, public-supply water use, rural water use, and self-supplied water use.

fish-farm water use–water used for the production of finfish and shellfish under controlled feeding, sanitation, and harvesting procedures for commercial purposes. Water use by fish farms is classified in the aquaculture category. *See also* animal-specialties water use, aquaculture water use, and fish-hatchery water use.

fish-hatchery water use–water used for raising fish for later release and in association with the operation of fish hatcheries or fishing preserves. Fish-hatchery water use is classified in the aquaculture category. *See also* aquaculture water use, commercial water use, and fish-farm water use.

freshwater–water that contains less than 1,000 milligrams per liter (mg/L) of dissolved solids; generally, more than 500 mg/L of dissolved solids is undesirable for drinking and for many industrial uses. *See also* saline water.

industrial water use–water used for fabrication, processing, washing, and cooling, and includes such industries as chemical and allied products, food, mining, paper and allied products, petroleum refining, and steel. Term used in previous water-use Circulars to describe the combined public-supply deliveries to industrial users and self-supplied industrial withdrawals. For 2000, industrial water use refers only to self-supplied industrial withdrawals. *See also* cooling system, cooling-system type, mining water use, public-supply deliveries, public-supply water use, self-supplied water use, and thermoelectric-power water use.

instream use – water that is used, but not withdrawn, from a surface-water source for such purposes as hydroelectric-power generation, navigation, water-quality improvement, fish propagation, and recreation. Instream water-use estimates for hydroelectric power were included in previous water-use Circulars but were omitted for 2000.

irrigation district – a cooperative, self-governing public corporation set up as a subdivision of the State government, with definite geographic boundaries, organized, and having taxing power to obtain and distribute water for irrigation of lands within the district; created under the authority of a State legislature with the consent of a designated fraction of the landowners or citizens. *See also* irrigation water use.

irrigation water use – water that is applied by an irrigation system to assist in the growing of crops and pastures or to maintain vegetative growth in recreational lands such as parks and golf courses. Irrigation includes water that is applied for pre-irrigation, frost protection, chemical application, weed control, field preparation, crop cooling, harvesting, dust suppression, the leaching of salts from the root zone, and water lost in conveyance. *See also* conveyance loss, microirrigation system, sprinkler irrigation system, and surface irrigation system.

livestock water use – water for livestock watering, feedlots, dairy operations, and other on-farm needs. Types of livestock include dairy cows and heifers, beef cattle and calves, sheep and lambs, goats, hogs and pigs, horses and poultry. *See also* animal-specialties water use, aquaculture water use, and rural water use.

microirrigation system – An irrigation system that wets only a discrete portion of the soil surface in the vicinity of the plant by means of applicators (orifices, emitters, porous tubing, perforated pipe, and so forth) operated under low pressure. The applicators can be placed on or below the surface of the ground or can be suspended from supports. *See also* irrigation water use, sprinkler irrigation system, and surface irrigation system.

mining water use – water used for the extraction of naturally occurring minerals including solids, such as coal, sand, gravel, and other ores; liquids, such as crude petroleum; and gases, such as natural gas. Also includes uses associated with quarrying, milling, and other preparations customarily done at the mine site or as part of a mining activity. Does not include water associated with dewatering of the aquifer that is not put to beneficial use. Also does not include water used in processing, such as smelting, refining petroleum, or slurry pipeline operations. These processing uses are included in industrial water use. *See also* industrial water use and self-supplied water use.

offstream use – water withdrawn or diverted from a ground-water or surface-water source for aquaculture, commercial, domestic self-supply, industrial, irrigation, livestock, mining, public supply, thermoelectric power, and other uses**.** *See also* entries for each of the previously mentioned uses.

once-through cooling system – cooling systems in which the water is withdrawn from a source, circulated through heat exchangers, and then returned to a body of water at a higher temperature. Once-through cooling systems may be referred to as open-loop systems. *See also* cooling system, cooling-system type, industrial water use, and thermoelectric-power water use.

