

Georgia's Water Resources

Population growth and economic prosperity in the state of Georgia are due in large part to our considerable water resources. Georgia contains parts of fourteen major river systems and multiple groundwater aquifer systems. Though water in Georgia seems to be abundant, it is not an unlimited resource. In recent years, Georgia's water use has expanded rapidly, growing by more than 20% between 1990 and 2000. The population growth and economic development which have contributed significantly to that expansion are expected to continue. Changing agricultural practices and recent droughts have also led Georgia's farmers to depend more heavily on irrigation to keep their crops healthy.

Each day, facilities in Georgia withdraw 6.5 billion gallons from the surface waters and aquifers of the state. We use that water for a broad range of purposes. Households and businesses use water to drink, cook, water lawns, bathe, wash clothing and dishes, and many

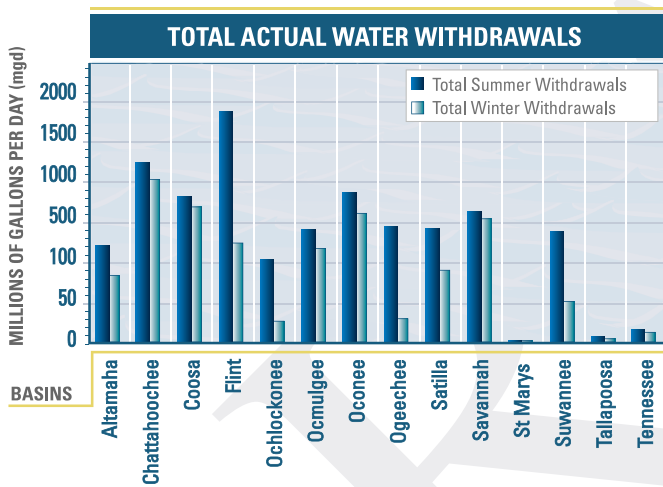
other uses. Industrial and mining operations use water for a wide variety of purposes. Large amounts of water are used to irrigate fields so as to produce maximum crop yields, especially during periods of drought. Fossil fuel and nuclear power plants, though they do not consume much water, depend on large amounts of water for power production. Our water use varies significantly by season. In the summer of 2004, irrigation used an estimated 2,890 million gallons per day (mgd), 1,820 mgd was withdrawn for municipal and industrial supply, and 2,530 mgd was withdrawn for use in thermoelectric power generation. In the winter months, 184 mgd was used for irrigation, 1,420 mgd for municipal and industrial uses, and 2,190 mgd for thermoelectric power production.

We also derive significant benefits from rivers and streams themselves. Streams and lakes provide valuable recreation areas, where visitors come to fish, hike, canoe, camp, and sight-see. Hydroelectric power is produced using falling water, usually below a dam and reservoir. Hydroelectric plants in 2005 generated approximately 228,000 megawatt hours (MWh) of electricity, enough to power over 20,000 households for an entire year. Hydroelectric power is vital to maintaining a reliable and inexpensive supply of power, especially during periods of peak power demand. Waters in some parts of the state are used for commercial navigation. Rivers and streams are a vital component to wildlife habitats across the state, providing water and food for a wide range of aquatic and terrestrial species. In the coastal areas, the rivers flow into the delicate marsh and estuarine ecosystems, supplying them with the freshwater that is critical to their health. These marshes and estuaries are crucial to the state's commercial fishing industry.

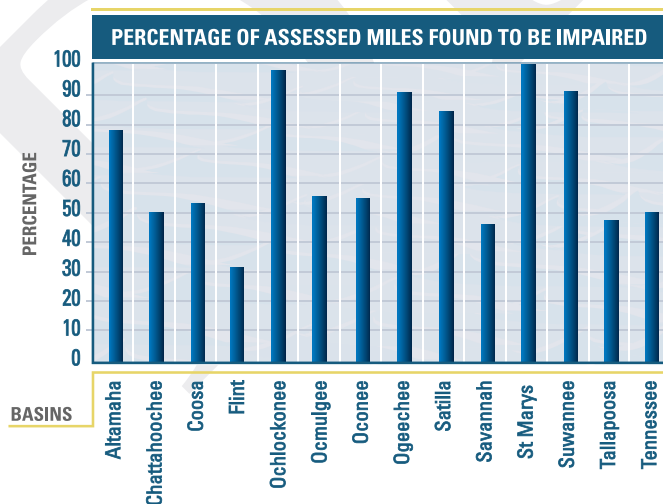
Rivers and streams also must be able to assimilate pollution from wastewater discharges and urban and rural runoff. In the past decades, the state has spent well over a billion dollars upgrading wastewater treatment facilities to reduce the amount of pollution discharged into our rivers and improve water quality. However, some communities have aging infrastructure, and system failures can cause pollution emergencies. In some fast-growing areas, wastewater infrastructure has difficulty keeping pace with population growth. In all areas, wastewater discharge permits assume a defined minimum flow rate will be available to dilute any residual contamination.

Currently, the most significant threat to water quality is non-point source pollution—contamination washed into the river from a variety of sources. Run-off from rural and urban areas can contribute a wide range of contaminants to streams, including chemicals, pesticides, metals, mud, sediment, bacteria, and nutrients. Land use practices have a significant effect on the quality of runoff. In Georgia, there are over 6,000 miles of streams that have been assessed that do not meet water quality standards. Most impairments are caused by non-point source pollution.

We all must share the state's water resources. Streams and rivers run through many political jurisdictions. The rain that falls in one region of Georgia may replenish the aquifers used by communities miles



SOURCES: Georgia Environmental Protection Division, Watershed Protection Branch and the 2005 Ag Water Pumping Report



SOURCES: Georgia 2006 305(b) list documents

away. When one city withdraws water from a river or pumps water out of the ground, less water is available for people elsewhere to support economic development, irrigate crops, and generate power. If too much water is removed, the entire water system suffers as water quality degrades and streams can no longer support aquatic life and riverine habitats. If the level of water in one lake is kept high so boaters and fisherman can enjoy recreational opportunities or to store water to meet future domestic supply needs, downstream water flows may be too low to support a variety of uses. Structures such as dams and reservoirs that alter the naturally fluctuating river flows can also have widespread impacts on a river's health. Waterways have naturally varying water levels throughout the year, and low, high, and even flood levels each play a role in shaping ecosystems and water supply capabilities.

The state has unique challenges in addressing future water supply needs. In the northern part of the state, which is the most populous, groundwater cannot reliably supply the quantities of water necessary for cities and large industrial operations. The majority of the state's residents rely on surface water to supply their homes.

