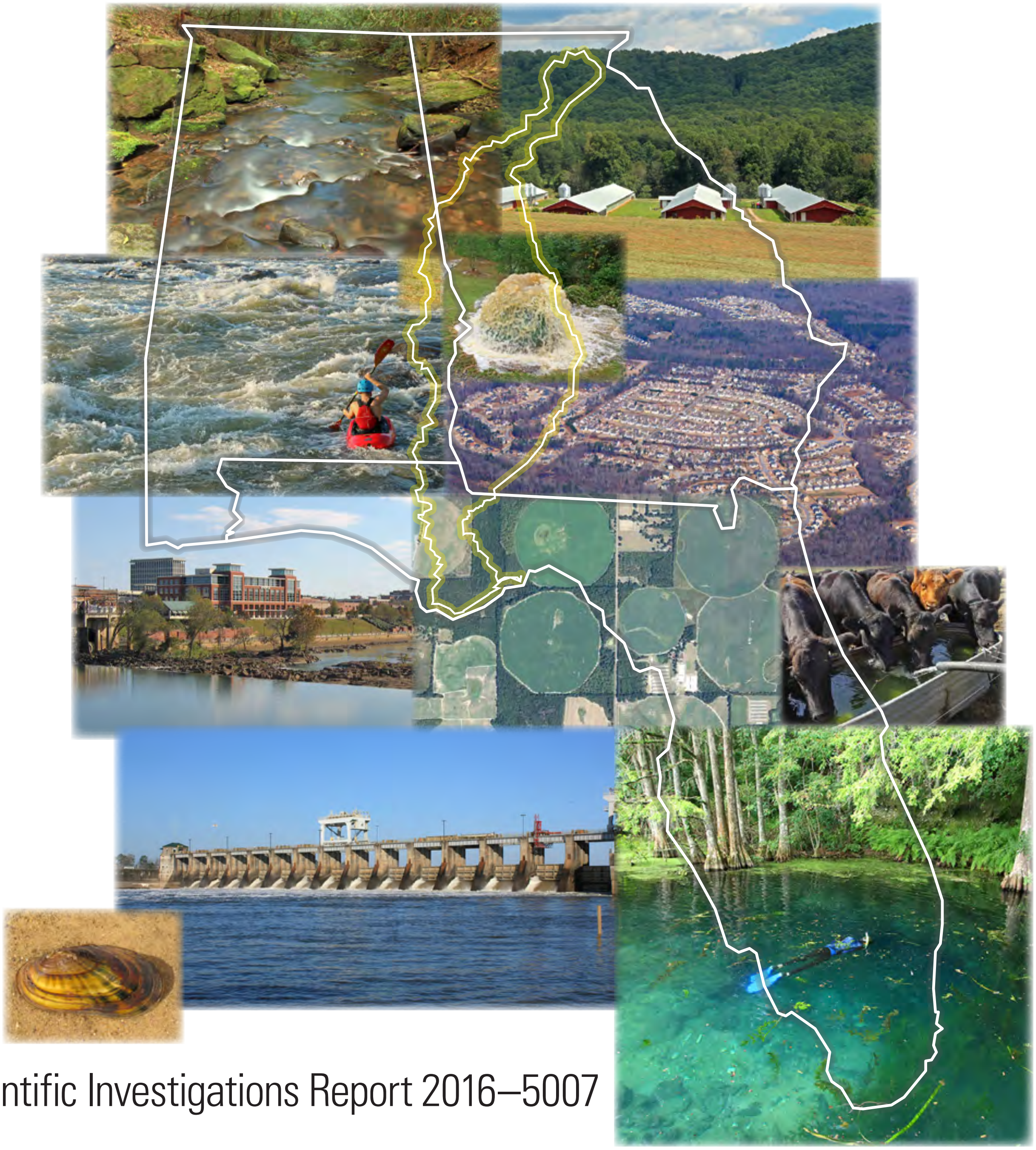
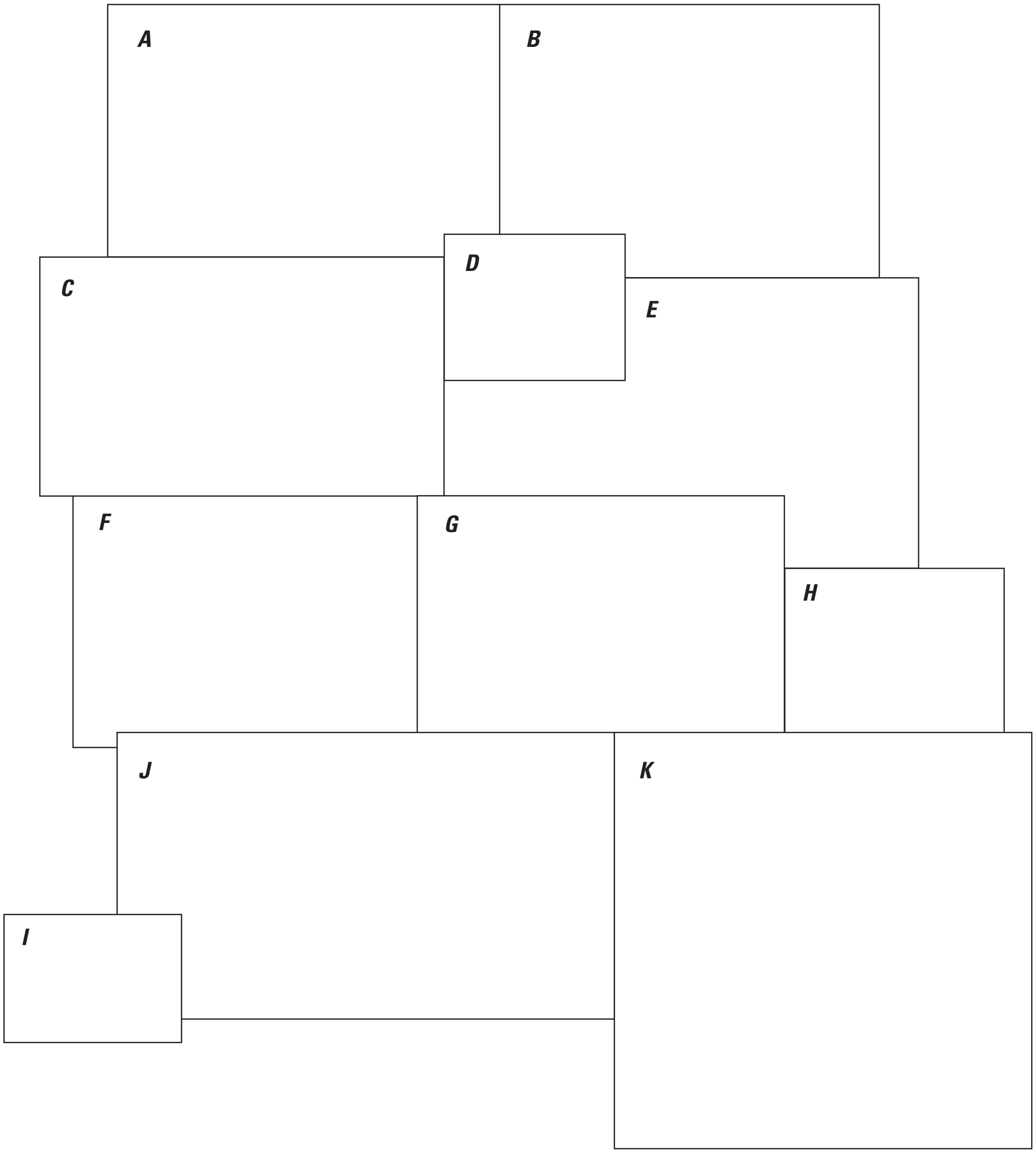
National Water Census Program

Water Use in the Apalachicola-Chattahoochee-Flint River Basin, Alabama, Florida, and Georgia, 2010, and Water-Use Trends, 1985–2010



Scientific Investigations Report 2016–5007

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



Cover. All photographs by Alan M. Cressler, U.S. Geological Survey, unless noted otherwise. *A*, Dicks Creek, Lumpkin County, Georgia. *B*, Chicken farm, White County, Georgia. *C*, Kayaker, Chattahoochee River, Georgia. *D*, Storm-sewer overflow. *E*, Housing areas, Douglas County, Georgia. *F*, Waterfront, Columbus, Georgia. *G*, Center-pivot irrigation west of Albany, Georgia (Google earth, image from USDA Farm Service Agency, December 31, 2009). *H*, Cattle, Dooly County, Georgia. *I*, Big Rainbow mussel. *J*, Jim Woodruff Dam, Lake Seminole. *K*, Hole In The Wall cave, Merritts Pond, Marianna, Florida.

Water Use in the Apalachicola-Chattahoochee-Flint River Basin, Alabama, Florida, and Georgia, 2010, and Water-Use Trends, 1985–2010

By Stephen J. Lawrence

National Water Census Program

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

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

U.S. Geological Survey
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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	4,047	square meter (m^2)
acre	0.4047	hectare (ha)
acre	0.004047	square kilometer (km^2)
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
gallon (gal)	0.003785	cubic meter (m^3)
million gallons (Mgal)	3,785	cubic meter (m^3)
cubic foot (ft^3)	0.02832	cubic meter (m^3)
acre-foot (acre-ft)	1,233	cubic meter (m^3)
acre-foot (acre-ft)	0.001233	cubic hectometer (hm^3)
	Flow rate	
gallon per day (gal/d)	0.003785	cubic meter per day (m^3/d)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)
million gallons per day per year (Mgal/d/y)	0.04381	cubic meter per second per year (m^3/s/y)

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

$$°C = (°F - 32) / 1.8$$

Datums

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

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

Altitude, as used in this report, refers to distance above the vertical datum.

Abbreviations

ACF	Apalachicola-Chattahoochee-Flint
ADECA	Alabama Department of Economic and Community Affairs, Office of Water Resources
ADEM	Alabama Department of Environmental Management
AWURP	Alabama Water Use Reporting Program
CAFR	Comprehensive Annual Financial Audit Report
FDEP	Florida Department of Environmental Protection
GaEPD	Georgia Environmental Protection Division, Watershed Protection Branch
GaSWCC	Georgia Soil and Water Conservation Commission
GIS	geographic information system
gpcd	gallons per capita per day
gpm	gallon per minute
HUC	hydrologic unit code
Mgal/d	million gallons per day
MOR	monthly operating report
NWFWMD	Northwest Florida Water Management District
NWUIP	National Water-Use Information Program
SECURE	Science and Engineering to Comprehensively Understand and Responsibly Enhance
SWUDS	site-specific water-use database system
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey

Acknowledgments

This compilation of water use in the Apalachicola-Chattahoochee-Flint (ACF) River Basin would not be possible without the assistance and data provided by State and local water supply (public and private) and water management agencies in Alabama, Florida, and Georgia. The author acknowledges the Georgia Power Company for providing water-use data and patiently explaining how a thermoelectric-power generation facility operates.

The author also acknowledges Amy Gill, U.S. Geological Survey, Alabama, and Richard Marella, U.S. Geological Survey, Florida, for providing water-use estimates in the ACF River parts of Alabama and Florida. The author gratefully acknowledges Michael Bradley, U.S. Geological Survey, and Vicki Trent, Georgia Environmental Protection Division, for providing a thorough review of this report.

Water Use in the Apalachicola-Chattahoochee-Flint River Basin, Alabama, Florida, and Georgia, 2010, and Water-Use Trends, 1985–2010

By Stephen J. Lawrence

Abstract

The Apalachicola-Chattahoochee-Flint (ACF) River Basin encompasses about 20,230 square miles in parts of Alabama, Florida, and Georgia. Increasing population growth and agricultural production from the 1970s to 2010 has prompted increases in water-resources development and substantially increased water demand in the basin. Since the 1980s, Alabama, Florida, Georgia, and the U.S. Army Corps of Engineers are parties to litigation concerning water management in the ACF River Basin.

Estimating the 2010 water use in the ACF River Basin is one aspect of a multipart water resources study on the ACF River Basin that began in 2011. This ACF River Basin study is one focus area of the U.S. Geological Survey's National Water Census program. The 2010 water-use estimates for the ACF River Basin are presented in this report. These estimates include an inventory of the quantity and sources of water withdrawn by category of use and location (State and river basin), and the surface-water returns in the ACF River Basin during 2010. Water-use trends from 1985 to 2010 in the basin also are presented. Offstream water-withdrawal data in the ACF River Basin are presented for each of the following categories: public supply, self-supplied domestic, self-supplied commercial, industrial, mining, agricultural (including crop irrigation, livestock, and aquaculture uses), and thermoelectric-power generation. Water-use data are compiled for the 14 subbasins in the ACF River Basin. For the counties in Alabama, Florida, and Georgia that are partially within the ACF River Basin, data are presented for only that part of the county that lies within the basin. A variety of Federal, State, local, private, and online sources in Alabama, Florida, and Georgia were used to gather surface-water and groundwater withdrawal, surface-water discharges (return flows), and water-use data for the ACF River Basin in 2010.

The population in the ACF River Basin was 3.835 million in 2010, a 45-percent increase from the 1990 population of nearly 2.636 million. About 92 percent of the 2010 ACF population resided in Georgia with nearly 75 percent living in the Atlanta metropolitan area. In 2010, 1,645 million gallons per day (Mgal/d) of water were withdrawn from groundwater (576 Mgal/d) and surface-water (1,069 Mgal/d) sources in the ACF River Basin. About 89 percent of the groundwater and 83 percent of the surface-water withdrawals were from Georgia. About 5.6 percent of the total groundwater and nearly 4 percent of the total surface-water withdrawals in the ACF River Basin were from Florida, whereas about 5.3 percent of groundwater and nearly 16 percent of surface water were withdrawn in Alabama. Total water use (withdrawals plus public-supplied deliveries) in the ACF River Basin was 1,593 Mgal/d in 2010. About 56 Mgal/d of water withdrawn in the ACF River Basin was delivered (interbasin transfer) to basins beyond the ACF River Basin. About 564 Mgal/d of water was returned to surface-water bodies in the ACF River Basin. Most of that amount, 63 percent, was treated wastewater discharged by public wastewater-treatment facilities. Water used for once-through cooling by thermoelectric-power facilities accounted for nearly 24 percent of the surface-water returns in the basin.

About 70 percent of all water withdrawals in the ACF River Basin were by self-supplied agricultural water users and public water suppliers. Agricultural withdrawals were greatest in the Flint River Basin (501 Mgal/d) with groundwater representing 84 percent of the withdrawals from that basin. Within the Flint River Basin, agricultural withdrawals were greatest in the Lower Flint River and Spring Creek subbasins. About 3.52 million people were served by public water suppliers in the ACF River Basin during 2010, and 88 percent of that population used surface water. Georgia had the largest public-supplied population, representing nearly 93 percent (3.17 million) of the public-supplied population in the ACF River Basin. Public water suppliers served 193,700 people (5.7 percent) in Alabama and 31,880 people in Florida (1.3 percent). Public-supply losses were estimated at 101 Mgal/d.

Withdrawals for public supply (483 Mgal/d) and self-supplied industry (141 Mgal/d) were greatest in the Chattahoochee River Basin. Surface water accounted for 96 percent of all withdrawals in the Chattahoochee River Basin. Withdrawals for public supply were greatest in the Upper Chattahoochee River subbasin (366 Mgal/d), whereas self-supplied industrial withdrawals were greatest in the Lower Chattahoochee River subbasin (110 Mgal/d).

Water-use trends in the ACF River Basin have varied during the 25 years between 1985 and 2010. Surface-water withdrawals declined between 1985 and 2000, sharply increased in 2000, and declined again between 2000 and 2010. In contrast, groundwater withdrawals increased between 1985 and 2000, declined in 2005, and increased between 2005 and 2010.

Introduction

The Apalachicola-Chattahoochee-Flint (ACF) River Basin encompasses about 20,227 square miles (mi^2) in parts of Alabama, Florida, and Georgia (U.S. Geological Survey, 2015; fig. 1). The surface-water resources in the ACF River Basin include the Apalachicola, Chattahoochee, and Flint Rivers and 26 water-supply reservoirs. These water bodies provide many water-related services and activities to the residents, municipalities, farms, electric power and other industries, recreationalists, and ecosystems within the basin.

Increasing population growth and agricultural production from the 1970s to 2010 has spurred water-resources development and substantially increased water demand in the basin. In addition to water withdrawn for human activities, water is needed to sustain healthy aquatic and terrestrial ecosystems. The water demand in 2010 and anticipated future increases in that demand among the three States in the basin coupled with annual and seasonal fluctuations in rainfall has resulted in conflicting water management goals in the ACF River Basin.

Since the 1980s, Alabama, Florida, Georgia, and the U.S. Army Corps of Engineers (USACE) have been parties to litigation concerning water management in the ACF River Basin, especially in the Chattahoochee River and Apalachicola River Basins (U.S. Court of Appeals, 2011). One major issue in this litigation is the use of Lake Sidney Lanier (fig. 1) in Georgia for water supply. The question has been raised by litigants—does the USACE have the authority to operate and manage reservoirs for water supply under the Rivers and Harbors Acts of 1945 and 1946, the Water Supply Act of 1958 (an amendment to the Rivers and Harbors Acts), or the Water Resources Development Act? Unlike other Congressional legislation that authorizes reservoir construction, water supply was not an explicitly stated purpose for Lake Sidney Lanier in Georgia. Under a ruling by the 11th U.S. Circuit Court of Appeals in 2011 (U.S. Court of Appeals, 2011), upheld by the U.S. Supreme Court in 2012, the USACE is authorized by Congress to operate and manage reservoirs for water supply under the provisions of the Rivers and Harbors Act; the Water Supply Act supplements that ruling. Another major issue is how much water should be allocated to sustain threatened and endangered aquatic species in the lower basins of the Flint and Apalachicola River Basins and to maintain the health of shellfish beds in the Apalachicola Bay estuary that are an economically important industry in Florida. Discussions are ongoing to resolve these issues in a manner that is equitable to all parties in the litigation. In addition, hydrologic and biological studies are underway in the ACF River Basin to provide more information on surface-water and groundwater withdrawals, water use, and the status of threatened and endangered aquatic species. The goal of these studies is to develop tools for managing the water resource in the ACF River Basin.

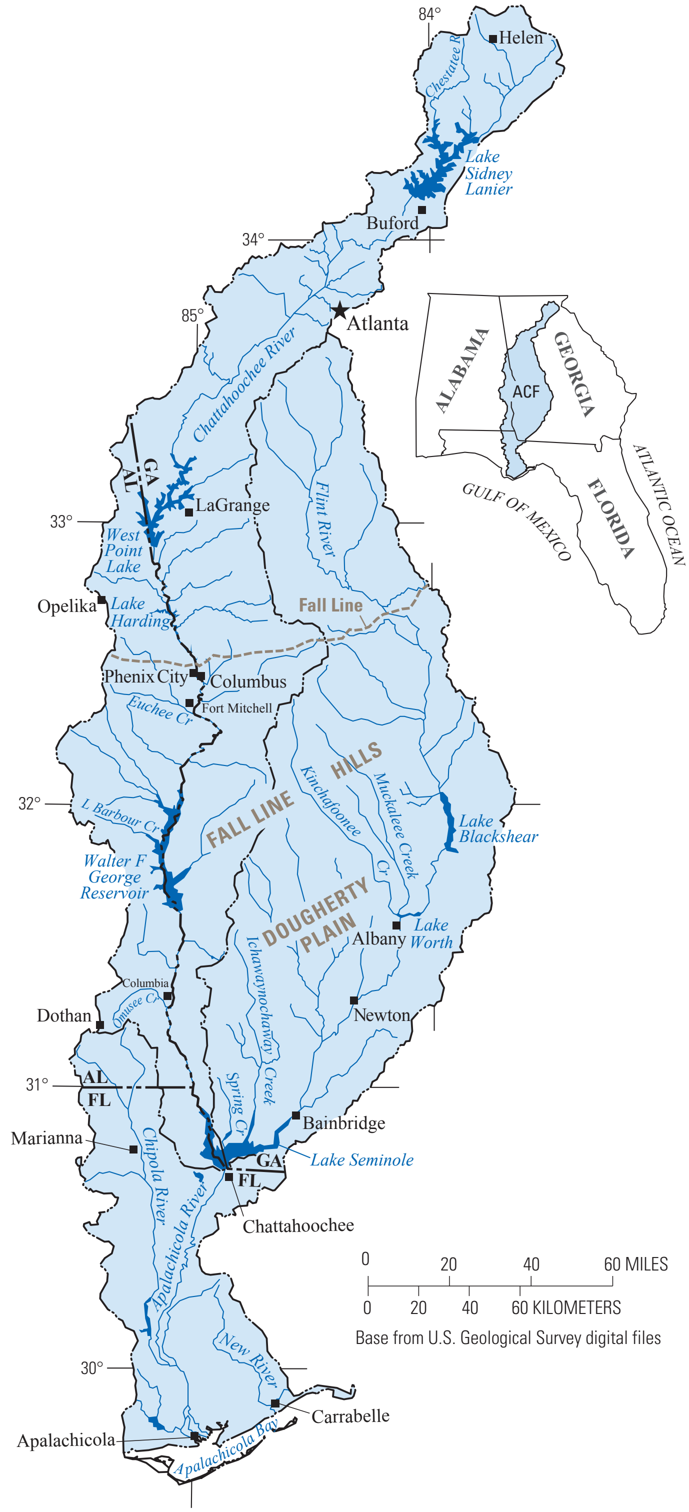


Figure 1. Apalachicola-Chattahoochee-Flint River Basin

Estimating the 2010 water use is one part of a focused, multipart water resources study on the ACF River Basin that began in 2011. The ACF focus-area study is funded by the U.S. Geological Survey (USGS) as part of the USGS National Water Census program (USGS National Water Census at http://water.usgs.gov/watercensus). The National Water Census is a USGS research program created to develop new water accounting tools that can assess water availability at regional and national scales. Through the National Water Census, the USGS is integrating diverse research on water availability and use and enhancing the understanding of the connection between water quality and water availability. The program is designed to provide the tools that water management agencies and other natural resource managers may need to manage the water resource. The National Water Census is one of six major science directions identified by the USGS 2007 Science Plan (U.S. Geological Survey, 2007), called for in the Science and Engineering to Comprehensively Understand and Responsibly Enhance (SECURE) Water Act, and implemented through the Department of the Interior's Sustain and Manage America's Resources for Tomorrow initiative (USGS WaterSMART at http://water.usgs.gov/watercensus/WaterSMART.html).

The data used for this report were collected and compiled as part of the USGS 5-year water-use assessment for the United States through arrangements with the following cooperating agencies: the Alabama Department of Environment and Conservation, the Florida Department of Environmental Protection (FDEP), Northwest Florida Water Management District (NWFWMD), and the Georgia Environmental Protection Division, Water Protection Branch (GaEPD).

Purpose and Scope

The purpose of this report is to present the 2010 water-use estimates for the ACF River Basin. These estimates include an inventory of the quantity and sources of water withdrawn by water-use category and location (State and river basin) and the surface-water returns in the ACF River Basin during 2010. Water-use trends from 1985 to 2010 in the basin also are presented. Only freshwater withdrawals (saline water withdrawals were not inventoried) are presented in this report. Offstream water withdrawal data in the ACF River Basin are presented for each of the following categories: public supply, self-supplied domestic, self-supplied commercial, industrial, mining, agricultural (including crop irrigation, livestock, and aquaculture uses), and thermoelectric-power generation. Water-use estimates for hydroelectric-power generation are not included in this report.

Water-use data are compiled for the 14 subbasins in the ACF River Basin. For those counties in Alabama, Florida, and Georgia that are partially within the ACF River Basin, data are presented for only that part of the county that lies within the basin. The water-use data presented in this report are for the year 2010. Water-use trends using data collected every 5 years from 1985 to 2010 are also presented. Information concerning instream (nonwithdrawal) water use, such as hydroelectric-power generation, navigation, water-based recreation, propagation of fish and wildlife, and dilution and conveyance of liquid or solid wastes, is not included.

Previous Studies

Many studies and reports have been published on various parts of the ACF River Basin. In 1984, an ACF River Basin water assessment by the USACE (U.S. Army Corps of Engineers, 1984) included a complete inventory and reconnaissance of the water resources in the ACF River Basin and a description of 1980 water use. The Georgia Department of Natural Resources published two reports (Georgia Department of Natural Resources, 1984a, 1984b) that provide a detailed inventory of water uses and discharges in the Chattahoochee and Flint River Basins for 1982 and summarized water-use data for 1980. Reports of 1985 water use for Alabama (Baker and Mooty, 1987; Mooty, 1990); Florida (Bielby, 1987; Marella, 1988, 1990); and Georgia (Turlington and others, 1987; Pierce, 1990) detail water use in the ACF River Basin by State. Water-use data for the ACF River Basin in 1985 were compiled from these reports by the USGS and published in the Proceedings of the 1991 Georgia Water Resource Conference (Marella, 1991, p. 9). Water-use data for the ACF River Basin in 1990 were compiled by Marella and others (1993) and for 2005 by Marella and Fanning (2011). Additional water-use reports exist for Alabama, Florida and Georgia; however, most of these reports summarize statewide water-use data for the year 2010 by category and county and do not provide totals for the ACF River Basin (Carter and Johnson, 1974; Pierce and others, 1982; Fanning, 1985; Trent and others, 1990; Fanning, 1997; Fanning and others, 1992).

Water Withdrawal and Water-Use Data Sources and Estimation Methods

As part of the USGS National Water-Use Information Program (NWUIP), water-use data are collected and compiled by county for each State every 5 years. The 2010 water-use data for Alabama, Florida, and Georgia were collected and compiled using guidelines specified by the USGS NWUIP (Hutson, 2007). A variety of Federal, State, local, private, and online sources in Alabama, Florida, and Georgia were used to gather surface-water and groundwater withdrawal, surface-water discharges (return flows), and water-use data for the ACF River Basin in 2010 (table 1). More detailed descriptions of Florida data sources and estimation methods used for the 2010 Florida water-use compilation are given in Marella (2014). More detailed descriptions of Georgia data sources and estimation methods used for the 2010 Georgia water-use compilation are given in Lawrence (2015).

Table 1. Water-withdrawal and water-use data sources for Alabama, Florida, and Georgia, 2010.

[ADECA, Alabama Department of Economic and Community Affairs, Office of Water Resources; FDEP, Florida Department of Environmental Protection; GaEPD, Georgia Environmental Protection Division, Watershed Protection Branch; NWFWMD, Northwest Florida Water Management District; USGS, U.S. Geological Survey; ADAI, Alabama Department of Agriculture and Industries; USDA–NASS, U.S. Department of Agriculture, National Agricultural Statistics Service; DOE–EIA, Department of Energy, Energy Information Administration; ADEM, Alabama Department of Environmental Management; NPDES, National Pollutant Discharge Elimination System]

Water-use category	Type of data	Data source
Public-supply withdrawals and deliveries	Reported groundwater and surface-water withdrawals by permitted users	ADECA–Alabama Water-Use Reporting Program; FDEP–Drinking Water Program; GaEPD–Drinking Water and Nonfarm Water Withdrawal Permit Program (groundwater and surface-water permitting units).
	Population served, wholesale and retail water sales, and wholesale purchases	Mail survey to operators of public-supply systems; ADECA–Alabama Water-Use Reporting Program; NWFWMD–2013 water resources assessment study (Northwest Florida Water Management District, 2014); City and County Comprehensive Planning documents and maps; U.S. Census Bureau (2011a), Population and Housing Occupancy Status: 2010–State-Place and (in selected States) County Subdivision.
	Total number of accounts; in some cases number of residential, commercial, and industrial accounts and amount of water billed	Mail survey to operators of public-supply systems; City and County 2010/2011 Comprehensive Financial Audit reports; City and County Comprehensive Planning documents and maps.
	Primarily water service area and zoning maps	City and County Comprehensive Planning documents and maps; NW–FWMD–2013 water resources assessment study (Northwest Florida Water Management District, 2014); U.S. Census Bureau (2011a, 2011b), Population and Housing Occupancy Status by county, place, and census block: 2010.
	Population served by small public suppliers (subdivisions and mobile home parks)	NWFWMD–2013 water resources assessment study (Northwest Florida Water Management District, 2014); GaEPD–Drinking Water and Water Withdrawal Program, Drinking Water permit unit; U.S. Census Bureau (2011a, 2011b), Population and Housing Occupancy Status by county, place, and census block: 2010.
Self-supplied domestic	Self-supplied population served and water use	U.S. Census Bureau (2011a), Population and Housing Occupancy Status: 2010–State-Place and (in selected States) County Subdivision. Population self-served computed by subtracting population served by public suppliers from total population, then multiplied by 75 gallons per person per day.
Self-supplied commercial and industrial withdrawals	Reported groundwater and surface-water withdrawals by permitted users	ADECA eWater database; NWFWMD–Consumptive water-use permit compliance files or 2010 annual report; GaEPD–Drinking Water and Water Withdrawal Program, groundwater and surface-water permitting units.
Mining	Reported groundwater and surface-water withdrawals by permitted users	NWFWMD–Permit Compliance Reports; GaEPD–Nonfarm Water Withdrawal Permit Program (groundwater and surface-water permitting units).
	Withdrawal estimates by county	John Lovelace, USGS, written commun., 2011 (estimated from USGS Minerals Information Team data).
Livestock and aquaculture	Livestock and aquaculture water-use estimates	Datasets supplied by John K. Lovelace, USGS, National Water-Use Program Office; Georgia Statewide Water Plan; Masters, 2009.
Irrigation—Crops	Withdrawal estimates and irrigated acreage by county	Alabama: Hutson and others, 2009, ADAI, USDA–NASS; Florida: see Marella, 2014; Georgia: Georgia Statewide Water Plan, Mullen and others, 2010; Hook, 2010.
	Metered agricultural withdrawals and estimated withdrawals in nonmetered counties in south Georgia	For Florida see Marella, 2014; Georgia Soil and Water Conservation Commission; USGS; Torak and Painter, 2011.

Table 1. Water-withdrawal and water-use data sources for Alabama, Florida, and Georgia, 2010.—Continued

[ADECA, Alabama Department of Economic and Community Affairs, Office of Water Resources; FDEP, Florida Department of Environmental Protection; GaEPD, Georgia Environmental Protection Division, Watershed Protection Branch; NWFWMD, Northwest Florida Water Management District; USGS, U.S. Geological Survey; ADAI, Alabama Department of Agriculture and Industries; USDA–NASS, U.S. Department of Agriculture, National Agricultural Statistics Service; DOE–EIA, Department of Energy, Energy Information Administration; ADEM, Alabama Department of Environmental Management; NPDES, National Pollutant Discharge Elimination System]

Water-use category	Type of data	Data source
Irrigation—Golf	Reported groundwater and surface-water withdrawals by permitted users	Alabama: ADAI, ADECA–Alabama Water-Use Reporting Program; Florida: Marella, 2014; Georgia: GaEPD–Drinking Water and Water Withdrawal Program, groundwater and surface-water permitting units.
	Acreage, water application rates	Alabama: Hutson and others, 2009; Florida: see Marella, 2014; Georgia: Georgia Statewide Water Plan, Lewis, 2010.
Thermoelectric power	Reported groundwater and surface-water withdrawals by permitted users	Alabama: ADECA, DOE–EIA, individual facilities; Florida: see Marella, 2014; Georgia: GaEPD–Drinking Water and Water Withdrawal Program, groundwater and surface-water permitting units.
Wastewater returns	Reported surface-water discharges by permitted users	Alabama: ADEM NPDES permitting unit; Florida: Florida Reuse Inventory Database (Florida Department of Environmental Protection, 2011); Georgia: GaEPD–Wastewater Regulatory Program, Municipal and Industrial permitting units.

Public-Supplied Population

The population served by public suppliers in the ACF River Basin was determined in several ways. Water service-area maps were obtained from comprehensive planning documents, water system planning documents and annual reports, and public supplier Web sites. A geographic information system (GIS) coverage of water service areas and census block data from the 2010 U.S. Population Census (U.S. Census Bureau, 2011a, 2011b) was created. The population served for each public water supplier was estimated in the following manner:

- If the number of domestic connections was available for a public supplier and the service area extent was the legal limits of a city or town, then the population served was the 2010 U.S. Census population for the city or town.
- If the number of domestic connections was available for a public supplier and the service area included and extended beyond the legal limits of a city or town, then the population served by a public water supplier was the summed census block population within the service area. Where census blocks were split by service area boundaries, only the proportion of the census block population in the service area was included in the population served. Prison populations were not included in population served estimates because prison water use is accounted for in the commercial use category.
- If the number of domestic connections was available for a public supplier and the service area was identified by the extent of major water lines (commonly county water systems), then those water lines were added as a layer to the census map, and census blocks closest to the water lines and with the greatest population density were selected. The occupied housing units in the selected census blocks were then summed until they equaled the known number of domestic connections. The population served was the summed population in the census blocks.
- If the number of domestic connections was available for a public supplier but the number was larger than the number of occupied housing units of the incorporated city or town, and the service area was unknown, then the service area was estimated. Beginning with the census blocks within the city or town boundaries, census blocks with the greatest number of housing units surrounding the city or town were added to those within the city boundary until the number of domestic connections equaled the number of occupied housing units; these census blocks became the estimated service area. The population served was the 2010 census population within the census blocks of the estimated service area.
- If the amount of water withdrawn was known and the service area and number of domestic connections was not known, then the population served was computed as follows: (1) domestic use was assumed to be 80–95 percent of the water withdrawn (average from empirical 2010 water-use data in all three States), depending on the size of the town or city and (2) the estimated average daily withdrawal on an annual basis was divided by 75 gallons to get an estimate of population served.

Public-Supplied Water

Public-supplied water is water withdrawn, treated, and delivered to domestic (residential), commercial, and industrial customers by public water suppliers. In Alabama, Florida, and Georgia, any water supplier (municipal, county, or private entity) that regularly serves at least 25 people or has at least 15 water connections is considered a public water system under Alabama law (regulation 335–7–1–.01qq), Florida law (Florida Department of Environmental Regulation, 1990), and Georgia law (OCGA 12–5–172–11). This definition includes large and small community water systems (public and privately owned), noncommunity water systems; and nontransient, noncommunity water systems.

Small community water systems commonly withdraw less than 100,000 gallons per day (gal/d; monthly average) of water and typically are not required to obtain a withdrawal permit, but a permit or certificate of use may be required to deliver drinking water to customers. Small community water systems include incorporated and unincorporated towns and cities, subdivisions, mobile home parks, and apartment or condominium complexes.

Alabama

In Alabama, legislative mandate requires all public water suppliers that are permitted to withdraw more than 100,000 gal/d to send yearly withdrawal reports to the Alabama Department of Economic and Community Affairs, Office of Water Resources (ADECA) through the Alabama Water Use Reporting Program (AWURP), which is an online database. Site-specific data for 2010 were acquired from AWURP and used as the basis for estimates of public-supply withdrawals and public-supplied deliveries. These data, aggregated by subbasin, were provided for this report by Amy Gill (U.S. Geological Survey, written commun., 2014).

Florida

In Florida, data for public-supply water withdrawals were obtained from (1) consumptive water-use permit compliance files or annual reports provided by the NWFWMD, (2) monthly operating reports (MORs) supplied to the FDEP Drinking Water Program (http://www.dep.state.fl.us/water/drinkingwater/flow.htm), or (3) individual public water suppliers directly. Nearly all of the reported water withdrawals by public water suppliers are from metered data or from estimates in the 2013 water resources assessment study by NWFWMD (Northwest Florida Water Management District, 2014). These data were then associated with the appropriate ACF subbasin (Richard Marella, U.S. Geological Survey, written commun, 2014).

The information regarding water service areas, population served, and water withdrawals by small public water suppliers was obtained from the 2013 water resources assessment study by NWFWMD (Northwest Florida Water Management District, 2014). A GIS coverage was made of the water service areas and combined with a GIS coverage of 2010 census block population data (U.S. Census Bureau, 2011b) to compute an estimate of population served for each public water supplier in the Florida part of the ACF River Basin.

Georgia

Compiling the public-supplied water use for Georgia in 2010 was a multitiered effort. Surface-water and groundwater withdrawals were summarized for permitted public water suppliers by county using data reported to GaEPD under the Nonfarm Water Withdrawal Permit Program (table 1). A list of entities with a drinking water permit under the GaEPD Drinking Water Program was used to identify small community water systems that withdraw less than 100,000 gal/d (monthly average) from surface-water or groundwater sources. Surface-water and groundwater withdrawals were estimated for small community water systems using population served multiplied by a per capita water use of 75 gal/d plus 5 percent for distribution losses. This per capita water use was derived from USGS surveys in 1983 of self-supplied domestic users near Athens, Georgia (Julia Fanning, U.S. Geological Survey, written commun., 1983). Among 86 public water suppliers who returned a 2010 water-use questionnaire, the median domestic use per capita was 76 gal/d. Moreover, the Metropolitan North Georgia Water Planning District published a per capita water use of 61gal/d in 2009 (Metropolitan North Georgia Water Planning District, 2011).

Several public-supply systems convey water withdrawn from a river or stream to a storage reservoir from which water is withdrawn for treatment and distribution. The reservoir may be used only when streamflow is too low to support direct withdrawals or may always be used as the direct source for the treatment plant. In the ACF River Basin, the withdrawal points and storage reservoirs were within the same county and basin; therefore, only water withdrawn from the reservoir was counted as a withdrawal for this compilation.

Public-Supplied Water Deliveries

Public-supplied water deliveries consist of water delivered by public water suppliers to billed domestic (residential), commercial, industrial, and irrigation customers and to unbilled water connections. Unbilled water connections (public use) include municipal and county administrative and maintenance buildings, public safety buildings, and public-use connections such as parks and recreation centers, fire hydrants, churches, and charitable organizations. Domestic customers use water for typical household purposes such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, washing cars, and watering lawns and gardens. Commercial customers include motels, hotels, restaurants, medical centers, hospitals, military installations, public safety, correctional institutions, retail stores, educational facilities (public and private), campgrounds, and recreational vehicle parks. Industrial customers include facilities that manufacture automobile, building, chemical, electronics, food, machinery, metal, paper, plastic, rubber, wood products, and metal and plastic fabrication. Public-supply losses include unauthorized water use, meter inaccuracies and data errors, and storage and delivery losses caused by leakage and pipe breakage (U.S. Environmental Protection Agency, 2009, p. 2–2).