public-supply deliveries – amount of water delivered from a public supplier to users for domestic, commercial, industrial, thermoelectric-power, or public-use purposes. Delivery estimates were included in some previous water-use Circulars but were omitted for 2000. *See also* commercial water use, domestic water use, industrial water use, public-supply water use, public water use, and thermoelectric-power water use.

public-supply water use – water withdrawn by public and private water suppliers that furnish water to at least 25 people or have a minimum of 15 connections. Public suppliers provide water for a variety of uses, such as domestic, commercial, industrial, thermoelectric power, and public water use. *See also* commercial water use, domestic water use, industrial water use, public-supply deliveries, public water use, and thermoelectric-power water use.

public water use – water supplied from a public supplier and used for such purposes as firefighting, street washing, flushing of water lines, and maintaining municipal parks and swimming pools. Generally, public-use water is not billed by the public supplier. *See also* public-supply deliveries and public-supply water use.

reclaimed wastewater – wastewater treatment plant effluent that has been diverted for beneficial use before it reaches a natural waterway or aquifer. Term used in previous water-use Circulars. *See also* water use.

return flow – water that reaches a ground-water or surface-water source after release from the point of use and thus becomes available for further use. Term used in previous water-use Circulars. *See also* water use.

rural water use – water used in suburban or farm areas for domestic and livestock needs. The water generally is self-supplied, and includes domestic use, drinking water for livestock, and other uses, such as dairy sanitation, cleaning, and waste disposal. Term used in previous water-use Circulars. *See also* animal-specialties water use, domestic water use, livestock water use, and self-supplied water use.

saline water – water that contains 1,000 mg/L or more of dissolved solids. *See also* freshwater.

self-supplied water use – water withdrawn from a ground-water or surface-water source by a user rather than being obtained from a public supply.

sprinkler irrigation system – An irrigation system in which water is applied by means of perforated pipes or nozzles operated under pressure so as to form a spray pattern. *See also* irrigation water use, microirrigation system, and surface irrigation system.

standard industrial classification (SIC) codes–four-digit codes established by the Office of Management and Budget, published in 1987, and used in the classification of establishments by type of activity in which they are engaged.

surface irrigation system–irrigation by means of flood, furrow, or gravity. *Flood* irrigation is the application of irrigation water in which the entire soil surface is covered by ponded water. *Furrow* is a partial surface-flooding method of irrigation normally used with clean-tilled crops in which water is applied in furrows or rows of sufficient capacity to contain the design irrigation stream. *Gravity* is an irrigation method in which water is not pumped, but flows in ditches or pipes and is distributed by gravity. *See also* irrigation water use, microirrigation system, and sprinkler irrigation system.

thermoelectric-power water use–water used in the process of generating electricity with steam-driven turbine generators. Term used in previous water-use Circulars to describe the combined public-supply deliveries to thermoelectric-power plants and self-supplied thermoelectric-power withdrawals. For 2000, thermoelectric-power water use refers only to self-supplied thermoelectric-power withdrawals. *See also* cooling system, cooling-system type, public-supply water use, and self-supplied water use.

wastewater-treatment return flow–term used in previous water-use Circulars to describe water returned to the hydrologic system by wastewater-treatment facilities. *See also* water use.

water use–(1) In a restrictive sense, the term refers to water that is withdrawn for a specific purpose, such as for public supply, domestic use, irrigation, thermoelectric-power cooling, or industrial processing. In previous water-use Circulars, water use for the domestic, commercial, industrial, and thermoelectric-power categories included both self-supplied withdrawals and deliveries from public supply. (2) More broadly, water use pertains to the interaction of humans with and influence on the hydrologic cycle, and includes elements such as water withdrawal, delivery, consumptive use, wastewater release, reclaimed wastewater, return flow, and instream use. *See also* offstream use and instream use.

watt-hour (Wh)–an electrical energy unit of measure equal to 1 watt of power supplied to, or taken from, an electric circuit steadily for 1 hour.

water withdrawal–water removed from the ground or diverted from a surface-water source for use. *See also* offstream use and self-supplied water use.

Drip irrigation emitter, New Mexico. (Photo courtesy of Jeff Vanuga, USDA Natural Resources Conservation Service.)