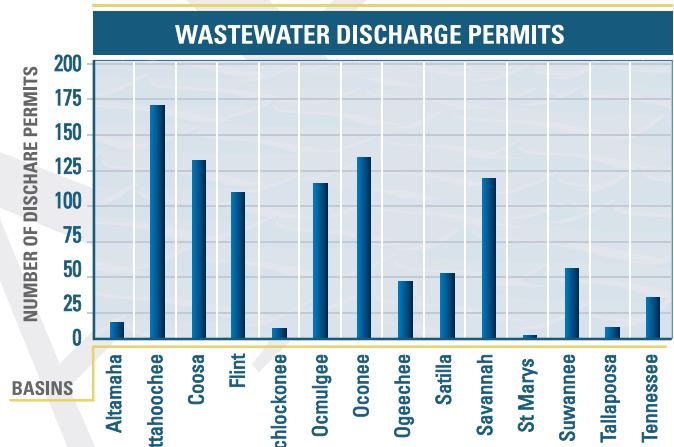
Georgia also faces significant groundwater management challenges. The Floridan aquifer, which underlies Georgia's Coastal Plain, is one of the most productive aquifers in the world, and those who live above it depend on it heavily to meet their water needs. However, extensive pumping in coastal areas contributes to the intrusion of saltwater into portions of the aquifer. Some wells have been abandoned as high salt levels have rendered the water unusable for irrigation or domestic supply, and a temporary moratorium on groundwater withdrawal permits was imposed in 1997. Under a 2006 plan, areas along the coast now face more limits on how much water they can withdraw from the Floridan aquifer.

Additionally, extensive reliance on the Floridan aquifer for irrigation during drought conditions, because of the significant connection between groundwater and surface water in southwest Georgia, contributed to reduced stream flows in the Chattahoochee and Flint river basins. In response to these reduced flows, the Environmental Protection Division (EPD) placed a moratorium on new agricultural withdrawal permits from the Floridan aquifer in southwest Georgia and on all agricultural surface water withdrawal permits for the entire Flint River Basin.

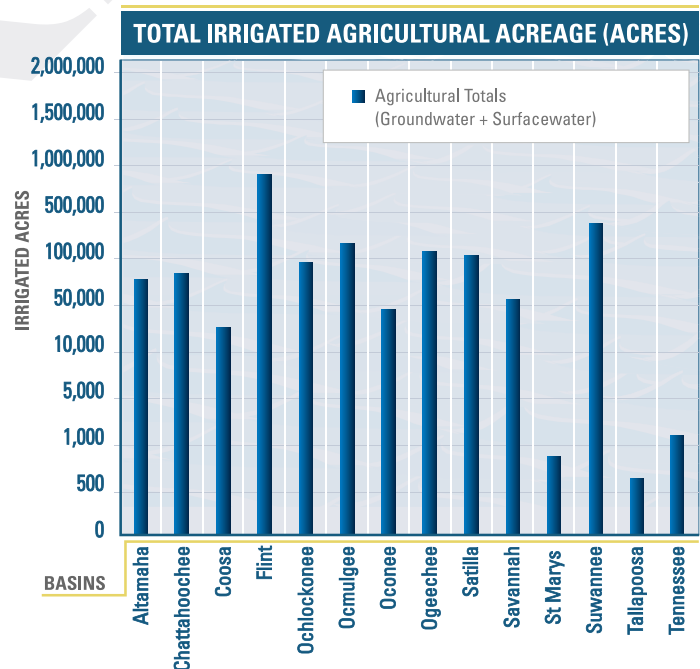
Groundwater sources, like surface water sources, have a limited capacity to produce reliable quantities of water. Some aquifers refill slowly, and if water is pumped out more quickly than it can be replenished, groundwater levels can fall, and the aquifer may not fully recover in the near future, even if pumping is greatly reduced. Under such circumstances, the aquifer cannot support increased water withdrawals.

Recent droughts, as well as a current drought that began in 2006, have made it clear that Georgia must take a more comprehensive and coordinated approach to managing water resources if we are to properly protect and preserve our water for future uses. The Comprehensive State-wide Water Management Planning Act, signed in May of 2004, required that the state develop this plan. It also establishes the following vision for Georgia's water management:

"That Georgia will manage water resources in a sustainable manner to support the state's economy, protect public health and natural systems, and enhance the quality of life for all citizens." This new comprehensive approach to water resource management will require new methods for gathering, organizing, and disseminating data to planners.



SOURCES: Georgia Environmental Protection Division, Watershed Protection Branch

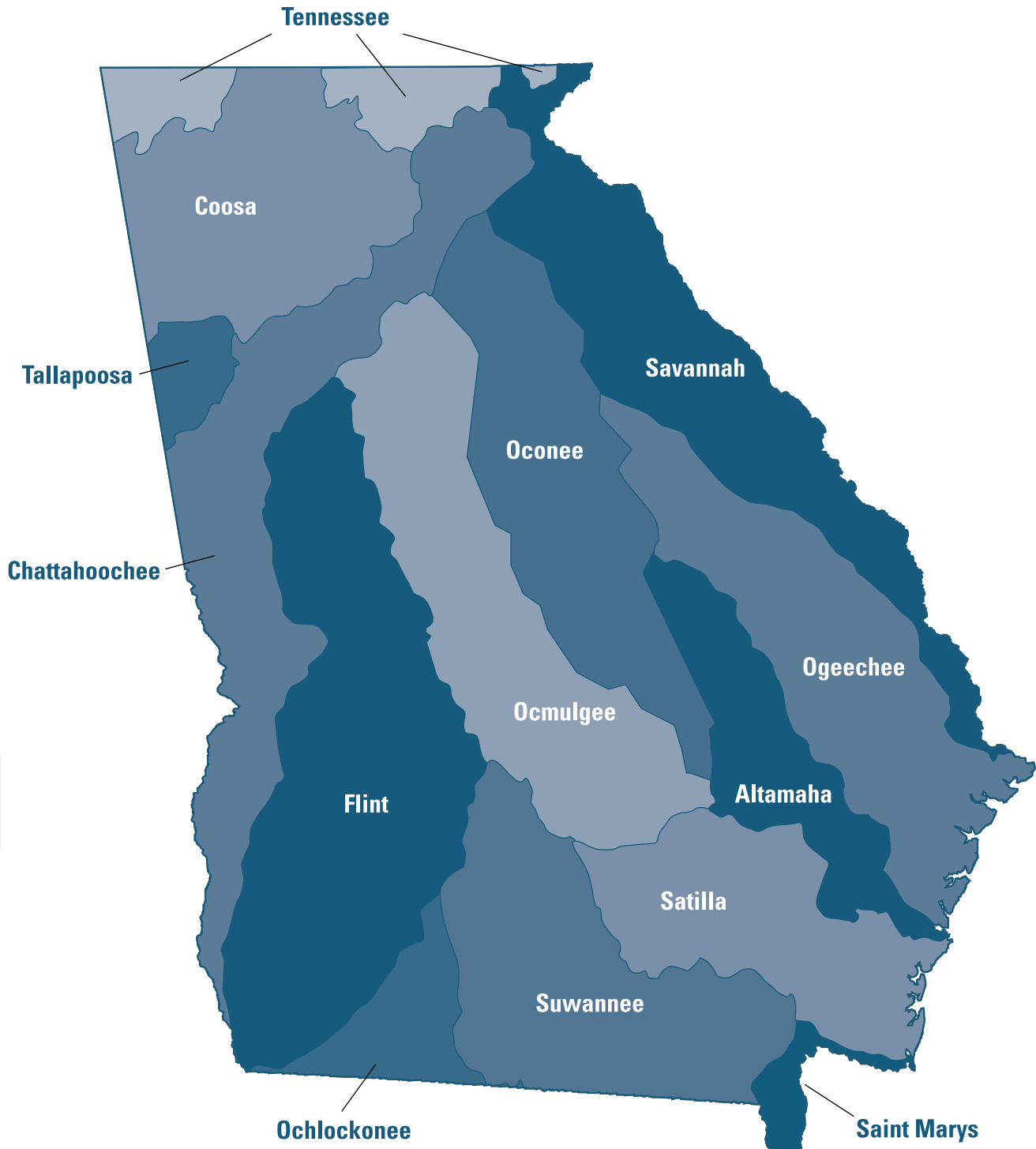


SOURCES: Georgia Environmental Protection Division, Watershed Protection Branch

GEORGIA'S RIVER BASINS

A river basin encompasses the area drained by a river and its tributaries. Georgia has 14 major river basins, comprised of many smaller watersheds. Six of these basins are contained entirely within the state's boundaries. Eight of the basins cross state boundaries and the water resources must be shared with other states.