Alabama

In 2014, water-use questionnaires were sent to 21 community water systems in the Alabama parts of the ACF River Basin. Although only five public water suppliers returned a questionnaire, these data gave some indication of per capita domestic and per customer commercial and industrial water deliveries in the Alabama part of the ACF River Basin. From those questionnaires, domestic deliveries ranged from 42 to 97 gal/d per person, commercial from 500 to 8,000 gal/d per customer, and industrial from 7,000 to 54,000 gal/d per customer. The number of possible commercial, industrial, and public-use customers in a known service area was determined by using internet business directories and visual identification using Google Earth®.

Florida

In Florida, the population served by public water suppliers was determined using 2010 U.S. Census Block population and water service area boundaries in a GIS as mentioned previously. Because the amount of water that was delivered to domestic (residential), commercial, and industrial customers was unavailable, these deliveries are estimated. Deliveries to domestic customers within a water service area are computed by multiplying the population served by 75 gal/d.

The number of commercial and industrial customers within a water service area is estimated from business listings and directories on the internet and visual counts from Google Earth. Excluding small resort towns along the Gulf of Mexico coast (such as Alligator Point and Carrabelle, Florida; fig. 1), commercial use is estimated at 350 gal/d per commercial customer when the population served is less than 1,000 people and commercial customers consisted primarily of small downtown businesses and gas station/convenience stores (as determined from Google Earth). Moreover, a public-supply delivery of 550 gal/d per commercial customer is used for all other commercial customers, including those in coastal resort towns along the Gulf of Mexico. Commercial deliveries were estimated as the number of commercial customers times the water-use coefficient. Industrial deliveries were estimated as the difference between the amount of water withdrawn and the sum of the estimated domestic, commercial, public use, and delivery losses.

The amount of water delivered for public use ranged from an estimated 125 to 200 gal/d per water connection, depending on the population in the water service area. The average amount of estimated public-supply losses (sometimes called system or conveyance losses) within each water service area ranged from 15 to 20 percent.

Georgia

In Georgia, information on public-supply deliveries to customer groups and on wholesale sales was obtained from questionnaires sent by the GaEPD and a variety of other public sources. In 2011, the GaEPD sent a water-use questionnaire to most public water suppliers in Georgia. All public water suppliers with withdrawal permits were surveyed. Many of the larger public water suppliers that withdraw a monthly average of less than 100,000 gal/d but have permits under the drinking water program were also surveyed. The questionnaire requested the following information:

- amount of water withdrawn;
- amount of water purchased, if any, and the entity selling the water;
- total number of service connections;
- population served;
- amount of water delivered and number of connections for customers in the domestic, commercial, industrial, and nonrevenue categories;
- amount of water sold and names of wholesale customers; and
- the three largest industrial customers and the amount of water delivered to each.

Unfortunately, many of the largest public water suppliers did not return a questionnaire. To acquire water-use information for those water suppliers that did not return a questionnaire, a number of different sources of information (table 1) were investigated in the following sequence:

- Statistical section of 2010–11 Comprehensive Annual Financial Audit Reports (CAFR) for total customers, amount of water billed to domestic, commercial, industrial, and public customers (municipal buildings, parks, and so forth).
- Comprehensive planning documents for service area maps, number of customers for 2010, if available, and proportion of domestic, commercial, and industrial customers.
- Public-supplier internet Web pages for total customers and service area.
- 2005 water-use survey conducted by GaEPD (proportion of domestic, commercial, and industrial customers).
- Internet business directories and Google Earth for the number of commercial and industrial businesses served within a service area, omitting those with a water withdrawal permit.
- 2010 U.S. Federal Census Block Population and Housing data (U.S. Census Bureau, 2011b) for population served within a service area boundary.

When the amount of water delivered to domestic customers was not known, the estimated population served as described previously was multiplied by 75 gal/d. Similarly, when the amount of water delivered to commercial customers was unknown and the number of commercial customers was known, the number of commercial customers was multiplied by a water-use coefficient. To estimate a water-use coefficient for commercial use, commercial water usage provided by 73 public water suppliers who returned a correctly completed water-use questionnaire or who listed commercial deliveries in a 2010–11 CAFR was used. The water-use coefficients were computed using the amount of water delivered divided by the number of commercial customers. For the 73 public water suppliers, the median water delivery per commercial customer was 540 gal/d. The populations served for these 73 water suppliers ranged from 360 to 753,000. Water-use coefficients were applied on a sliding scale depending upon the population or potential tourist activity in a water service area. A coefficient of 200 gal/d was used for public suppliers serving fewer than 2,000 people and with commercial customers consisting primarily of small downtown businesses and gas station/convenience stores (as determined from Google Earth). In contrast, a public-supplied delivery of 550 gal/d per commercial customer was used for all other areas.

Industrial customers include those involved with the manufacturing of chemical, food, textile, paper, wood, and petroleum products; metal fabrication; and machinery. The amount of water delivered to industries by public water suppliers in 2010 is determined from the 2010 water-use questionnaire, 2010–11 CAFR, the proportion of industry connections given in the 2005 water-use questionnaire, or estimated using water-use coefficients. In some instances, the number of possible industrial customers in a known service area was determined by using internet business directories, Google Earth, and the Dun and Bradstreet Hoovers database (Dun and Bradstreet, Inc., 2011).

A water-use coefficient was used when the number of industrial customers was known, but the amount of water delivered was unknown. Among 81 public water suppliers who returned a correctly completed water-use questionnaire or listed industrial deliveries in a 2010–11 CAFR, the median water delivery per industrial customer was 2,000 gal/d and ranged from 100 to 280,000 gal/d. This median value of 2,000 gal/d was used as the industrial water-use coefficient. Industrial deliveries were computed as the number of industrial customers times the water-use coefficient.

Nonrevenue deliveries include water deliveries to unbilled customers and to public connections (public use). Nonrevenue deliveries also include public-supply (system or conveyance) losses. Public-use deliveries and public-supply losses were inconsistently reported on 2010 water-use questionnaires and in some cases were reported as the difference between the sum of water withdrawals and purchases and the sum of domestic, commercial, and industrial deliveries. Unbilled customers may include churches, charitable organizations, schools, public connections (including office buildings), vehicle garages and maintenance buildings, parks, recreation complexes, athletic fields, golf courses, and so forth. In most cases, public connections are unbilled; however, others may be billed, especially if water is provided by a private entity.

Public-supply losses reported on 2010 water-use questionnaires or in 2010–11 CAFRs ranged from about 4 to 32 percent of the total water entering the distribution system. If the actual public-supply loss was not available, then the average loss was estimated at 15 percent for public water suppliers and 5 percent for subdivisions. The 15 percent loss was about the average for all water losses reported on the 2010 questionnaires or in the 2010–11 CAFRs and was similar to that reported by U.S. Environmental Protection Agency (2009, p. B–2, B–3) and by CH2M HILL (2007).

Water transfers refer to water purchased from other water suppliers and water sold to wholesale customers. The amount of water purchased or sold in 2010 was obtained from the 2010 water-use questionnaire, from the 2010–11 CAFRs (if reported), or from the 2005 water-use questionnaire.

Self-Supplied Water Withdrawals

Self-supplied water is surface water or groundwater that is withdrawn, treated (drinking water use), and used onsite by an individual user (such as private domestic household), by a facility (such as a factory or power plant), for irrigation, or for agricultural use. Many self-supplied commercial, industrial, and mining establishments hold surface-water or groundwater (or both) withdrawal permits. A self-supplied user may also receive water from a public supplier.

Self-supplied groundwater withdrawals for domestic uses are commonly less than 100,000 gal/d and typically happen at individual dwellings in rural or semirural areas where access to public-supplied water is nonexistent. Surface water is generally not a source for self-supplied domestic uses in the ACF River Basin. County-level data were used as a basis for aggregating estimates of self-supplied domestic and agricultural withdrawals (crop irrigation, livestock, and aquaculture) by subbasin in the ACF River Basin.

Self-supplied commercial and industrial water users that withdraw more than 100,000 gal/d typically are required to be permitted or registered by a State water resources agency and must report water withdrawals on a monthly basis. Small, self-supplied commercial establishments such as campgrounds, marinas, State or county parks, restaurants, convenience stores, recreation areas, and recreational vehicle parks do not withdraw enough water to require a withdrawal permit; however, the establishments do have drinking water permits and withdraw and treat water for drinking and other indoor or outdoor uses. Water use by these small commercial establishments are not included in the 2010 estimates because they are not required to report water withdrawals and water-use coefficients could not be determined. Because of the relatively small amount of water used, the omission of these data will have little effect on withdrawal estimates in the ACF River Basin.

Most of the water withdrawn during mining operations is used for the extraction of minerals, quarrying, milling, and other typical preparations at a mine site. These mining operations commonly do not require large quantities of water. Although large amounts of water may be pumped to dewater mining sites, this water is typically discharged to a nearby river or stream and not actually used. As a result, those withdrawals are not included in the mining water-use estimates, but may be included in the surface-water return estimates. Kaolin and fuller's earth operations use large amounts of water to transport and process the clay after extraction. Although some mining operations (especially kaolin and fuller's earth) had water withdrawal permits that indicated withdrawals of more than 100,000 gal/d, these withdrawals were included in the industrial-use category rather than the mining category because the water is not used in the extraction but in the processing of the clay.

Alabama

Self-supplied domestic withdrawals were not reported as part of the AWURP and were not collected as part of this study. Instead, self-supplied domestic withdrawals were estimated from a self-supplied population and a per capita water-use coefficient of 75 gal/d. Self-supplied domestic use is computed as the self-supplied population multiplied by 75 gal/d.

Legislative mandate (Alabama Water Resources Act, Act Number 93–44, codified as Code of Alabama 1975, Article 9–10B–1, et seq.) requires all entities that are permitted to withdraw more than 100,000 gal/d to send yearly withdrawal reports to the ADECA through the AWURP. Site-specific data for 2010 were acquired from AWURP and were used as the basis for estimates of commercial, industrial, and mining withdrawals. These data, aggregated by subbasin, were provided for this ACF River Basin report by Amy Gill (U.S. Geological Survey, written commun., 2014). Water withdrawals from small commercial establishments that are less than 100,000 gal/d are not included in this report. Small commercial establishments include campgrounds, marinas, parks, restaurants, convenience stores, recreation areas, and recreational vehicle parks. Mining water use was estimated from per ton water-use coefficients and crude ore production in tons for 2010 from the USGS Minerals Information Team; from coal production in tons from the Department of Energy, Energy Information Administration; and from site-specific mining withdrawal data reported to the AWURP. Mining estimates were provided by the USGS NWUIP as part of the Federal effort to estimate water use for the United States for 2010. The methods used for these mining estimates are given in Lovelace (2009a).

The water use for each county totally or partially in the ACF River Basin was provided by Amy Gill (U.S. Geological Survey, written commun., 2014) using water withdrawal data from the ADECA through the AWURP. Estimates of water withdrawals by county for crops were derived from the estimated number of acres in 2007 and a statewide or watershed crop application rate by irrigation-system type (U.S. Department of Agriculture, 2009a, 2010; table 1). Crop application rates ranged from 0.3 to 0.8 acre-foot per acre for sprinkler irrigation systems and from 1.1 to 2.1 acre-feet per acre for micro-irrigation systems. The statewide average application rate for crops was 0.7 acre-foot per acre (U.S. Department of Agriculture, 2009a, 2010).

County-level water withdrawals by source for livestock, aquaculture, and mining were from estimates determined by the USGS NWUIP as part of the Federal effort to estimate water use for the United States for 2007. Estimates of livestock withdrawals by county were calculated from the 2007 livestock census by the U.S. Department of Agriculture (USDA; U.S. Department of Agriculture, 2009a) and by statewide drinking water-requirement coefficients, such as those for dairy cattle (35 gallons per capita per day [gpcd]), other cattle (12 gpcd), horses and other equine (12 gpcd), hogs (5 gpcd), sheep and goats (2 gpcd), and poultry (0.05 gpcd; Kammerer, 1976; Mooty and Richardson, 1998). The coefficients do not reflect the effect of climate on animal watering across the State or facility maintenance needs.

Water withdrawals for livestock by subbasin were determined by applying GIS techniques. The subbasin boundaries were superimposed on the county boundaries to create a subbasin/county areal unit. Each subbasin/county unit represents the percentage of the subbasin area within a county. Surface-water and groundwater withdrawals were distributed among the subbasin/county units based on the assigned areal percentage. Water withdrawals for each subbasin/county unit were summarized by subbasin. The difference in the county and subbasin totals was 0.05 million gallons per day (Mgal/d; +0.02 Mgal/d for groundwater and +0.03 Mgal/d for surface water). An attempt was not made to balance the withdrawals because the difference in totals was due to methodology and rounding.

Aquaculture withdrawals were estimated from the commercial and noncommercial operations datasets produced by the USDA for the 2007 Census of Aquaculture (U.S. Department of Agriculture, 2009a). County-level data for commercial operations included number of raceways, average flow rates to raceways, pond acreage, number of tanks, average tank volumes, and the number of farms using groundwater and surface water. Water-withdrawal estimates for local, State, and Federal hatcheries were based on the coefficients applied to the number of pounds and types of fish and eggs produced. Groundwater and surface-water data were divided according to the divisions for the commercial operation as reported to the USDA or according to the USGS estimates for source of water for aquaculture for Alabama for 2010 (Lovelace, 2009b). Hutson and others (2009) describe in more detail the methods used to compute agricultural water use in Alabama.

Water withdrawals for golf courses were estimated from site-specific data provided by ADECA (golf course water-use survey), a Web search (TheGolfCourses.net, 2007), and interviews with selected golf course staff on watering practices.

All water withdrawals were assumed to be from surface water and applied with sprinkler systems because reliable source-of-supply data were limited; however, some golf courses were known to use groundwater in 2005. The 320 golf courses, covering approximately 26,720 acres, were classified into the following three tiers: tier 1, extensive watering; tier 2, frequent watering; and tier 3, essential watering. A water withdrawal was estimated for each golf course based on a number of holes and a tier classification coefficient.

Water withdrawals for agriculture by subbasin were determined for each subcategory crop, which includes crops, nurseries, and sod farms, by applying GIS techniques. The subbasin boundaries were superimposed on the county boundaries to create a subbasin/county areal unit. Each subbasin/county unit represents a percent of the subbasin area within a county. Surface-water and groundwater withdrawals were distributed among the subbasin/county units based on the assigned areal percentage. Water withdrawals for each subbasin/county unit were summarized by subbasin. The difference in the county and subbasin totals was 0.01 Mgal/d (–0.05 Mgal/d for groundwater and +0.04 Mgal/d for surface water). An attempt was not made to balance the withdrawals because the difference in totals was due to methodology and rounding differences. Addresses obtained from the master list for golf courses were used to assign the estimated withdrawals for the specific sites to the correct subbasin. Hutson and others (2009) describe in more detail the methods used to compute golf course water use in Alabama.

The water use for thermoelectric-power generation for each county totally or partially in the ACF River Basin was provided by Amy Gill (U.S. Geological Survey, written commun., 2014). Hutson and others (2009) describe in more detail the methods used to compute water use for thermoelectric power in Alabama. Thermoelectric-power and industrial water use were estimated from site-specific data. The primary sources of data for thermoelectric-power water withdrawals and power produced were the Department of Energy, Energy Information Agency, ADECA eWater database, and the individual thermoelectric-power facilities (table 1).

Florida

Water-use data for Florida were compiled through an ongoing cooperative program with the FDEP as part of the 2010 USGS National Water Cooperative Program. Data also were obtained from the FDEP, Drinking Water and Wastewater Sections and the NWFWMD.

Domestic self-supplied population estimates for each ACF subbasin in Florida are computed by subtracting the public-supplied population from the total 2010 population in each ACF subbasin. Domestic self-supplied withdrawals are calculated by multiplying the self-supplied population in each subbasin by a per capita coefficient of 75 gal/d. Although Marella (2014) uses a per capita coefficient of 85 gal/d to estimate the 2010 self-supplied domestic withdrawals in Florida, 75 gal/d is used in this report for consistency with the computation of self-supplied domestic withdrawals in Alabama and Georgia as previously described.

Self-supplied water withdrawals data for commercial, industrial, and mining were obtained from (1) the consumptive water-use permit compliance files or annual reports provided by the NWFWMD, (2) the MORs supplied to the FDEP Drinking Water Program, or (3) the individual commercial, industrial, and mining water users. Water users in these water-use categories are not required to have a consumptive water-use permit and may only have a general water-use permit. Furthermore, some of these permitted users are not required to report annual withdrawals as part of their permit conditions. In addition, some industrial or mining water users are not required to submit MORs to the FDEP; therefore, some users were contacted directly for their withdrawal information. Nearly all of the reported water-use values for this category are from metered data. These data were then associated with the appropriate ACF subbasins (Richard Marella, U.S. Geological Survey, written commun., 2014).

Water-withdrawal estimates for agriculture use are mostly a composite of (1) estimates made by multiplying irrigated crop acreage by a calculated net irrigation requirement coefficient (commonly referred to as an application rate) and (2) actual withdrawal totals from metered data. Most of this category is estimated because only a small percentage (12 percent) of the total agricultural self-supplied water withdrawals presented in this report were metered in 2010. Metered data alone cannot provide a cumulative total because not all users are metered; therefore, estimates must be made to aggregate withdrawal totals for any county or region. Estimates for nonirrigation withdrawals, such as those for livestock watering and fish farming, were made using the USGS methods for the national water-use compilation (Lovelace, 2009b)

Water withdrawal estimates for the counties within the NWFWMD were computed using estimated irrigated crop acreage and a net irrigation requirement coefficient for selected crops based on climatic conditions. The NWFWMD developed estimates of irrigated acreage by crop and county based on data from consumptive water-use permit files, USDA reports (U.S. Department of Agriculture, 2009b), information obtained from personnel at University of Florida Institute of Food and Agriculture Science county extension offices, and a review of recent aerial photography (Kathleen Coates, Northwest Florida Water Management District, written commun., 2013). These data were then associated with the appropriate ACF subbasins (Richard Marella, U.S. Geological Survey, written commun., 2014).

Water-withdrawal estimates for golf course irrigation are mostly a composite of (1) estimates made by multiplying irrigated acreage by a calculated net irrigation requirement coefficient and (2) actual withdrawal totals from metered data. Most of this category is estimated, because only a small percentage (12 percent) of the total recreational-landscape irrigation water withdrawals presented in this report were derived from actual metered data for 2010. Golf course irrigation data were provided by the NWFWMD (Kathleen Coates, Northwest Florida Water Management District, written commun., 2013). These data were then associated with the appropriate

ACF subbasins (Richard Marella, U.S. Geological Survey, written commun., 2014).

Water withdrawals for thermoelectric-power generation were obtained by the USGS directly from the many power companies and municipally owned public utilities in the State. Additional data were obtained from consumptive water-use permit files or annual reports and the Energy Information Administration database of the U.S. Department of Energy (Susan Hutson, U.S. Geological Survey, written commun., 2012). Withdrawal data were collected for groundwater and surface-water sources. In many cases, the withdrawal amount reported represents the amount of water used to augment cooling ponds or towers or other water bodies that retain water for cooling purposes, as opposed to the amount of water actually withdrawn for once-through cooling. The amount of water recirculated within a power plant is not accounted for in this report. Information about the amount of water purchased from public supplies was obtained from each power generation facility (if available) along with the total gross power generated. Most of the water-use values presented for this category are from metered or recorded data maintained by the power companies or public utilities. These data were then associated with the appropriate ACF subbasins (Richard Marella, U.S. Geological Survey, written commun., 2014).

Estimates of water withdrawals by aquifer were made for each water-use category. Water withdrawals from the primary aquifer used for public supply, self-supplied commercial, industrial, mining, and thermoelectric-power generation were obtained from permits in the NWFWMD consumptive water-use permit files. Estimates were made for self-supplied domestic, agricultural, and golf course irrigation withdrawals using information obtained from selected groundwater studies that were completed in the ACF part of Florida during the past 20 years. For the counties that had little or no information, estimates were made by assuming that 90 percent of water withdrawals were from the primary aquifer used for public supply and the remaining 10 percent were from the local water table or shallow aquifer.

Georgia

Permitted withdrawal data for self-supplied commercial, industrial, agricultural, golf course irrigation, and thermoelectric-power generation uses were obtained from the GaEPDs Nonfarm Water Withdrawal Permit Program. These data were derived from monthly surface-water and groundwater withdrawal and discharge monitoring reports submitted to the GaEPD by permit holders. Georgia law (the Georgia Groundwater Use Act and the Georgia Water Supply Act) requires a withdrawal permit for any city, industry, or other water user that withdraws more than 100,000 gal/d (monthly average) and to report monthly withdrawals to the GaEPD each year.

The percentage of water withdrawals from the various aquifers in Georgia was determined by location from withdrawal permits, by lithology at the well using drillers logs and borehole geophysics, and by aquifer tests (Lester Williams, U.S. Geological Survey, written comm., 2013). A GIS coverage was created by using these data and known locations of the various aquifers.

Surface water is commonly not a source for self-supplied domestic uses in Georgia. The amount of water withdrawn and used for domestic purposes was the self-supplied population multiplied by 75 gal/d. The self-supplied domestic population was computed as the difference between the total population and the public-supplied population as described previously.

The 2010 annual and monthly withdrawal amounts for large self-supplied commercial and industrial establishments were reported to GaEPD and provided to the USGS for this report. Small-community water systems and small commercial establishments that typically withdraw less than 100,000 gal/d (monthly average) of water are not required to obtain a withdrawal permit but may be required to obtain a Drinking Water Permit from GaEPD under the Georgia Safe Drinking Water Act of 1977 (OCGA 12–5–70).

The two different datasets that were used to estimate crop irrigation are as follows: (1) modeled estimates for north Georgia and nonmetered irrigation in some parts of south Georgia computed by the GaEPD for the Statewide Water Plan and (2) metered data in south Georgia supplied by the Georgia Soil and Water Conservation Commission (GaSWCC). The modeled estimates used for north Georgia and unmetered irrigated fields were those forecasted for 2011 under dry conditions. Estimates for 2010 were not available.

Detailed methods used to estimate crop irrigation forecasts (irrigated acres, amount of water applied, and irrigation type such as center pivot, drip, micro, and so forth) for the Georgia Statewide Water Plan (Georgia Environmental Protection Division, 2008; Mullen and others, 2010) and links to datasets are available (Georgia Environmental Protection Division, 2010). Crop irrigation was modeled for an average, above average, and below average rainfall during the growing season. Because most of the 2010 growing season in Georgia was dry to very dry, the mean of the crop irrigation estimates for average and below average rainfall was used for this compilation.

For the Georgia Statewide Water Plan, withdrawal quantities for nonmetered irrigation were computed for each county or drainage area as the product of the following three values:

- projected irrigated area for a crop, in acres;
- predicted monthly irrigation depth, in inches; and
- proportion of irrigation water derived from a source.

The annualized withdrawal for each county, in million gallons per day, was the product of total acres irrigated and the total amount of water applied, in inches, converted to million gallons and divided by 365 days. Initial irrigated areas were measured on aerial imagery from 2007 and 2008 using fields that had been identified as irrigated by farmers, the GaEPD Agriculture Water Permitting Unit, the GaSWCC Agriculture Meter Program, and the University of Georgia Agricultural Water Demand GIS. The 2007 and 2008 irrigated acreages were assumed to represent irrigated acreage in 2010.

Estimates of metered and unmetered crop irrigation in the Georgia part of the ACF River Basin south of the Fall Line (fig. 1) were based on geostatistical modeling of metered groundwater pumping data supplied by the GaSWCC. This model is described in a report published by Torak and Painter (2011). Datasets that were created contained a meter identification number, acres associated with each meter, annually reported withdrawals (acre-inches converted to million gallons per day) supplied by the GaSWCC, and a water source (groundwater, surface water, and well-to-pond). Irrigated acres were assigned to a meter using acreages determined for the Georgia Statewide Water Plan and 2010 aerial imagery. Metered data were not used if a meter was not assigned an estimated acreage, if irrigation depth was less than 2 inches (field not irrigated), or if irrigation depth was greater than 62 inches (malfunctioning meter or rollback was occurring). Rollback occurs when pumping ends and water in the pipes returns to the well. When water in the pipes returns to the well, the water spins the meter impeller and erroneously increases the amount of water recorded during pumping. Regardless of the direction of the spinning impeller, each revolution is incremental; therefore, during rollback, the impeller rotates in reverse but incrementally adds to the metered value rather than subtracts from the metered value.

The geostatistical model outputs were brought into GIS for linkage to agricultural fields. Within the GIS, the centroid for each field polygon was determined and used as a feature to represent each unmetered field. The estimated irrigation depths from the model were assigned to each field centroid. Irrigation demand, in acre-inches, was computed by multiplying irrigated acres by irrigation depth. Irrigation usage for fields that were not assigned to a meter represented the unmetered irrigation demand. The data from the geostatistical model were checked using hot-spot, cluster, and outlier analyses to identify erroneous or incomplete data and data that represented different populations of metered usage. Irrigation demand was computed by multiplying the computed irrigation depth by the irrigated acres. Irrigation demand in acre-inches was converted to million gallons per day using a conversion factor and divided by 365 to annualize the demand.

The water-use estimates for the livestock category were supplied by Mark Masters, Albany State University, Flint River Water Policy Center for the Georgia Statewide Water Plan (Georgia Environmental Protection Division, 2008; Masters, 2010). The methods described in Masters (2010) are briefly summarized as follows: (1) the amount of water used for each livestock category in gallons per day per head was compiled in 2008 and was the most current data in 2010, (2) the animal census data by county were obtained from the 2011 Farm Gate report (University of Georgia, 2011) for 2010, and (3) the annual water use for each livestock category was computed by multiplying the water use per head by the number of animals multiplied by 365 and then converted to million gallons per day. The annual livestock use for each county, river basin, water planning region, and major aquifer was the sum of the annual water use for each livestock category. Estimates of livestock water use for each major river basin were computed by disaggregating the livestock water use in a county by the proportion of livestock in the ACF subbasin within the county.

In 2010, catfish and trout production were the predominant aquaculture enterprises in Georgia (University of Georgia, 2011). The 2010 water-use estimates for aquaculture for each county in Georgia were computed by the USGS NWUIP. A detailed description of the methods used for commercial and noncommercial aquaculture operations are given in Lovelace (2009b). In the Lovelace (2009b) report, county-level data on the number of farms using particular sources of water (groundwater, surface water, and so forth), pond acreage, number of raceways and raceway flow rates, and the number of recirculating and nonrecirculating tanks and their volumes were obtained from the USDA, National Agricultural Statistics Service (U.S. Department of Agriculture, 2009a). Estimates of aquaculture water use for each major river basin were computed by plotting known aquaculture operations in GIS and then disaggregating the aquaculture water use in a county by the proportion of aquaculture operations in the ACF subbasin within the county.

Surface-water and groundwater withdrawals for golf course irrigation in 2010 were estimated using data from the following two sources: (1) farm water-withdrawal permits and (2) nonfarm water-withdrawal permits, which are both managed by the GaEPD. Under the Georgia Groundwater Use Act, the definition of farm use includes “the irrigation of recreational turf, except in Bryan, Chatham, Effingham, and Glynn Counties.” In addition, the 1988 amendments to the Georgia Water Quality Control Act state that the irrigation of recreational turf in the Chattahoochee River Basin above the Peachtree Creek confluence is not a farm use.

The Georgia Golf Course Superintendents Association partnered with GaEPD to estimate water use in golf course operations with agricultural water withdrawal permits throughout Georgia. In addition, Clint Waltz, University of Georgia Assistant Professor and Turfgrass Extension Specialist, University of Georgia, Griffin campus, provided data related to his research on the Georgia Golf Course Superintendents Association Best Management Practices regarding annual irrigation needs for well-managed golf courses (Lewis, 2010).

Some assumptions were made to estimate water use for the agriculture-permitted golf courses in Georgia. Permitted acreages for golf courses in Georgia were gleaned from the GaEPD agricultural permit database. These permitted acreages represented the most reliable source of irrigated golf-course acreage available to GaEPD. A comparison was not made between acreage permitted and as-installed acreage of tees, greens, fairways, and other irrigated landscapes within those golf courses.

The recommended irrigation depth for turfgrass is 1 inch per week without rainfall. Because Georgia has a 30-week growing season (April 1–October 31), 30 inches of water is the recommended golf course irrigation rate in Georgia for a dry year. The average irrigation depth reported in the Georgia Golf Course Superintendents Association Best Management Practices was 14.06 inches per year from 2004 to 2007 (Lewis, 2010). The 14.06 inches were considered the amount of water needed to irrigate golf courses in an average rainfall year. For each GaEPD agriculture-permitted golf course, 14.06 inches was multiplied by the permitted acreage to get the amount of water needed to irrigate golf courses in an average rainfall year. The amount of water needed to irrigate golf courses in dry and wet years was calculated for the Georgia Statewide Water Plan. The golf course irrigation demand for a dry year was used in this report. The irrigation demand for golf courses was then aggregated by ACF subbasin.

By legislative decree, golf course irrigation in the Chattahoochee River Basin upstream from Peachtree Creek is not considered a farm use, and water withdrawals are permitted under the GaEPD Nonfarm Water Withdrawal Permit Program (municipal/industrial). Under this permit program, 52 golf courses were permitted to withdraw water in 2010. The reported 2010 withdrawals for these golf courses were summed by ACF subbasin and added to the estimates from golf courses in the agriculture permit program as described earlier.

Most of the water withdrawn for thermoelectric-power generation is used for cooling. Four thermoelectric-power-generation facilities were permitted to withdraw water in 2010. All of these facilities use fossil fuels such as oil, coal, or natural gas to generate electricity. The 2010 water withdrawal data for thermoelectric facilities in Georgia were obtained from the following three sources (table 1): (1) monthly surface-water withdrawals, water-discharge, and consumptive-use data were provided by the Georgia Power Company for the thermoelectric facilities that they own or operate; (2) permitted groundwater and surface-water withdrawals were provided by the GaEPD under their groundwater and surface-water withdrawal Nonfarm Water Withdrawal Permit Program; and (3) water-withdrawal data for small, independent facilities were obtained from the U.S. Energy Information Administration's annual electric generator report (form EIA–23) database as reported by facility operators (U.S. Energy Information Administration, 2011).

Surface-Water Returns

Surface-water returns represent the discharge of treated wastewater from public and private wastewater-treatment plants, commercial and industrial establishments, raw and treated water from mining activities and dewatering of mining pits and quarries, and discharges from thermoelectric-power facilities using once-through cooling processes.

Alabama

Site-specific surface-water returns in the ACF River Basin were provided by Amy Gill (U.S. Geological Survey, written commun., 2014). The original source of surface-water return data is from the Alabama Department of Environmental Management (ADEM) eDMR database. This database is a Web-based system for entities with a surface-water discharge permit to comply with monthly reporting requirements as dictated by Alabama State law.

Florida

The amount of water returned to surface-water bodies in 2010 was obtained from the 2010 Florida Reuse Inventory, published annually by the FDEP Domestic Wastewater Section (Florida Department of Environmental Protection, 2011). The data used in this report were provided by Richard Marella (U.S. Geological Survey, written commun., 2014).

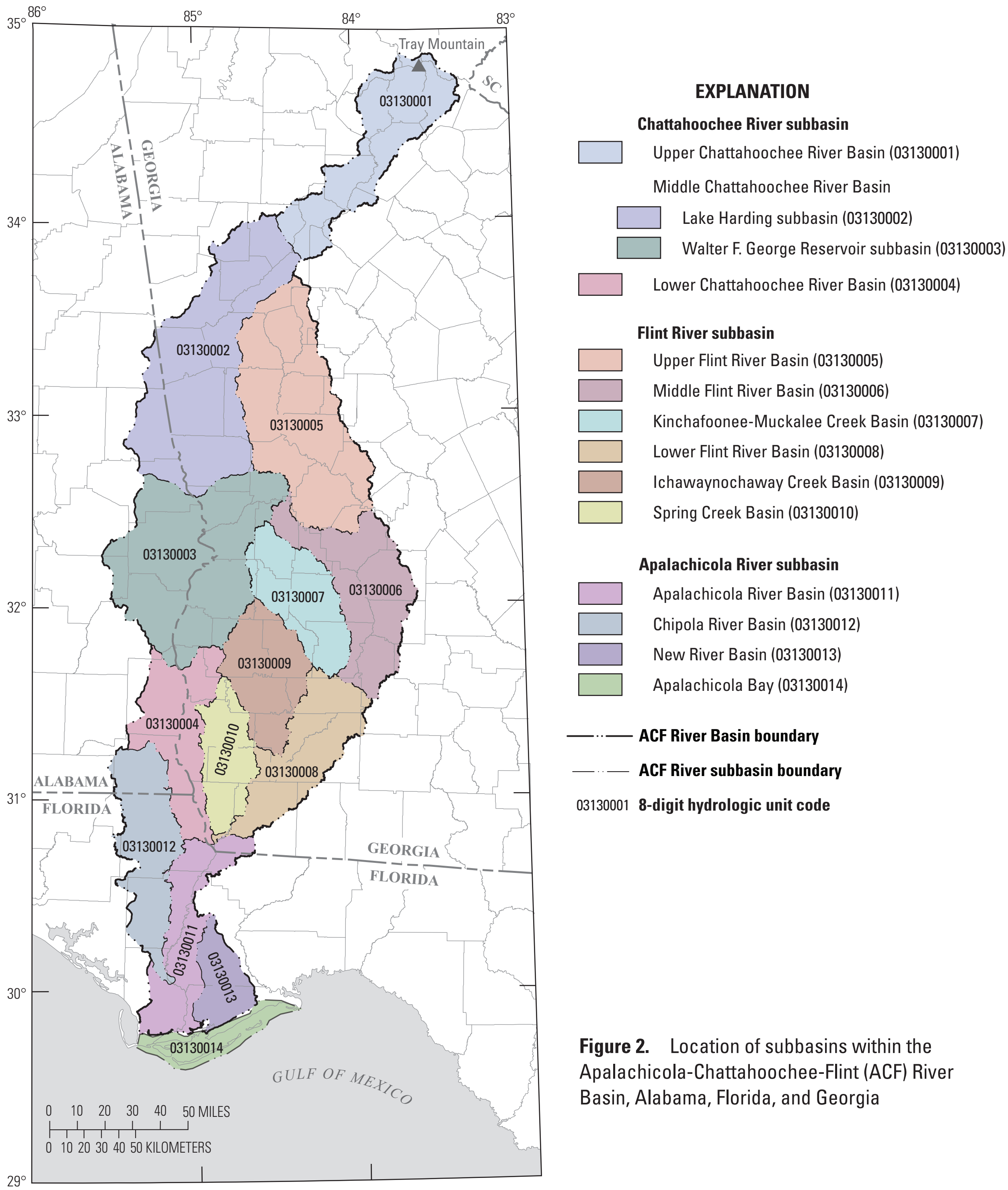
Georgia

Under the National Pollutant Discharge Elimination System, all point discharges with the potential to carry pollutants to surface water must be permitted regardless of the volume discharged (U.S. Environmental Protection Agency, 2014). All National Pollutant Discharge Elimination System permit holders are required to submit a discharge monitoring report to GaEPD that gives the average monthly surface-water discharges. The amount of treated and untreated water discharged (surface-water returns) to rivers, streams, and reservoirs in Georgia during 2010 were provided by GaEPD from discharge monitoring reports and the Georgia Power Company. These data were then summarized and compiled for each river basin and subbasin in the Georgia part of the ACF River Basin. These discharge data were entered into the USGS site-specific water-use database system (SWUDS) before compiling the data for this report.

Hydrologic Unit Codes and Water-Use Reporting Units

In the nationwide basin numbering system of the USGS, in which basins are assigned a unique hydrologic unit code (HUC), the ACF River Basin is in subregion 0313 and contains three major river basins (the Apalachicola, Chattahoochee, and Flint River Basins) and 14 subbasins (Seaber and others, 1987, p. 23; fig. 2).

Water-use estimates presented in this report are in million gallons per day and are average daily quantities derived from annual data. The tables in this report list values in million gallons per day and are reported to four significant figures or to the nearest 10,000 gal/d. In the text, however, water-use values are rounded to three significant figures.



Base from U.S. Geological Survey digital files

Figure 2. Location of subbasins within the Apalachicola-Chattahoochee-Flint (ACF) River Basin, Alabama, Florida, and Georgia

Study Area Description

The ACF River Basin drains 20,227 mi^2 in north-central, west-central, and southwestern parts of Georgia, southeastern Alabama, and the central panhandle of northwestern Florida (figs. 1 and 2, table 2). The basin extends from north Georgia to Apalachicola Bay in the Gulf of Mexico and includes all or part of 80 counties—10 in Alabama, 8 in Florida, and 62 in Georgia (fig. 2). The ACF River Basin consists of 14 hydrologic units (subbasins) each identified by an 8-digit HUC (fig. 2). Seven of these subbasins are entirely within Georgia, two subbasins are entirely within Florida, two subbasins are shared by Alabama and Georgia, one subbasin is shared by Alabama and Florida, and 1 subbasin is shared by all three States. The three major rivers that exist in the basin are the Apalachicola, Chattahoochee, and Flint Rivers.

The population of the ACF River Basin was 3.835 million in 2010, a 45-percent increase from the 1990 population of nearly 2.636 million (U.S. Census Bureau, 1991, p. 29; U.S. Census Bureau, 2011a). About 92 percent of the 2010 ACF population resided in Georgia and nearly 75 percent lived in the Atlanta metropolitan area. In 2010, the most populous cities in the basin were Columbus, Ga. (population 190,000), Dothan, Ala. (population 65,500), Phenix City, Ala. (population 32,800), Marianna, Fla. (population 6,100), Chattahoochee, Fla. (population 3,650), and Carrabelle, Fla. (population 2,800; U.S. Census Bureau, 2011a).

The ACF River Basin is within parts of the Blue Ridge, Piedmont, and Coastal Plain physiographic provinces (fig. 3). Similar to much of the southeastern United States, the basin's physiography reflects a geologic history of mountain building in the Appalachian Mountains, and long periods of repeated land submergence in the Coastal Plain Province. Although similar physiography may extend across state boundaries, different names may be assigned to different districts by state geologists in each State. The extreme northern part of the basin is rural and predominantly consists of forest and farm land, the north-central part of the basin is highly urbanized, and the southern part of the basin is primarily farm land, bottomland forest, and wetlands (Couch and others, 1996). Approximately 736,000 acres were irrigated in the ACF River Basin during 2010 (table 3) and 91 percent of those acres were irrigated in Georgia. Most of the irrigated acres were in the Dougherty Plain area of southwest Georgia (fig. 1). Peanuts, corn, soybeans, and cotton were the major crops grown and irrigated within the basin (Hook, 2010).