Water in each of these basins is used for both off-stream purposes (uses for which water is withdrawn from the stream or aquifer) and in-stream purposes (uses of the water while it is still within the stream). Off-stream uses include public supply, industrial uses, and thermoelectric power generation. In-stream uses include the assimilation of pollution from point and non-point sources, support of aquatic life, hydroelectric power generation, recreation, and navigation. Each river basin has a unique pattern of water uses and water needs.



INTRA-STATE RIVERS

Oconee River Basin

The Oconee River Basin covers 5,330 square miles and includes parts of both the Piedmont and the Coastal Plain. The basin includes three major impoundments. Lake Oconee and Lake Sinclair are created by hydroelectric dams operated by Georgia Power. The Bear Creek Reservoir, which began operating in May of 2002, was constructed to address the water demands of Barrow, Oconee, Jackson and Clarke counties.

Groundwater in the Oconee Basin is supplied by three major aquifer systems: crystalline rock; Cretaceous; and the Floridan.

Off-Stream Water Uses

The largest amount of water in the basin is withdrawn by Plant Branch, a fossil fuel plant near Lake Sinclair. The plant is the second largest generator of electricity in the state. The plant withdraws approximately 650 mgd from Lake Sinclair, but almost all of that water is returned to the lake.

Municipal and industrial uses also constitute a significant water use in the basin. The basin supplies drinking water for the eastern Atlanta metropolitan area and the growing areas around Athens. Communities above the Fall Line, as well as the cities of Dublin and Milledgeville, rely on surface water sources, while smaller cities and communities to the south of the Fall Line are able to pump groundwater to meet demands. There is also significant water use by the kaolin, paper, and textile industries. Municipal and industrial users in the basin currently withdraw approximately 85 mgd. Estimates project that water demands in the upper part of the basin will more than double over the next few decades.

Approximately 20% of the basin is dedicated to agriculture, including cattle and poultry production in the northern part of the basin, and row crops in the bottom half. Total agricultural use in the period between 1999 and 2004 averaged 2 mgd in the winter and 30 mgd in the summer. The majority of water for irrigation is withdrawn from groundwater sources.

In-Stream Water Uses

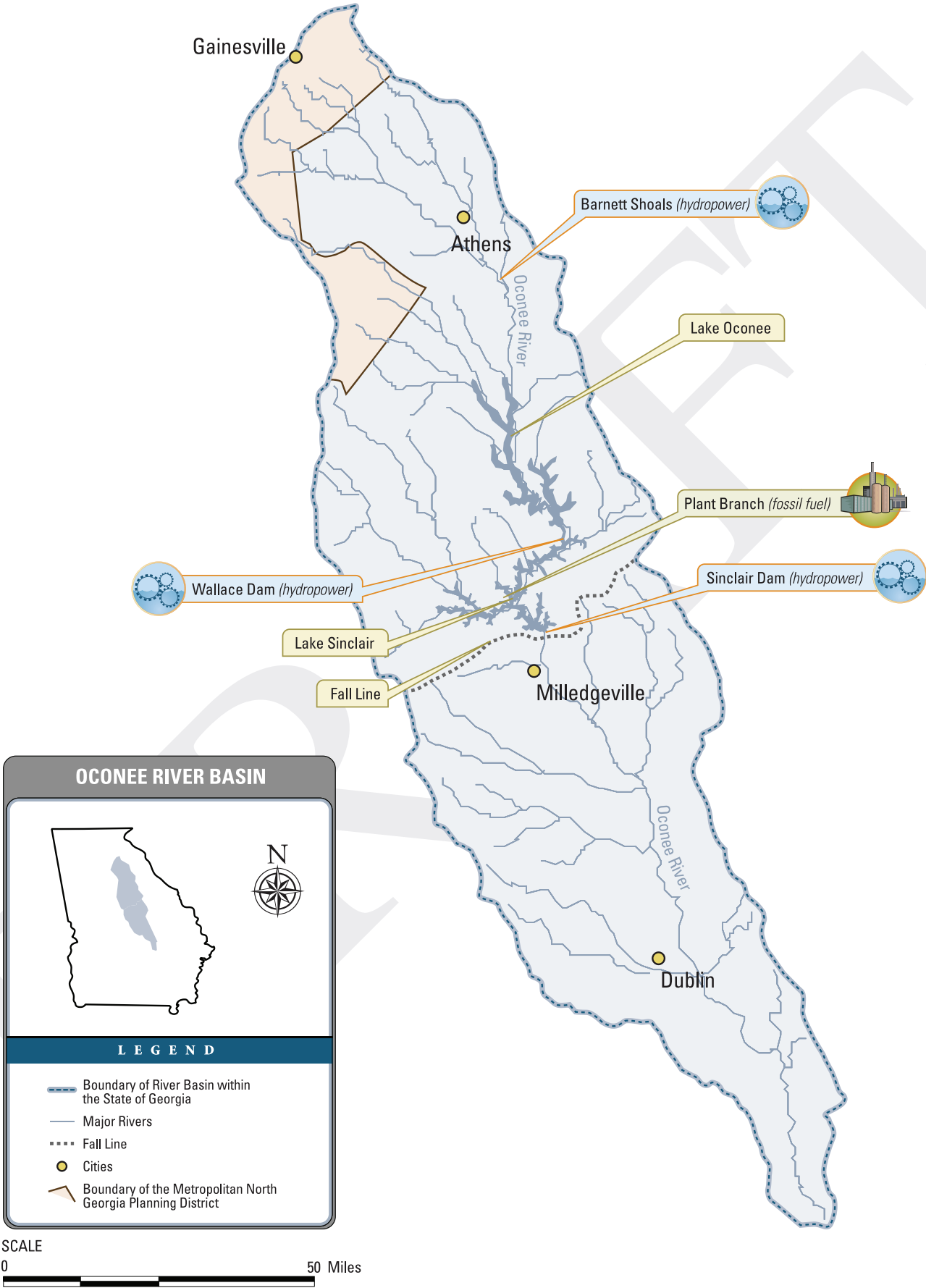
In the past decades, the state has spent \$15 million upgrading the treatment facilities in the Oconee River Basin, and pollutants emanating from point sources have been greatly reduced. However, the 2006 list of impaired waters classifies 4% of the stream miles assessed as impaired due in part to point source contamination. Point source discharge from the power plant on Lake Sinclair has also affected water quality, raising the temperature of the lake water.

Non-point source pollution poses a larger problem. The 2006 list of impaired waters classifies 53% of assessed stream miles as impaired by urban and rural runoff. The most prevalent problems in the basin are fecal coliform bacteria contamination, nutrients and sediment loading. A small number of stream segments have problems with pH, low dissolved oxygen levels, and metals contamination.

The basin supports many important habitats. The basin includes significant wetland areas and is home to at least 74 species of fish, 37 species of amphibian, 11 turtles, and 7 snakes, as well as the American alligator. Of these, the spotted turtle is listed as 'unusual' on the state Protected Species List. The eastern indigo snake is federally listed as 'threatened'. The southern part of the basin supports the only known viable population of robust redhorse sucker. Aquatic communities in 30 stream segments have been significantly impacted by non-point source contamination.

The surface waters of the basin are used for a range of recreational purposes. The two reservoirs on the Oconee are used locally for boating and fishing, which is dependent on the level of water maintained in the reservoir. The lakes support populations of bass, crappie, sunfish, and catfish. The Charlie Elliott Wildlife Center, which stretches across Jasper and Newton counties, provides wildlife education. The 6,400 acre center also contains the Marben Farms Public Fishing Area and the Clybel Wildlife Management Area, which are managed for public hunting. Other smaller areas along the river and its tributaries are used for fishing, hiking and hunting.

Hydroelectric power generation is also a significant in-stream use. Georgia Power operates two major hydropower dams in the Oconee Basin, the Wallace Dam and the Sinclair Dam. Both are used to provide power during times of peak power demand.



Ocmulgee River Basin

The Ocmulgee River Basin is located in central Georgia, between the Flint and Oconee river basins, and it drains approximately 6,085 square miles. The basin includes the Ocmulgee River and several major tributaries. Approximately half of the basin lies in the Piedmont province, and half in the Coastal Plain.

The largest impoundment in the basin is Lake Jackson, a Georgia Power hydroelectric impoundment. Other significant impoundments include Black Shoals Reservoir in Rockdale County and Lake Varner in Newton County, which are both water supply reservoirs. Lake Juliette in Monroe County provides cooling water for Plant Scherer. Lake Tobesofkee, operated by Bibb County, is used primarily for recreation.

Groundwater is supplied by three major aquifer systems: crystalline rock aquifers; Cretaceous aquifers; and the Floridan aquifer.

Off-Stream Water Uses

During the winter, the majority of the water withdrawn in the basin is for municipal and industrial purposes. Approximately 125 mgd is withdrawn during the winter and 174 mgd in the summer. Surface water is the primary water source in the Piedmont province; drinking water is almost exclusively drawn from groundwater sources in the southern portion. Population is concentrated in the metropolitan Atlanta area in the northern part of the basin and around Macon and Warner Robins, near the Fall Line. Water demand is expected to increase in the near future, especially in Gwinnett, Bibb and Houston counties, due to above average population growth rates.

During the summer, agriculture constitutes the largest water use in the basin, with withdrawals of 208 mgd. Agricultural surface water demand in the southern half of the Ocmulgee River Basin is considerable, especially throughout Pulaski, Houston, Dodge, Telfair, and Ben Hill counties. The majority of water used for irrigation, however, is taken from groundwater sources.

Power generation also represents a significant offstream use. The basin includes the largest power plant in the state, Plant Scherer on Lake Juliette in Monroe County. The basin includes two smaller fossil fuel facilities, Smarr Energy Facility and Plant Robins in Houston County. In 2004, power plants in the Ocmulgee Basin withdrew approximately 94 mgd. Most of the water withdrawn for power generation is returned to the source.

In-Stream Water Uses

Currently, 125 facilities discharge into the surface waters of the basin. Over the past several decades, Georgia has invested more than \$100 million in upgrading the treatment facilities in the Ocmulgee River Basin, and pollutants emanating from point sources have been greatly reduced. However, the 2006 list of impaired waters identified 6% of assessed stream miles as impaired by point sources, including three municipal wastewater treatment plants, two industrial

facilities, and the combined sewer overflow in the metro Atlanta area. The most prevalent problem is fecal coliform bacteria.

As in the rest of the state, non-point source pollution causes more water quality problems than point source pollution. The 2006 list of impaired waters classifies 55% of stream segments as impaired due to non-point source contamination. The most prevalent problem in the basin is the impaired fish communities caused principally by erosion and sediment loading. Erosion and sedimentation are often problems in agricultural areas, as well as areas where there is significant development and construction. High levels of fecal coliform bacteria are also a significant problem in the basin.

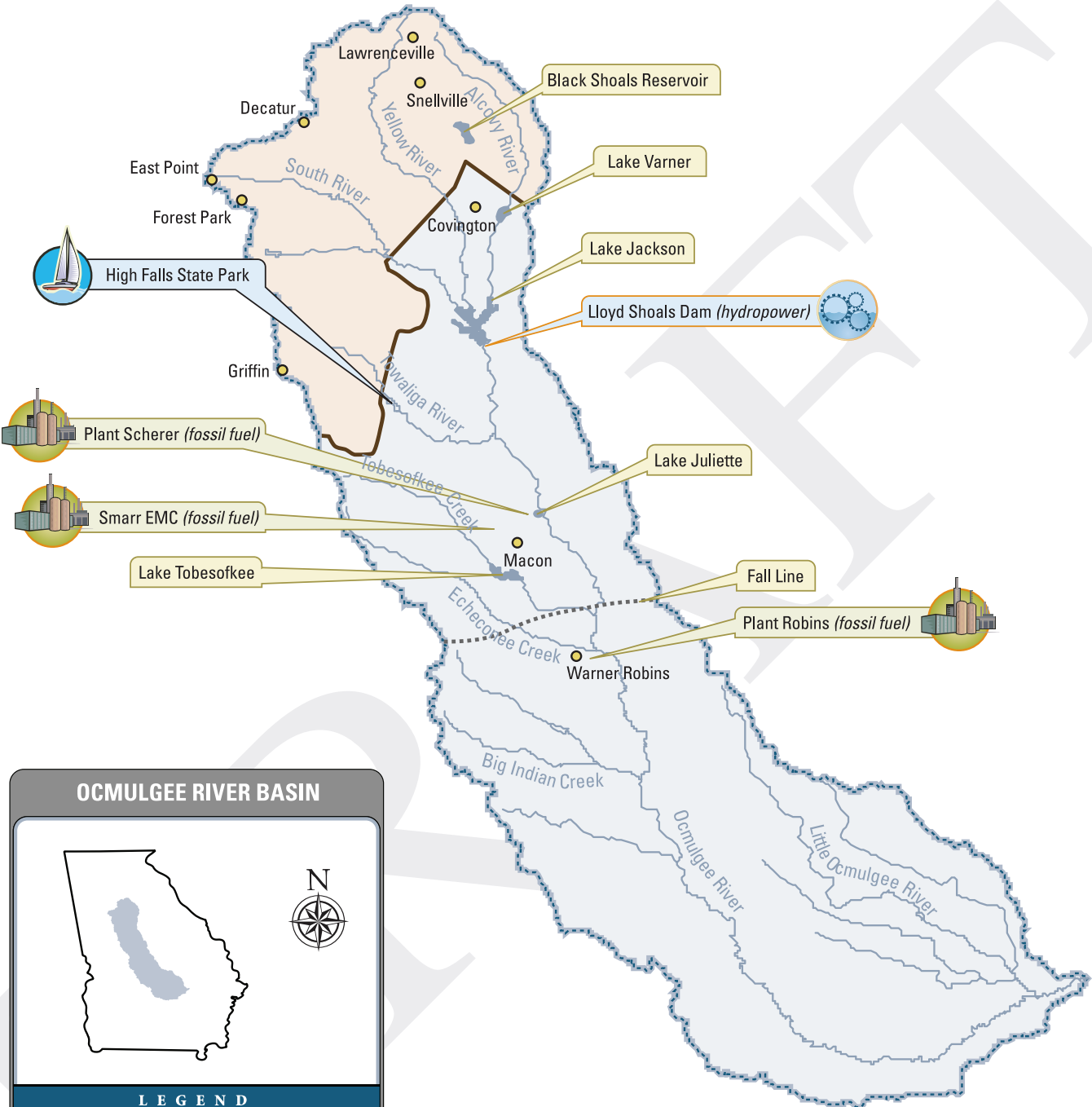
As one of Georgia's few remaining free flowing streams, the Ocmulgee River contains excellent habitat for numerous freshwater fish species, including many prized game fish. The basin is also home to the state-listed rare goldstripe darter and redeye chub and the endangered Altamaha shiner. In 65 stream segments in the basin, fish communities are impaired due to point and non-point source contamination. Fish consumption guidelines are in effect in three segments of the main stem of the Ocmulgee River and one segment of the South River due to PCB contamination.