Apalachicola River Basin

The Apalachicola River is formed by the confluence of the Chattahoochee and Flint Rivers at the Jim Woodruff Lock and Dam, which impounds Lake Seminole (fig. 1). The Apalachicola River flows from Jim Woodruff Lock and Dam to Apalachicola Bay in the Gulf of Mexico (fig. 1). The Apalachicola River Basin occupies 3,190 mi^2 in Alabama (8 percent), Florida (91 percent), and Georgia (1 percent) and consists of four subbasins: Apalachicola River (HUC 03130011), Chipola River (HUC 03130012), New River (HUC 03130013), and Apalachicola Bay (HUC 03130014; fig. 2, table 2). The Apalachicola River Basin lies in the Coastal Plain physiographic province (fig. 3). The 2010 population in the basin was nearly 112,000 and 71 percent of that population lived in Florida. Of the nearly 112,000 people in the basin, nearly 68 percent lived in the Chipola River subbasin. About 1 percent of the basin population lived in Georgia, all in the Apalachicola River subbasin.

Hydrologic Setting

Groundwater is the primary source of water for public and self-supplied water users in the Apalachicola River Basin. The geology of the basin consists of Coastal Plain sediments deposited during a series of transgressions and regressions of a prehistoric sea. As a result, Coastal Plain sediments typically consist of sand and interbedded or lensoidal deposits of clay (Faye and Mayer, 1990). These sediments are pre-Cretaceous to Quaternary in age and consist of layers of sand, clay, sandstone, dolomite, and limestone that dip gently, and generally thicken, to the southeast (Hicks and others, 1987).

The Floridan aquifer system consists of the Upper and Lower Floridan aquifers and is the principal aquifer system in the Apalachicola River Basin (fig. 4, table 2). This aquifer is composed of an offset sequence of geologically older to younger carbonate sediments consisting of the Ocala, Suwannee, and Tampa Limestones, Marianna Formation, and in some areas the Clinchfield Sand. These sediments typically are sequentially younger in a seaward direction. In the Apalachicola River Basin, the Upper Floridan aquifer consists primarily of the Ocala Limestone, the geologically oldest layer (Wagner and Allen, 1984; Hicks and others, 1987).

Large amounts of water are pumped annually from the Upper Floridan aquifer (Hicks and others, 1987; Fanning and Trent, 2009). The capacity of the Upper Floridan aquifer to store and convey large amounts of water is due to the fractured nature of the Ocala Limestone (Hayes and others, 1983) and interconnected dissolution channels and cavities in the limestone. Dissolution channels and cavities form as groundwater circulates along bedding planes and fractures in the limestone (Hicks and others, 1987). A system of major dissolution channels between an escarpment along the southeastern edge of the Flint River Basin and the Apalachicola River Basin transmits large amounts of groundwater from the Upper Floridan aquifer to springs that discharge to the Apalachicola River.

The principal surface-water resources in the basin are the Apalachicola River, the Chipola River, and the New River. The median streamflow (1913–2010) in the Apalachicola River near Chattahoochee, Fla. (USGS site 02358000), which is just below the Jim Woodruff Lock and Dam, is 22,120 cubic

Table 2. Basin area, 2010 population, physiographic provinces, and geology of subbasins in the Apalachicola-Chattahoochee-Flint River Basin, Alabama, Florida, and Georgia.

[River basin area by State from Sugarbaker and Carswell (2011) and U.S. Geological Survey (2015). Principal aquifer percentages computed by U.S. Geological Survey personnel: Amy Gill—Alabama, Lester Williams—Georgia, Richard Marella—Florida. HUC–8, 8-digit hydrologic unit code; mi², square mile; —, not applicable or basin not present; >, greater than; <, less than]

River basin and subbasin names (fig. 2)	HUC–8	River basin area by State (mi²)			2010 population by State (thousands)		
		Alabama	Florida	Georgia	Alabama	Florida	Georgia
Apalachicola River Basin, totals	—	**260**	**2,885**	**42**	**30.983**	**79.408**	**1.114**
Apalachicola River	03130011	0	1,075	42	0	27.168	1.114
Chipola River	03130012	260	1,030	0	30.983	44.549	0
New River	03130013	0	510	0	0	5.262	0
Apalachicola Bay	03130014	0	270	0	0	2.429	0
Chattahoochee River Basin, totals	—	**2,450**	**270**	**5,860**	**196.80**	**9.002**	**2,669.5**
Upper Chattahoochee River	03130001	0	0	1,590	0	0	1,528.7
Middle Chattahoochee–Lake Harding	03130002	540	0	2,370	49.642	0	930.63
Middle Chattahoochee–Walter F. George Reservoir	03130003	1,430	0	1,410	111.33	0	202.38
Lower Chattahoochee River	03130004	480	270	490	35.778	9.002	7.848
Flint River Basin, totals	—	**0**	**0**	**8,460**	**0**	**0**	**848.46**
Upper Flint River	03130005	0	0	2,630	0	0	537.17
Middle Flint River	03130006	0	0	1,560	0	0	77.706
Kinchafoonee-Muckalee Creek	03130007	0	0	1,100	0	0	78.948
Lower Flint River	03130008	0	0	1,275	0	0	110.05
Ichawaynochaway Creek	03130009	0	0	1,105	0	0	21.811
Spring Creek	03130010	0	0	790	0	0	22.766
Total	—	**2,710**	**3,155**	**14,362**	**227.78**	**88.410**	**3,519.07**

Table 2. Basin area, 2010 population, physiographic provinces, and geology of subbasins in the Apalachicola-Chattahoochee-Flint River Basin, Alabama, Florida, and Georgia.—Continued

[River basin area by State from Sugarbaker and Carswell (2011) and U.S. Geological Survey (2015). Principal aquifer percentages computed by U.S. Geological Survey personnel: Amy Gill—Alabama, Lester Williams—Georgia, Richard Marella—Florida. HUC–8, 8-digit hydrologic unit code; mi^2, square mile; —, not applicable or basin not present; >, greater than; <, less than]

<table>
<tr><th colspan="3">Physiographic provinces by State (fig. 3)</th><th colspan="3">Principal aquifers by State (fig. 4)</th></tr>
<tr><th>Alabama</th><th>Florida</th><th>Georgia</th><th>Alabama</th><th>Florida</th><th>Georgia</th></tr>
<tr><td colspan="6">Apalachicola River Basin</td></tr>
<tr><td>Coastal Plain</td><td>Coastal Plain</td><td>Coastal Plain</td><td>—</td><td rowspan="4">Floridan aquifer system, surficial aquifer in some areas</td><td>Floridan aquifer system, surficial aquifer in some areas</td></tr>
<tr><td>—</td><td>Coastal Plain</td><td>—</td><td>Floridan aquifer system, surficial aquifer in some areas</td><td>—</td></tr>
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<tr><td>—</td><td>Coastal Plain</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td colspan="6">Chattahoochee River Basin</td></tr>
<tr><td>—</td><td>—</td><td>Piedmont (>99 percent) and Blue Ridge (<1 percent)</td><td>—</td><td>—</td><td rowspan="2">Crystalline-rock aquifer</td></tr>
<tr><td>Piedmont</td><td>—</td><td>Piedmont</td><td>Crystalline-rock aquifer</td><td>—</td></tr>
<tr><td>Coastal Plain, Piedmont (<1 percent)</td><td>—</td><td>Coastal Plain, Piedmont (<1 percent)</td><td>Cretaceous aquifer system (95 percent), Crystalline-rock aquifers (4 percent), Clayton aquifer (1 percent)</td><td>—</td><td>Cretaceous aquifer (95 percent), Crystalline-rock aquifers (4 percent), Clayton aquifer (1 percent)</td></tr>
<tr><td>Coastal Plain</td><td></td><td>Coastal Plain</td><td>Clayton aquifer (65 percent), Claiborne aquifer 20 percent), Floridan aquifer system (15 percent)</td><td>Floridan aquifer system</td><td>Clayton aquifer (65 percent), Claiborne aquifer (20 percent), Floridan aquifer system (15 percent)</td></tr>
<tr><td colspan="6">Flint River Basin</td></tr>
<tr><td>—</td><td>—</td><td>Piedmont and Coastal Plain (27 percent)</td><td>—</td><td>—</td><td>Crystalline-rock aquifers (84 percent), Cretaceous aquifer system (16 percent)</td></tr>
<tr><td>—</td><td>—</td><td>Coastal Plain</td><td>—</td><td>—</td><td>Cretaceous aquifer system (26 percent), Clayton aquifer (20 percent), Claiborne aquifer (28 percent), Floridan aquifer system (26 percent)</td></tr>
<tr><td>—</td><td>—</td><td>Coastal Plain</td><td>—</td><td>—</td><td>Cretaceous aquifer system (19 percent), Clayton aquifer (60 percent), Claiborne aquifer (20 percent), Floridan aquifer system (<1 percent)</td></tr>
<tr><td>—</td><td>—</td><td>Coastal Plain</td><td>—</td><td>—</td><td>Floridan aquifer system (>99 percent), Claiborne aquifer (<1 percent)</td></tr>
<tr><td>—</td><td>—</td><td>Coastal Plain</td><td>—</td><td>—</td><td>Clayton aquifer (40 percent), Claiborne aquifer (40 percent), Floridan aquifer system (20 percent)</td></tr>
<tr><td>—</td><td>—</td><td>Coastal Plain</td><td>—</td><td>—</td><td>Floridan aquifer system (65 percent), Claiborne aquifer (25 percent), Clayton aquifer (10 percent)</td></tr>
</table>

feet per second (ft³/s). The median streamflow (1913–2010) at the Chipola River near Altha, Fla. (USGS site 02359000) is 1,415 ft³/s. The median streamflow (1999–2010) at the New River near Sumatra, Fla. (USGS site 02330400) is 287 ft³/s.

Two canals facilitate the transfer of water between subbasins within the ACF River Basin (Mattraw and Elder, 1984). The Chipola Cutoff conveys water from the Apalachicola River to the Chipola River near Wewahitchka, Fla., in the Chipola River subbasin. The Brickyard Cutoff conveys water from the Apalachicola River to the Brothers River near Sumatra, Fla., in the New River subbasin.

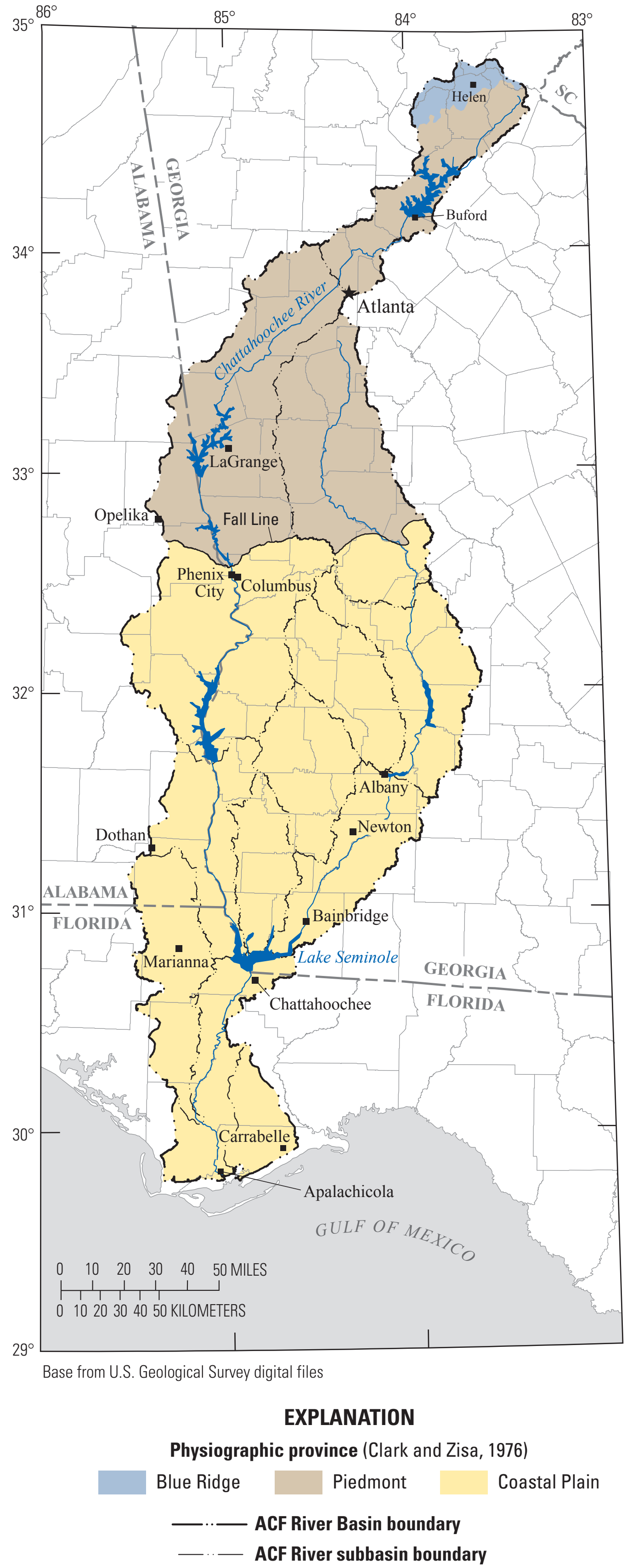


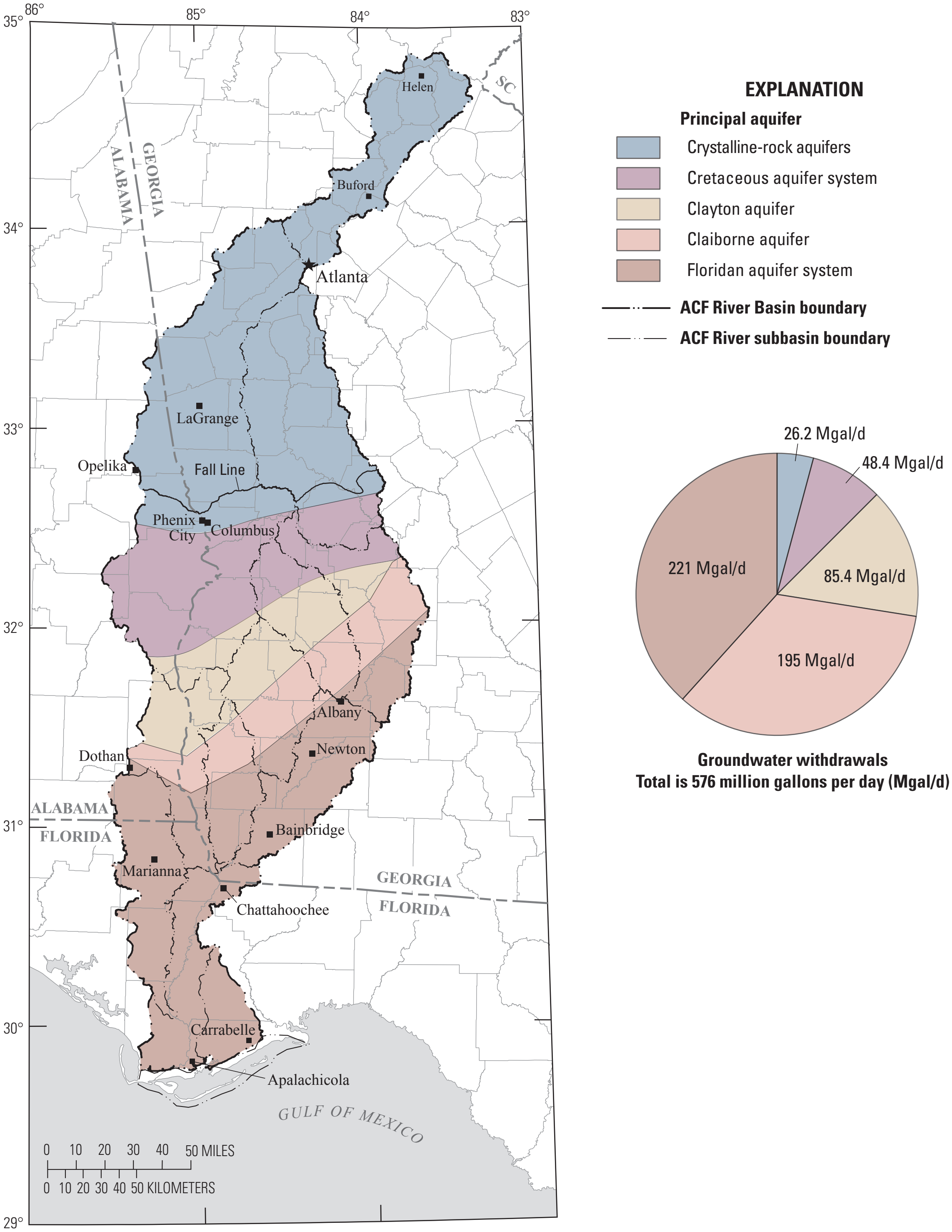
Figure 3. Physiographic provinces in the Apalachicola-Chattahoochee-Flint (ACF) River Basin, Alabama, Florida, and Georgia.

Chattahoochee River Basin

The Chattahoochee River Basin occupies 8,580 mi² and consists of four subbasins in Georgia, Florida, and Alabama (fig. 2, table 2): the Upper Chattahoochee River (HUC 03130001), the Middle Chattahoochee River–Lake Harding (HUC 03130002), the Middle Chattahoochee River–Walter F. George Reservoir (HUC 03130003), and the Lower Chattahoochee River (HUC 03130004). Sixty-eight percent of the Chattahoochee River Basin is in Georgia, 29 percent in Alabama, and the remainder in Florida (table 2). The 2010 population in the Chattahoochee River Basin was nearly 2.88 million people, about 93 percent of that population resided in Georgia and nearly 7 percent resided in Alabama. The Upper Chattahoochee River subbasin was the most populous in the Chattahoochee River Basin with 1.53 million people in 2010. Most of Alabama's population (161,000 people) resided in the Middle Chattahoochee–Lake Harding and Walter F. George Reservoir subbasins. About 9,000 people resided in the Florida part of the Lower Chattahoochee River subbasin (table 2).

The headwaters of the Chestatee and Chattahoochee Rivers originate as small springs in the Blue Ridge physiographic province near the north Georgia town of Helen (fig. 1). The Chestatee River enters the Chattahoochee River west of Gainesville, Ga., and the confluence is inundated by Lake Sidney Lanier (locally known as Lake Lanier). From its headwaters, the Chattahoochee River flows 436 miles (mi) southwestward through the Piedmont physiographic province, then southward in the Coastal Plain Province, and into Lake Seminole (fig. 3; Edmiston and Tuck, 1987).

The Chattahoochee River flows through the urban areas of Metropolitan Atlanta and Columbus, Ga., and Phenix City, Ala. The river is controlled by 16 dams, but only 5 dams impound major reservoirs: Buford (forming Lake Lanier), West Point Lake, Lake Harding, Walter F. George, and Jim Woodruff Lock and Dam (Lake Seminole; fig. 1). From the West Point Lake dam to Jim Woodruff Lock and Dam at Lake Seminole, the Chattahoochee River defines the State boundaries of Alabama and Georgia.



Base from U.S. Geological Survey digital files

Figure 4. General location of principal aquifers and groundwater withdrawals from each aquifer in the Apalachicola-Chattahoochee-Flint (ACF) River Basin, Alabama, Florida, and Georgia.

Physiography

The northernmost part of the Upper Chattahoochee River subbasin is within the Blue Ridge Province where the headwaters of the Chattahoochee River arise (fig. 2 and 3). Less than 1 percent of the basin is within the Blue Ridge Province. The Blue Ridge Province is dominated by rugged mountains and ridges that typically range in altitude from 3,000 to 3,500 feet (ft); the topographic feature with the highest altitude in the Upper Chattahoochee River subbasin is the 4,370 ft Tray Mountain. The boundary between the Blue Ridge and the Piedmont Provinces is defined by a sharp change in slope at an altitude of approximately 1,700 ft. The Blue Ridge Province is distinguished from the Piedmont Province chiefly by its greater topographic relief (Clark and Zisa, 1976).

Nearly the entire Upper Chattahoochee River and all of the Middle Chattahoochee–Lake Harding subbasins are within the Piedmont physiographic province. Piedmont topography is characterized by low, rolling hills in the north and a broad rolling upland or plateau in the south (Cressler and others, 1983). Land-surface altitudes in the Piedmont Province range from 2,586 ft to the northeast in Hall County, Ga., upstream from Lake Lanier to 340 ft to the southwest in Coweta County, Ga. The Piedmont Province is highly dissected by streams, and has little level land surface other than floodplains (Clark and Zisa, 1976).

The Middle Chattahoochee–Walter F. George Reservoir and Lower Chattahoochee River subbasins are in the Coastal Plain physiographic province (table 2). The average altitude ranges from about 500 ft above the North American Vertical Datum of 1988 in the north to about 100 ft near Lake Seminole. The northern boundary of the Middle Chattahoochee–Walter F. George Reservoir subbasin is in the Fall Line Hills district of the Coastal Plain Province (fig. 1). The Fall Line Hills district is a highly dissected series of ridges and valleys that diminish in relief to the south and east into lowlands of the Dougherty Plain (Wagner and Allen, 1984). The Dougherty Plain district is characterized by karst topography of nearly level plains (Hicks and others, 1987).

The part of Middle Chattahoochee–Walter F. George Reservoir subbasin north of Uchee Creek in Alabama consists mainly of flat to moderately rolling sandy uplands dissected by deeply entrenched streams (Kidd, 1989). From Uchee Creek near Fort Mitchell, Ala., south to about Little Barbour Creek near Walter F. George Reservoir, the physiography is characterized by sandy hills with shallow backslopes and steep frontslopes, fairly steep north-facing escarpments, and gently to moderately rolling backslopes. Farther south to central Henry County, Ala., in the Lower Chattahoochee River subbasin, the area is dissected by southerly and southeasterly flowing streams (Kidd, 1989). The area that is drained by Omusee Creek near Columbia in Henry County, Ala., is a relatively flat upland that slopes gently southward except where dissected by streams (Scott and Cobb, 1988).

Hydrologic Setting

More surface water than groundwater is used in the Chattahoochee River Basin (Marella and Fanning, 2011). The Chestatee and Chattahoochee Rivers are impounded by Buford Dam forming the main arms of Lake Lanier. At 38,000 acres (full conservation pool), Lake Lanier is the largest reservoir in the Chattahoochee River Basin. The reservoir was completed in 1958 and is operated by the USACE. Lake Lanier provides hydroelectric power, recreation, and water supply for much of the Atlanta metropolitan area. The flow of the Chattahoochee River is regulated by water releases from Buford Dam and 11 additional dams on the Chattahoochee River. Eight of these dams are small and used for hydroelectric-power generation. Six of the dams impound large reservoirs and are operated by the USACE. These dams are Buford, West Point Lake, Lake Harding, Walter F. George, George W. Andrews, and Jim Woodruff Lock and Dam.

Jim Woodruff Lock and Dam, which forms Lake Seminole, is the southernmost control structure in the lower ACF River Basin. The Jim Woodruff Lock and Dam is about 1 mi downstream from the confluence of the Chattahoochee and Flint Rivers at the Georgia-Florida State line. The dam impounds Lake Seminole, a 37,600-acre reservoir operated by the USACE. Water releases from the reservoir create the headwater of the Apalachicola River.

The principal aquifer in the Upper Chattahoochee River and the Middle Chattahoochee–Lake Harding subbasins is the Crystalline-rock aquifers. This aquifer is a fracture-conduit aquifer consisting of fractured and crushed parent rocks (fig. 4, table 2). The parent rocks of this aquifer are sequences of structurally deformed igneous rocks of Precambrian to Paleozoic age and metamorphic rocks of late Precambrian to Permian age (Miller, 1990). These igneous and metamorphic rocks are overlain by a layer of weathered rock and soil known as regolith. The regolith consists of a porous and permeable soil zone at land surface that grades downward into a clay-rich, relatively impermeable zone that overlies and grades into porous and permeable saprolite (highly degraded regolith). The regolith ranges in thickness from a few feet to more than 150 ft, depending upon the type of parent rock, topography, and hydrogeologic history.

Water-bearing zones occur in areas where the regolith is present along folded and fractured features in the bedrock, resulting in openings that enhance permeability and enable the storage and flow of groundwater (Chapman and others, 1993). Because of the limited storage in fractures, water levels in fracture-conduit aquifers typically respond rapidly to pumping. Typical pumping rates range from 1 to 25 gallons per minute (gpm) but can be as much as 550 gpm (Chapman and others, 1993).

The principal aquifers in the Middle Chattahoochee–Walter F. George Reservoir and Lower Chattahoochee River subbasins are primarily Cretaceous-age sediments (fig. 4; Pollard and Vorhis, 1980; Clarke and others, 1983, 1984;

Scott and Cobb, 1988; DeJarnette, 1989; Kidd, 1989). The Cretaceous aquifer is the primary aquifer in the Middle Chattahoochee–Walter F. George Reservoir subbasin (table 2). The Cretaceous aquifer consists of fine- to coarse-grained sand and medium- to coarse-grained quartzite with interbedded, carbonaceous clay. Typical pumping rates in the Cretaceous aquifer range from 50 to 600 gpm, but can be as much as 1,000 gpm.

In the Lower Chattahoochee River subbasin, the principal aquifers are the Clayton (Nanfalia-Clayton aquifer in Alabama; 65 percent of the basin), Claiborne (Lisbon aquifer in Alabama; 20 percent of the basin), and the Upper Floridan (15 percent of the basin; fig. 4, table 2). The Clayton aquifer consists of fossiliferous, clayey sands; limestone and calcareous sands; whereas, the Claiborne aquifer consists of Eocene-age fossiliferous and clayey sands (Clarke and others, 1984). Typical pumping rates range from 100 to 700 gpm in the Clayton aquifer, less than 100 gpm in the Claiborne aquifer but can be as much as 1,000 gpm.

Flint River Basin

The Flint River Basin occupies about 8,460 mi^2 entirely within Georgia and consists of six subbasins: Upper Flint River (HUC 03130005), Middle Flint River (HUC 03130006), Kinchafoonee-Muckalee Creek (HUC 03130007), Lower Flint River (HUC 03130008), Ichawaynochaway Creek (HUC 03130009), and Spring Creek (HUC 03130010; fig. 2, table 2). The 2010 population in the Flint River Basin was 848,460 (U.S. Census Bureau, 2011a) and 63 percent of those people lived in the Upper Flint River subbasin (table 2). The Ichawaynochaway Creek and Spring Creek were the least populated subbasins in the Flint River Basin.

About 75 percent of the Upper Flint River subbasin is within the Piedmont physiographic province, and the remainder of the subbasin is within the Coastal Plain Province (fig. 2). The Fall Line Hills district is a highly dissected series of ridges and valleys at the upper end of the Coastal Plain Province that diminish in relief to the south and east into lowlands of the Dougherty Plain (Wagner and Allen, 1984). The Dougherty Plain district is characterized by karst topography of nearly level plains (Hicks and others, 1987) with numerous sinkholes (shallow, circular depressions) that range in size from a few square feet to several hundred acres. Most depressions are filled with low-permeability material and some contain water year round (Middleton, 1968). Relief within most of the Dougherty Plain rarely exceeds 20 ft.

Hydrologic Setting

The Flint River Basin encompasses an area of 8,460 mi^2 within Georgia (table 2). The Flint River originates just south of Atlanta, Ga., in the Piedmont physiographic province and flows 346 mi south and then southwestward through the agricultural areas of the Coastal Plain Province in southwestern Georgia (Edmiston and Tuck, 1987; fig. 1). Major tributaries originate west of the river within the Coastal Plain Province and include the Ichawaynochaway, Kinchafoonee, Muckalee, and Spring Creeks. Two run-of-the-river dams exist on the Flint River for hydroelectric-power generation. The Warwick Dam creates Lake Blackshear and is the farthest upstream control structure on the Flint River (fig. 1). About 2 mi north of Albany, Ga., is the Flint River Dam, which impounds the Flint River and Kinchafoonee Creek to form Lake Worth.

Except in the Upper Flint River subbasin, groundwater is the primary source of water used in the Flint River Basin. Surface water is the primary source of water used in the Upper Flint River subbasin. Eight water supply reservoirs are on tributaries in the Upper Flint River subbasin. These reservoirs capture natural runoff from small- to moderate-size watersheds in the subbasin; two of these reservoirs also store water withdrawn and conveyed from the Flint River, and one also stores water withdrawn and conveyed from a stream tributary to the Flint River.

All five of the principal aquifers in the ACF River Basin are represented in the Flint River Basin (fig. 4, table 2). The principal aquifer in the Upper Flint River subbasin is the Crystalline-rock aquifers (84 percent of withdrawals), but some water is withdrawn from the Cretaceous aquifer system (16 percent of withdrawals) where the subbasin overlaps the Coastal Plain Province (table 2). In the Middle Flint River subbasin, the principal aquifers are the Claiborne (28 percent of withdrawals), Cretaceous (26 percent of withdrawals), and Upper Floridan (26 percent of withdrawals). The Clayton aquifer provides about 20 percent of the groundwater withdrawn in the Middle Flint River subbasin (table 2). In the Kinchafoonee-Muckalee Creek subbasin, the principal aquifer is the Clayton aquifer (60 percent of the withdrawals), and about 40 percent of groundwater withdrawals are from the Claiborne (20 percent) and Cretaceous aquifers (19 percent; table 2). Nearly all of the groundwater withdrawn from the Lower Flint River subbasin and 65 percent of groundwater withdrawals in the Spring Creek subbasin are from the Upper Floridan aquifer (table 2). In the Ichawaynochaway Creek subbasin, the Clayton and Claiborne aquifers (40 percent each) are the primary sources of groundwater.

Climate

The climate in the ACF River Basin is diverse and is affected by several factors such as latitude, topography, and the presence and location of persistent weather systems (Konrad and Fuhrman, 2013). The ACF River Basin is in a humid subtropical climate zone. Commonly, a high pressure system called the Bermuda High is located off the Atlantic Coast and pulls moisture from the Atlantic Ocean and Gulf of Mexico into the ACF River Basin (Konrad and

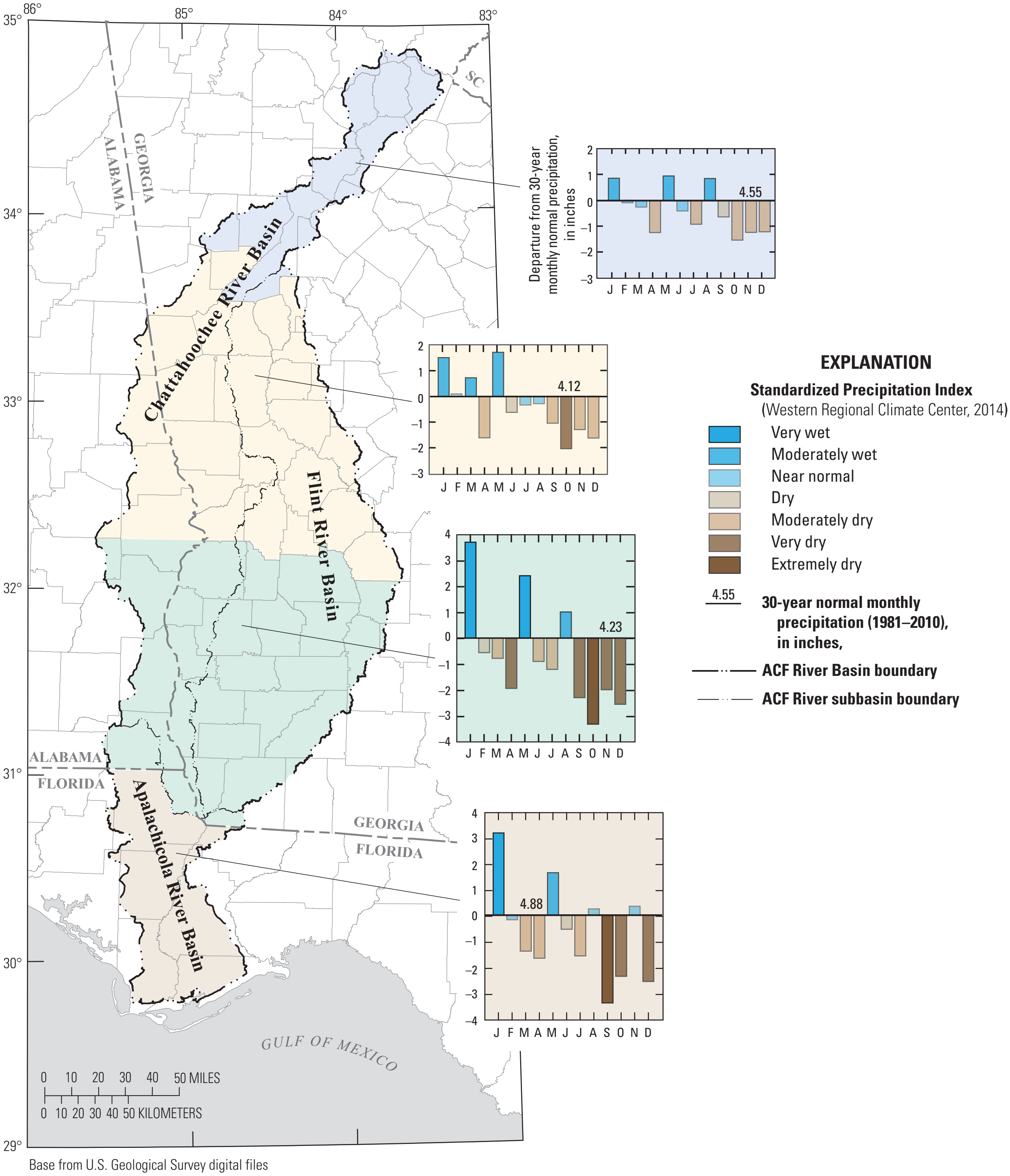
Fuhrman, 2013). Thus, summers typically are warm and humid with frequent late-afternoon and evening thunderstorms. In the upper ACF River Basin, the average maximum temperature in July ranges from 85 to 89 degrees Fahrenheit (°F; 29 to 32 degrees Celsius, [°C]); in contrast, the average maximum temperature in July temperatures range from 90 to 100 °F (32 to 38 °C) in the lower ACF River Basin (Konrad and Fuhrman, 2013, p. 11).

The winter climate is dominated by continental air masses and frontal storms driven west to east by the jet stream (Konrad and Fuhrman, 2013, p. 11). Typically, winter and early spring precipitation is caused by frontal storms moving west to east from the Pacific Coast of the United States. Mid-spring to early fall precipitation is caused by thunderstorms. In the upper ACF River Basin, the 70-year average annual rainfall is about 68 inches in the Blue Ridge physiographic province, about 50 inches near Lake Harding, about 54 inches at Lake Seminole, and about 62 inches in the Apalachicola and New River subbasins (Konrad and Fuhrman, 2013). The average minimum temperature in January ranges from 27 to 33 °F (–2.8 to 0.56 °C; Konrad and Fuhrman, 2013, p. 10). In the lower ACF River Basin, winters are mild and temperatures generally are above freezing but infrequently may drop below 20 °F (–6.7 °C). In the lower ACF River Basin, the average minimum temperature in January ranges from 33 to 42 °F (0.56 to 5.6 °C; Konrad and Fuhrman, 2013, p. 10).

Climate in the Apalachicola-Chattahoochee-Flint River Basin, 2010

Following the record rainfall in the third and fourth quarters of 2009 in the ACF River Basin, wet to normal conditions generally continued into the first one-half of 2010; based on a standardized precipitation index, rainfall was highly variable during this period (fig. 5). The standardized precipitation index is based on the probability of recording a given amount of precipitation within a specific time (month, year, and so forth), and the probabilities are standardized so that an index of zero indicates the median precipitation amount (one-half of the historical precipitation amounts are below the median and one-half are above). The index is negative for dry conditions and positive for wet conditions. As the dry or wet conditions become more severe, the index becomes more negative or more positive, respectively (National Oceanic and Atmospheric Administration, 2011).

Beginning in July 2010, rainfall was below average and conditions were considered dry in most areas of the ACF River Basin (fig. 5). By December, the Upper Chattahoochee River, Middle Chattahoochee–Lake Harding, Middle Chattahoochee–Walter F. George Reservoir, Upper Flint River, and Middle Flint River subbasins were moderately dry (nearly 2 inches below the 30-year monthly average precipitation, 1981–2010). By December, the lower parts of the ACF River Basin were very dry to extremely dry (3 to nearly 4 inches below the 30-year monthly average precipitation; fig. 5). The lack of rainfall in the lower ACF River Basin, especially during the growing season, probably resulted in increased crop irrigation and livestock water use in 2010. In the urban areas of the ACF River Basin, however, increases in water use were tempered by mandatory restrictions on outdoor watering.



Base from U.S. Geological Survey digital files

Figure 5. Departures of the monthly average 2010 precipitation from the 30-year normal monthly precipitation (1981–2010) in the Apalachicola-Chattahoochee-Flint (ACF) River Basin, Alabama, Florida, and Georgia

Water Use in the Apalachicola-Chattahoochee-Flint River Basin

In 2010, about 1,645 Mgal/d of water was withdrawn from groundwater and surface-water sources in the ACF River Basin (table 3, fig. 6). About 70 percent of all water withdrawals were by self-supplied agricultural water users and public water suppliers. About 35 percent of all withdrawals were groundwater; nearly 37 percent of the groundwater withdrawals came from the Upper Floridan aquifer and nearly 34 percent from the Claiborne aquifer (table 4, fig. 4). The Crystalline-rock aquifers accounted for only 4.5 percent of groundwater withdrawals in the ACF River Basin. Of the groundwater withdrawn in the ACF River Basin, 89 percent was withdrawn in Georgia and about 11 percent (5.5 percent each) was withdrawn in Alabama and Florida during 2010 (table 3).

Table 3. Population and water use by source and category in the Apalachicola-Chattahoochee-Flint River Basin, Alabama, Florida, and Georgia, 2010.