The Ocmulgee River Basin hosts a wide variety of recreational activities, including boating, swimming, fishing and picnicking. Lake Tobesofkee is a 1,750-acre reservoir near Macon operated by Bibb County. The lake provides good fishing for white x striped bass hybrids, largemouth bass, channel catfish, and black crappie. It is also very popular with pleasure boaters, especially during the summer. Lake Juliette is located about 17 miles north of Macon, Georgia, and is maintained in cooperation with the Georgia DNR. Lake Juliette is a fishing lake with limited hunting, fishing and camping allowed. Bowens Mill Fish Hatchery, located in Ben Hill and Wilcox counties, produces bluegill, redear sunfish, largemouth bass, channel catfish, and white x striped bass hybrids.

Lake Jackson is a 4,750 acre lake located in Jasper, Butts, and Newton counties, with 135 miles of shoreline. It is a popular recreational area, and offers some of the best bream fishing in middle Georgia. Indian Springs State Park, a 528-acre park located in Flovilla, features a 105-acre lake with a swimming beach, a boating ramp and pedal boat rental. The High Falls State Park, a 1,050-acre park located in Jackson on the Towaliga River, features a 650-acre lake and hosts such surface water recreational activities as fishing, boating (two ramps), and canoe and fishing boat rental.

Black Shoals Reservoir in Rockdale County and Lake Varner in Newton County both provide good fishing for largemouth bass, bream, crappie, and channel catfish.

Georgia Power owns and operates one hydropower facility within the Ocmulgee River Basin. Lloyd Shoals Dam, below Lake Jackson, has a small generating capacity of 14,400 kilowatts.



OCMULGEE RIVER BASIN

LEGEND

- Boundary of River Basin within the State of Georgia
- Major Rivers
- Fall Line
- Cities
- Boundary of the Metropolitan North Georgia Planning District



Altamaha River Basin

The Altamaha River begins at the confluence of the Oconee and Ocmulgee Rivers in Telfair County, and its basin stretches southeast between the Ogeechee and Satilla river basins. The basin covers 2,870 square miles in Georgia. The Altamaha River empties into the Atlantic Ocean near Darien at an average annual flow rate of 14,300 cfs. Though it begins in the Piedmont Province, 95% of the basin is within the Coastal Plain. The largest tributary in the basin is the Ohooppee, which has an annual flow rate of 1,200 cfs. Under low flow conditions, tidal influences can extend 30-35 miles up the river, and saltwater wedges can be detected upstream nearly that far as well. Groundwater in the basin is supplied by the Floridan and Brunswick aquifers.

Off-Stream Water Uses

The only significant use of surface water in the basin is thermoelectric power generation. Plant Hatch, one of the state's two nuclear facilities, withdraws approximately 59 mgd from the Altamaha. Of the water withdrawn, approximately 34 mgd is not returned to the Altamaha.

Municipal, industrial, and agricultural water is almost exclusively drawn from groundwater sources. Between 1999 and 2004, approximately 50 mgd was withdrawn for municipal and industrial purposes. Approximately 67 mgd was withdrawn for agricultural purposes during the summer, and 8 mgd during the winter. Future agricultural water demand is expected to increase slightly.

In-Stream Water Uses

Currently, 19 facilities discharge wastewater into the surface waters of the basin. Over the past several decades, Georgia has invested more than \$96 million in upgrading the treatment facilities in the Altamaha River Basin, and pollutants emanating from these sources have been greatly reduced. However, 4% of assessed stream miles were listed as impaired on the 2006 list of impaired waters, due in part to municipal discharges. Water quality problems include fecal coliform bacteria and low dissolved oxygen.

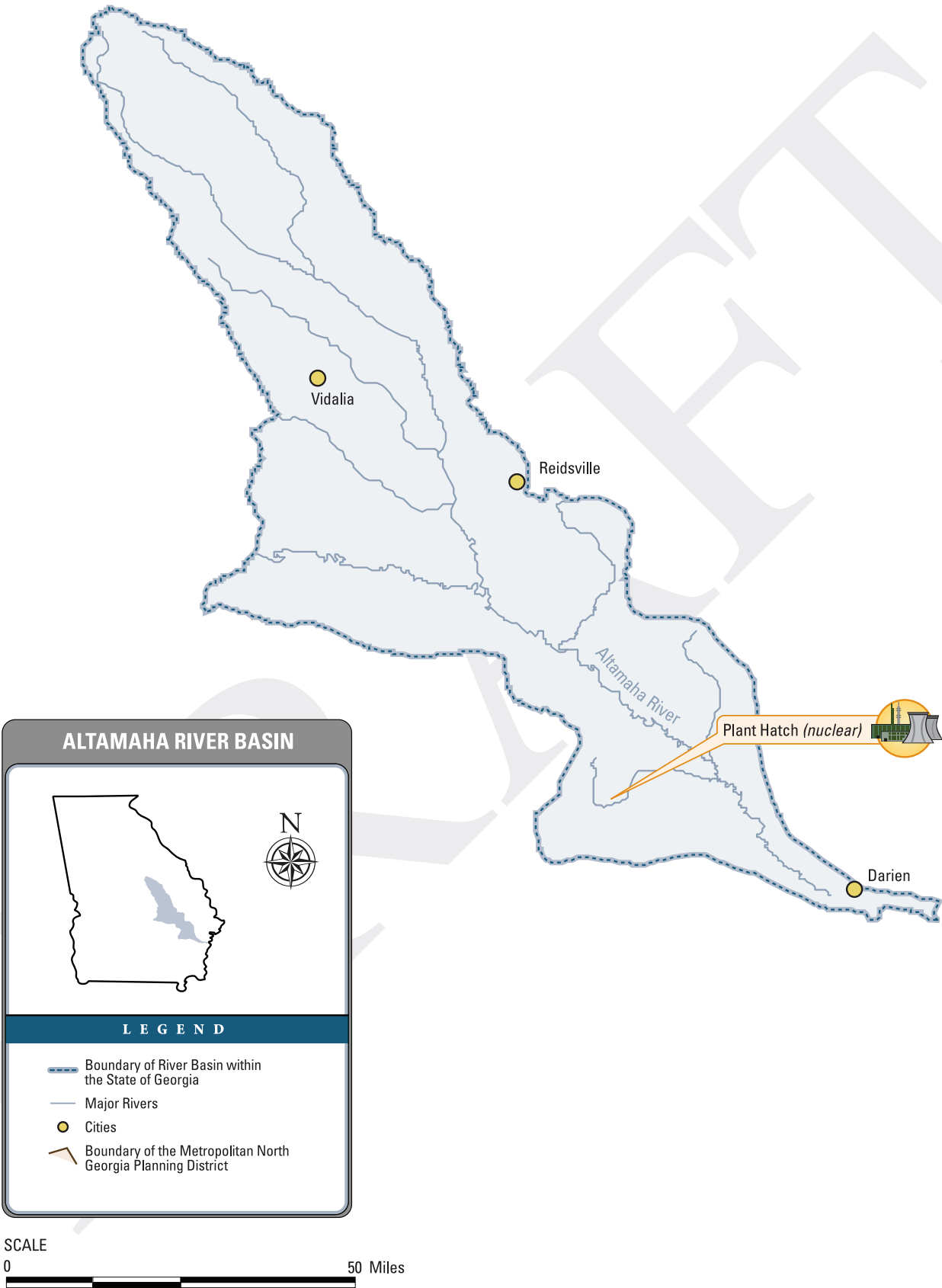
As with the rest of the state, non-point pollution causes more water quality problems than point source pollution. In the recent assessment, 69% of assessed stream miles were impaired due to non-point sources. The major concerns were low dissolved oxygen and fecal coliform contamination. Four streams, as well as Sand Hill Lake in Treutlen County had elevated levels of mercury.

The Altamaha River Basin is home to 74 species of fish. Due to a dramatic increase in the abundance of flathead catfish within the river—a non-native species introduced in the late 1970s—there has been a significant decline in the numbers of some native species, such as the bullhead catfish and the redbreast sunfish. American shad, hickory shad, blueback herring, Atlantic sturgeon and shortnose sturgeon all swim up the Altamaha River in the spring to spawn, and the river supports the largest commercial American shad harvest of Georgia's rivers. Historically, Atlantic and shortnose sturgeon were also harvested commercially from the Altamaha River. However, the decline in abundance of these two species has led to the listing of the shortnose sturgeon as an endangered species and the closure of commercial fisheries for both species.

The Altamaha River drains into Georgia's coastal marshlands, which include a significant proportion of the Atlantic seaboard's salt marshes and thousands of acres of rare tidal freshwater wetlands. The estuaries along the coast provide a nursery for crab, shrimp, oysters, clams and many fish species. These species have significant recreational and commercial significance: the commercial fishing industry off of Georgia's coast contributes over \$22 million to the economy each year. Many of the coastal ecosystems are sensitive to water quality problems, and the Department of Natural Resources is making a concerted effort to promulgate regulations that will protect the coastal wetlands.

The Altamaha River is popular with fishermen, offering excellent fishing for redbreast sunfish, largemouth bass, bluegill, redear sunfish, black crappie, flathead catfish, and channel catfish. There is some commercial navigation in the lower portion of the Altamaha River, particularly in the intracoastal waterway.

The most popular recreational areas are in the coastal areas. More than 500,000 fishermen travel to the coast to fish each year, and tourism in the area brings more than \$2 billion to the state annually.



Ogeechee River Basin

The Ogeechee River Basin drains 5,540 square miles between the Altamaha and Savannah basins. The main tributary in the Ogeechee River Basin is the Canoochee River, which flows through extensive river swamps on the Coastal Plain before joining the Ogeechee near King's Ferry. The Ogeechee and the Canoochee have significantly different flow regimes; periods of low flow in the Canoochee are far more extreme than the lows in the Ogeechee. The mean discharge of the Canoochee at Claxton is 472 cubic feet per second (cfs). The mean discharge of the Ogeechee at Eden is 2,283 cfs.

Groundwater is supplied to the Ogeechee Basin from four different aquifer systems: crystalline rock aquifers; the Cretaceous and the Gordon aquifer in the area around the Fall Line, and the Floridan and Brunswick aquifers in the southern part of the basin.

Off-Stream Water Uses

Irrigation is the largest use of water in the basin. The area is a center for Vidalia onion growing, and also has significant acreage dedicated to commodities production, including peanuts, tobacco, cotton, and small grains. Agricultural water demand is highly concentrated in the summer months; between 1999 and 2004, agricultural withdrawals were 154 mgd during the summer, and only 16 mgd during the winter. Almost all agricultural water is supplied by groundwater.

The population in the basin is concentrated in the suburban area south of Savannah as well as the city of Statesboro. Most water demands can be met by the Floridan aquifer, and there are only two surface water withdrawal permits in the basin. An average of 19 mgd is withdrawn from surface water and groundwater for public supply purposes.

Kaolin operations are a significant water user in the basin, utilizing both surface water and groundwater sources. Groundwater withdrawals by mining operations, as well as clay pit dewatering, can cause localized drops in water level in the Cretaceous aquifers in Washington and Jefferson counties. Total industrial use is approximately 9 mgd.

In-Stream Water Uses

A total of 46 facilities have permits to discharge treated wastewater into the surface waters of the Ogeechee River Basin. In the past decades, the state has spent \$12.5 million upgrading the treatment facilities in the Ogeechee River Basin, and pollutants emanating from these sources have been greatly reduced. The 2006 list of impaired waters classifies 1% of assessed stream miles as impaired due to low levels of dissolved oxygen created by waste from municipal wastewater treatment facilities.