[Mgal/d, million gallons per day; —, not applicable]

Population: 3,835,260
Population served by public supply: 3,395,720
Population using groundwater: 409,510
Population using surface water: 2,986,210
Self-supplied population (groundwater): 439,540
Acres irrigated: 736,200

Water-use category	Water withdrawals (Mgal/d)							Deliveries from public supply (Mgal/d)	Total use[1] (Mgal/d)	Surface-water returns (Mgal/d)
	Groundwater (GW)			Surface water (SW)			Total GW and SW			
	Alabama	Florida	Georgia	Alabama	Florida	Georgia				
Public supply	16.12	5.83	46.55	13.57	0.00	485.5	567.5	—	—	—
Domestic	2.55	4.24	26.17	0.00	0.00	0.00	32.96	286.5	319.5	—
Commercial/ public use[2]	0.14	2.78	0.45	0.00	0.00	0.14	3.51	84.52	88.03	0.07
Industrial	2.94	0.00	12.06	27.64	0.00	121.0	163.6	39.29	202.9	66.58
Public-supply losses[3]	—	—	—	—	—	—	—	101.30	101.30	—
Public wastewater treatment	—	—	—	—	—	—	—	—	—	356.5
Mining	0.10	0.00	6.00	0.18	0.00	0.08	6.36	0.00	6.36	6.84
Agriculture	8.63	18.66	417.4	7.76	1.57	122.1	576.1	0.00	576.1	—
Crop irrigation	8.27	16.98	4416.2	7.24	1.57	99.65	549.9	0.00	549.9	—
Livestock and aquaculture	0.36	1.68	1.23	0.52	0.00	22.44	26.23	0.00	26.23	—
Golf course irrigation	0.00	0.32	4.88	0.39	0.30	7.77	13.66	3.14	16.80	—
Thermoelectric power	0.00	0.28	0.16	89.30	40.67	151.2	281.6	0.00	281.6	134.1
Total	**30.48**	**32.11**	**513.7**	**138.8**	**42.54**	**887.8**	**1,645**	**514.7**	**1,593**	**564.1**

[1]Total use is total withdrawal plus public-supply deliveries.

[2]Public use includes self-supplied withdrawals and unbilled public water delivered to municipal buildings, parks, golf courses, schools, churches, and so forth.

[3]Public-supplied water lost by leaks or breaks in the water distribution system.

[4]Includes permitted well-to-pond systems.

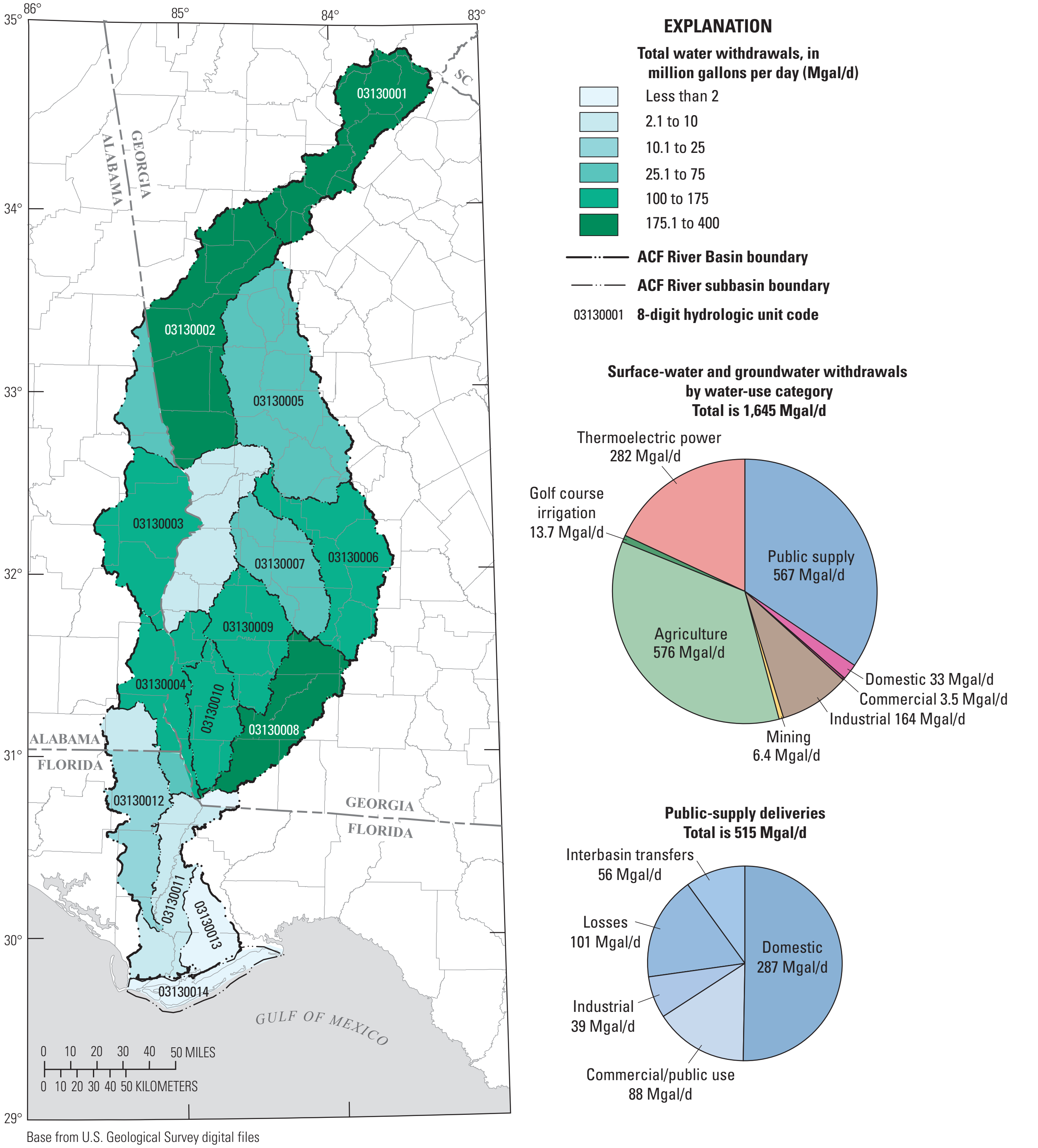


Figure 6. Total water withdrawals by subbasin and water-use category and public-supplied deliveries within the Apalachicola-Chattahoochee-Flint (ACF) River Basin, Alabama, Florida, and Georgia, 2010. Withdrawals may be different for neighboring States in the same river basin.

Groundwater withdrawals amounted to 576 Mgal/d in 2010 (table 3, fig. 7), whereas surface-water withdrawals amounted to 1,069 Mgal/d in 2010 (table 3, fig. 8). Georgia withdrew about 83 percent of the surface water in the basin, whereas Alabama withdrew 13 percent and Florida about 4 percent. Total water use in the ACF River Basin was 1,592 Mgal/d in 2010 (table 3); about 56 Mgal/d of water that was withdrawn in the basin was delivered (interbasin transfers) to river basins beyond the ACF River Basin (fig. 6). About 564 Mgal/d of water was returned to surface-water bodies in the ACF River Basin (table 3).

Public-Supply Water Withdrawals

Public water suppliers in the ACF River Basin withdrew about 567 Mgal/d of water in 2010 and 88 percent of that amount was surface water (tables 3 and 5). Among the public water suppliers in the ACF River Basin, those in Georgia withdrew the most water in 2010—about 94 percent of all public-supply withdrawals. Public water suppliers in Alabama withdrew slightly more surface water than groundwater and in Florida only groundwater was withdrawn (table 3).

Table 4. Groundwater withdrawals by water-use category for the principal aquifers in the Apalachicola-Chattahoochee-Flint River Basin, 2010.

[Mgal/d, million gallons per day]

Aquifer or aquifer system (fig. 3)	National aquifer code	Withdrawals by water-use category (Mgal/d)								
		Public supply	Domestic	Commercial and public	Industrial	Mining	Agri-culture[1]	Golf course irrigation	Thermo-electric	Totals
Floridan aquifer system	S400FLORDN	31.66	8.96	3.10	6.59	0.11	169.9	0.95	0.28	221.5
Claiborne	S100SECSLP	8.87	5.53	0.02	1.62	0.56	177.1	0.84	0.15	194.7
Clayton	S100SECSLP	7.18	2.72	0.01	1.41	0.86	73.10	0.11	0.00	85.39
Cretaceous aquifer system	S100SECSLP	14.80	2.79	0.16	5.02	1.49	22.95	1.21	0.00	48.42
Crystalline-rock	N400PDMBRX	5.98	12.96	0.08	0.36	3.08	1.63	2.09	0.00	26.18
Total		**68.49**	**32.96**	**3.37**	**15.00**	**6.10**	**444.7**	**5.20**	**0.43**	**576.3**

[1]Includes crop irrigation, livestock, and aquaculture uses.

Table 5. Population and public-supply withdrawals and deliveries by water-use category in the Apalachicola River, Chattahoochee River, and Flint River Basins, 2010.

[Mgal/d, million gallons per day; ACF, Apalachicola-Chattahoochee-Flint]

River basin (fig. 2)	Public-supplied population (thousands)			Public supply (Mgal/d)							
				Withdrawals			Deliveries by water-use category				
	Ground-water	Surface water	Total	Ground-water	Surface water	Total	Domestic	Commercial and public use	Industrial	System losses	Total[1]
Apalachicola River	46.63	0.09	46.72	7.94	0.00	7.94	3.82	1.27	0.12	1.08	6.29
Chattahoochee River	117.57	2,591.50	2,709.07	19.16	464.1	483.3	223.1	372.35	32.81	82.10	410.4
Flint River	245.31	394.62	639.93	41.40	34.93	76.33	59.55	14.03	6.36	14.96	94.90
Total	**409.51**	**2,986.21**	**3,395.72**	**68.50**	**499.0**	**3567.5**	**286.5**	**87.65**	**39.29**	**98.14**	**511.6**

[1]Differences between water withdrawn and water delivered in a basin represent interbasin transfers into or out of the basin.

[2]Includes 3.14 Mgal/d delivered for irrigation.

[3]About 56 Mgal/d of water are delivered to users outside of the ACF River Basin.

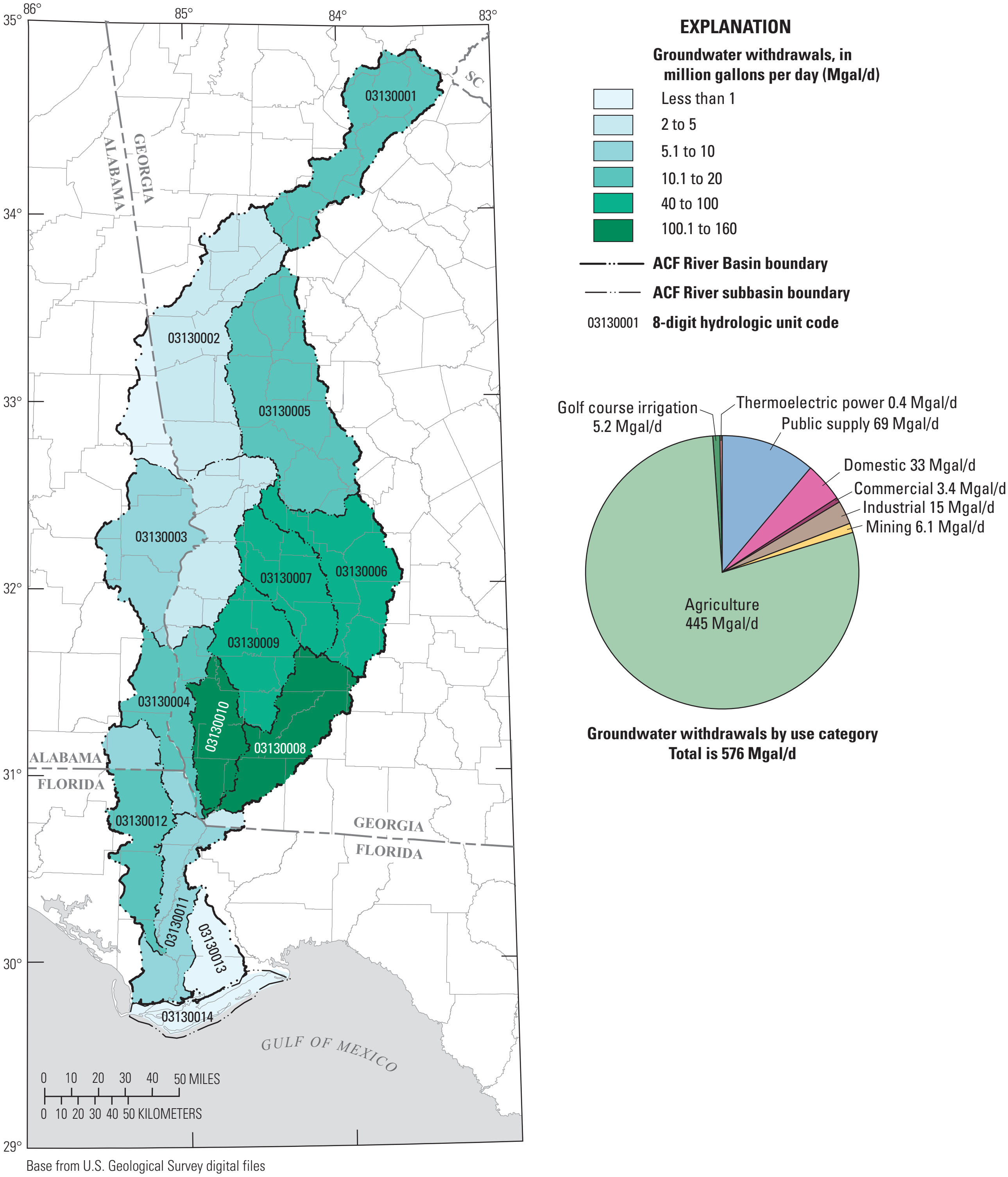


Figure 7. Groundwater withdrawals by subbasin and water-use category within the Apalachicola-Chattahoochee-Flint (ACF) River Basin, Alabama, Florida, and Georgia, 2010. Withdrawals may be different for neighboring States in the same river basin.

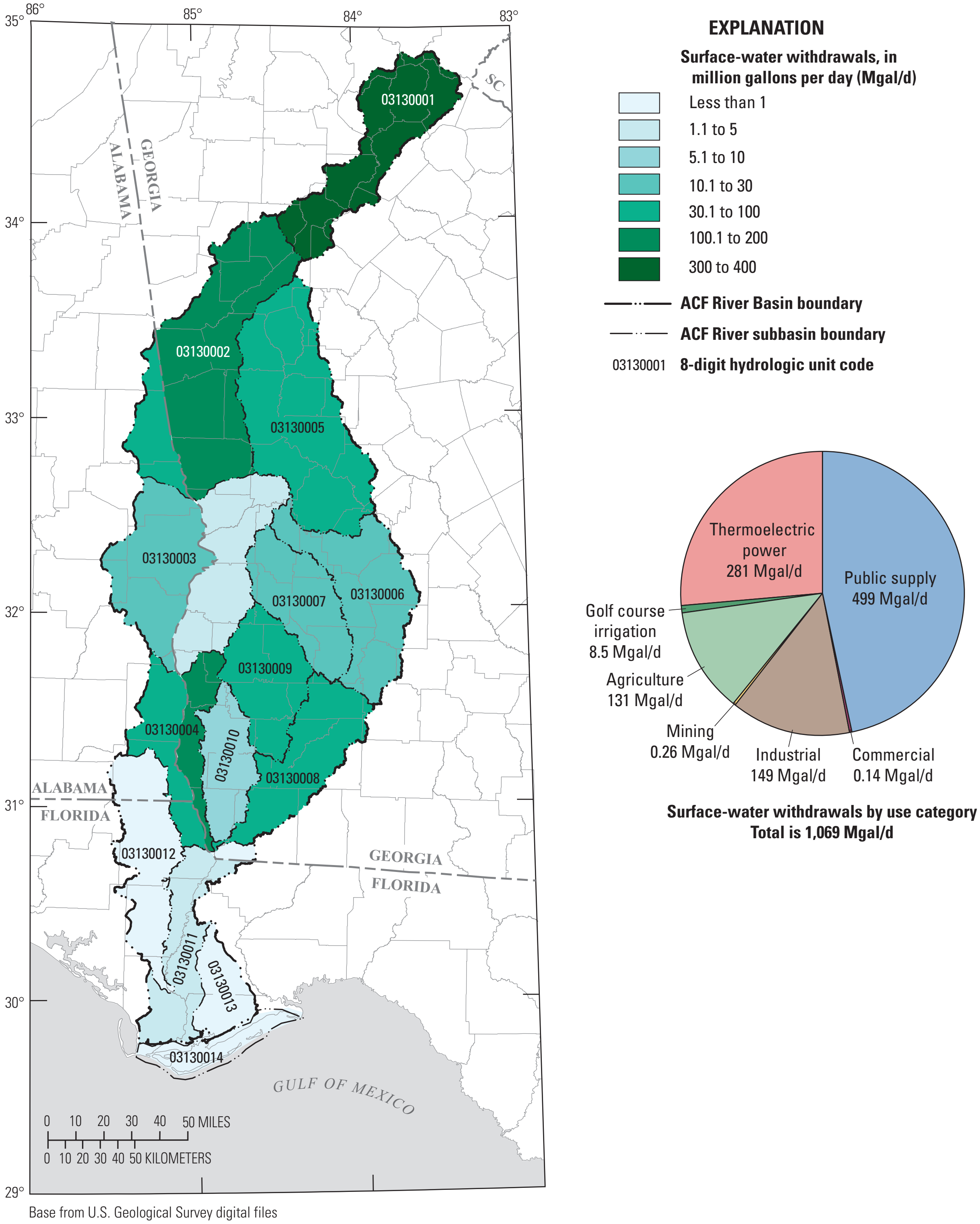


Figure 8. Surface-water withdrawals by subbasin and water-use category within the Apalachicola-Chattahoochee-Flint River Basin, Alabama, Florida, and Georgia, 2010. Withdrawals may be different for neighboring States in the same river basin.

Public-Supplied Water Deliveries

About 3.40 million people were served by public water suppliers in the ACF River Basin during 2010 (table 3). Water from surface-water sources was delivered to 3.0 million people (88 percent) and nearly 410,000 people were served by public-supplied groundwater. Georgia had the largest public-supplied population, representing nearly 93 percent (3.17 million) of the public-supplied population in the ACF River Basin. Public water suppliers served 193,700 people (5.5 percent) in Alabama and 31,880 people in Florida.

Public-supplied water was predominately surface water in Georgia (table 3). In Alabama, slightly more surface water than groundwater was withdrawn by public water suppliers. Groundwater was the only source of public-supplied water in the Florida part of the ACF River Basin (table 3). Domestic uses accounted for nearly 56 percent (287 Mgal/d) of public-supplied deliveries (fig. 6, table 3). Commercial and public-use deliveries were 88 Mgal/d and represent 17 percent of all public-supplied deliveries in the ACF River Basin, and industrial deliveries were 39 Mgal/d and represent nearly 7.7 percent of all public-supplied deliveries in the ACF River Basin. System losses were estimated at 101 Mgal/d, which account for 19 percent of deliveries in the ACF River Basin (fig. 6, table 3). Interbasin transfers to river basins outside of the ACF River Basin amounted to about 56 Mgal/d and represent the difference between public-supply withdrawals and deliveries (fig. 6). The per capita use of public-supplied water was 153 gal/d in Alabama, 183 gal/d in Florida, and 168 gal/d in Georgia (table 6).

Self-Supplied Water Withdrawals

About 65 percent (1,078 Mgal/d) of all water withdrawals in the ACF River Basin were by self-supplied water users (table 3). Among this group, an average of about 508 Mgal/d was withdrawn from groundwater and 570 Mgal/d from surface water in 2010. Self-supplied users in the Georgia part of the ACF River Basin withdrew the largest amounts of groundwater and surface water (table 3).

Agricultural users in the ACF River Basin withdrew on average the largest amounts of self-supplied water (576 Mgal/d), about 35 percent of all water withdrawn in 2010 (table 3). In addition, 445 Mgal/d was withdrawn by self-supplied thermoelectric-power (about 282 Mgal/d; 17 percent of all withdrawals) and industrial facilities (about 164 Mgal/d; 10 percent of all withdrawals). The paper and pulp industries withdrew 143 Mgal/d of water, by far the greatest amount of self-supplied industrial water withdrawn from the ACF River Basin during 2010 (table 7). Water withdrawals by the chemical industry amounted to 10.8 Mgal/d, and the remaining self-supplied users withdrew about 3 percent of all water withdrawn in the ACF River Basin during 2010 (table 7).

Surface-Water Returns

In 2010, an average of 564 Mgal/d of treated and untreated water was discharged to the surface waters in the ACF River Basin (table 3). Most of that amount, 357 Mgal/d or 63 percent was treated wastewater discharged by public wastewater-treatment facilities. Water used for once-through cooling by thermoelectric-power-generation facilities (134 Mgal/d) accounted for nearly 24 percent of the surface-water returns in the basin. Moreover, commercial (0.07 Mgal/d) and industrial discharges (67 Mgal/d) represented nearly 12 percent of all surface-water returns in the basin. Discharges from mining activities (6.8 Mgal/d) contributed the remainder of the water returned to surface water in the ACF River Basin.

Water Use in the Apalachicola River Basin

The Apalachicola River Basin encompasses about 3,190 mi^2, mostly in the eastern part of the Florida panhandle (table 2, fig. 2). According to the 2010 U.S. Census, 111,500 people resided in the basin (U.S. Census Bureau, 2011a). The Apalachicola River Basin is in the Coastal Plain physiographic province. Total water withdrawals ranged from less than 2 Mgal/d in the New River and Apalachicola Bay subbasins to 16 Mgal/d in the Chipola River subbasin (fig. 6). Most of the withdrawals in the Apalachicola River Basin is groundwater (figs. 7 and 8). Groundwater from the Floridan aquifer system (especially the Upper Floridan aquifer) is the primary source of public-supplied water. A small percentage of water is withdrawn from the surficial aquifer system in the basin. Surface water is used for agriculture and thermoelectric-power generation. Public water suppliers withdrew less than 10,000 gal/d of surface water in 2010 (table 5).

Public-Supply Water Withdrawals

In 2010, public water suppliers withdrew an average of 7.9 Mgal/d from groundwater sources in the Apalachicola River Basin; this amount represents nearly 12 percent of the groundwater withdrawn for public supply in the ACF River Basin and 1.4 percent of all withdrawals for public supply in the ACF River Basin (table 5). Of all water withdrawn by public water suppliers in the Apalachicola River Basin, 73 percent (5.8 Mgal/d) was withdrawn in Florida and 27 percent (2.1 Mgal/d) was withdrawn in Alabama (table 6).

Among the four subbasins in the Apalachicola River Basin, public-supply withdrawals were greatest in the Chipola River subbasin (HUC 03130012) at 3.6 Mgal/d and least in the Apalachicola Bay subbasin (HUC 03130014) at 0.86 Mgal/d (table 6, fig. 6). Of the 3.6 Mgal/d withdrawn by public water suppliers in the Chipola River subbasin during 2010, about 58 percent was withdrawn in Alabama and the remainder was withdrawn in Florida.

Table 6. Population and public-supply water withdrawals and deliveries by water-use category for subbasins in the Apalachicola-Chattahoochee-Flint River Basin, Alabama, Florida, and Georgia, 2010.

[HUC–8, 8-digit hydrologic unit code; Ala., Alabama; Fla., Florida; Ga., Georgia; <, less than; —, not applicable or basin does not extend into the State]

River basin and subbasin name (fig. 2)	HUC–8	Public-supplied population (thousands)		Public-supply withdrawals by State (million gallons per day)		
		Ground-water	Surface water	Ala.	Fla.	Ga.
Apalachicola River Basin, totals		**46.63**	**0.09**	**2.11**	**5.83**	**<0.01**
Apalachicola River	03130011	16.45	0.09	0.00	2.49	<0.01
Chipola River	03130012	24.54	0.00	2.11	1.52	—
New River	03130013	3.88	0.00	—	0.96	—
Apalachicola Bay	03130014	1.76	0.00	—	0.86	—
Chattahoochee River Basin, totals		**117.57**	**2,591.50**	**27.58**	**0.00**	**455.7**
Upper Chattahoochee River	03130001	30.98	1,390.81	—	—	365.9
Middle Chattahoochee-Lake Harding	03130002	15.38	945.74	6.25	—	86.40
Middle Chattahoochee-Walter F. George Reservoir	03130003	37.24	254.95	10.88	—	3.05
Lower Chattahoochee River	03130004	33.97	0.00	10.45	0.00	0.30
Flint River Basin, totals		**245.31**	**394.62**	**—**	**—**	**76.33**
Upper Flint River	03130005	28.04	394.62	—	—	37.98
Middle Flint River	03130006	43.34	0.00	—	—	[1]20.33
Kinchafoonee-Muckalee Creek	03130007	55.75	0.00	—	—	5.75
Lower Flint River	03130008	91.28	0.00	—	—	7.31
Ichawaynochaway Creek	03130009	14.15	0.00	—	—	2.78
Spring Creek	03130010	12.75	0.00	—	—	2.18
TOTAL		**409.51**	**2,986.21**	**29.69**	**5.83**	**532.0**
Per capita water use, in gallons per day	—	—	—	**[2]153**	**[3]183**	**[4]168**

[1]About 15 million gallons per day of water were delivered from the Middle Flint River subbasin to the Lower Flint River subbasin by public suppliers in 2010.

[2]Public-supply withdrawal divided by public-supplied population of 193,700.

[3]Public-supply withdrawal divided by public-supplied population of 31,880.

[4]Public-supply withdrawal divided by public-supplied population of 3,170,140.

Table 6. Population and public-supply water withdrawals and deliveries by water-use category for subbasins in the Apalachicola-Chattahoochee-Flint River Basin, Alabama, Florida, and Georgia, 2010.—Continued

[HUC–8, 8-digit hydrologic unit code; Ala., Alabama; Fla., Florida; Ga., Georgia; <, less than; —, not applicable or basin does not extend into the State]

Public-supply deliveries by water-use category (million gallons per day)													
Domestic			Commercial and public use			Industrial			Irrigation			Public-supply losses	Total deliveries
Ala.	Fla.	Ga.	Ala.	Fla.	Ga.	Ala.	Fla.	Ga.	Ala.	Fla.	Ga.		
0.64	**3.18**	**0.00**	**0.07**	**1.20**	**—**	**0.00**	**0.12**	**—**	**0.00**	**0.00**	**—**	**1.09**	**6.30**
—	1.48	0.00	—	0.47	0.00	—	0.00	0.00	—	0.00	0.00	0.38	2.33
0.64	0.71	0.00	0.07	0.46	—	0.00	0.12	—	0.00	0.00	—	0.39	2.39
—	0.60	0.00	—	0.17	—	—	0.00	—	—	0.00	—	0.19	0.96
—	0.39	0.00	—	0.10	—	—	0.00	—	—	0.00	—	0.13	0.62
11.59	**0.00**	**211.5**	**3.62**	**0.00**	**65.58**	**4.17**	**0.00**	**28.67**	**0.00**	**0.00**	**3.14**	**83.66**	**412.0**
—	—	173.5	—	—	57.28	—	—	19.27	—	—	0.25	67.57	317.9
1.94	—	37.05	0.44	—	8.24	0.47	—	5.56	0.00	—	2.89	11.03	67.63
6.32	—	0.74	2.37	—	0.03	2.83	—	3.84	0.00	—	0.00	2.91	19.01
3.33	0.00	0.24	0.81	0.00	0.03	0.87	0.00	0.00	0.00	0.00	0.00	2.15	7.43
—	**—**	**59.55**	**—**	**—**	**14.04**	**—**	**—**	**6.36**	**—**		**0.00**	**16.55**	**96.49**
—	—	39.50	—	—	6.73	—	—	2.80	—	—	0.00	9.13	58.17
—	—	2.58	—	—	0.87	—	—	0.69	—	—	0.00	0.95	5.09
—	—	3.85	—	—	0.76	—	—	0.10	—	—	0.00	1.04	5.75
—	—	11.02	—	—	4.79	—	—	2.48	—	—	0.00	4.15	22.42
—	—	1.19	—	—	0.47	—	—	0.28	—	—	0.00	0.86	2.80
—	—	1.41	—	—	0.42	—	—	0.01	—	—	0.00	0.42	2.26
12.23	**3.18**	**271.1**	**3.69**	**1.20**	**79.62**	**4.17**	**0.12**	**35.03**	**0.00**	**0.00**	**3.14**	**101.3**	**514.8**

Table 7. Permitted industrial water withdrawals by major North American Industrial Classification code (NAICS) in the Apalachicola-Chattahoochee-Flint River Basin, 2010.

NAICS	Withdrawals (million gallons per day)		
	Groundwater	Surface water	Total
322–Paper, pulp	6.40	137.1	143.5
325–Chemicals	1.54	9.24	10.78
312–Beverage manufacturing	2.82	0.00	2.82
311–Food	2.16	0.00	2.16
423–Wholesale trade-durable goods	0.00	1.72	1.72
221–Electric utility-thermoelectric power	0.74	0.00	0.74
212–Mining (kaolin and clay processing)	0.31	0.27	0.58
313 and 314–Textiles	0.20	0.26	0.46
321–Lumber and wood products	0.36	0.00	0.36
331–Primary metals	0.28	0.00	0.28
327–Stone, clay	0.17	0.00	0.17
All other	0.02	0.04	0.06
Total	**15.00**	**148.6**	**163.6**

In the Apalachicola River subbasin (HUC 03130011), withdrawals by public water suppliers in Florida (2.49 Mgal/d) amounted to 31 percent of all public-supply withdrawals in the Apalachicola River Basin (table 6). Public-supply withdrawals from the New River (HUC 03130013; 0.96 Mgal/d) and Apalachicola Bay (HUC 03130014; 0.86 Mgal/d) subbasins account for 12 and 11 percent, respectively, of all public-supply withdrawals in Apalachicola River Basin.

Public-Supplied Water Deliveries

During 2010, an average of 6.3 Mgal/d of water was delivered to domestic, commercial and public, and industrial customers by public water suppliers in the Alabama and Florida parts of the Apalachicola River Basin (table 6). In addition, about 1.1 Mgal/d of water was lost (public supply or system losses) during the delivery of public-supplied water. Public-supplied water deliveries were greatest in the Chipola River (2.39 Mgal/d) and Apalachicola River (2.33 Mgal/d) subbasins and were least in the Apalachicola Bay subbasin (0.62 Mgal/d).

Deliveries for domestic uses (3.8 Mgal/d) accounted for 60 percent of all public-supply deliveries in the Apalachicola River Basin (table 6). Domestic deliveries were greatest in Florida, accounting for 83 percent of all domestic deliveries; nearly 17 percent of the domestic deliveries were in Alabama. Domestic deliveries in Florida were greatest in the Apalachicola River subbasin (1.5 Mgal/d) and were least in the Apalachicola Bay subbasin (0.39 Mgal/d). Domestic deliveries in the Chipola River subbasin (1.3 Mgal/d) were slightly greater in the Florida part of the subbasin (0.71 Mgal/d) than in Alabama (0.64 Mgal/d).

Public-supply deliveries for commercial, public, and industrial uses in the Apalachicola River Basin amounted to 1.39 Mgal/d in 2010. Of the 1.39 Mgal/d, only 8.6 percent was delivered for industrial uses and all deliveries were in the Chipola River subbasin (table 6). Deliveries for commercial and public uses were greatest in the Chipola River subbasin (0.53 Mgal/d) and were least in the Apalachicola Bay subbasin (0.10 Mgal/d). Commercial and public uses in Florida accounted for 87 percent of the 0.53 Mgal/d delivered in the Chipola River subbasin; the remainder was delivered in Alabama.

Total public-supply losses in the Apalachicola River Basin were estimated at 1.1 Mgal/d during 2010 (table 6) and represent an estimated loss of 19 percent. Because public-supplied deliveries were greatest in the Apalachicola River and Chipola River subbasins, system losses were greatest as well. Public-supply losses were least in the Apalachicola Bay subbasin.

Self-Supplied Water Withdrawals

During 2010, self-supplied water users withdrew an average of 27.9 Mgal/d from groundwater (91 percent) and surface-water (9 percent) sources in the Apalachicola River Basin (table 8). Self-supplied withdrawals were greatest in Florida, accounting for 77 percent of the 27.9 Mgal/d used in the basin. Self-supplied water users in Georgia withdrew the least amount of water in 2010, about 7.5 percent of the total used in the basin (table 9).

Among the self-supplied water-use categories, agriculture used the greatest amount of water in the Apalachicola River Basin during 2010 (table 8); mining and thermoelectric-power facilities did not withdraw water in 2010. Agriculture used an average of 20 Mgal/d (72 percent of the average self-supplied withdrawals in the basin); 75 percent of agricultural withdrawals were in Florida (15 Mgal/d), 15 percent in Alabama (3 Mgal/d), and the remainder in Georgia (2 Mgal/d; table 9).

An estimated annual average of 4.9 Mgal/d of water was withdrawn by self-supplied domestic users in the Apalachicola River Basin (table 8). The self-supplied domestic population was greatest in the Chipola River subbasin (nearly 51,000) and least in the Apalachicola Bay subbasin (670; table 9). Nearly 11,800 people were self supplied by domestic wells in the Apalachicola River subbasin and nearly 1,400 in the New River subbasin. In the Georgia part of the Apalachicola River Basin, more than 90 percent of the population was self supplied in 2010 (fig. 9). In the Alabama part of the Chipola River subbasin, 52 percent of the population was self supplied; whereas in the Florida part of the Chipola River subbasin, 78 percent of the population was self supplied (fig. 9).

Of the four subbasins in the Apalachicola River Basin, self-supplied water withdrawals were greatest in the Chipola River subbasin (19 Mgal/d), accounting for nearly 70 percent of all self-supplied withdrawals in the Apalachicola River Basin (table 9). Self-supplied withdrawals were least in the New River (0.40 Mgal/d) and Apalachicola Bay (0.05 Mgal/d) subbasins and account for less than 2 percent of the total withdrawn in the Apalachicola River Basin. Of the total water withdrawn in the Chipola River subbasin, 78 percent was withdrawn in Florida and the remainder was withdrawn in Alabama. Seventy-one percent of the self-supplied withdrawals in the Chipola River subbasin were for agricultural uses and 20 percent for domestic uses, whereas commercial and public uses and golf course irrigation account for the remaining 9 percent (table 9).

An average of about 8.0 Mgal/d of self-supplied water was withdrawn in the Apalachicola River subbasin in 2010, primarily for domestic, commercial and public, and agricultural uses (table 9). Agricultural uses in Florida and Georgia account for 53 and 25 percent, respectively, of the self-supplied withdrawals in the Apalachicola River subbasin. Self-supplied domestic withdrawals averaged 0.88 Mgal/d of which 91 percent was withdrawn in Florida. An annual average of 0.88 Mgal/d was withdrawn for commercial uses—all in Florida. Industrial, mining, golf course irrigation, and thermoelectric-power facilities did not withdraw water in the Apalachicola River subbasin in 2010.

Surface-Water Returns

In 2010, an average of 1.64 Mgal/d of water was discharged to surface water in the Apalachicola River Basin (table 10). Public wastewater discharges contributed 88 percent of these returns; mining activities discharged the remainder. Most of the public wastewater discharged in 2010 (82 percent) occurred in the Apalachicola River subbasin, whereas all of the mining discharges occurred in the Chipola River subbasin. Most of the public and commercial wastewater (3.28 Mgal/d) in the Apalachicola River Basin is not returned to surface water but is reused for irrigation.

Water Use in the Chattahoochee River Basin

The Chattahoochee River Basin encompasses about 8,580 mi^2 in the north-central, western, and southwestern parts of Georgia (68 percent), the eastern and southeastern parts of Alabama (29 percent), and the northeast part of the Florida panhandle (3 percent; table 2, fig. 2). According to the 2010 U.S. Census, 2.87 million people resided in the basin (U.S. Census Bureau, 2011a), and more than 99 percent of this population lived in Georgia (table 2).

The Chattahoochee River Basin spans the Blue Ridge, Piedmont, and Coastal Plain physiographic provinces resulting in marked differences in topography, geology, climate, and water supply sources. All of the principal aquifers in the ACF River Basin exist in the Chattahoochee River Basin (table 2).

An annual average of nearly 935 Mgal/d of water was withdrawn from groundwater and surface-water sources in the Chattahoochee River Basin during 2010 (tables 5 and 8). Surface-water withdrawals averaged 866 Mgal/d or 93 percent and groundwater withdrawals averaged 69 Mgal/d (7 percent). The principal aquifers in the basin include the Crystalline-rock aquifers, Cretaceous aquifer system, the Clayton aquifer, Claiborne aquifer, and Floridan aquifer system (table 2). A small percentage of water is withdrawn from the surficial aquifer system in the basin. Lake Lanier and the Chattahoochee River are the principal sources of surface water in the basin.

Public-Supply Water Withdrawals

In 2010, public water suppliers withdrew an annual average of 483 Mgal/d of water from all sources in the Chattahoochee River Basin; 96 percent of this water was surface water (table 5). Of all public-supplied water withdrawn in the Chattahoochee River Basin, about 94 percent was withdrawn in Georgia and about 6 percent was withdrawn in Alabama (table 6).

Among the four subbasins in the Chattahoochee River Basin, public-supply withdrawals were greatest in the Upper Chattahoochee River subbasin (HUC 03130001) and least in the Lower Chattahoochee River subbasin (HUC 03130004; fig. 6). An annual average of 366 Mgal/d of water was withdrawn by public water suppliers in the Upper Chattahoochee River subbasin during 2010, which represents about 76 percent of all water withdrawn by public suppliers in the Chattahoochee River Basin (table 6). In the Middle Chattahoochee–Lake Harding subbasin (HUC 03130002), public water suppliers withdrew an annual average of 93 Mgal/d in 2010; 93 percent was withdrawn in Georgia (86 Mgal/d) and the remainder was withdrawn in Alabama (6.3 Mgal/d).

In the Middle Chattahoochee–Walter F. George Reservoir subbasin (HUC 03130003), public water suppliers withdrew nearly 14 Mgal/d in 2010 (table 6). Of the 14 Mgal/d, nearly 11 Mgal/d (78 percent) were withdrawn in Alabama and about 3 Mgal/d (22 percent) were withdrawn in Georgia. In contrast, public water suppliers withdrew 10.7 Mgal/d from the Lower Chattahoochee River subbasin. Of the 10.7 Mgal/d, about 10.5 Mgal/d (97 percent) were withdrawn in Alabama and 0.3 Mgal/d (3 percent) were withdrawn in Georgia.

Public-Supplied Water Deliveries

During 2010, about 2.71 million people in the Chattahoochee River Basin were served by public water suppliers (table 5). Surface water was the source of water for nearly 96 percent of the population served by public water suppliers. Groundwater was used as a source of public-supplied water for 117,570 people in the Chattahoochee River Basin. About 410 Mgal/d of water were delivered to domestic, commercial and public, and industrial customers by public water suppliers in the Chattahoochee River Basin (table 5). These deliveries include water lost from distribution systems (system losses). An estimated annual average of 82 Mgal/d of water was lost from public-supply distribution systems in 2010 (table 5).

Of the 410 Mgal/d of water delivered by public water suppliers in the Chattahoochee River Basin, 77 percent was used in the Upper Chattahoochee River (318 Mgal/d) and 16 percent was used in the Middle Chattahoochee–Lake Harding subbasins (68 Mgal/d; table 6). Public-supplied deliveries were least in the Lower Chattahoochee River subbasin (5.9 Mgal/d). Deliveries for domestic uses (223 Mgal/d) accounted for 54 percent of all public-supplied deliveries in the Chattahoochee River Basin (table 5). Georgia accounted for 95 percent of the domestic deliveries and the remainder was delivered in Alabama (table 6). Domestic deliveries in Georgia were greatest in the Upper Chattahoochee River subbasin (173 Mgal/d) and least in the Lower Chattahoochee River subbasin (0.24 Mgal/d; table 6). In Alabama, public-supplied deliveries were greatest in the Middle Chattahoochee–Walter F. George Reservoir subbasin (6.3 Mgal/d) and least in the Middle Chattahoochee–Lake Harding subbasin (1.9 Mgal/d; table 6). Domestic deliveries in the Middle Chattahoochee–Walter F. George Reservoir and the Lower Chattahoochee River subbasins were greater in Alabama than in Georgia. Public-supplied deliveries for commercial and public and industrial uses follow the same pattern as described above for public-supplied domestic deliveries (table 6).

Table 8. Population and self-supplied freshwater withdrawals by water source and water-use category for the Apalachicola, Chattahoochee, and Flint River Basins, 2010.

[GW, groundwater; SW, surface water]

River basin (fig. 2)	Self-supplied domestic population by State (thousands)				Self-supplied freshwater withdrawals by water-use category (million gallons per day)		
					Domestic	Commercial and public	
	Alabama	Florida	Georgia	Total	GW	GW	SW
Apalachicola River	16.05	47.71	1.02	64.78	4.86	2.34	0.00
Chattahoochee River	17.98	8.82	139.43	166.23	12.46	0.60	0.00
Flint River	0.00	0.00	208.53	208.53	15.64	0.43	0.14
Total	**34.03**	**56.53**	**348.98**	**439.54**	**32.96**	**3.37**	**0.14**

[1]Includes withdrawals for crop irrigation, livestock, and aquaculture.

Table 9. Population and self-supplied freshwater withdrawals by water-use category and subbasin in the Apalachicola-Chattahoochee-Flint River Basin, Alabama, Florida, and Georgia, 2010.

[HUC–8, 8-digit hydrologic unit code; Ala., Alabama; Fla., Florida; Ga., Georgia; —, not applicable or basin does not extend into the State]

River basin and subbasin names (fig. 2)	HUC–8	Self-supplied population (thousands)	Self-supplied water withdrawals by water-use category, in million gallons per day								
			Domestic			Commercial and public			Industrial		
			Ala.	Fla.	Ga.	Ala.	Fla.	Ga.	Ala.	Fla.	Ga.
Apalachicola River Basin, totals	**—**	**64.78**	**1.20**	**3.58**	**0.08**	**0.00**	**2.34**	**0.00**	**0.00**	**0.00**	**0.00**
Apalachicola River	03130011	11.74	0.00	0.80	0.08	0.00	0.88	0.00	0.00	0.00	0.00
Chipola River	03130012	50.99	1.20	2.63	—	0.00	1.46	—	0.00	0.00	—
New River	03130013	1.38	—	0.10	—	—	0.00	—	—	0.00	—
Apalachicola Bay	03130014	0.67	—	0.05	—	—	0.00	—	—	0.00	—
Chattahoochee River Basin, totals	**—**	**166.23**	**1.35**	**0.66**	**10.45**	**0.14**	**0.44**	**0.02**	**30.58**	**0.00**	**110.5**
Upper Chattahoochee River	03130001	106.90	—	—	8.02	—	—	0.00	—	—	0.22
Middle Chattahoochee–Lake Harding	03130002	19.15	0.29	—	1.14	0.00	—	0.02	0.00	—	0.52
Middle Chattahoochee–Walter F. George Reservoir	03130003	21.52	0.77	—	0.84	0.14	—	0.00	30.14	—	0.28
Lower Chattahoochee River	03130004	18.66	0.29	0.66	0.45	0.00	0.44	0.00	0.44	0.00	109.5
Flint River Basin, totals	**—**	**208.53**	**—**	**—**	**15.64**	**—**	**—**	**0.57**	**—**	**—**	**22.54**
Upper Flint River	03130005	114.51	—	—	8.59	—	—	0.22	—	—	1.98
Middle Flint River	03130006	34.37	—	—	2.58	—	—	0.00	—	—	13.25
Kinchafoonee-Muckalee Creek	03130007	23.20	—	—	1.74	—	—	0.10	—	—	0.00
Lower Flint River	03130008	18.77	—	—	1.41	—	—	0.24	—	—	7.13
Ichawaynochaway Creek	03130009	7.66	—	—	0.57	—	—	0.01	—	—	0.18
Spring Creek	03130010	10.02	—	—	0.75	—	—	0.00	—	—	0.00
Total	**—**	**439.54**	**2.55**	**4.24**	**26.17**	**0.14**	**2.78**	**0.59**	**30.58**	**0.00**	**133.0**

[1]Includes crop irrigation, livestock, and aquaculture uses.

Table 8. Population and self-supplied freshwater withdrawals by water source and water-use category for the Apalachicola, Chattahoochee, and Flint River Basins, 2010.—Continued

[GW, groundwater; SW, surface water]

Self-supplied freshwater withdrawals by water-use category (million gallons per day)—Continued											
Industrial		Mining		Agriculture[1]		Golf course irrigation		Thermoelectric		Total withdrawals	
GW	SW	GW	SW	GW	SW	GW	SW	GW	SW	GW	SW
0.00	0.00	0.00	0.00	17.89	2.14	0.32	0.35	0.00	0.00	25.41	2.49
3.68	137.4	2.94	0.25	26.47	28.14	2.67	5.37	0.28	231.0	49.10	402.2
11.32	11.22	3.16	0.02	400.3	101.1	2.21	2.74	0.16	50.20	433.2	165.4
15.00	**148.6**	**6.10**	**0.27**	**444.7**	**131.4**	**5.20**	**8.46**	**0.44**	**281.2**	**507.7**	**570.1**

Table 9. Population and self-supplied freshwater withdrawals by water-use category and subbasin in the Apalachicola-Chattahoochee-Flint River Basin, Alabama, Florida, and Georgia, 2010.—Continued

[HUC–8, 8-digit hydrologic unit code; Ala., Alabama; Fla., Florida; Ga., Georgia; —, not applicable or basin does not extend into the State]

Self-supplied water withdrawals by water-use category, in million gallons per day—Continued												
Mining			Agriculture[1]			Golf course irrigation			Thermoelectric power			Total with-drawals
Ala.	Fla.	Ga.	Ala.	Fla.	Ga.	Ala.	Fla.	Ga.	Ala.	Fla.	Ga.	
0.00	**0.00**	**0.00**	**3.01**	**15.01**	**2.01**	**0.05**	**0.62**	**0.00**	**0.00**	**0.00**	**0.00**	**27.90**
0.00	0.00	0.00	0.00	4.28	2.01	0.00	0.00	0.00	0.00	0.00	0.00	8.05
0.00	0.00	—	3.01	10.73	—	0.05	0.32	—	0.00	0.00	—	19.40
—	0.00	—	—	0.00	—	0.00	0.30	—	—	0.00	—	0.40
—	0.00	—	—	0.00	—	0.00	0.00	—	—	0.00	—	0.05
0.28	**0.00**	**2.91**	**13.38**	**5.22**	**36.03**	**0.34**	**0.00**	**7.70**	**89.30**	**40.95**	**101.0**	**451.3**
—	—	0.96	—	—	14.48	0.00	—	4.15	—	—	0.00	27.83
0.07	—	1.25	0.40	—	3.16	0.03	—	2.49	0.00	—	101.0	110.4
0.21	—	0.70	4.03	—	1.32	0.18	—	1.06	0.00	—	0.00	39.66
0.00	0.00	0.00	8.95	5.22	17.07	0.13	0.00	0.00	89.30	40.95	0.00	273.4
—	**—**	**3.17**	**—**	**—**	**501.4**	**—**	**—**	**4.95**	**—**	**—**	**50.35**	**598.7**
—	—	1.29	—	—	7.88	—	—	2.42	—	—	0.00	22.38
—	—	1.39	—	—	71.25	—	—	1.03	—	—	0.20	89.70
—	—	0.36	—	—	64.08	—	—	0.32	—	—	0.00	66.60
—	—	0.11	—	—	143.4	—	—	0.76	—	—	50.15	203.2
—	—	0.02	—	—	96.59	—	—	0.11	—	—	0.00	97.48
—	—	0.00	—	—	118.2	—	—	0.31	—	—	0.00	119.4
0.28	**0.00**	**6.08**	**16.39**	**20.23**	**539.5**	**0.39**	**0.62**	**12.65**	**89.30**	**40.95**	**151.3**	**1,078**

Table 10. Surface-water returns by 8-digit hydrologic unit code (HUC–8) and water-use category in the Apalachicola-Chattahoochee-Flint River Basin, Alabama, Florida, and Georgia, 2010.

[HUC–8, 8-digit hydrologic unit code; —, not applicable or basin does not extend into the State]

River basin and subbasin names (fig. 2)	HUC–8	Surface-water returns by water-use category and State, (million gallons per day)					
		Public wastewater treatment			Commercial and industrial		
		Alabama	Florida	Georgia	Alabama	Florida	Georgia
Apalachicola River Basin, totals	—	**0.00**	**1.45**	**0.00**	**0.00**	**0.00**	**0.01**
Apalachicola River	03130011	—	1.34	0.00	—	0.00	0.01
Chipola River	03130012	0.00	0.11	—	0.00	—	0.00
New River	03130013	—	0.00	—	—	—	0.00
Apalachicola Bay	03130014	—	0.00	—	—	0.00	—
Chattahoochee River Basin, totals	—	**13.69**	**0.00**	**279.8**	**21.23**	**0.00**	**43.06**
Upper Chattahoochee River	03130001	—	—	96.20	—	—	0.49
Middle Chattahoochee–Lake Harding	03130002	4.04	—	153.0	0.00	—	0.02
Middle Chattahoochee–Walter F. George Reservoir	03130003	5.50	—	30.52	21.23	—	0.01
Lower Chattahoochee River	03130004	4.15	0.00	0.09	0.00	0.00	42.54
Flint River Basin, totals	—	—	—	**61.64**	—	—	**2.35**
Upper Flint River	03130005	—	—	27.17	—	—	0.01
Middle Flint River	03130006	—	—	8.33	—	—	0.02
Kinchafoonee-Muckalee Creek	03130007	—	—	3.52	—	—	0.28
Lower Flint River	03130008	—	—	18.37	—	—	1.99
Ichawaynochaway Creek	03130009	—	—	2.20	—	—	0.05
Spring Creek	03130010	—	—	2.05	—	—	0.00
Total	—	**13.69**	**1.45**	**341.4**	**21.23**	**0.00**	**45.42**

Average annual public-supply losses in the Chattahoochee River Basin were estimated at 82 Mgal/d during 2010 (table 5). Because public-supplied deliveries were greatest in the Upper Chattahoochee River and the Middle Chattahoochee–Lake Harding subbasins, system losses were greatest as well. Public-supply losses were least in the Lower Chattahoochee River subbasin (table 6).

Self-Supplied Water Withdrawals

During 2010, self-supplied water users withdrew an annual average of 451 Mgal/d from groundwater and surface-water sources in the Chattahoochee River Basin (table 8); surface water accounted for 89 percent (402 Mgal/d) of this water (table 8). Of the 451 Mgal/d of self-supplied water withdrawn in the Chattahoochee River Basin, 60 percent (269 Mgal/d) was withdrawn in Georgia (table 9). Self-supplied water users in Florida withdrew an annual average of about 47 Mgal/d, the least amount of water withdrawn in the basin in 2010 (table 9). In Alabama, self-supplied water users withdrew an average of 135 Mgal/d in 2010 (table 9).

Among the water-use categories defined in this report, thermoelectric power (231 Mgal/d) and industrial (141 Mgal/d) facilities withdrew the greatest amount of water among self-supplied users in the Chattahoochee River Basin during 2010, and nearly all of the withdrawals were from surface water (table 8). In the Upper Chattahoochee River subbasin, the largest industrial uses of water were at poultry processing (food) facilities (0.21 Mgal/d). In the Middle Chattahoochee–Lake Harding subbasin, the largest industrial uses of water were at paper- and pulp-processing facilities (0.39 Mgal/d) and lumber and wood product facilities (0.11 Mgal/d). In the Middle Chattahoochee–Walter F. George Reservoir subbasin, the largest industrial uses of water were at paper- and pulp-processing facilities (28.6 Mgal/d), food manufacturing facilities (1.58 Mgal/d), and kaolin processing facilities (0.27 Mgal/d). In the Lower Chattahoochee River subbasin, the largest industrial uses of water were at paper- and pulp-processing facilities (109 Mgal/d), primary metal industries (0.28 Mgal/d), and thermoelectric-power facilities (0.17 Mgal/d).

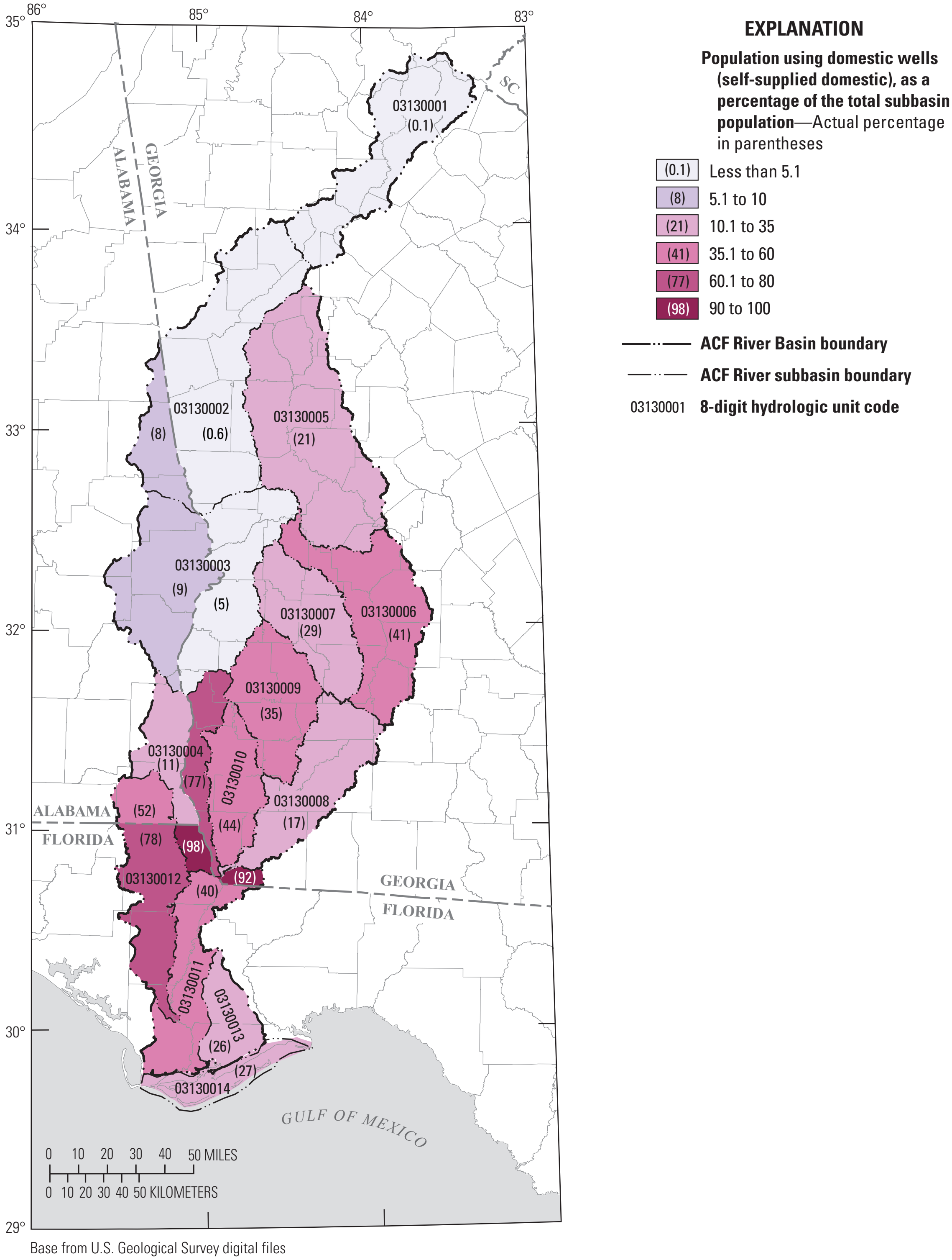
Table 10. Surface-water returns by 8-digit hydrologic unit code (HUC–8) and water-use category in the Apalachicola-Chattahoochee-Flint River Basin, Alabama, Florida, and Georgia, 2010.—Continued

[HUC–8, 8-digit hydrologic unit code; —, not applicable or basin does not extend into the State]

Surface-water returns by water-use category and State, (million gallons per day)						
Mining			Thermoelectric			Total returns
Alabama	Florida	Georgia	Alabama	Florida	Georgia	
0.00	**0.19**	**0.00**	**0.00**	**0.00**	**0.00**	**1.64**
—	0.00	0.00	—	0.00	0.00	1.35
0.00	0.19	—	0.00	0.00	—	0.30
—	0.00	—	—	0.00	—	0.00
—	0.00	—	—	0.00	—	0.00
0.00	**0.00**	**3.96**	**83.10**	**0.00**	**1.00**	**445.8**
—	—	0.34	—	—	0.00	97.03
0.00	—	3.52	1.56	—	1.00	163.1
0.00	—	0.10	0.00	—	0.00	57.36
0.00	0.00	0.00	81.54	0.00	0.00	128.3
—	**—**	**2.69**	**—**	**—**	**50.00**	**116.6**
—	—	2.69	—	—	0.00	29.87
—	—	0.00	—	—	0.00	8.35
—	—	0.00	—	—	0.00	3.80
—	—	0.00	—	—	50.00	70.36
—	—	0.00	—	—	0.00	2.25
—	—	0.00	—	—	0.00	2.05
0.00	**0.19**	**6.65**	**83.10**	**0.00**	**51.00**	**564.1**

Agricultural uses withdrew an annual average of about 55 Mgal/d or 12 percent of the self-supplied withdrawals in the Chattahoochee River Basin (table 9). Of the 55 Mgal/d withdrawn for agriculture, 66 percent was withdrawn in Georgia (36 Mgal/d), 24 percent was withdrawn in Alabama (13.4 Mgal/d), and the remaining 10 percent (5.2 Mgal/d) was withdrawn in Florida (table 9). An annual average of 8 Mgal/d of water was withdrawn for golf course irrigation in 2010 and 67 percent of that water was surface water (tables 8 and 9). Georgia withdrew the greatest amount of water for golf course irrigation in 2010 (table 9). Self-supplied water withdrawals were the least for mining (3.2 Mgal/d) and for commercial and public uses (0.60 Mgal/d) in the Chattahoochee River Basin; groundwater was the primary source of this water in 2010 (table 8). Mining withdrawals were greatest in the Upper Chattahoochee River (0.96 Mgal/d) and the Middle Chattahoochee–Lake Harding (1.25 Mgal/d) subbasins within Georgia (table 9). In Alabama, mining withdrawals were greatest in the Middle Chattahoochee–Walter F. George Reservoir (0.21 Mgal/d) and the Middle Chattahoochee–Lake Harding (0.07 Mgal/d) subbasins. In Alabama, water for commercial and public uses (0.14 Mgal/d) was only withdrawn in the Alabama portion of the Middle Chattahoochee–Walter F. George Reservoir subbasin, whereas in Florida self-supplied commercial and public users (0.44 Mgal/d) only withdrew water from the Lower Chattahoochee River subbasin (table 9).

During 2010, approximately 166,230 people in the Chattahoochee River Basin were served by private domestic wells (table 8). Nearly 84 percent of these people were in Georgia, 11 percent were in Alabama, and 5 percent were in Florida (table 8). The percentage of the population in each subbasin that was self supplied in 2010 is shown in figure 10. Among the four subbasins in the Chattahoochee River Basin, the Lower Chattahoochee River subbasin had the largest self-supplied population percentage (35 percent). About 2 percent of the population in the Middle Chattahoochee–Lake Harding subbasin was self supplied—the smallest percentage in the ACF River Basin. About 7 percent of the population was self supplied in the Upper Chattahoochee River subbasin.



Base from U.S. Geological Survey digital files

Figure 9. Subbasin population using domestic wells (self-supplied domestic population) as a percentage of the total subbasin population in the Apalachicola-Chattahoochee-Flint (ACF) River Basin, Alabama, Florida, and Georgia, 2010. Percentages may be different for neighboring States in the same river basin.

In the Georgia and Alabama parts of the Lower Chattahoochee River subbasin, the self-supplied populations were 77 and 11 percent, respectively. Between 5 and 10 percent of the population in the Middle Chattahoochee–Walter F. George Reservoir subbasin were self supplied (fig. 10).

In the Chattahoochee River Basin, groundwater withdrawals by self-supplied domestic users averaged 12.5 Mgal/d during 2010 (table 8). Surface water typically was not a source of water for self-supplied domestic uses. Because a per capita water-use coefficient of 75 gal/d was used to calculate self-supplied domestic use, the percentage of water used in this category mirrors the self-supplied population percentages. Thus, 84 percent of the self-supplied domestic water withdrawals were in Georgia (10.5 Mgal/d), 11 percent were in Alabama (1.3 Mgal/d) and 5 percent were in Florida (0.66 Mgal/d; table 9).

Among the four subbasins in the Chattahoochee River Basin, the greatest self-supplied domestic water withdrawals were in the Upper Chattahoochee River subbasin (8 Mgal/d; table 9). Self-supplied domestic withdrawals in the Middle Chattahoochee–Walter F. George Reservoir subbasin (1.61 Mgal/d) were nearly equally split between the Alabama and Georgia parts of this subbasin (table 9). An annual average of 0.71 Mgal/d was withdrawn by self-supplied domestic users in the Middle Chattahoochee–Lake Harding subbasin; 59 percent of the withdrawals were in Georgia and the remainder was in Alabama (table 9). In the Lower Chattahoochee River subbasin, self-supplied domestic users withdrew an annual average of 1.4 Mgal/d of groundwater; 47 percent in Florida (0.66 Mgal/d), 32 percent in Georgia (0.45 Mgal/d), and 21 percent in Alabama (0.29 Mgal/d).

Surface-Water Returns

In 2010, an annual average of 446 Mgal/d of water was discharged to surface water in the Alabama and Georgia parts of the Chattahoochee River Basin (table 10). In Florida, however, water was not discharged to surface water in the Chattahoochee River Basin. Public wastewater discharges contributed nearly 66 percent of the 446 Mgal/d returned to surface water in the Chattahoochee River Basin; 19 percent was returned by thermoelectric-power facilities (nearly all in Alabama), 14 percent by commercial and industrial facilities, and 1 percent by mining activities. In the Chattahoochee River Basin, surface-water returns from public wastewater, commercial and industrial, and mining facilities were greatest in Georgia. Surface-water returns were greatest in the Middle Chattahoochee–Lake Harding subbasin (163 Mgal/d) with nearly 97 percent discharged in Georgia (157 Mgal/d). Public wastewater discharges accounted for 99 and 97 percent of surface-water returns in the Upper Chattahoochee River and Middle Chattahoochee–Lake Harding subbasins, respectively. Surface-water returns from thermoelectric-power facilities were greatest in the Alabama part of the Lower Chattahoochee River subbasin (81 Mgal/d), whereas commercial and industrial returns were greatest in the Alabama part of the Middle Chattahoochee–Walter F. George Reservoir subbasin.

Water Use in the Flint River Basin

The Flint River Basin encompasses about 8,460 mi^2 in southwest Georgia (table 2, fig. 2). According to the 2010 U.S. Census, 848,460 people resided in the basin (U.S. Census Bureau, 2011a; table 2). About 61 percent of the public-supplied population relies on surface water for their water supply needs and 39 percent rely on groundwater (table 5). The Flint River Basin spans the Piedmont and Coastal Plain physiographic provinces (fig. 3). As a result, the topography, geology, climate, and water supply sources from the upper to the lower parts of the basin are markedly different. All of the principal aquifers in the ACF River Basin are present within the Flint River Basin (table 2).

An annual average of nearly 474 Mgal/d of groundwater and 200 Mgal/d of surface water was withdrawn from the Flint River Basin in 2010. The principal aquifers in the basin include the Crystalline-rock, Cretaceous aquifer, the Clayton aquifer, Claiborne aquifer, and Floridan aquifer system (table 2). A small percentage of water is withdrawn from the surficial aquifer system in the basin. Most of the groundwater is withdrawn from the Upper Floridan aquifer. The Flint River is the main source of surface water in the basin.

Public-Supply Water Withdrawals

In 2010, public water suppliers withdrew an average of 76 Mgal/d of water from all sources in the Flint River Basin; 54 percent of this water was groundwater (table 5). Among the six subbasins in the Flint River Basin, public-supply withdrawals were greatest in the Upper Flint River (HUC 03130005) and Middle Flint River (HUC 03130006) subbasins and were least in the Spring Creek subbasin (HUC 03130010; table 6). Of the 76 Mgal/d of water withdrawn by public water suppliers in the Flint River Basin, about 77 percent came from the Upper and Middle Flint River subbasins (table 6). In the Upper Flint River subbasin, an average of 38.4 Mgal/d of water was withdrawn by public suppliers in 2010, accounting for 50 percent of the public-supplied water in the Flint River Basin (table 6). About 92 percent of the water withdrawn in the Upper and Middle Flint River subbasins was surface water, and public water suppliers withdrew only surface water in the Upper Flint River subbasin. Public water suppliers in the Middle Flint River subbasin withdrew an annual average of 20.3 Mgal/d, accounting for 27 percent of the public-supplied water withdrawn from the Flint River Basin in 2010. Withdrawals for public supply in the Lower Flint River subbasin (HUC 03130008) amounted to 7.3 Mgal/d and were 2.5–3.3 times greater than the withdrawals from the Ichawaynochaway Creek (HUC 03130009; 2.8 Mgal/d) and Spring Creek subbasins (2.2 Mgal/d, table 7).

Public-Supplied Water Deliveries

The 2010 population in the Flint River Basin was 848,460 (U.S. Census Bureau, 2011a) and 639,930 (about 75 percent) were served by public water suppliers (table 5). The remaining 208,530 people were self supplied by onsite domestic wells. Groundwater was the water source for 39 percent of the public-supplied population (245,310 people) in the Flint River Basin during 2010 (table 5).

During 2010, an annual average of nearly 95 Mgal/d of water was delivered to domestic, commercial and public, and industrial customers (including system losses) by public water suppliers in the Flint River Basin (table 5). An average of 19 Mgal/d of public-supplied water was delivered into the Flint River Basin from other basins and accounts for the difference between the amounts withdrawn and delivered. The total amount of water delivered by public suppliers includes an average of 15 Mgal/d of water lost from distribution systems (system losses; table 5).

Among the six subbasins, public-supplied deliveries were greatest in the Upper Flint (58 Mgal/d) and Lower Flint River (22 Mgal/d) subbasins; these subbasins accounted for nearly 84 percent of public-supplied deliveries in the Flint River Basin (table 6). Public-supplied deliveries were least in the Spring Creek subbasin (2.3 Mgal/d; table 6).

Deliveries for domestic uses (about 60 Mgal/d) accounted for 62 percent of all public-supplied deliveries in the Flint River Basin (table 6). Domestic deliveries were greatest in the Upper Flint River subbasin (about 40 Mgal/d) and least in the Ichawaynochaway Creek subbasin (1.2 Mgal/d). Domestic deliveries in the Lower Flint River subbasin (11 Mgal/d) accounted for 19 percent of all domestic deliveries in the Flint River Basin. Domestic deliveries in the Kinchafoonee-Muckalee Creek (3.9 Mgal/d) and Middle Flint River (2.6 Mgal/d) subbasins accounted for 6.5 and 4.3 percent, respectively, of the domestic deliveries in the Flint River Basin.

In the Flint River Basin during 2010, public water suppliers delivered an annual average of 14 Mgal/d to commercial and public-use customers and 6.4 Mgal/d to industrial customers (table 5). Deliveries for commercial and public-use customers and for industrial customers were greatest in the Upper Flint River subbasin (6.7 and 2.8 Mgal/d, respectively) and were least in the Spring Creek subbasin (0.42 and 0.01 Mgal/d, respectively; table 6).

Total public-supply losses in the Flint River Basin were estimated at 14 Mgal/d during 2010 (table 6) and represent an estimated loss of 17.5 percent of all withdrawals by public suppliers in the Flint River Basin. Because public-supply deliveries were greatest in the Upper and Lower Flint River subbasins, public-supply losses were greatest as well. Public-supply losses were 7.1 Mgal/d in the Upper Flint River subbasin and 3.1 Mgal/d in the Lower Flint River subbasin (table 6). Public-supply losses were least in the Spring Creek subbasin (0.42 Mgal/d).

Self-Supplied Water Withdrawals

During 2010, self-supplied water users withdrew an annual average of about 599 Mgal/d from groundwater and surface-water sources in the Flint River Basin (table 8). About 72 percent of these withdrawals were groundwater (433 Mgal/d). The self-supplied domestic population relied solely on groundwater as the source of their water.

The 2010 self-supplied domestic population in the Flint River Basin was estimated at 208,530, representing about 25 percent of the total population in the Flint River Basin (tables 2 and 8). The Upper Flint River subbasin had the largest self-supplied domestic population (114,510 people), which represents 21 percent of the 2010 population in the Upper Flint River subbasin (fig. 10). The Spring Creek and Middle Flint River subbasins had the largest percentage of people that were self supplied among all subbasins in the Flint River Basin (fig. 10). In the Spring Creek subbasin, the self-supplied population was 10,020 or about 44 percent of the 2010 population in the subbasin, whereas in the Middle Flint River subbasin the self-supplied population was 34,370 or about 41 percent of the 2010 population in the subbasin. In contrast, the self-supplied population in the Lower Flint River subbasin was 18,770, representing 17 percent of the total population in the subbasin (table 9, fig. 10).

In the Flint River Basin, an estimated annual average of 15.6 Mgal/d of groundwater was withdrawn by self-supplied domestic users during 2010 (table 8). Of the 15.6 Mgal/d withdrawn by self-supplied domestic users, about 55 percent was withdrawn in the Upper Flint River subbasin and 16 percent was withdrawn in the Middle Flint River subbasin (table 9). Self-supplied domestic withdrawals were least in the Ichawaynochaway Creek subbasin (0.57 Mgal/d; table 9).

Agricultural uses withdrew the most water in the Flint River Basin during 2010; these withdrawals averaged 501 Mgal/d or 84 percent of all self-supplied water withdrawals in the Flint River Basin (table 8). Groundwater was the source for 80 percent of agricultural withdrawals in 2010 (table 8). Agricultural withdrawals were greatest in the Lower Flint River (143 Mgal/d), the Spring Creek (118 Mgal/d), and the Ichawaynochaway Creek (about 97 Mgal/d) subbasins—accounting for 71 percent of all agricultural withdrawals in the Flint River Basin (table 9). In contrast, agricultural withdrawals were least in the Upper Flint River subbasin (7.9 Mgal/d).

Self-supplied withdrawals for commercial and public (2 percent) and industrial (98 percent) uses averaged 23.1 Mgal/d (table 9), with slightly more groundwater than surface water withdrawn during 2010 (table 8). Of the 23.1 Mgal/d withdrawn for commercial and industrial uses, 59 percent were in the Middle Flint River subbasin and about 32 percent were in the Lower Flint River subbasin (table 9). In the Middle Flint River subbasin, the chemical (9.2 Mgal/d) and beverage (2.8 Mgal/d) industries withdrew the most water during 2010 (appendix 3). Moreover, the paper- and pulp-processing (5.4 Mgal/d) and chemical (0.94 Mgal/d) industries withdrew the most water in the Lower Flint River subbasin (appendix 3).

Surface-Water Returns

In 2010, an average of 117 Mgal/d of water was discharged to surface water in the Flint River Basin (table 10). Public wastewater discharges contributed 53 percent of these returns, whereas thermoelectric-power facilities contributed 43 percent. In 2010, public wastewater discharges were greatest in the Upper Flint River (27 Mgal/d) and Lower Flint River (18 Mgal/d) subbasins, accounting for 74 percent of the public wastewater discharges in the Flint River Basin. Surface-water returns from thermoelectric-power facilities (50 Mgal/d) and most of the commercial and industrial returns (2 Mgal/d) occurred in the Lower Flint River subbasin. All of the surface-water returns from mining activities (2.7 Mgal/d) were in the Upper Flint River subbasin.

Water-Use Trends in the Apalachicola-Chattahoochee-Flint River Basin, 1985–2010

Water withdrawals in the ACF River Basin have varied during the 25 years between 1985 and 2010 (fig.10). Surface-water withdrawals declined between 1985 and 2000, sharply increased in 2000, and declined again between 2000 and 2010. In contrast, groundwater withdrawals increased between 1985 and 2000, declined in 2005, and increased between 2005 and 2010.

Apalachicola River Basin

Between 1995 and 2010, water withdrawals in the Apalachicola River Basin declined substantially (fig. 11). Groundwater withdrawals peaked in 1995 and by 2005 had declined by nearly 32 percent. Groundwater withdrawals in 2010, however, were nearly 18 percent greater than in 2005. In contrast, surface-water withdrawals peaked in 1990 at 41.7 Mgal/d and by 2010 had declined 94 percent to 2.5 Mgal/d (fig. 11).

In the Chipola River subbasin, the 25-year trends in groundwater and surface-water withdrawals were markedly different (fig. 11). Groundwater withdrawals increased by nearly 100 percent between 1985 and 2000. Since 2000, groundwater withdrawals in the Chipola River subbasin declined, on average, about 9 percent; however, between 2000 and 2005 withdrawals declined 23 percent. Surface-water withdrawals in the Chipola River subbasin declined from 36.8 to 0.72 Mgal/d in 2010—a 98-percent decrease (fig. 11).

In the Apalachicola River, New River, and Apalachicola Bay subbasins, the 25-year trend in groundwater and surface-water withdrawals was also substantially different. Groundwater withdrawals in the Apalachicola River subbasin peaked at 18.9 Mgal/d in 1995, declined to 8.1 Mgal/d by 2005 (a 57-percent decrease), and increased slightly between 2005 and 2010 (fig. 11). Between 1985 and 2010, groundwater withdrawals were relatively constant in the New River and Apalachicola Bay subbasins. Surface-water withdrawals in the Apalachicola River subbasin peaked at 4.9 Mgal/d in

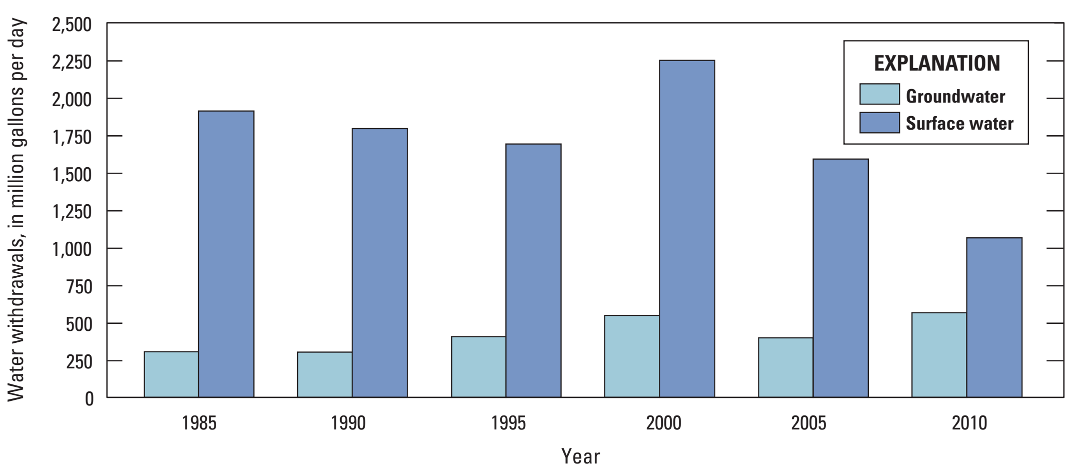


Figure 10. Trends in surface-water and groundwater withdrawals in the Apalachicola-Chattahoochee-Flint (ACF) River Basin, 1985–2010.