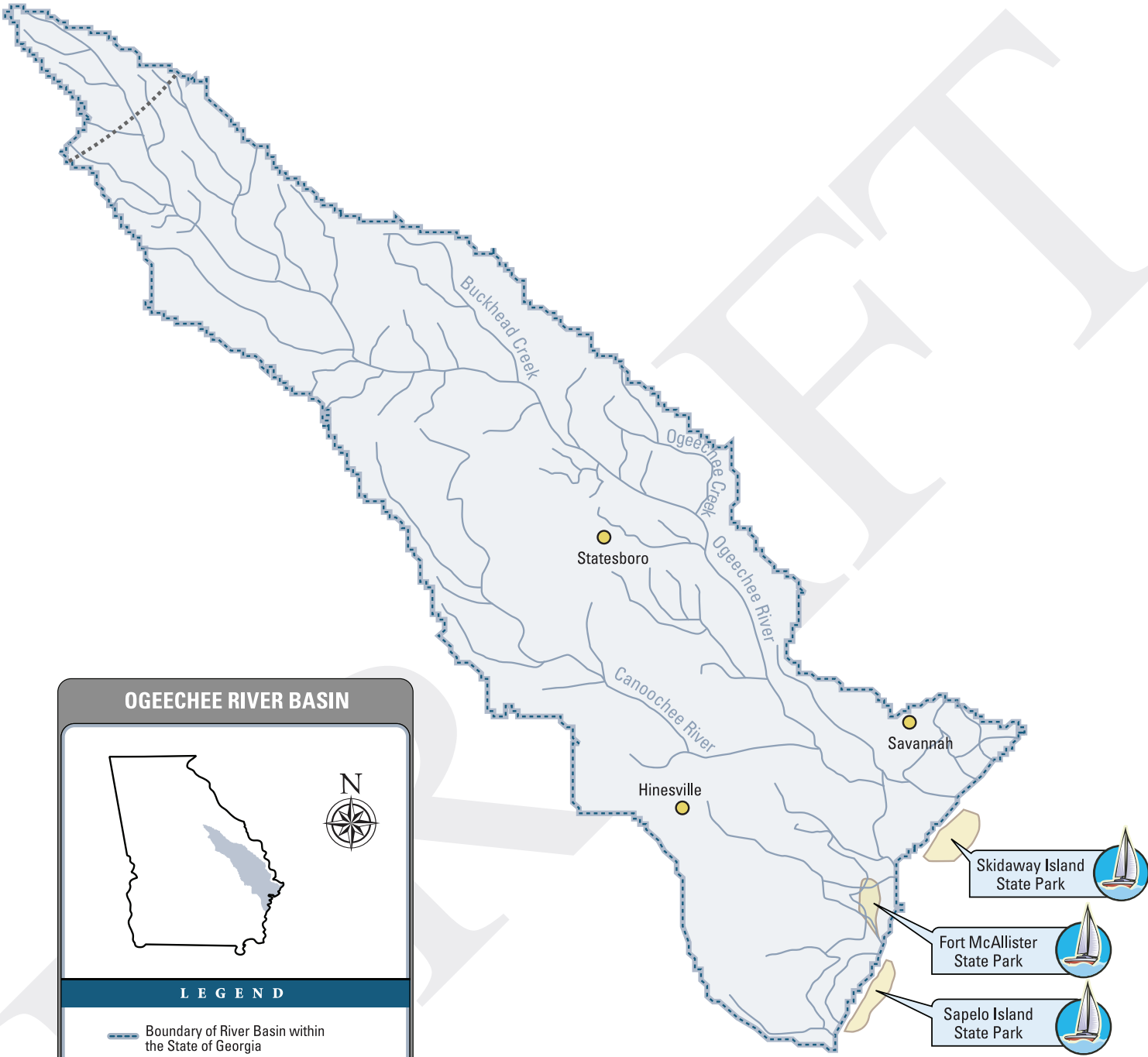
As with the rest of the state, non-point pollution causes more water quality problems than point source pollution. The 2006 list of impaired waters classifies 91% of assessed stream miles as impaired due to non-point source pollution. The principal problems are fecal coliform bacteria and high nutrient loads from urban and agricultural runoff. Fish in a significant portion of the Ogeechee River have high levels of mercury and the pesticide dieldrin in their tissues, which have warranted fish consumption guidelines.

The basin is home to 59 species of fish, including large numbers of catfish, sunfish and suckers. The basin is also home to a large variety of larger animals strongly associated with the surface waters, including snakes, turtles, and the American alligator.

The Ogeechee River drains into Georgia's coastal marshlands, which include a significant proportion of the Atlantic seaboard's salt marshes and thousands of acres of rare tidal freshwater wetlands. The estuaries along the coast provide a nursery for crab, shrimp, oysters, clams and many fish species. These species have significant recreational and commercial significance: the commercial fishing industry off of Georgia's coast contributes over \$22 million to the economy each year. Many of the coastal ecosystems are sensitive to water quality problems, and the Department of Natural Resources has recently written new regulations to help protect the coastal wetlands.

Fishing and swimming are popular in areas along the length of the Ogeechee and Canoochee rivers. Both the Ogeechee and Canoochee rivers support fisheries for sunfish, bass, and catfish. In addition, the Wildlife Resources Division raises bass at the Richmond Hill Hatchery in Bryan County for stocking in streams across Georgia.

The most popular recreational attractions are in the coastal areas of the state. More than 500,000 fishermen travel to Georgia's coast to fish each year, and tourism in the area provides more than \$2 billion to the economy each year. Skidaway Island is home to Skidaway Island State Park, which offers campgrounds, shelters, nature trails, and observation towers for bird-watchers. Sapelo Island, which is also a state park, offers attractions for nature lovers, who can explore the marsh, and history buffs, who can take guided tours of the island's historic communities. Fort McAllister, a state park on the Ogeechee just south of Savannah, offers camping, hiking and fishing, as well as a Civil War museum highlighting the park's preserved earthwork fortifications.



SCALE
0 50 Miles

Satilla River Basin

The Satilla River Basin covers 3,940 square miles entirely within the state of Georgia, in the southeast corner between the Altamaha and Suwannee river basins. The Satilla River is a blackwater stream that empties into the Atlantic Ocean between Cumberland and Jekyll islands at a rate of approximately 2700 cfs at its mouth. During extended dry periods, many of the smaller streams within the basin have virtually no flow, and the northernmost headwaters are especially unreliable as surface water sources. Groundwater in the Satilla River Basin is supplied by the Floridan and Brunswick aquifers.

Off-Stream Water Uses

The pulp and paper industry is the major water user in the basin. Industrial water withdrawals average a total of 51 mgd. The basin also supplies drinking water to Waycross, Douglas, and Brunswick. Approximately 17 mgd is withdrawn for public supply purposes. The basin supports more than 135,000 irrigated acres, and an average of 77 mgd is withdrawn during the summers. Most water is supplied by groundwater.

Power generation is also a significant water use in the basin. Plant McManus, a two-unit, oil-fired power plant, is located on Crispin Island in Turtle Creek near Brunswick. The facility has a generating capacity of 596,000 kilowatts, and serves as a quick-response peaking plant, used to respond to seasonal peaks and system emergencies. The facility withdraws an average of 27 mgd.