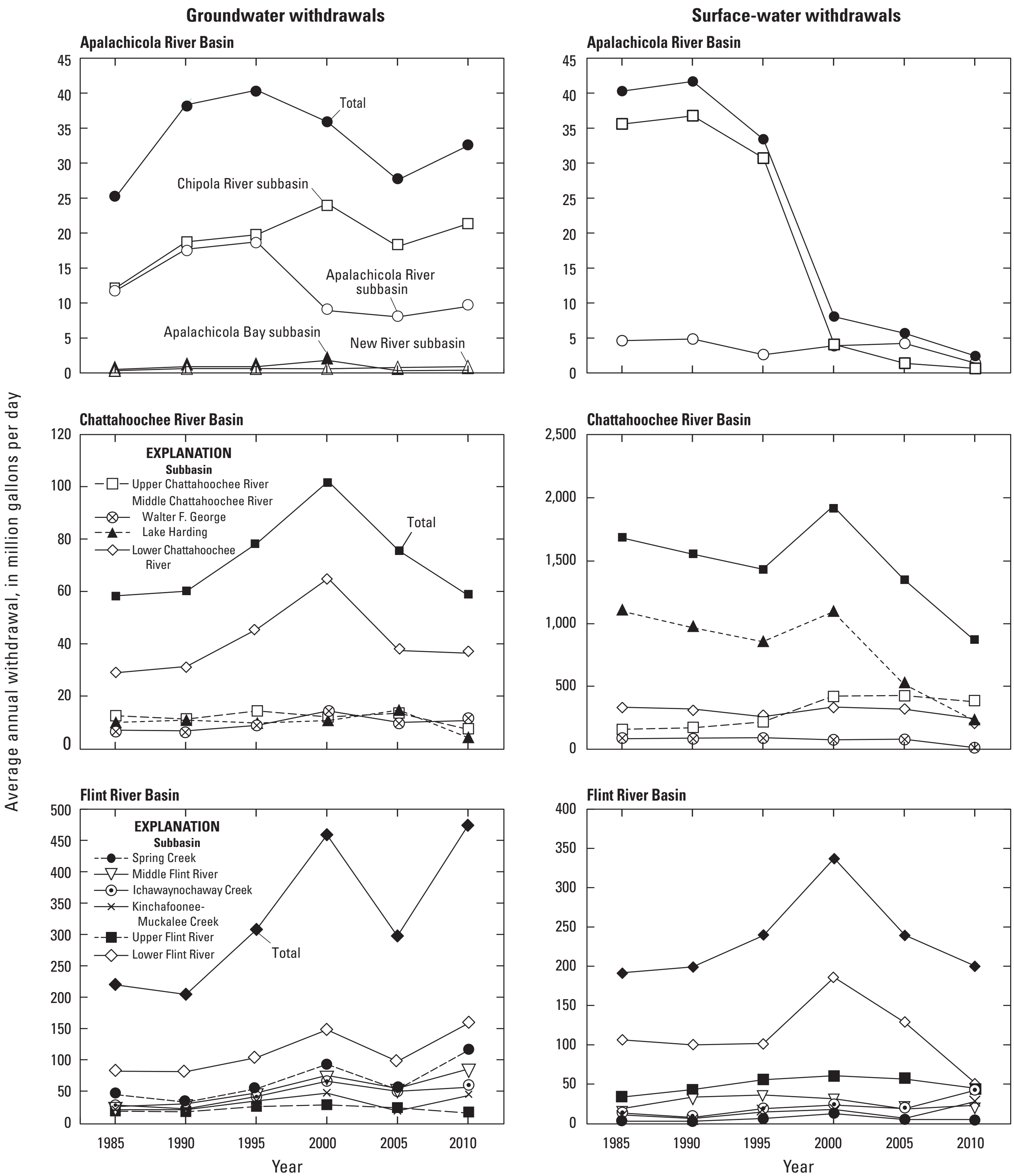


Figure 11. Trends in surface-water and groundwater withdrawals for subbasins in the Apalachicola, Chattahoochee, and Flint River Basins, 1985–2010.

1990, declined to 2.7 Mgal/d by 2000 (a 45-percent decrease), increased to 4.3 Mgal/d by 2005 (a 60-percent increase), and decreased to 1.5 Mgal/d in 2010 (a 65-percent decrease between 2005 and 2010; fig. 11). Surface water was not withdrawn in the New River subbasin until 2010, when 0.28 Mgal/d was withdrawn; surface water has not been withdrawn in the Apalachicola Bay subbasin.

Chattahoochee River Basin

During the 25 years between 1985 and 2010, water withdrawals in the Chattahoochee River Basin were greatest in 2000 (fig. 11). The high water use in 2000 probably is due to drought conditions in the basin, in which precipitation was 40–60 percent below normal (National Oceanic and Atmospheric Administration, 2014). The total water withdrawal trend in the Chattahoochee River Basin was affected by the trend in surface-water withdrawals. Water withdrawals decreased by 13 percent from 1985 to 1995, increased by 35 percent from 1995 to 2000, and then declined 54 percent from 2000 to 2010 (fig. 11).

In the Chattahoochee River Basin, groundwater withdrawals increased 75 percent from 1985 to 2000 and decreased 43 percent by 2010 (fig. 11). The trend in groundwater withdrawals from the Lower Chattahoochee River subbasin mirrored the trend for the Chattahoochee River Basin. In the Upper Chattahoochee River and the Middle Chattahoochee–Lake Harding subbasins, the trends in groundwater withdrawals were markedly similar to each other (fig. 11). In these two subbasins, groundwater withdrawals were greatest in 1995 and 2005. The trend in groundwater withdrawals from the Middle Chattahoochee–Walter F. George Reservoir subbasin mirrored the trend seen in the Lower Chattahoochee River subbasin, although on a smaller scale.

In contrast, surface-water withdrawals decreased by 15 percent from 1985 to 1995, increased by 35 percent from 1995 to 2000, and decreased by 55 percent from 2000 to 2010. The trend in surface-water withdrawals for the Middle Chattahoochee–Lake Harding subbasin mirrored the surface-water trend seen for the entire Chattahoochee River Basin (fig. 11). Surface-water withdrawals in the Upper Chattahoochee River subbasin gradually increased from 1985 to 2000 and were constant from 2000 to 2010. In the Lower Chattahoochee River subbasin, surface-water withdrawals declined slightly from 1985 to 1995, increased from 1995 to 2000, then decreased from 2000 to 2010. From 1985 to 2005, surface-water withdrawals in the Middle Chattahoochee–Walter F. George subbasin were constant and declined nearly 82 percent from 2005 to 2010.

Flint River Basin

Between 1985 and 2010, the trends in groundwater and surface-water withdrawals were similar in the Flint River Basin (fig. 11). After steady increases in groundwater withdrawals (15.9 million gallons per day per year, Mgal/d/yr) and surface-water withdrawals (9.7 Mgal/d/yr) since 1990, withdrawals peaked in 2000. In 2005, groundwater withdrawals were 35 percent and surface-water withdrawals were 29 percent less than the withdrawals in 2000. Moreover, groundwater withdrawals in 2010 were 59 percent greater than in 2005, whereas surface-water withdrawals continued to decrease.

Because agricultural water use, primarily crop irrigation, withdraws most of the self-supplied water withdrawals (and most of the groundwater withdrawals) in the Flint River Basin, the amount of water withdrawn in any given year is dependent on rainfall patterns in the basin. Rainfall in 2000 and 2010, especially during the growing season, was well below the 30-year average. As a result, groundwater withdrawals for crop irrigation were greatest in those 2 years and least in 2005, which was a wetter than average year. In contrast to the groundwater withdrawals, surface-water withdrawals decreased by 41 percent between 2000 and 2010, an average decline of 13.7 Mgal/d/yr. In 2010, thermoelectric-power facilities using once-through cooling systems needed less water for cooling than in previous years. The decrease in surface-water withdrawals by thermoelectric-power facilities in the Lower Flint River subbasin offset any increases in surface-water withdrawals because of below average rainfall.

Summary

The Apalachicola-Chattahoochee-Flint (ACF) River Basin drains 20,227 square miles (mi^2) in north-central, west-central, and southwestern parts of Georgia, southeastern Alabama, and the central panhandle of northwestern Florida. The basin extends from north Georgia to Apalachicola Bay in the Gulf of Mexico and includes all or part of 80 counties—10 in Alabama, 8 in Florida, and 62 in Georgia. The three major rivers that exist in the basin are the Apalachicola, Chattahoochee, and Flint Rivers. The ACF River Basin is within parts of the Blue Ridge, Piedmont, and Coastal Plain physiographic provinces. Similar to much of the southeastern United States, the basin's physiography reflects a geologic history of mountain building in the Appalachian Mountains, and long periods of repeated land submergence in the Coastal Plain Province.

The population of the ACF River Basin was 3.835 million in 2010, a 45-percent increase from the 1990 population of nearly 2.636 million. About 92 percent of the 2010 ACF population resided in Georgia and nearly 75 percent of the Georgia population lived in the Atlanta metropolitan area.

In 2010, about 1,645 million gallons per day (Mgal/d) of water was withdrawn from groundwater (576 Mgal/d) and surface-water (1,069 Mgal/d) sources in the ACF River Basin. About 70 percent of all water withdrawals were by self-supplied agricultural water users and public water suppliers. About 35 percent of all withdrawals were groundwater; nearly 38 percent of the groundwater withdrawals came from the Upper Floridan aquifer and nearly 34 percent from the Claiborne aquifer. The Crystalline-rock aquifers accounted for only 4.5 percent of groundwater withdrawals in the ACF River Basin. Of the groundwater withdrawn in the ACF River Basin, 89 percent was withdrawn in Georgia and about 11 percent (5.5 percent each) was withdrawn in Alabama and Florida during 2010.

Georgia withdrew about 83 percent of the surface water in the ACF River Basin, whereas Alabama withdrew 13 percent and Florida about 4 percent. Total water use in the ACF River Basin was 1,593 Mgal/d in 2010; about 56 Mgal/d of water that was withdrawn in the basin was delivered (interbasin transfers) to river basins beyond the ACF River Basin. About 564 Mgal/d of water was returned to surface-water bodies in the ACF River Basin.

About 3.52 million people were served by public water suppliers in the ACF River Basin during 2010. Water from surface-water sources was delivered to 3.1 million people (88 percent) and 415,000 people were served by public-supplied groundwater. Georgia had the largest public-supplied population, representing nearly 94 percent (3.29 million) of the public-supplied population in the ACF River Basin. Public water suppliers served 193,700 people (5.5 percent) in Alabama and 31,880 people in Florida.

Public water suppliers in the ACF River Basin withdrew about 568 Mgal/d of water in 2010 and 88 percent of that amount was surface water. Among the public water suppliers in the ACF River Basin, those in Georgia withdrew the most water in 2010—about 94 percent of all public-supply withdrawals (mostly surface water). Public water suppliers in Alabama withdrew slightly more surface water than groundwater and in Florida only groundwater was withdrawn.

Public water suppliers delivered nearly 515 Mgal/d to customers within their respective service areas in 2010. Domestic uses accounted for nearly 56 percent (287 Mgal/d) of public-supplied deliveries. Commercial and public-use deliveries were 88 Mgal/d and represent 17 percent of all public-supplied deliveries in the ACF River Basin, and industrial deliveries were 39 Mgal/d and represent nearly 7.7 percent of all public-supplied deliveries in the ACF River Basin. System losses were estimated at 101 Mgal/d, which account for 19 percent of deliveries in the ACF River Basin. Interbasin transfers to river basins outside of the ACF River Basin amounted to about 56 Mgal/d and represent the difference between public-supply withdrawals and deliveries. The per capita use of public-supplied water was 153 gal/d in Alabama, 183 gal/d in Florida, and 168 gal/d in Georgia.

About 65 percent (1,078 Mgal/d) of all water withdrawals in the ACF River Basin were by self-supplied water users. Among this group, an average of about 508 Mgal/d was withdrawn from groundwater and 570 Mgal/d from surface water in 2010. Self-supplied users in the Georgia part of the ACF River Basin withdrew the largest amounts of groundwater and surface water.

Agricultural users in the ACF River Basin withdrew on average the largest amounts of self-supplied water (576 Mgal/d), about 35 percent of all water withdrawn in 2010. In addition, 445 Mgal/d was withdrawn by self-supplied thermoelectric-power facilities (about 282 Mgal/d; 17 percent of all withdrawals) and industrial facilities (about 164 Mgal/d; 10 percent of all withdrawals). The paper and pulp industries withdrew 143 Mgal/d of water, by far the greatest amount of self-supplied industrial water withdrawn from the ACF River Basin during 2010.

In 2010, an average of 564 Mgal/d of treated and untreated water was discharged to the surface waters in the ACF River Basin. Most of that amount, 357 Mgal/d or 63 percent was treated wastewater discharged by public wastewater-treatment facilities. Water used for once-through cooling by thermoelectric-power facilities (134 Mgal/d) accounted for nearly 24 percent of the surface-water returns in the basin.

Apalachicola River Basin

The Apalachicola River Basin encompasses 3,190 mi^2 in the Coastal Plain physiographic province and consists of four subbasins: Apalachicola River (HUC 03130011), Chipola River (HUC 03130012), New River (HUC 03130013), and

Apalachicola Bay (HUC 03130014). The basin occupies parts of in Alabama, Florida, and Georgia. The 2010 population in the basin was nearly 112,000 and 71 percent of that population lived in Florida. Of the nearly 112,000 people in the basin, nearly 68 percent lived in the Chipola River subbasin. About 1 percent of the basin population lived in Georgia, all in the Apalachicola River subbasin. The Apalachicola River is formed by the confluence of the Chattahoochee and Flint Rivers at the Jim Woodruff Lock and Dam, which impounds Lake Seminole. The Apalachicola River flows from Jim Woodruff Lock and Dam to Apalachicola Bay in the Gulf of Mexico.

Groundwater is the primary source of water for public and self-supplied water users in the Apalachicola River Basin. The geology of the basin consists of Coastal Plain sediments deposited during a series of transgressions and regressions of a prehistoric sea. The Floridan aquifer system consists of the Upper and Lower Floridan aquifers and is the principal aquifer system in the Apalachicola River Basin.

The principal surface-water resources in the Apalachicola River Basin are the Apalachicola River, the Chipola River, and the New River. Two canals facilitate the transfer of water between subbasins within the ACF River Basin. The Chipola Cutoff conveys water from the Apalachicola River to the Chipola River near Wewahitchka, Fla., in the Chipola River subbasin. The Brickyard Cutoff conveys water from the Apalachicola River to the Brothers River near Sumatra, Fla., in the New River subbasin.

In 2010, public water suppliers withdrew an average of 7.9 Mgal/d from groundwater sources in the Apalachicola River Basin; this amount represents nearly 12 percent of the groundwater withdrawn for public supply in the ACF River Basin and 1.4 percent of all withdrawals for public supply in the ACF River Basin. Of all water withdrawn by public water suppliers in the Apalachicola River Basin, 73 percent (5.8 Mgal/d) was withdrawn in Florida and 27 percent (2.1 Mgal/d) was withdrawn in Alabama. Among the four subbasins in the Apalachicola River Basin, public-supply withdrawals were greatest in the Chipola River subbasin at 3.6 Mgal/d (58 percent withdrawn in Alabama) and least in the Apalachicola Bay subbasin at 0.86 Mgal/d.

During 2010, an average of 6.3 Mgal/d of water was delivered to domestic, commercial and public, and industrial customers by public water suppliers in the Alabama and Florida parts of the Apalachicola River Basin. Deliveries for domestic uses (3.8 Mgal/d) accounted for 60 percent of all public-supply deliveries in the Apalachicola River Basin. Domestic deliveries were greatest in Florida, accounting for 83 percent of all domestic deliveries. Public-supply deliveries for commercial and public and industrial uses in the Apalachicola River Basin amounted to 1.39 Mgal/d in 2010. Of the 1.39 Mgal/d, only 8.6 percent was delivered for industrial uses. Deliveries for commercial and public and industrial uses were greatest in the Chipola River subbasin.

Chattahoochee River Basin

The Chattahoochee River Basin drains 8,580 mi^2 and consists of four subbasins in Georgia, Florida, and Alabama: the Upper Chattahoochee River (HUC 03130001), the Middle Chattahoochee River–Lake Harding (HUC 03130002), the Middle Chattahoochee River–Walter F. George Reservoir (HUC 03130003), and the Lower Chattahoochee River (HUC 03130004). Sixty-eight percent of the Chattahoochee River Basin is in Georgia, 29 percent in Alabama, and the remainder in Florida. The 2010 population in the Chattahoochee River Basin was 2.88 million people, nearly 93 percent of that population resided in Georgia and nearly 7 percent resided in Alabama. The Upper Chattahoochee River subbasin was the most populous in the Chattahoochee River Basin with 1.53 million people in 2010. Most of Alabama's population (161,000 people) resided in the Middle Chattahoochee–Lake Harding and Walter F. George Reservoir subbasins. About 9,000 people resided in the Florida part of the Lower Chattahoochee River subbasin.

The headwaters of the Chestatee and Chattahoochee Rivers originate as small springs in the Blue Ridge physiographic province near the north Georgia town of Helen. From its headwaters, the Chattahoochee River flows 436 miles (mi) southwestward through the Piedmont physiographic province, then southward in the Coastal Plain physiographic province, and into Lake Seminole. The Chattahoochee River flows through the urban areas of Metropolitan Atlanta and Columbus, Ga., and Phenix City, Ala. The river is controlled by 16 dams, but only 5 dams impound major reservoirs and control streamflow in the river: Buford (forming Lake Lanier), West Point Lake, Lake Harding, Walter F. George, and Jim Woodruff Lock and Dam (Lake Seminole). From the West Point Lake dam to Jim Woodruff Lock and Dam at Lake Seminole, the Chattahoochee River defines the State boundaries of Alabama and Georgia.

The hydrologic setting of the basin is such that more surface water than groundwater is used in the Chattahoochee River Basin; however, small amounts of groundwater are used in the basin. The principal aquifer in the Upper Chattahoochee River and the Middle Chattahoochee–Lake Harding subbasins is the Crystalline-rock aquifers. This aquifer is a fracture-conduit aquifer that consists of fractured and crushed igneous and metamorphic parent rocks. Because of the limited storage in fractures, water levels in fracture-conduit aquifers typically respond rapidly to pumping. Typical pumping rates range from 1 to 25 gallons per minute (gpm), but can be as much as 550 gpm. The Cretaceous aquifer system is the primary aquifer in the Middle Chattahoochee–Walter F. George Reservoir subbasin. In the Lower Chattahoochee River subbasin, the principal aquifers are the Clayton (Nanfalia-Clayton aquifer in Alabama; 65 percent), Claiborne (Lisbon aquifer in Alabama; 20 percent), and the Upper Floridan (15 percent).

An annual average of nearly 935 Mgal/d of water was withdrawn from groundwater and surface-water sources in the Chattahoochee River Basin during 2010. Surface-water withdrawals averaged 866 Mgal/d or 93 percent and groundwater withdrawals averaged 69 Mgal/d (7 percent).

In 2010, public water suppliers withdrew an annual average of 483 Mgal/d of water from all sources in the Chattahoochee River Basin; 96 percent of this water was surface water. Of all public-supplied water withdrawn in the Chattahoochee River Basin, about 94 percent was withdrawn in Georgia and about 6 percent was withdrawn in Alabama. An annual average of 366 Mgal/d of water was withdrawn by public water suppliers in the Upper Chattahoochee River subbasin during 2010, which represents about 76 percent of all water withdrawn by public suppliers in the Chattahoochee River Basin. In the Middle Chattahoochee–Lake Harding subbasin, public water suppliers withdrew an annual average of 93 Mgal/d in 2010; 93 percent was withdrawn in Georgia (86 Mgal/d) and the remainder was withdrawn in Alabama (6.3 Mgal/d).

During 2010, about 2.71 million people in the Chattahoochee River Basin were served by public water suppliers. Surface water was the source of water for nearly 96 percent of the population served by public water suppliers. Groundwater was used as a source of public-supplied water for 117,570 people in the Chattahoochee River Basin. About 410 Mgal/d of water were delivered to domestic, commercial and public, and industrial customers by public water suppliers in the Chattahoochee River Basin. These deliveries include 82 Mgal/d of water lost from public-supply distribution systems (system losses). Of the 410 Mgal/d of water delivered by public water suppliers in the Chattahoochee River Basin, 77 percent was used in the Upper Chattahoochee River (318 Mgal/d) and 16 percent was used in the Middle Chattahoochee–Lake Harding subbasins (68 Mgal/d). Public-supplied deliveries were least in the Lower Chattahoochee River subbasin (5.9 Mgal/d). Domestic deliveries in Georgia were greatest in the Upper Chattahoochee River subbasin (173 Mgal/d) and least in the Lower Chattahoochee River subbasin (0.24 Mgal/d). In Alabama, public-supplied deliveries were greatest in the Middle Chattahoochee–Walter F. George Reservoir subbasin (6.3 Mgal/d) and least in the Middle Chattahoochee–Lake Harding subbasin (1.9 Mgal/d). Domestic deliveries in the Middle Chattahoochee–Walter F. George Reservoir and the Lower Chattahoochee River subbasins were greater in Alabama than in Georgia.

During 2010, self-supplied water users withdrew an annual average of 451 Mgal/d from groundwater and surface-water sources in the Chattahoochee River Basin; surface water accounted for 89 percent (402 Mgal/d) of this water. Of the 451 Mgal/d of self-supplied water withdrawn in the Chattahoochee River Basin, 60 percent (269 Mgal/d) was withdrawn in Georgia. Self-supplied water users in Florida withdrew an annual average of about 47 Mgal/d, the least amount of water withdrawn in the basin in 2010. In Alabama, self-supplied water users withdrew an average of 135 Mgal/d in 2010. Among the water-use categories defined in this report, thermoelectric power (231 Mgal/d) and industrial (141 Mgal/d) facilities withdrew the greatest amount of water among self-supplied users in the Chattahoochee River Basin during 2010, and nearly all of the withdrawals were from surface water.

During 2010, approximately 166,230 people in the Chattahoochee River Basin were served by private domestic wells. Nearly 84 percent of these people were in Georgia, 11 percent were in Alabama, and 5 percent were in Florida. Among the four subbasins in the Chattahoochee River Basin, the Lower Chattahoochee River subbasin had the largest self-supplied population percentage (35 percent).

Agricultural uses withdrew an annual average of about 55 Mgal/d or 12 percent of the self-supplied withdrawals in the Chattahoochee River Basin. Of the 55 Mgal/d withdrawn for agriculture, 66 percent was withdrawn in Georgia (36 Mgal/d), 24 percent was withdrawn in Alabama (13.4 Mgal/d), and the remaining 10 percent (5.2 Mgal/d) was withdrawn in Florida. An annual average of 8 Mgal/d of water was withdrawn for golf course irrigation in 2010 and 67 percent of that water was surface water. Georgia withdrew the greatest amount of water for golf course irrigation in 2010. Self-supplied water withdrawals were the least for mining (3.2 Mgal/d) and for commercial and public uses (0.60 Mgal/d) in the Chattahoochee River Basin; groundwater was the primary source of this water in 2010.

In 2010, an annual average of 446 Mgal/d of water was discharged to surface water in the Alabama and Georgia parts of the Chattahoochee River Basin. In Florida, however, water was not discharged to surface water in the Chattahoochee River Basin. Public wastewater discharges contributed nearly 66 percent of the 446 Mgal/d returned to surface water in the Chattahoochee River Basin; 19 percent was returned by thermoelectric-power facilities (nearly all in Alabama), 14 percent by commercial and industrial facilities, and 1 percent by mining activities. In the Chattahoochee River Basin, surface-water returns from public wastewater, commercial and industrial, and mining facilities were greatest in Georgia.

Flint River Basin

The Flint River Basin occupies about 8,460 mi^2 entirely within Georgia and consists of six subbasins: Upper Flint River (HUC 03130005), Middle Flint River (HUC 03130006), Kinchafoonee-Muckalee Creek (HUC 03130007), Lower Flint River (HUC 03130008), Ichawaynochaway Creek (HUC 03130009), and Spring Creek (HUC 03130010). The 2010 population in the Flint River Basin was 848,460 and 63 percent of those people lived in the Upper Flint River subbasin. The Ichawaynochaway Creek and Spring Creek were the least populated subbasins in the Flint River Basin.

About 75 percent of the Upper Flint River subbasin is within the Piedmont physiographic province, and the remainder of the subbasin is within the Coastal Plain physiographic province. The Flint River originates just south of Atlanta, Ga., in the Piedmont physiographic province and flows 346 mi south and then southwestward through the agricultural areas of the Coastal Plain physiographic province in southwestern Georgia.

Surface water is the primary source of water used in the Upper Flint River subbasin. Eight water supply reservoirs are on tributaries in the Upper Flint River subbasin. Groundwater, however, is the primary source of water used in the other Flint River subbasins. All five of the principal aquifers in the ACF River Basin are represented in the Flint River Basin. The principal aquifer in the Upper Flint River subbasin is the Crystalline-rock aquifers, but some water is withdrawn from the Cretaceous aquifer system where the subbasin overlaps the Coastal Plain physiographic province. In the Middle Flint River subbasin, groundwater is withdrawn almost equally among the Claiborne, Cretaceous, and Upper Floridan aquifers and the remainder from the Clayton aquifer. In the Kinchafoonee-Muckalee Creek subbasin, groundwater is withdrawn from the Clayton, Claiborne, and Cretaceous aquifers. Nearly all of the groundwater withdrawn from the Lower Flint River subbasin and most of the groundwater withdrawals in the Spring Creek subbasin are from the Upper Floridan aquifer. In the Ichawaynochaway Creek subbasin, the Clayton and Claiborne aquifers are the primary sources of groundwater.

An annual average of nearly 474 Mgal/d of groundwater and 200 Mgal/d of surface water was withdrawn from the Flint River Basin in 2010. The principal aquifers in the basin include the Crystalline-rock aquifers, Cretaceous aquifer, the Clayton aquifer, Claiborne aquifer, and Floridan aquifer system. A small percentage of water is withdrawn from the surficial aquifer system in the basin. Most of the groundwater is withdrawn from the Upper Floridan aquifer. The Flint River is the main source of surface water in the basin.

In 2010, public water suppliers withdrew an average of 76 Mgal/d of water from all sources in the Flint River Basin; 54 percent of this water was groundwater. Among the six subbasins in the Flint River Basin, public-supply withdrawals were greatest in the Upper Flint River (HUC 03130005; 38.4 Mgal/d) and Middle Flint River (HUC 03130006; 20.3 Mgal/d) subbasins and were least in the Spring Creek subbasin (HUC 03130010). Of the 76 Mgal/d of water withdrawn by public water suppliers in the Flint River Basin, about 50 percent came from the Upper Flint River subbasin and 27 percent from the Middle Flint River subbasin. About 92 percent of this water was surface water, and public water suppliers withdrew only surface water in the Upper Flint River subbasin.

The 2010 population in the Flint River Basin was 848,460 and 639,930 (about 75 percent) were served by public water suppliers. The remaining 208,530 people were self supplied by onsite domestic wells. Groundwater was the water source for 39 percent of the public-supplied population (245,310 people) in the Flint River Basin during 2010.

During 2010, an annual average of nearly 95 Mgal/d of water was delivered to domestic, commercial and public, and industrial customers (including system losses) by public water suppliers in the Flint River Basin. An average of 19 Mgal/d of public-supplied water was delivered into the Flint River Basin from other basins and accounts for the difference between the amounts withdrawn and delivered.

The total amount of water delivered by public suppliers includes an average of 15 Mgal/d of water lost from distribution systems (system losses). Deliveries for domestic uses (about 60 Mgal/d) account for 62 percent of all public-supplied deliveries in the Flint River Basin. In the Flint River Basin during 2010, public water suppliers delivered an annual average of 14 Mgal/d to commercial and public-use customers and 6.4 Mgal/d to industrial customers. Total public-supply losses in the Flint River Basin were estimated at 14 Mgal/d during 2010 and represent an estimated loss of 17.5 percent of all withdrawals by public suppliers in the Flint River Basin. Public-supplied deliveries were greatest in the Upper Flint River subbasin for all water-use categories.

During 2010, self-supplied water users withdrew an annual average of about 599 Mgal/d from groundwater and surface-water sources in the Flint River Basin. About 72 percent of these withdrawals were groundwater (433 Mgal/d). The self-supplied domestic population relied solely on groundwater as the source of their water.

The 2010 self-supplied domestic population in the Flint River Basin was estimated at 208,530, representing about 25 percent of the total population in the Flint River Basin. The Upper Flint River subbasin had the largest self-supplied domestic population (114,510 people), which represents 21 percent of the 2010 population in the Upper Flint River subbasin. The Spring Creek and Middle Flint River subbasins had the largest percentage of people that were self supplied among all subbasins in the Flint River Basin. In the Flint River Basin, an estimated annual average of 15.6 Mgal/d of groundwater was withdrawn by self-supplied domestic users during 2010.

Agricultural uses withdrew the most water in the Flint River Basin during 2010; these withdrawals averaged 501 Mgal/d or 84 percent of all self-supplied water withdrawals in the Flint River Basin. Groundwater was the source for 80 percent of agricultural withdrawals in 2010. Agricultural withdrawals were greatest in the Lower Flint River (143 Mgal/d), the Spring Creek (118 Mgal/d), and the Ichawaynochaway Creek (about 97 Mgal/d) subbasins—accounting for 71 percent of all agricultural withdrawals in the Flint River Basin. In contrast, agricultural withdrawals were least in the Upper Flint River subbasin (7.9 Mgal/d).

Self-supplied withdrawals for commercial and public (2 percent) and industrial (98 percent) uses averaged 23.1 Mgal/d, with slightly more groundwater than surface water withdrawn during 2010. Of the 23.1 Mgal/d withdrawn for commercial and industrial uses, 59 percent was in the Middle Flint River subbasin and about 32 percent was in the Lower Flint River subbasin. In the Middle Flint River subbasin, the chemical (9.2 Mgal/d) and beverage (2.8 Mgal/d) industries withdrew the most water during 2010. Moreover, the paper- and pulp-processing (5.4 Mgal/d) and chemical (0.94 Mgal/d) industries withdrew the most water in the Lower Flint River subbasin.

In 2010, an average of 117 Mgal/d of water was discharged to surface water in the Flint River Basin. Public wastewater discharges contributed 53 percent of these returns, whereas thermoelectric-power facilities contributed 43 percent. Public wastewater discharges were greatest in the Upper Flint River (27 Mgal/d) and Lower Flint River (18 Mgal/d) subbasins, accounting for 74 percent of the public wastewater discharges in the Flint River Basin. Surface-water returns from thermoelectric facilities (50 Mgal/d) and most of the commercial and industrial returns (2 Mgal/d) occurred in the Lower Flint River subbasin. All of the surface-water returns from mining activities (2.7 Mgal/d) were in the Upper Flint River subbasin.

Water-Use Trends, 1985–2010

Water withdrawals in the ACF River Basin have varied during the 25 years between 1985 and 2010. Surface-water withdrawals declined between 1985 and 2000, sharply increased in 2000, and declined again between 2000 and 2010. In contrast, groundwater withdrawals increased between 1985 and 2000, declined in 2005, and increased between 2005 and 2010.

Between 1995 and 2010, water withdrawals in the Apalachicola River Basin declined substantially. Groundwater withdrawals peaked in 1995 and by 2005 had declined by nearly 32 percent. Groundwater withdrawals in 2010, however, were nearly 18 percent greater than in 2005. In contrast, surface-water withdrawals peaked in 1990 at 41.7 Mgal/d and by 2010 had declined 94 percent to 2.5 Mgal/d.

During the 25 years between 1985 and 2010, water withdrawals in the Chattahoochee River Basin were greatest in 2000. The high water use in 2000 probably is due to drought conditions in the basin, in which precipitation was 40–60 percent below normal. The total water withdrawal trend in the Chattahoochee River Basin was affected by the trend in surface-water withdrawals. Water withdrawals decreased by 13 percent from 1985 to 1995, increased by 35 percent from 1995 to 2000, and then declined 54 percent from 2000 to 2010. In the Chattahoochee River Basin, groundwater withdrawals increased 75 percent from 1985 to 2000 and decreased 43 percent by 2010. In contrast, surface-water withdrawals decreased by 15 percent from 1985 to 1995, increased by 35 percent from 1995 to 2000, and decreased by 55 percent from 2000 to 2010.

Between 1985 and 2010, the trends in groundwater and surface-water withdrawals were similar in the Flint River Basin. After steady increases in groundwater withdrawals (15.9 million gallons per day per year, Mgal/d/yr) and surface-water withdrawals (9.7 Mgal/d/yr) since 1990, withdrawals peaked in 2000. In 2005, groundwater withdrawals were 35 percent and surface-water withdrawals were 29 percent less than the withdrawals in 2000. Moreover, groundwater withdrawals in 2010 were 59 percent higher than in 2005, whereas surface-water withdrawals continued to decrease.

Because agricultural water use, primarily crop irrigation, withdraws most of the self-supplied water withdrawals (and most of the groundwater withdrawals) in the Flint River Basin, the amount of water withdrawn in any given year is dependent on rainfall patterns in the basin. Rainfall in 2000 and 2010, especially during the growing season, was well below the 30-year average. As a result, groundwater withdrawals for crop irrigation were greatest in those 2 years and least in 2005, which was a wetter than average year. In contrast to the groundwater withdrawals, surface-water withdrawals decreased by 41 percent between 2000 and 2010, an average decline of 13.7 Mgal/d/yr. In 2010, thermoelectric-power facilities using once-through cooling systems needed less water for cooling than in previous years.

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Glossary

The following terms are referenced or used in the text of this report.

aquaculture water use Water used for the offstream farming of water organisms such as finfish and shellfish in ponds, raceways, and fish hatcheries.

census block United States census blocks are statistical areas bounded by visible features such as roads, streets, water bodies, railroad tracks, city, town, county, township, or school district boundaries.

commercial water use Public- or self-supplied water used for motels, hotels, restaurants, small businesses, medical centers, hospitals, military installations, public safety, correctional institutions, educational facilities (public and private), campgrounds, and recreational vehicle parks.

domestic water use Water used for indoor household purposes such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets and outdoor purposes such as watering lawns and gardens. Includes water supplied by a public water supplier or domestic well (self supplied).

freshwater Water that contains less than 1,000 milligrams per liter (mg/L) of dissolved solids.

groundwater All subsurface water, distinct from surface water. Specifically, that part of the subsurface water in the saturated zone, which is a zone where all voids are filled with water.

industrial water use Water used for the fabrication, processing, washing, and cooling in industries associated with the fabrication of machinery and steel products, and the production of chemical, food, paper, wood, petroleum, and their allied products. This category includes self-supplied water and deliveries from a public supplier.

irrigation water use Water applied to land for the production of fruit, vegetable, and nut crops, pasture, hay, turf, flower and ornamental horticulture and nurseries. This use also includes water applied for pre-irrigation soil conditioning, frost protection, and crop cooling.

livestock water use Water used for the production of animals for food or hobby and raised in feedlots, dairy operations, corrals, barns, or pens and in this report includes aquaculture operations.

mining water use Water used in the extraction of minerals and includes quarrying, and milling, but does not include water used to transport material to a processing facility, or the dewatering of quarries or mine pits.

offstream water use Water that is withdrawn from a surface-water source and used in areas not within the surface-water channel or wetted basin.

once-through cooling system Also known as open-loop cooling system. A cooling system in which water is withdrawn from a source (typically surface water), circulated through heat exchangers and then returned to a water body at a higher temperature than it was at withdrawal.

per capita water use The average amount of water used per person during a standard time period, generally per day. Per capita use may be calculated based on total water use, public-supply water use, self-supplied domestic water use, or domestic deliveries from public supply.

public-supplied deliveries The amount of water delivered by a public water supplier to domestic (residential), commercial, industrial, public use, and wholesale customers.

public-supply withdrawals The amount of water withdrawn by a public water supplier.

public wastewater treatment The process of treating human sewage by public entities (county or municipal governments) using settling ponds, filtration, and disinfection before discharge to a surface-water body.

public water supplier Any water supplier (public or private entity) that regularly serves at least 25 people or has at least 15 water connections is considered a public water system under Alabama, Florida, and Georgia law.

public use Public-supplied water used in firefighting, street washing, wastewater treatment, public buildings, public schools, parks, recreation centers, and public swimming pools. *See also* public-supply water use.

recirculation cooling system Also known as closed-loop cooling system. Water is withdrawn from a source, circulated through heat exchangers, cooled, and then re-used in the same process.

raw water Water that has not been filtered or treated before use.

surface-water return flows Raw or treated water discharges to a river, stream, pond, lake, or reservoir and is available for further use.

saline water Water that contains more than 1,000 milligrams per liter of dissolved solids.

self-supplied domestic use Surface-water or groundwater withdrawn from a private intake or well for domestic use at a single residence.

self-supplied water Water that is withdrawn directly from a groundwater or a surface-water source by a user, as opposed to water that is delivered by a public water supplier.

surface water An open body of water, such as a stream, lake, or reservoir.

thermoelectric-power use Water used to generate electricity with steam-driven turbine generators. Water is cooled using three different strategies: recirculating, once-through, and a mixture of the two. Recirculating systems consume the greatest amount of water.

water use Water used for a beneficial purpose, such as domestic activities (drinking, washing), industrial processes, agriculture, thermoelectric and hydroelectric-power generation.

water-use coefficient A computed value to estimate the average quantity of water used by a specific category of water users. Examples of water-use coefficients include daily per capita water use, consumptive crop irrigation requirements, livestock water requirements, per employee water use, and per unit of product water use.

water withdrawal The removal of water from a surface-water body or aquifer that is conveyed to a storage tank or reservoir, or a place of use such as an agricultural field, water treatment facility or commercial, industrial, or thermoelectric facility.

Appendixes 1–3

Appendix 1. Water Withdrawals, Surface-Water Returns, and Interbasin Transfers Using the U.S. Geological Survey National Hydrologic Dataset and a Geographic Information System—A Pilot Study

In Georgia, interbasin transfers have existed since the early 1900s, with most resulting from public-supply deliveries in the metropolitan Atlanta region (Draper, 2004). The river basins in the Atlanta metropolitan area are long and narrow, and many public-supply systems extend over more than one basin. In several instances, systems withdraw and use water from one basin and return wastewater into a different basin. Interbasin transfer of water commonly takes place within public-supply distribution system and wastewater collection system networks as opposed to transfers from one basin to another by a single large pipeline or canal system. Data on these more dispersed interbasin transfers may be difficult to determine and, thus, require a data model that allows for storing the known water-use information and ancillary data. Such a model will assist in making estimates of other data such as coefficients for the percentage of water transferred, water sales to other water systems in different basins, and so forth. The National Hydrologic Dataset (NHD) provides a unified structure for surface-water resources and, thus, can play an important role in tracking points of withdrawal and return flow within and outside of a basin. The study was designed to integrate water-withdrawal and return-flow data derived from the U.S. Geological Survey (USGS) site-specific water-use database system (SWUDS) with the NHD dataset to enable tracking of water withdrawals and return flows both within and outside of a basin (interbasin transfer).

Purpose and Scope

The purpose of this pilot study was to determine if water-use data from the USGS SWUDS dataset can be linked with the USGS NHD to provide a thematic system of identifying water use and interbasin water transfers in the Apalachicola-Chattahoochee-Flint (ACF) River Basin. Data on water withdrawal and surface-water return locations and associated water-use information described in the earlier parts of this report were linked with the high-resolution NHD structure in a geographic information system (GIS). Linkages with public water suppliers and interbasin transfer points were established. The complex water infrastructure of the Atlanta metropolitan area provides a good test case for characterization of interbasin transfers.

Methods

A number of layers were created in ArcGIS, a commercially-available geographic information software system. These layers included (1) the high resolution NHD dataset, (2) point locations of surface-water withdrawals and surface-water returns in the ACF River Basin from the USGS SWUDS, (3) city and county boundaries, (4) topographic maps, and (5) various imagery. Google Map was used to verify locations of commercial, industrial, and treatment facilities. Unfortunately, a water service area layer could not be created because most public water suppliers would not provide a map of their water service areas that indicated the location of water mains.

Transfers of finished water (treated for public consumption) among public water suppliers occur at metered junctions connecting one distribution system with another or from a storage tank to another distribution system. Within the GIS, linkages among point locations, NHD stream reaches, and 8-digit hydrologic unit code boundaries were created using a software add-on developed by the USGS and the Bureau of Land Management. This add-on is named the Hydrologic Event Management Tool (HEM, available online at http://nhd.usgs.gov/tools.html#hem) and was used to create water-use linkages in the ACF River Basin. Using the HEM, a NHD-reach identification was assigned to each surface-water withdrawal and return location, and NHD flowline connectivity and flow directions were created, which included linear references. The HEM tools are used to create two separate event table feature classes, one for inflows and one for outflows. In these event tables, a record was created for the respective point location (intake or outfall location). Finally, tables were created to develop and populate attributes relating to interbasin transfers, which include coefficients used to estimate interbasin flows (such as the percentage of water transferred), the receiving basin or discharge point location, consumptive use, conveyance loss, percentages or quantities of return flow derived from a groundwater source, metadata on data quality, and service area polygons.

Water Withdrawal, Surface-Water Return, and Interbasin Transfer Locations

Although the HEM tools can automatically snap a point location to the nearest stream or lake, the closest stream or lake was commonly not the correct one. Thus, creating one point at a time provided the correct location of the intake or outfall point and allowed for verification at the same time. In this way, locating intake points was straightforward. In contrast, the location of outfall points was more difficult because latitude/longitude coordinates were not consistently associated with the actual surface-water return point on a stream or lake. In some cases, the outfall coordinates were the location of a wastewater treatment facility, an industrial facility, or the outfall was located in the middle of a town or subdivision nowhere near a recieving stream or lake. In other cases, the description of a surface-water return point was on a named stream, but the point actually was on an unnamed tributary of that stream. In some instances, the surface-water return point was described on an unnamed tributary to a named stream (for example, unnamed tributary to xyz creek); in those instances, the tributary had to be followed downstream to confirm that it actually was a tributary to the named stream. Other issues that made locating outfalls difficult are as follows: (1) location names that use local stream names that were not indicated in the NHD; (2) locations on dry, first order stream channels that were not identified as a flowline in the NHD; and (3) facilities that no longer existed.

Unfortunately, interbasin transfers could not be included in this study because point locations for the transfers could not be determined because of the lack of data. Although the locations of water mains were available for about three public water supply systems from data gathered for the 2010 water-use compilation study in Georgia, none of these systems were in the ACF River Basin. To use the NHD for identifying and quantifying interbasin transfers in the Southeast United States, locations of water mains (especially metered points where transfers take place) and locations of water storage tanks are needed. With these data and further refinement of the NHD/ArcGIS model, the model would be a useful, visual source of water-use data in most areas of the Southeast United States.

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Appendix 2. North American Industrial Classification Codes

Industrial water use is given by industry type, classified by North American Industrial Classification System Code. The following is a brief description of the codes used in this publication (U.S. Census Bureau, 2012).

212 Mining and processing of kaolin and fuller's earth.—This major group includes establishments engaged in the mining and processing of kaolin and fuller's earth. Water washing is a processing method in which water and chemical dispersants are added to the mined clay to produce a slurry. The slurry is then transported through pipes to the processing facility.

221 Electric utilities-thermoelectric.—This United States industry consists of establishments primarily engaged in operating electric power-generation facilities. These facilities use fossil fuels (such as coal, oil, or gas) in internal combustion engines that heat water to create steam that drives turbine generators, which produce electric energy. The electric energy produced in these establishments is provided to electric power transmission systems or to electric power distribution systems

311 Food and kindred products.—This major group includes establishments that manufacture or process foods and beverages for human consumption and for certain related products, such as manufactured ice, chewing gum, vegetable oils and animal fats, and prepared feeds for animals and fowls.

312 Beverage manufacturing.—The industrial group includes establishments such as breweries, distilleries, wineries, and establishments that produce soft drinks and bottled water.

313, 314 Textile mills and textile product mills.—This major group includes establishments that are involved in any of the following operations: (1) preparation of fiber and subsequent manufacturing of yarn, thread, braids, twine, and cordage; (2) manufacturing broad woven fabric, narrow woven fabric, knit fabric, and carpets and rugs from yarn; (3) dyeing and finishing fiber, yarn, fabric, and knit apparel; (4) coating, waterproofing, or otherwise treating fabric; (5) the integrated manufacturing of knit apparel and other finished articles from yarn; and (6) the manufacturing of felt goods, lace goods, nonwoven fabrics, and miscellaneous textiles.

321 Wood product manufacturing, except furniture—.This major group includes sawmills, lathe mills, shingle mills, cooperage stock mills, planing mills, and pulpwood mills and also includes veneer mills that produce veneers, plywood, engineered wood products, millwork, and wood doors and window manufacturing.

322 Paper, pulp, and allied products.—This major group includes the manufacturing of pulps from wood and other cellulose fibers and from rags; the manufacturing of paper and paperboard; and the manufacturing of paper and paperboard into converted products such as paper coated off the paper machine, paper bags, paper boxes, and envelopes.

325 Chemicals and allied products.—This major group includes establishments producing basic chemicals and establishments manufacturing products by predominantly chemical processes. Establishments classified in this major group manufacture the following three general classes of products: (1) basic chemicals such as acids, alkalies, salts, and organic chemicals; (2) chemical products to be used in further manufacturing such as synthetic fibers, plastics materials, dry colors, and pigments; and (3) finished chemical products to be used for ultimate consumption such as drugs, cosmetics, and soaps or to be used as materials or supplies in other industries such as paints, fertilizers, and explosives.

327 Stone, clay, glass, and concrete products.—This major group includes establishments engaged in manufacturing flat glass and other glass products, cement, structural clay products, pottery, ceramics, concrete and gypsum products, cut stone, abrasive and asbestos products, and so forth, from materials taken principally from the earth in the form of stone, clay, and sand.

331 Primary metal industries.—This major group includes establishments involved in the smelting and refining of ferrous and nonferrous metals from ore, pig, or scrap; in the rolling, drawing, and alloying of ferrous and nonferrous metals; in the manufacturing of castings and other basic products of ferrous and nonferrous metals; and in the manufacturing of aluminum sheet, foil, extruded products such as pipes, tubes, nails, spikes, and insulated wire and cable.

339 Miscellaneous manufacturing.—This major group includes establishments engaged in manufacturing medical equipment such as surgical, dental, and medical instruments and supplies, laboratory apparatus and furniture; manufacturing of jewelry and silverware, toys, sporting goods and athletic equipment, office supplies, musical instruments, signs, fasteners, needles, buttons, and caskets.

Reference Cited

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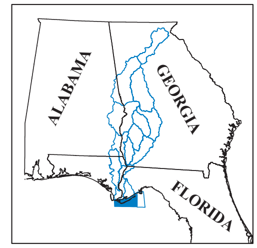
Appendix 3. Population, Water Withdrawals, and Water Use by Source of Water for Each Subbasin in the Apalachicola-Chattahoochee-Flint River Basin, 2010

Abbreviations

Ala.	Alabama
Auth.	Authority
Fla.	Florida
Ga.	Georgia
Mgal/d	million gallons per day
NAICS	North American Industrial Classification System
<	less than
—	not applicable

APALACHICOLA BAY BASIN



Hydrologic unit code	03130014
Population	2,430
Population served by public supply	1,760
Groundwater	1,760
Surface water	0
Self-supplied population	670
Acres irrigated	0

2010 WATER WITHDRAWALS AND ESTIMATED USE, IN MILLION GALLONS PER DAY

Category	Withdrawals			Total use[1]	Surface-water returns
	Ground-water	Surface water	Total		
Public supply	0.86	0.00	0.86	—	—
Domestic	0.05	0.00	0.05	0.44	—
Commercial/public use	0.00	0.00	0.00	0.10	0.00
Industrial	0.00	0.00	0.00	0.00	0.00
Public-supply losses	—	—	—	0.13	–
Public wastewater treatment	—	—	—	—	0.00
Mining	0.00	0.00	0.00	0.00	0.00
Irrigation—Crop	0.00	0.00	0.00	0.00	—
Irrigation—Golf course	0.00	0.00	0.00	0.00	—
Livestock and aquaculture	0.00	0.00	0.00	0.00	0.00
Thermoelectric power	0.00	0.00	0.00	0.00	0.00
TOTAL	**0.91**	**0.00**	**0.91**	**0.67**	**0.00**

[1]Total use is total withdrawal plus public-supply deliveries and losses. About 0.24 Mgal/d of water is delivered from St. Andrews-St. Joseph Bays Basin (hydrologic unit code 03140101) to the Apalachicola Bay Basin in 2010.

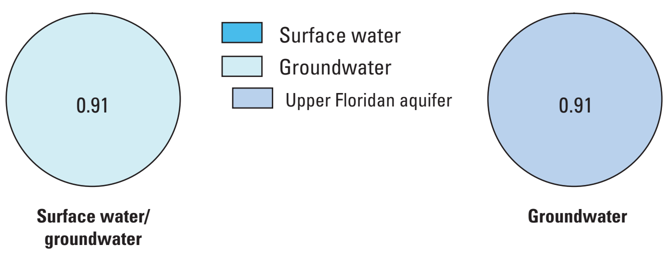
Withdrawals by Major Industrial Groups

NAICS	Groundwater	Surface water
None	—	—

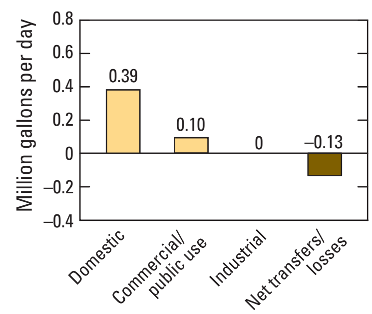
Withdrawals by Major Public Suppliers

Name	Groundwater	Surface water
Water Management Services, St. George Island, Fla.	0.47	0.00
Lighthouse Utilities, Fla.	0.39	0.00

2010 Withdrawals by Source, in Mgal/d

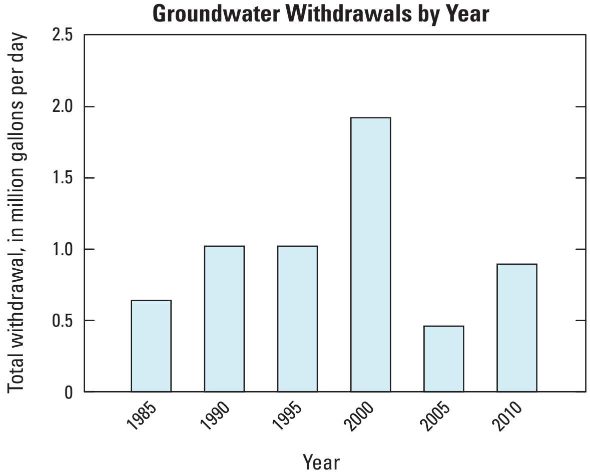


Public-Supply Deliveries[1] by Use Category

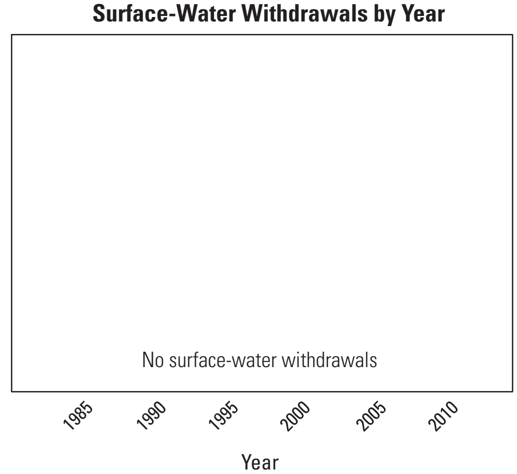


[1]Deliveries from public supply typically do not equal withdrawals because of intercounty withdrawals and purchases, public use, and system losses.

Groundwater Withdrawals by Year

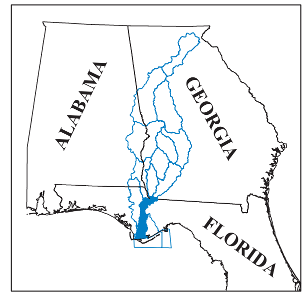


Surface-Water Withdrawals by Year



APALACHICOLA RIVER BASIN

Hydrologic unit code: 03130011



		Population				
			Public supplied			
	Acres irrigated	Total	Ground-water	Surface water	Total	Self supplied
Florida	4,690	27,170	16,450	0	16,450	10,720
Georgia	2,180	1,110	0	90	90	1,020
Total	6,870	28,280	16,450	90	16,540	11,740

2010 WATER WITHDRAWALS AND ESTIMATED USE, IN MILLION GALLONS PER DAY

Category	Withdrawals			Total use[1]	Surface-water returns
	Ground-water	Surface water	Total		
Public supply	[2]2.49	<0.01	2.49	—	—
Domestic	0.88	0.00	0.88	2.36	—
Commercial/public use	[2]0.88	0.00	0.88	1.35	0.00
Industrial	0.00	0.00	0.00	0.00	0.00
Public-supply losses	—	—	—	0.38	—
Public wastewater treatment	—	—	—	—	1.34
Mining	0.00	0.00	0.00	0.00	0.00
Irrigation—Crop	4.12	1.49	5.61	5.61	—
Irrigation—Golf course	0.00	0.00	0.00	0.00	—
Livestock and aquaculture	0.68	0.00	0.68	0.68	0.00
Thermoelectric power	0.00	0.00	0.00	0.00	0.00
TOTAL	**9.05**	**1.49**	**10.54**	**10.38**	**1.34**

[1]Total use is total withdrawal plus public-supply deliveries and losses. About 0.16 Mgal/d delivered to the Chipola River Basin in 2010.
[2]Florida only.

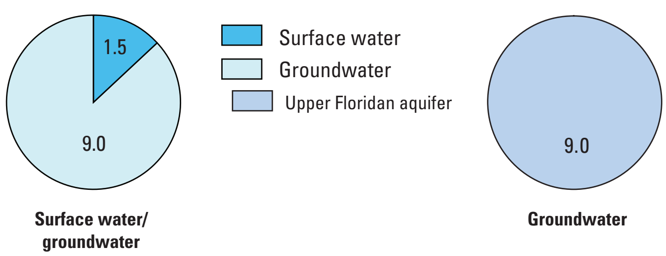
Withdrawals by Major Industrial Groups

NAICS	Groundwater	Surface water
None	—	—

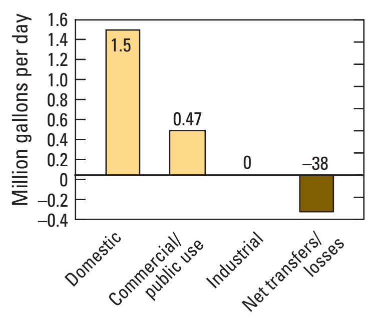
Withdrawals by Major Public Suppliers

Name	Groundwater	Surface water
City of Blountstown, Fla.	0.58	0.00
City of Apalachicola, Fla.	0.51	0.00
City of Chattahoochee, Fla.	0.38	0.00
City of Bristol, Fla.	0.27	0.00
City of Sneads, Fla.	0.24	0.00
Town of Grand Ridge, Fla.	0.12	0.00

2010 Withdrawals by Source, in Mgal/d

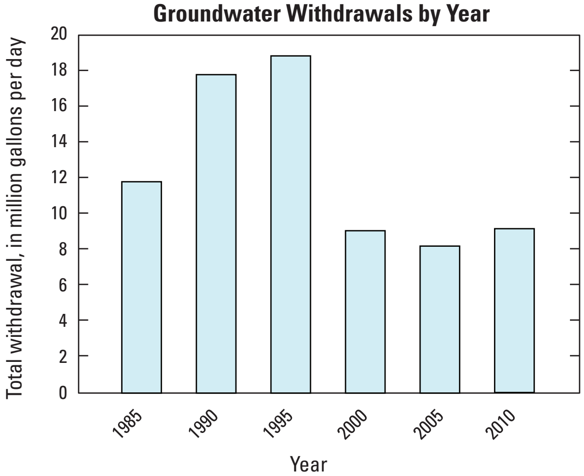


Public-Supply Deliveries[1] by Use Category

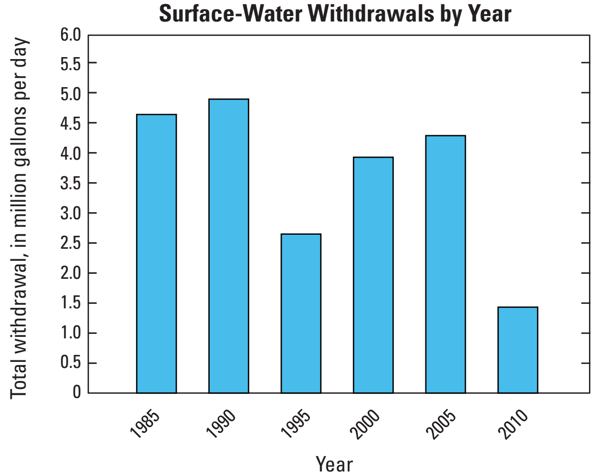


[1]Deliveries from public supply typically do not equal withdrawals because of intercounty withdrawals and purchases, public use, and system losses.

Groundwater Withdrawals by Year

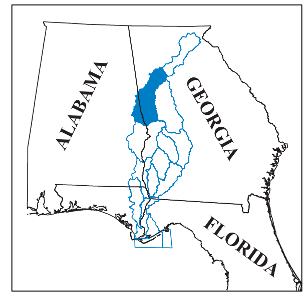


Surface-Water Withdrawals by Year



MIDDLE CHATTAHOOCHEE RIVER–LAKE HARDING BASIN

Hydrologic unit code: 03130002



	Acres irrigated	Population				
		Total	Public supplied			Self supplied
			Ground-water	Surface water	Total	
Alabama	470	49,640	3,590	42,170	45,760	3,880
Georgia	2,210	930,630	11,790	903,570	915,360	15,270
Total	2,680	980,270	15,380	945,740	961,120	19,150

2010 WATER WITHDRAWALS AND ESTIMATED USE, IN MILLION GALLONS PER DAY

Category	Withdrawals			Total use[1]	Surface-water returns
	Ground-water	Surface water	Total		
Public supply	0.95	91.70	92.65	—	—
Domestic	1.43	0.00	1.43	40.42	—
Commercial/public use	0.02	0.00	0.02	8.71	0.00
Industrial	0.13	0.39	0.52	6.55	0.00
Public-supply losses	—	—	—	11.03	—
Public wastewater treatment	—	—	—	—	157.04
Mining	1.31	0.01	1.32	1.32	3.52
Irrigation—Crop	0.51	0.26	0.77	0.77	—
Irrigation—Golf course	0.00	2.52	2.52	2.52	—
Livestock and aquaculture	0.23	2.56	2.79	2.79	0.02
Thermoelectric power	0.00	101.03	101.03	101.03	2.56
TOTAL	**4.58**	**198.44**	**203.02**	**175.14**	**163.14**

[1]Total use is total withdrawal plus public-supply deliveries and losses. About 37 Mgal/d delivered to other basins.

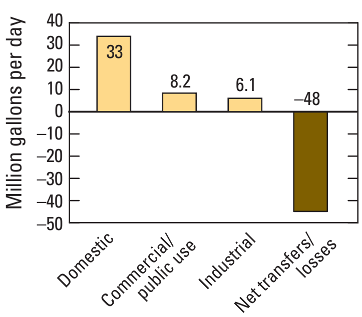
Withdrawals by Major Industrial Groups

NAICS	Groundwater	Surface water
322–Paper products	0.00	0.39
311–Lumber and wood	0.11	0.00

Withdrawals by Major Public Suppliers

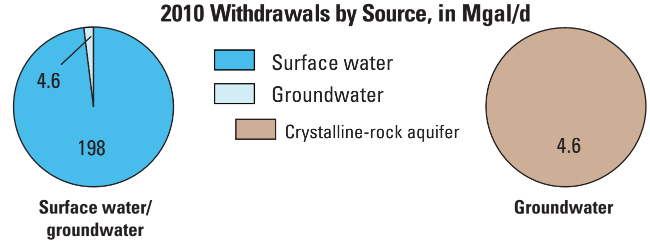
Name	Groundwater	Surface water
Columbus Water Works, Ga.	0.00	34.94
Douglasville–Douglas County Water Authority, Ga.	0.00	11.96
City of LaGrange, Ga.	0.00	9.58
Opelika Water Works, Ala.	0.00	8.61
City of East Point, Ga.	0.00	7.97
City of Newnan, Ga.	0.00	6.57
Harris County Water System, Ga.	0.00	2.08
Heard County Water Auth., Ga.	0.00	1.40
City of Villa Rica, Ga.	0.05	1.31

Public-Supply Deliveries[1] by Use Category

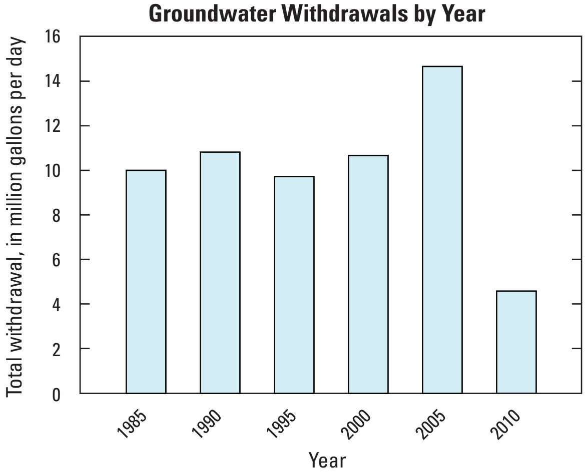


[1]Deliveries from public supply typically do not equal withdrawals because of intercounty withdrawals and purchases, public use, and system losses.

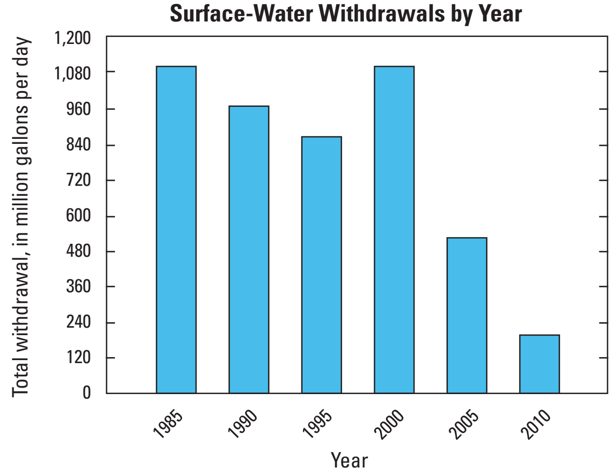
2010 Withdrawals by Source, in Mgal/d



Groundwater Withdrawals by Year

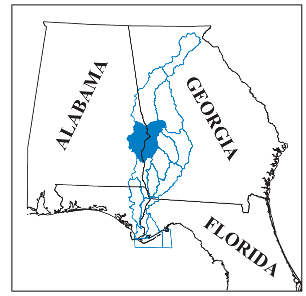


Surface-Water Withdrawals by Year



MIDDLE CHATTAHOOCHEE RIVER BASIN–WALTER F. GEORGE RESERVOIR

Hydrologic unit code: 03130003



	Acres irrigated	Population				
		Total	Public supplied			Self supplied
			Ground-water	Surface water	Total	
Alabama	4,380	111,330	25,510	75,550	101,060	10,270
Georgia	4,890	202,380	11,730	179,400	191,130	11,250
Total	9,270	313,710	37,240	254,950	292,190	21,520

2010 WATER WITHDRAWALS AND ESTIMATED USE, IN MILLION GALLONS PER DAY

Category	Withdrawals			Total use[1]	Surface-water returns
	Ground-water	Surface water	Total		
Public supply	4.25	9.68	13.93	—	—
Domestic	1.61	0.00	1.61	8.67	—
Commercial/public use	0.14	0.00	0.14	2.54	0.00
Industrial	2.51	27.91	30.42	37.06	21.23
Public-supply losses	—	—	—	2.91	—
Public wastewater treatment	—	—	—	—	36.02
Mining	0.73	0.18	0.91	0.91	0.10
Irrigation—Crop	0.68	4.12	4.80	4.80	—
Irrigation—Golf course	0.58	0.66	1.24	1.24	—
Livestock and aquaculture	0.18	0.36	0.54	0.54	0.00
Thermoelectric power	0.00	0.00	0.00	0.00	0.00
TOTAL	**10.68**	**42.91**	**53.59**	**58.67**	**57.35**

[1]Total use is total withdrawal plus public-supply deliveries and losses. About 5.1 Mgal/d was withdrawn from the Lake Harding Basin (hydrologic unit code 03130002) but delivered and used in the Walter F. George Basin in 2010.

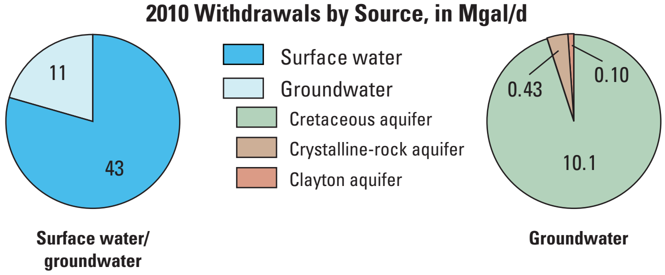
Withdrawals by Major Industrial Groups

NAICS	Groundwater	Surface water
322–Paper, pulp products	0.92	27.64
311–Food products	1.58	0.00
212–Kaolin, clay processing	0.00	0.27

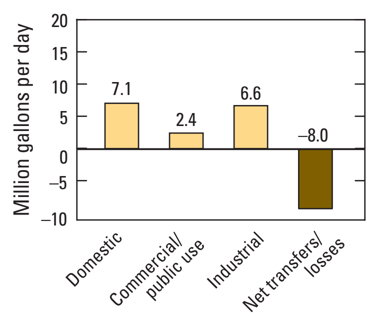
Withdrawals by Major Public Suppliers

Name	Groundwater	Surface water
Phenix City, Ala., Water Works	0.00	7.32
Smith Water Authority, Ala.	0.00	2.36
Eufaula, Ala., Water Works	1.92	0.00
City of Fort Mitchell, Ala.	0.68	0.00
Russell County Water Auth., Ala.	0.55	0.00
Chattahoochee County, Ga.	0.34	0.00

2010 Withdrawals by Source, in Mgal/d

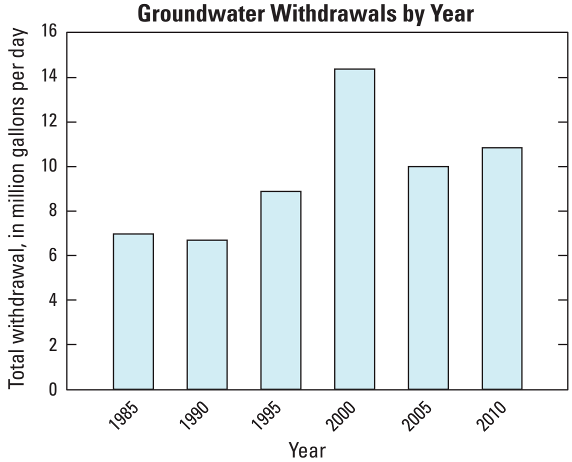


Public-Supply Deliveries[1] by Use Category

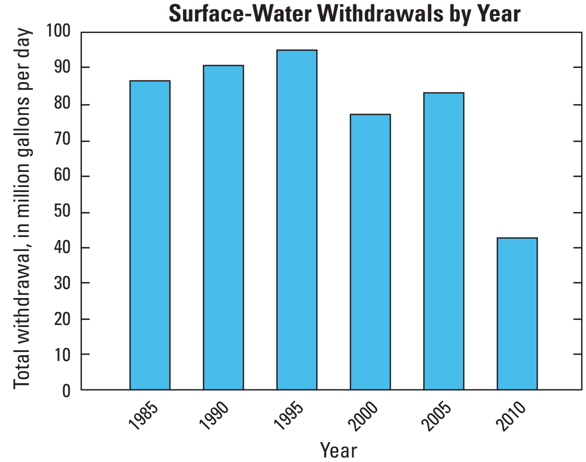


[1]Deliveries from public supply typically do not equal withdrawals because of intercounty withdrawals and purchases, public use, and system losses.

Groundwater Withdrawals by Year

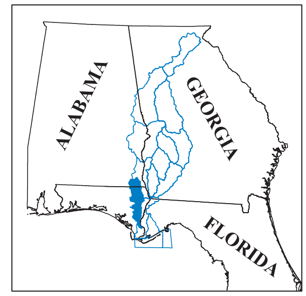


Surface-Water Withdrawals by Year



CHIPOLA RIVER BASIN

Hydrologic unit code: 03130012



	Acres irrigated	Population				
			Public supplied			
		Total	Ground-water	Surface water	Total	Self supplied
Alabama	5,920	30,980	14,930	0	14,930	16,050
Florida	31,810	44,550	9,610	0	9,610	34,940
Total	37,730	75,530	24,540	0	24,540	50,990

2010 WATER WITHDRAWALS AND ESTIMATED USE, IN MILLION GALLONS PER DAY

Category	Withdrawals			Total use[1]	Surface-water returns
	Ground-water	Surface water	Total		
Public supply	3.63	0.00	3.63	—	—
Domestic	3.83	0.00	3.83	5.18	—
Commercial/public use	[2]1.46	0.00	1.46	1.99	0.00
Industrial	0.00	0.00	0.00	0.12	0.00
Public-supply losses	—	—	—	0.39	—
Public wastewater treatment	—	—	—	—	0.11
Mining	0.00	0.00	0.00	0.00	0.19
Irrigation—Crop	12.76	0.65	13.41	13.41	—
Irrigation—Golf course	0.30	0.07	0.37	0.37	—
Livestock and aquaculture	0.33	0.00	0.33	0.33	0.00
Thermoelectric power	0.00	0.00	0.00	0.00	0.00
TOTAL	**22.31**	**0.72**	**23.03**	**21.79**	**0.30**

[1]Total use is total withdrawal plus public-supply deliveries and losses. About 1.2 Mgal/d delivered to the Lower Chattahoochee River Basin in 2010.
[2]Florida only.

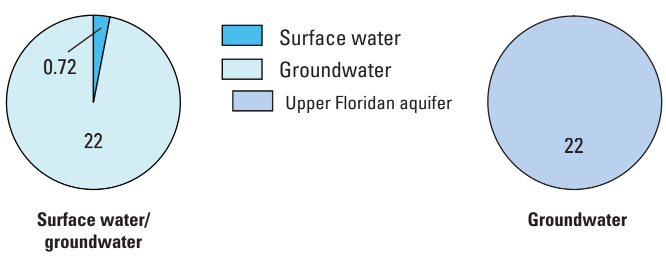
Withdrawals by Major Industrial Groups

NAICS	Groundwater	Surface water
None	—	—

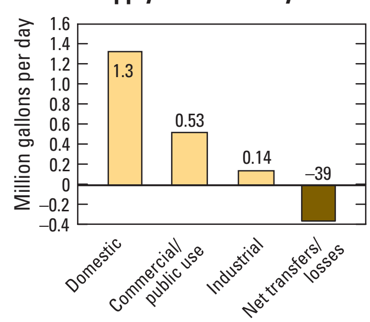
Withdrawals by Major Public Suppliers

Name	Groundwater	Surface water
City of Marianna, Fla.	1.11	0.00
City of Cowarts, Ala.	0.35	0.00
City of Cottonwood, Ala.	0.31	0.00
City of Taylor, Ala.	0.29	0.00
City of Wewahitchka, Fla.	0.17	0.00

2010 Withdrawals by Source, in Mgal/d

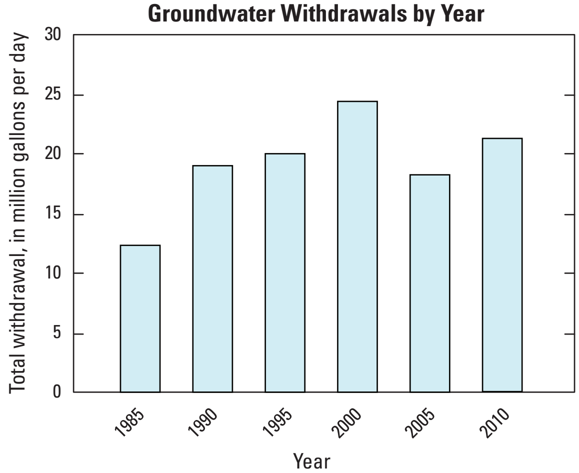


Public-Supply Deliveries[1] by Use Category

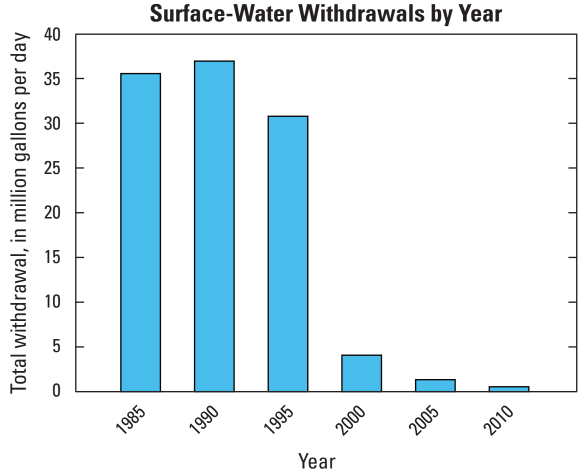


[1]Deliveries from public supply typically do not equal withdrawals because of intercounty withdrawals and purchases, public use, and system losses.

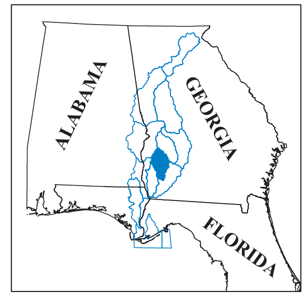
Groundwater Withdrawals by Year



Surface-Water Withdrawals by Year



ICHAWAYNOCHAWAY CREEK BASIN



Hydrologic unit code	03130009
Population	21,810
Population served by public supply	14,150
Groundwater	14,150
Surface water	0
Self-supplied population	7,660
Acres irrigated	111,060

2010 WATER WITHDRAWALS AND ESTIMATED USE, IN MILLION GALLONS PER DAY

Category	Withdrawals			Total use[1]	Surface-water returns
	Ground-water	Surface water	Total		
Public supply	2.78	0.00	2.78	—	—
Domestic	0.57	0.00	0.57	1.73	—
Commercial/public use	0.01	0.00	0.01	0.49	0.05
Industrial	0.18	0.00	0.18	0.46	0.00
Public-supply losses	—	—	—	0.86	—
Public wastewater treatment	—	—	—	—	2.20
Mining	0.02	0.00	0.02	0.02	0.00
Irrigation—Crop	52.88	42.65	95.53	95.53	—
Irrigation—Golf course	0.00	0.11	0.11	0.11	—
Livestock and aquaculture	0.16	0.90	1.06	1.06	0.00
Thermoelectric power	0.00	0.00	0.00	0.00	0.00
TOTAL	**56.60**	**43.66**	**100.26**	**100.26**	**2.25**

[1]Total use is total withdrawal plus public-supply deliveries and losses.

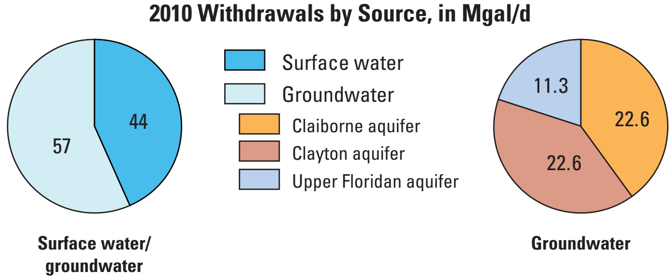
Withdrawals by Major Industrial Groups

NAICS	Groundwater	Surface water
311–Food Products	0.18	0.00

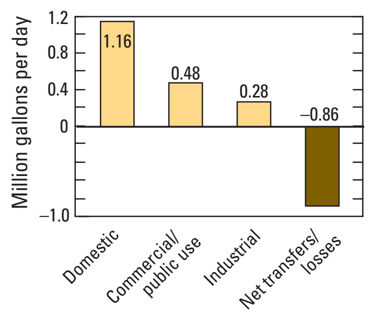
Withdrawals by Major Public Suppliers

Name	Groundwater	Surface water
City of Dawson, Ga.	1.54	0.00
City of Cuthbert, Ga.	0.32	0.00
City of Morgan, Ga.	0.27	0.00
City of Shellman, Ga.	0.21	0.00

2010 Withdrawals by Source, in Mgal/d

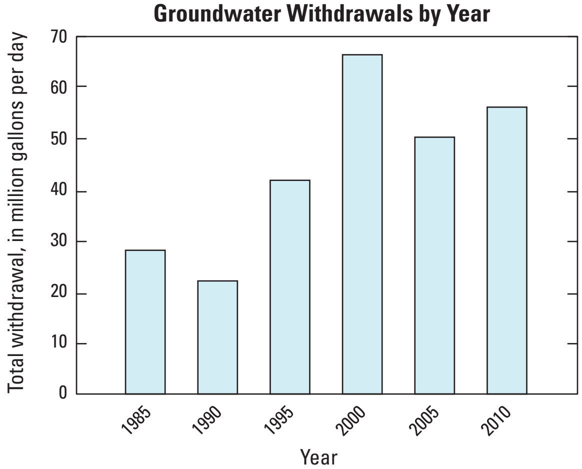


Public-Supply Deliveries[1] by Use Category

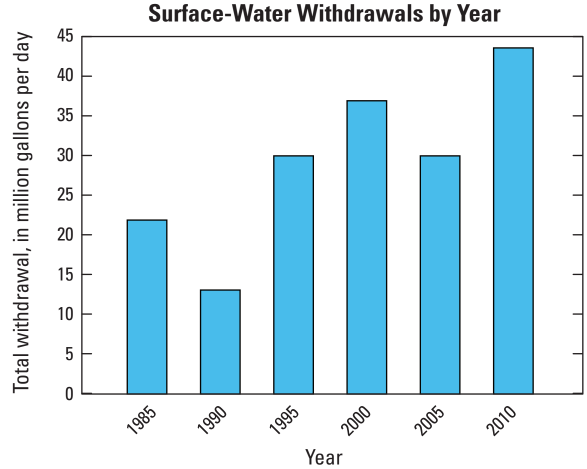


[1]Deliveries from public supply typically do not equal withdrawals because of intercounty withdrawals and purchases, public use, and system losses.

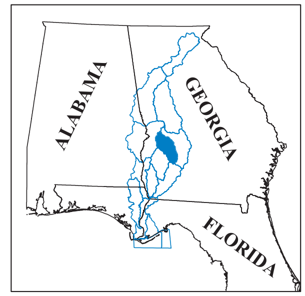
Groundwater Withdrawals by Year



Surface-Water Withdrawals by Year



KINCHAFOONEE-MUCKALEE CREEKS BASIN



Hydrologic unit code	03130007
Population	78,950
Population served by public supply	55,750
Groundwater	55,750
Surface water	0
Self-supplied population	23,200
Acres irrigated	80,500

2010 WATER WITHDRAWALS AND ESTIMATED USE, IN MILLION GALLONS PER DAY

Category	Withdrawals: Ground-water	Withdrawals: Surface water	Withdrawals: Total	Total use[1]	Surface-water returns
Public supply	5.75	0.00	5.75	—	—
Domestic	1.74	0.00	1.74	5.59	—
Commercial/public use	0.10	0.00	0.10	0.86	0.00
Industrial	0.00	0.00	0.00	0.10	0.28
Public-supply losses	—	—	—	1.04	—
Public wastewater treatment	—	—	—	—	3.52
Mining	0.36	0.00	0.36	0.36	0.00
Irrigation—Crop	34.79	27.24	62.03	62.03	—
Irrigation—Golf course	0.32	0.00	0.32	0.32	—
Livestock and aquaculture	0.22	1.83	2.05	2.05	0.00
Thermoelectric power	0.00	0.00	0.00	0.00	0.00
TOTAL	**43.28**	**29.07**	**72.35**	**72.35**	**3.80**

[1]Total use is total withdrawal plus public-supply deliveries and losses.

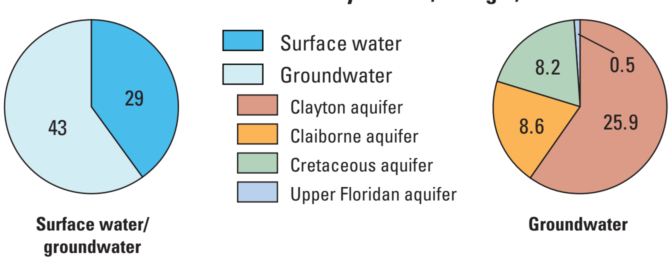
Withdrawals by Major Industrial Groups

NAICS	Groundwater	Surface water
None	—	—

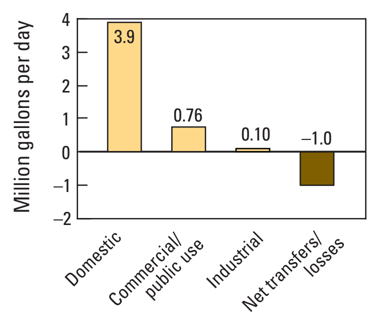
Withdrawals by Major Public Suppliers

Name	Groundwater	Surface water
City of Americus, Ga.	2.55	0.00
Lee County Water Auth., Ga.	1.41	0.00
Buena Vista-Marion County, Ga.	0.72	0.00
City of Leesburg, Ga.	0.37	0.00

2010 Withdrawals by Source, in Mgal/d

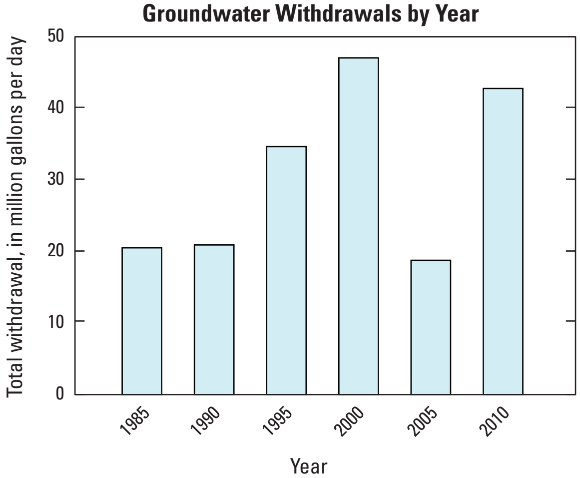


Public-Supply Deliveries[1] by Use Category

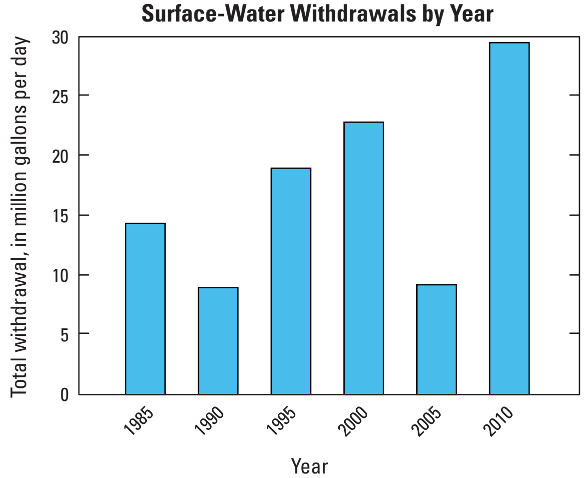


[1]Deliveries from public supply typically do not equal withdrawals because of intercounty withdrawals and purchases, public use, and system losses.

Groundwater Withdrawals by Year

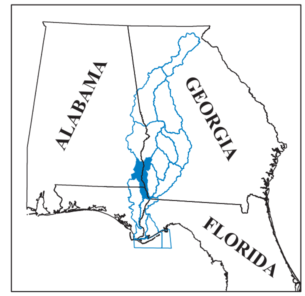


Surface-Water Withdrawals by Year



LOWER CHATTAHOOCHEE RIVER BASIN

Hydrologic unit code: 03130004



	Acres irrigated	Population				
		Total	Public supplied			Self supplied
			Ground-water	Surface water	Total	
Alabama	6,350	35,780	31,950	0	31,950	3,830
Florida	13,920	9,000	180	0	180	8,820
Georgia	33,460	7,850	1,840	0	1,840	6,010
Total	53,730	52,630	33,970	0	33,970	18,660

2010 WATER WITHDRAWALS AND ESTIMATED USE, IN MILLION GALLONS PER DAY

Category	Withdrawals			Total use[1]	Surface-water returns
	Ground-water	Surface water	Total		
Public supply	10.75	0.00	10.75	—	—
Domestic	1.40	0.00	1.40	4.97	0.00
Commercial/public use	0.44	0.00	0.44	1.28	0.00
Industrial	0.82	109.12	109.94	110.81	42.54
Public-supply losses	—	—	—	2.15	—
Public wastewater treatment	—	—	—	—	4.24
Mining	0.00	0.00	0.00	0.00	0.00
Irrigation—Crop	23.36	6.64	30.00	30.00	0.00
Irrigation—Golf course	0.00	0.13	0.13	0.13	0.00
Livestock and aquaculture	0.89	0.34	1.23	1.23	0.00
Thermoelectric power	0.28	129.97	130.25	130.25	81.54
TOTAL	**37.94**	**246.20**	**284.14**	**280.82**	**128.32**

[1]Total use is total withdrawal plus public-supply deliveries and losses. About 0.48 Mgal/d was transfered within the ACF River Basin and 2.84 Mgal/d were transfered out of the ACF River Basin in 2010.

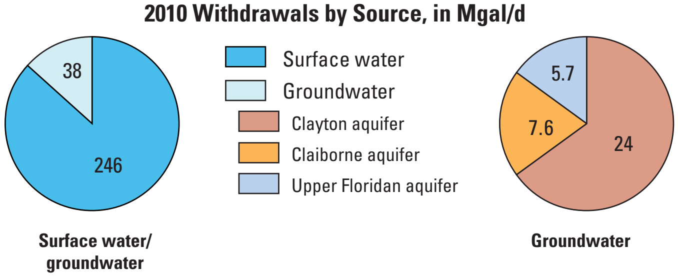
Withdrawals by Major Industrial Groups

NAICS	Groundwater	Surface water
322–Paper, pulp products	0.00	109.12
331–Primary metals	0.28	0.00
221–Thermoelectric	0.17	0.00

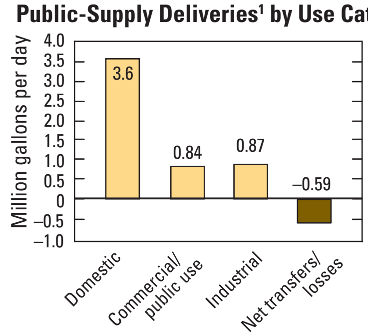
Withdrawals by Major Public Suppliers

Name	Groundwater	Surface water
City of Dothan Utilities, Ala.	8.92	0.00
Henry County, Ala.	0.74	0.00
City of Abbeville, Ala.	0.55	0.00
Houston County, Ala., Water Authority	0.40	0.00
Headland Water Works, Ala.	0.26	0.00
Town of Ashford, Ala.	0.25	0.00
City of Fort Gaines, Ga.	0.24	0.00

2010 Withdrawals by Source, in Mgal/d

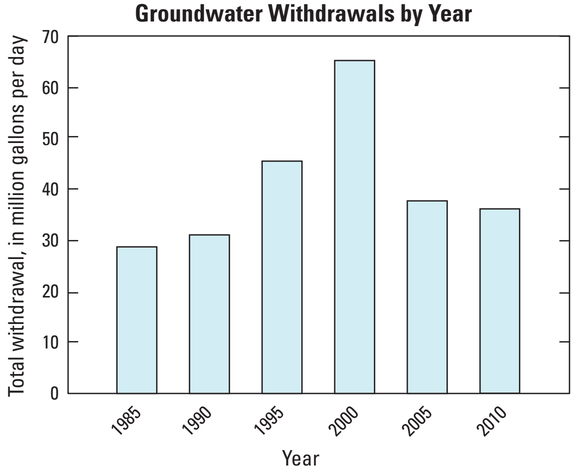


Public-Supply Deliveries[1] by Use Category

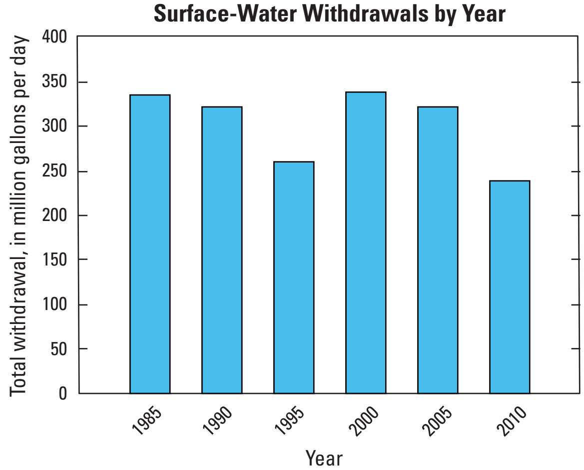


[1]Deliveries from public supply typically do not equal withdrawals because of intercounty withdrawals and purchases, public use, and system losses.

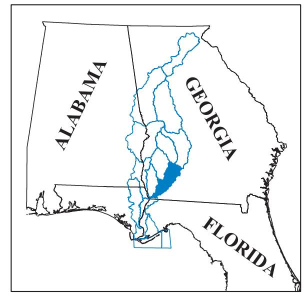
Groundwater Withdrawals by Year



Surface-Water Withdrawals by Year



LOWER FLINT RIVER BASIN



Hydrologic unit code	03130008
Population	110,050
Population served by public supply	91,280
Groundwater	91,280
Surface water	0
Self-supplied population	18,770
Acres irrigated	162,700

2010 WATER WITHDRAWALS AND ESTIMATED USE, IN MILLION GALLONS PER DAY

Category	Withdrawals			Total use[1]	Surface-water returns
	Ground-water	Surface water	Total		
Public supply	7.31	0.00	7.31	–	—
Domestic	1.41	0.00	1.41	12.43	—
Commercial/public use	0.24	0.00	0.24	5.01	0.00
Industrial	7.13	0.00	7.13	9.61	1.99
Public-supply losses	—	—	—	4.15	—
Public wastewater treatment	—	—	—	—	18.37
Mining	0.11	0.00	0.11	0.11	0.00
Irrigation—Crop	141.22	1.30	142.52	142.52	—
Irrigation—Golf course	0.76	0.00	0.76	0.76	—
Livestock and aquaculture	0.15	0.71	0.86	0.86	0.00
Thermoelectric power	0.16	50.00	50.16	50.16	50.00
TOTAL	**158.50**	**52.01**	**210.51**	**225.61**	**70.36**

[1]Total use is total withdrawal plus public-supply deliveries and losses. About 15 Mgal/d of water was delivered from Middle Flint River Basin to the Lower Flint River Basin in 2010.

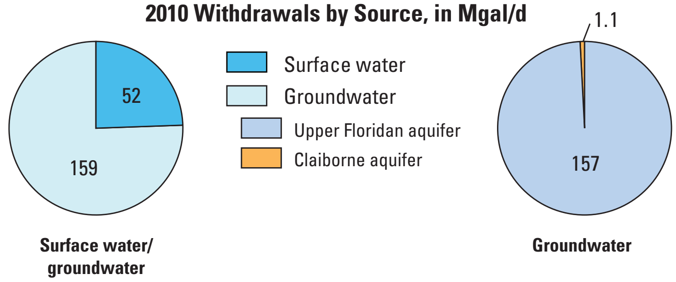
Withdrawals by Major Industrial Groups

NAICS	Groundwater	Surface water
322–Paper Products	5.38	0.00
325–Chemical Products	0.94	0.00

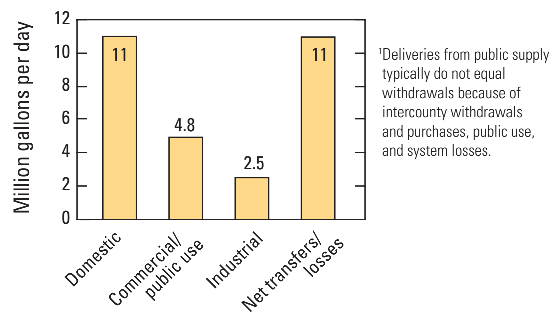
Withdrawals by Major Public Suppliers

Name	Groundwater	Surface water
City of Camilla, Ga.	3.06	0.00
City of Bainbridge, Ga.	2.75	0.00
City of Pelham, Ga.	0.69	0.00

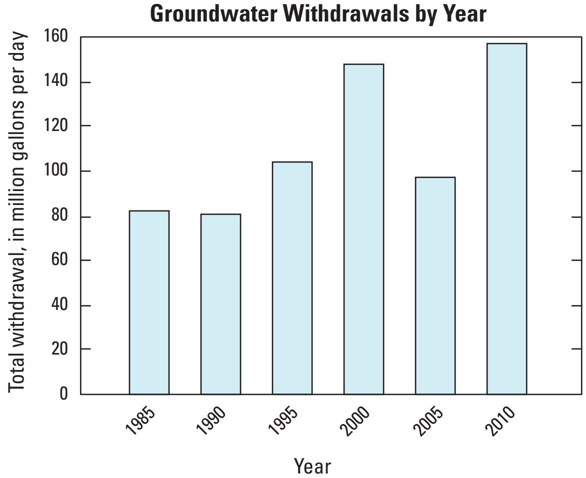
2010 Withdrawals by Source, in Mgal/d



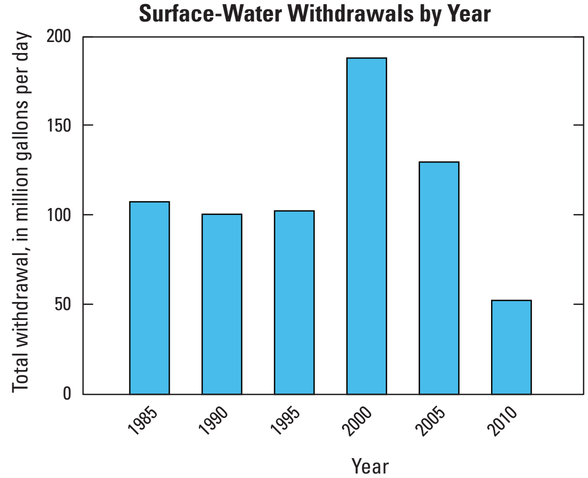
Public-Supply Deliveries[1] by Use Category



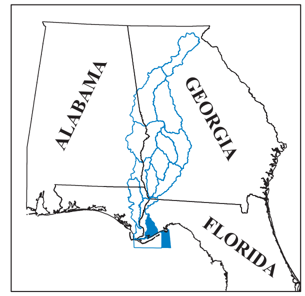
Groundwater Withdrawals by Year



Surface-Water Withdrawals by Year



NEW RIVER BASIN



Hydrologic unit code	03130013
Population	5,260
Population served by public supply	3,880
Groundwater	3,880
Surface water	0
Self-supplied population	1,380
Acres irrigated	300

2010 WATER WITHDRAWALS AND ESTIMATED USE, IN MILLION GALLONS PER DAY

Category	Withdrawals			Total use[1]	Surface-water returns
	Ground-water	Surface water	Total		
Public supply	0.96	0.00	0.96	—	—
Domestic	0.10	0.00	0.10	0.70	—
Commercial/public use	0.00	0.00	0.00	0.17	0.00
Industrial	0.00	0.00	0.00	0.00	0.00
Public-supply losses	—	—	—	0.19	—
Public wastewater treatment	—	—	—	—	0.00
Mining	0.00	0.00	0.00	0.00	0.00
Irrigation—Crop	0.00	0.00	0.00	0.00	—
Irrigation—Golf course	0.02	0.28	0.30	0.30	—
Livestock and aquaculture	0.00	0.00	0.00	0.00	0.00
Thermoelectric power	0.00	0.00	0.00	0.00	0.00
TOTAL	**1.08**	**0.28**	**1.36**	**1.36**	**0.00**

[1]Total use is total withdrawal plus public-supply deliveries and losses.

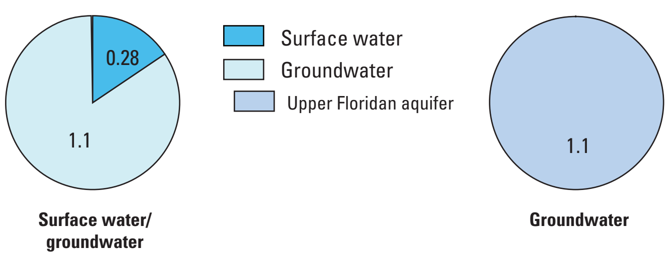
Withdrawals by Major Industrial Groups

NAICS	Groundwater	Surface water
None	—	—

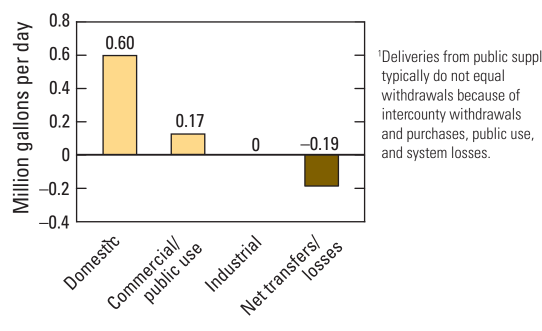
Withdrawals by Major Public Suppliers

Name	Groundwater	Surface water
City of Carrabelle, Fla.	0.61	0.00
City of Eastpoint, Fla.	0.26	0.00
City of Alligator Point, Ga.	0.09	0.00

2010 Withdrawals by Source, in Mgal/d

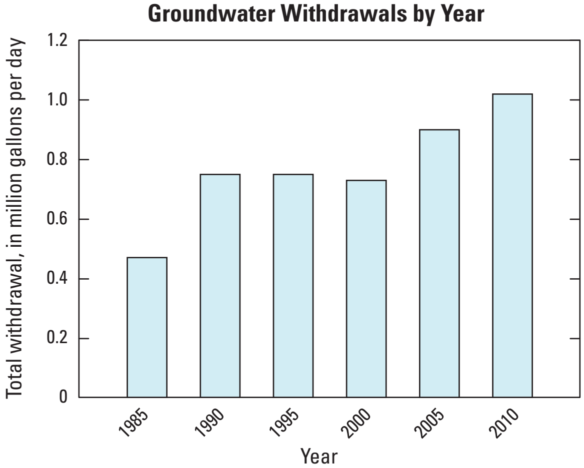


Public-Supply Deliveries[1] by Use Category

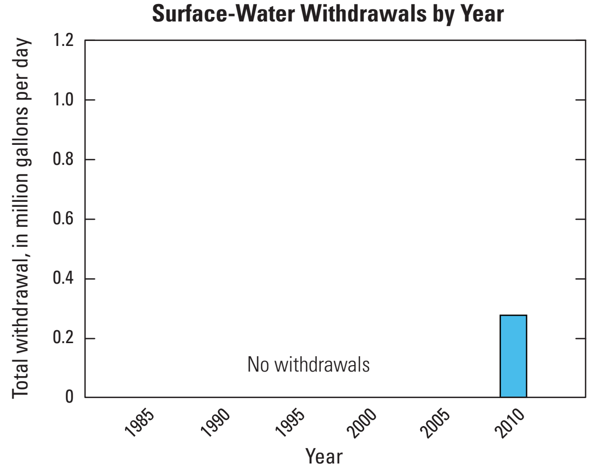


[1]Deliveries from public supply typically do not equal withdrawals because of intercounty withdrawals and purchases, public use, and system losses.

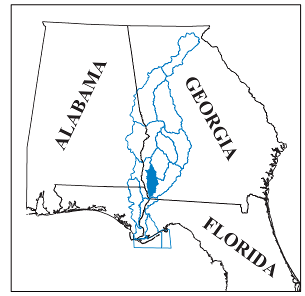
Groundwater Withdrawals by Year



Surface-Water Withdrawals by Year



SPRING CREEK BASIN



Hydrologic unit code	03130010
Population	22,770
Population served by public supply	12,750
Groundwater	12,750
Surface water	0
Self-supplied population	10,020
Acres irrigated	139,590

2010 WATER WITHDRAWALS AND ESTIMATED USE, IN MILLION GALLONS PER DAY

Category	Withdrawals			Total use[1]	Surface-water returns
	Ground-water	Surface water	Total		
Public supply	2.18	0.00	2.18	—	—
Domestic	0.75	0.00	0.75	2.08	—
Commercial/public use	0.00	0.00	0.00	0.42	0.00
Industrial	0.00	0.00	0.00	0.01	0.00
Public-supply losses	—	—	—	0.42	–
Public wastewater treatment	—	—	—	—	2.05
Mining	0.00	0.00	0.00	0.00	0.00
Irrigation—Crop	112.00	5.89	117.90	117.90	—
Irrigation—Golf course	0.31	0.00	0.31	0.31	—
Livestock and aquaculture	0.08	0.27	0.35	0.35	0.00
Thermoelectric power	0.00	0.00	0.00	0.00	0.00
TOTAL	**115.32**	**6.16**	**121.49**	**121.49**	**2.05**

[1]Total use is total withdrawal plus public-supply deliveries and losses.

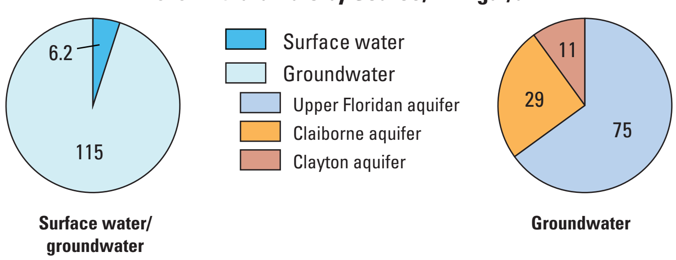
Withdrawals by Major Industrial Groups

NAICS	Groundwater	Surface water
None	—	—

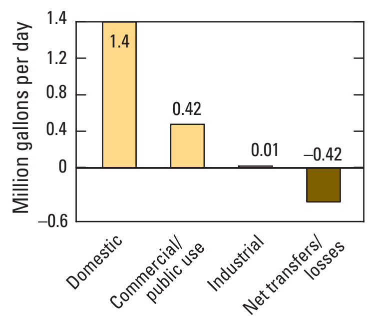
Withdrawals by Major Public Suppliers

Name	Groundwater	Surface water
City of Blakely, Ga.	1.24	0.00
City of Donalsonville, Ga.	0.52	0.00
City of Colquitt, Ga.	0.27	0.00
City of Damascus, Ga.	0.09	0.00

2010 Withdrawals by Source, in Mgal/d

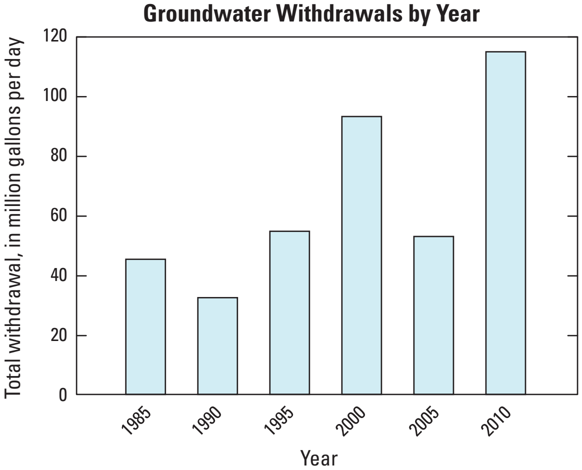


Public-Supply Deliveries[1] by Use Category

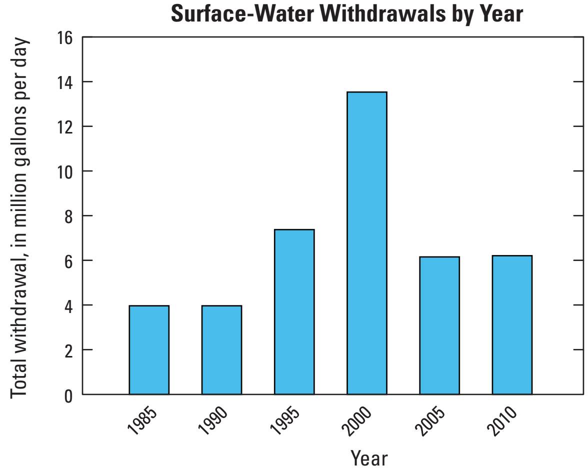


[1]Deliveries from public supply typically do not equal withdrawals because of intercounty withdrawals and purchases, public use, and system losses.

Groundwater Withdrawals by Year

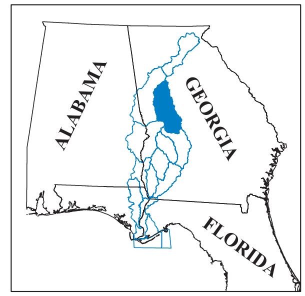


Surface-Water Withdrawals by Year



UPPER FLINT RIVER BASIN

Hydrologic unit code	03130005
Population	537,170
Population served by public supply	422,660
Groundwater	28,040
Surface water	394,620
Self-supplied population	114,510
Acres irrigated	12,510



2010 WATER WITHDRAWALS AND ESTIMATED USE, IN MILLION GALLONS PER DAY

Category	Withdrawals			Total use[1]	Surface-water returns
	Ground-water	Surface water	Total		
Public supply	3.05	34.93	37.98	—	—
Domestic	8.59	0.00	8.59	48.09	—
Commercial/public use	0.08	0.14	0.22	6.96	0.00
Industrial	0.00	1.98	1.98	4.78	0.01
Public-supply losses	—	—	—	9.13	—
Public wastewater treatment	—	—	—	—	27.17
Mining	1.28	0.02	1.30	1.30	2.69
Irrigation—Crop	2.28	3.55	5.83	5.83	—
Irrigation—Golf course	0.00	2.42	2.42	2.42	—
Livestock and aquaculture	0.12	1.93	2.05	2.05	0.00
Thermoelectric power	0.00	0.00	0.00	0.00	0.00
TOTAL	**15.40**	**44.97**	**60.37**	**80.56**	**29.87**

[1]Total use is total withdrawal plus public-supply deliveries and losses. About 19 Mgal/d was delivered from other basins to the Upper Flint River Basin in 2010.

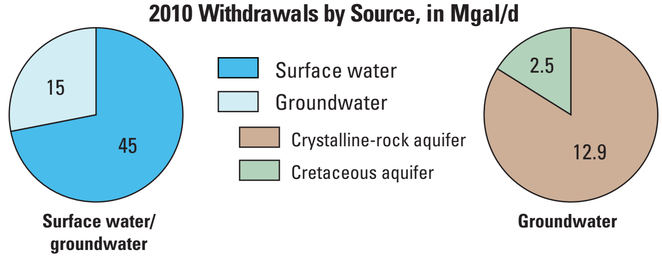
Withdrawals by Major Industrial Groups

NAICS	Groundwater	Surface water
423–Wholesale, durable goods	0.00	1.72
313–Textile mill products	0.00	0.26

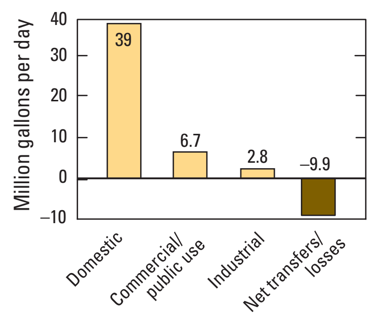
Withdrawals by Major Public Suppliers

Name	Groundwater	Surface water
City of Griffin, Ga.	0.00	9.43
Fayette County, Ga.	0.12	9.02
City of Thomaston, Ga.	0.00	4.00
Clayton County Water Auth.	0.00	3.61
City of Manchester, Ga.	0.00	1.36
City of Fayetteville, Ga.	0.63	0.71
City of Butler, Ga.	0.59	0.00

2010 Withdrawals by Source, in Mgal/d

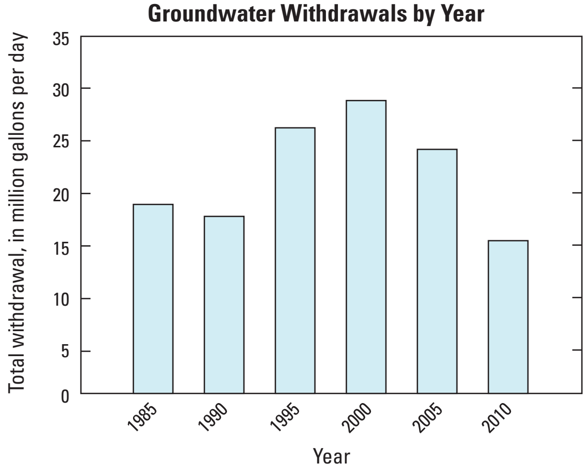


Public-Supply Deliveries[1] by Use Category

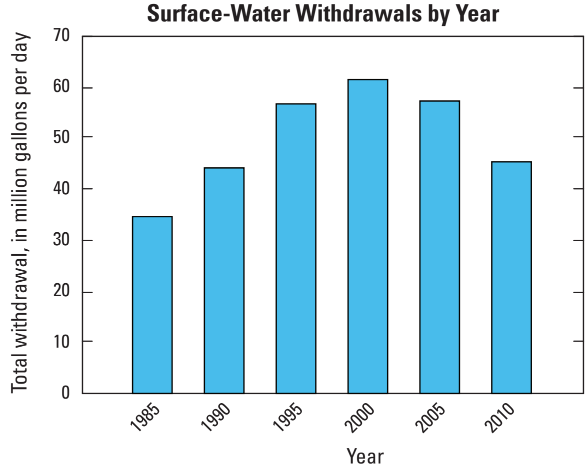


[1]Deliveries from public supply typically do not equal withdrawals because of intercounty withdrawals and purchases, public use, and system losses.

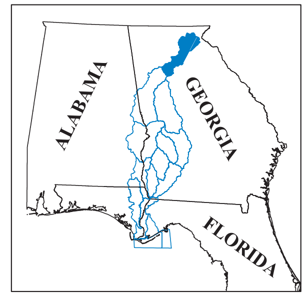
Groundwater Withdrawals by Year



Surface-Water Withdrawals by Year



UPPER CHATTAHOOCHEE RIVER BASIN



Hydrologic unit code	03130001
Population	1,528,690
Population served by public supply	1,421,790
Groundwater	30,980
Surface water	1,390,810
Self-supplied population	106,900
Acres irrigated	2,290

2010 WATER WITHDRAWALS AND ESTIMATED USE, IN MILLION GALLONS PER DAY

Category	Withdrawals			Total use[1]	Surface-water returns
	Groundwater	Surface water	Total		
Public supply	3.21	362.74	365.95	—	—
Domestic	8.02	0.00	8.02	181.52	—
Commercial/public use	0.00	0.00	0.00	57.28	0.00
Industrial	0.22	0.00	0.22	19.49	0.49
Public-supply losses	—	—	—	67.57	—
Public wastewater treatment	—	—	—	—	96.20
Mining	0.90	0.06	0.96	0.96	0.34
Irrigation—Crop	0.52	0.41	0.93	0.93	—
Irrigation—Golf course	2.09	2.06	4.15	[2]4.40	—
Livestock and aquaculture	0.10	13.45	13.55	13.55	0.00
Thermoelectric power	0.00	0.00	0.00	0.00	0.00
TOTAL	**15.06**	**378.72**	**393.78**	**345.70**	**97.03**

[1]Total use is total withdrawal plus public-supply deliveries and losses. About 48 Mgal/d delivered to other basins by DeKalb County, Gwinnett County Deptartment of Water Resources, and City of Atlanta.

[2]Includes 0.25 Mgal/d of public-supplied water for irrigation.

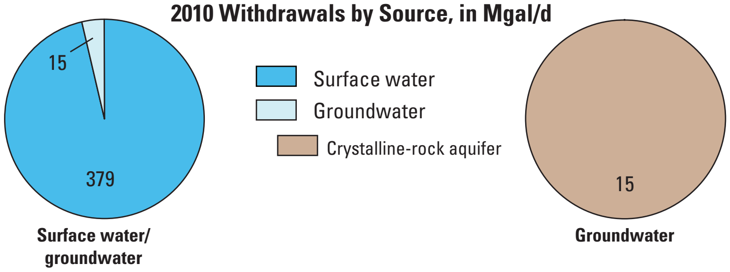
Withdrawals by Major Industrial Groups

NAICS	Groundwater	Surface water
221–Thermoelectric	0.57	0.00
311–Food and kindred products	0.21	0.00

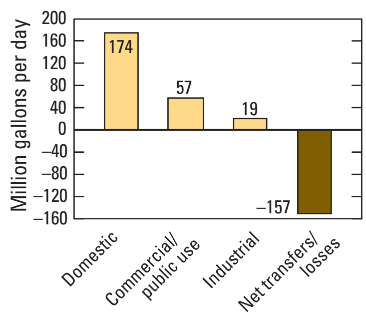
Withdrawals by Major Public Suppliers

Name	Groundwater	Surface water
City of Atlanta, Ga.	0.00	84.10
DeKalb County, Ga.	0.00	74.95
Gwinnett County Department of Water Resources	0.00	68.85
Cobb County-Marietta Water Authority	0.00	43.27
Atlanta-Fulton County Water Resources Commission	0.00	40.15
City of Gainesville, Ga.	0.00	17.52
City of Cumming, Ga.	0.00	11.41
Forsyth County Water and Sewer	0.00	7.77

2010 Withdrawals by Source, in Mgal/d

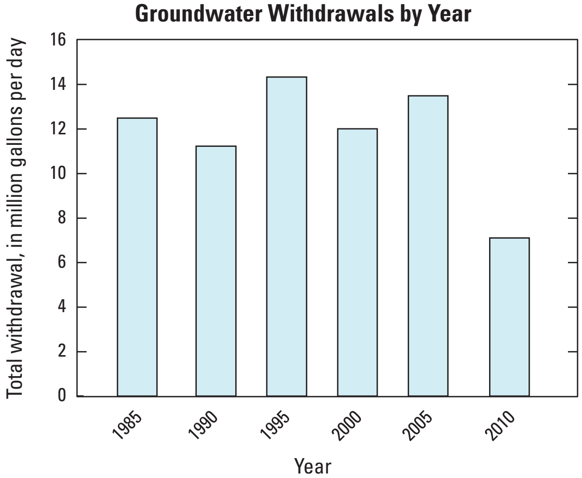


Public-Supply Deliveries[1] by Use Category

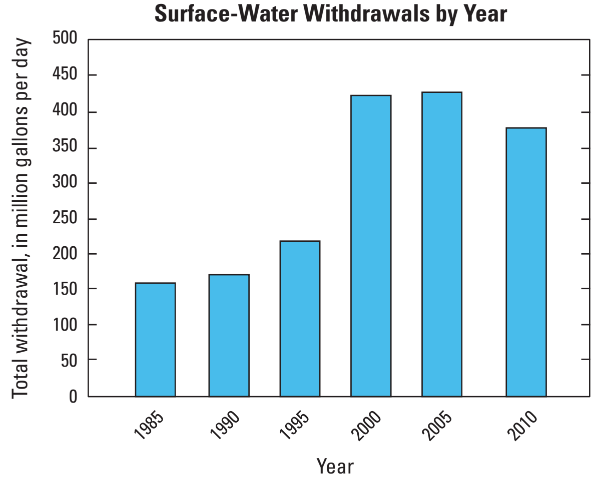


[1]Deliveries from public supply typically do not equal withdrawals because of intercounty withdrawals and purchases, public use, and system losses

Groundwater Withdrawals by Year



Surface-Water Withdrawals by Year



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