In-Stream Water Uses

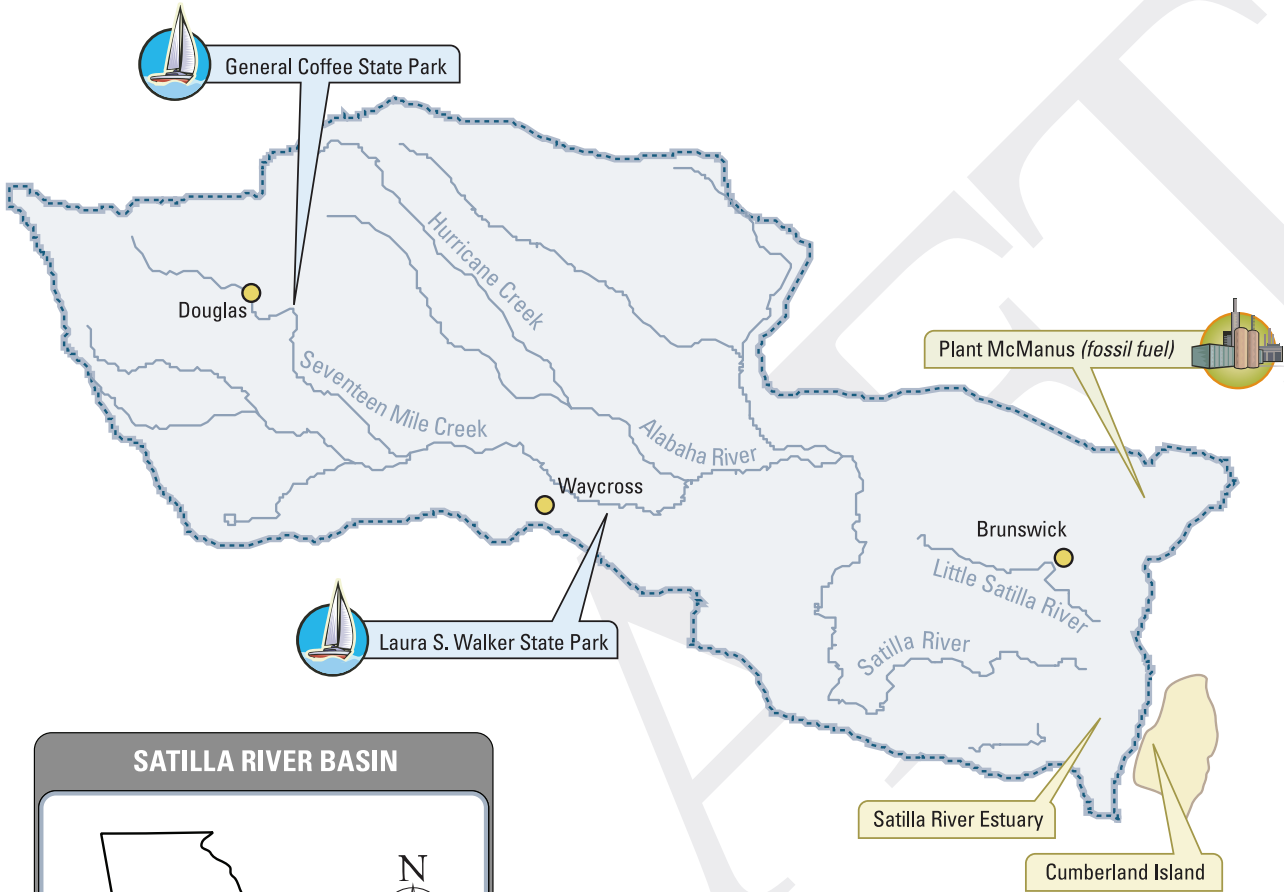
A total of 51 facilities have permits to discharge treated wastewater into the surface waters of the Satilla River Basin. Over the past several decades, Georgia has invested more than \$12.5 million in upgrading the treatment facilities in the Satilla River basin. The 2006 list of impaired waters classifies only one stream segment, the eight mile-long Little Red Bluff Creek in Atkinson County, as impaired by municipal discharge. Seven estuarine areas, all located in Glynn County, are unable to support fishing due to point source pollution from industrial facilities. The estuaries are contaminated with industrial chemicals, including PCBs and toxaphene, and metals, including mercury and cadmium. All of these estuaries are currently under a shellfish ban, and commercial fishing is prohibited in one estuary.

Non-point source pollution causes more water quality issues. The 2006 list of impaired waters classifies 85% of assessed stream miles as impaired by non-point source contamination. The most prevalent issues are low dissolved oxygen levels and fecal coliform bacteria contamination. Tissues in fish from two long segments of the main stem of the Satilla River have elevated levels of mercury.

Fish species diversity within the Satilla River is limited by acidic water, low alkalinity, extreme variation in flows, and the relatively homogenous habitat present throughout most of the river. However, the estuaries along the coast are important ecosystems. More than 70% of recreationally and commercially important fishes, crustaceans and shellfish spend at least a part of their lives in the estuarine areas. Commercial fishery stocks have declined significantly in recent years, largely due to environmental deterioration in the estuaries.

A wide variety of recreational activities are available throughout the Satilla River basin, including fishing, camping, boating, swimming, picnicking, and other activities. Recreational fishing is especially popular in the coastal area, which draws sport fishermen from across the region. The Satilla River also supports major fisheries for redbreast sunfish and catfish, along with smaller fisheries for sunfish, chain pickerel, warmouth and largemouth bass. Fisheries for largemouth bass, bluegill, chain pickerel, flier and catfish are present in the Laura Walker State Park Lake.

Fishing and canoe rentals are offered at the General Coffee State Park, in Nicholls, Georgia. The Seventeen-Mile River winds through a cypress swamp in the park, where rare and endangered plants and animals can be found. The Cumberland Island National Seashore is a popular destination for hikers and campers. The island contains four major historic districts as well as some of the oldest archeological artifacts in North America.



SATILLA RIVER BASIN

LEGEND

- Boundary of River Basin within the State of Georgia
- Major Rivers
- Cities
- Boundary of the Metropolitan North Georgia Planning District



Flint River Basin

The Flint River covers 8,460 square miles. The river begins in the southern part of metropolitan Atlanta and terminates in Lake Seminole on the Georgia-Florida border, along with the Chattahoochee River. Though the river is contained entirely within the state of Georgia, the use of water in the Flint River Basin has been one of the subjects of a water dispute between Alabama, Florida, and Georgia. The principle concern is low water levels in Lake Seminole and in the Apalachicola River, which continues from Lake Seminole across Florida into the Gulf of Mexico. A future agreement between the states may limit the amount of water communities in Georgia can withdraw from the Flint and Chattahoochee Rivers.

The river includes only two moderate impoundments, Lake Blackshear, near Warwick, and Lake Worth, near Albany. Both have minimal impact on the flow of the river. The Flint is far less modified than most of Georgia's rivers and in fact contains one of the longest stretches of free-flowing water in the contiguous 48 states.

The Flint River Basin overlies 4 major aquifer systems: the crystalline rock aquifers, the Clayton, the Claiborne, and the Floridan. Overall water use in the Flint River Basin increased 42% between 1970 and 1990 and is projected to continue growing. Groundwater withdrawals saw the sharpest increase, rising 240% over the 20 year period. Because of the strong connection between groundwater and surface waters in the lower Flint Basin, groundwater pumping reduces flows in the river and its tributaries. In the past, drought conditions have seriously strained the water resources of the Flint Basin. There are long-term concerns about water availability in the Flint River Basin, and a regional water plan has been developed to manage irrigation withdrawals through farm use withdrawal permits.

Off-Stream Water Uses

Approximately 40% of the basin is used for agriculture, and irrigation is the principal water use. The basin supports 895,536 irrigated acreage in the southern part of the basin. The most extensively irrigated crops are cotton, peanuts, corn, vegetables, and pecans, and most water for irrigation is taken from groundwater sources.

The amount of water necessary for irrigation varies greatly depending on rainfall. In drought years, according to the 2006 Flint River Basin Regional Water Plan, as much as 250 mgd can be withdrawn from surface waters for irrigation during peak irrigation months; 950 mgd may be withdrawn from groundwater sources.

The Flint is also used for public water supply and industrial purposes. The southwestern counties of the metropolitan Atlanta area use the Flint River, and the city of Albany utilizes both the Flint River and groundwater sources to meet its supply needs. Below Albany, communities rely on groundwater for municipal supply. Between 1999 and 2004, withdrawals for public supply and industrial purposes averaged 97 mgd.

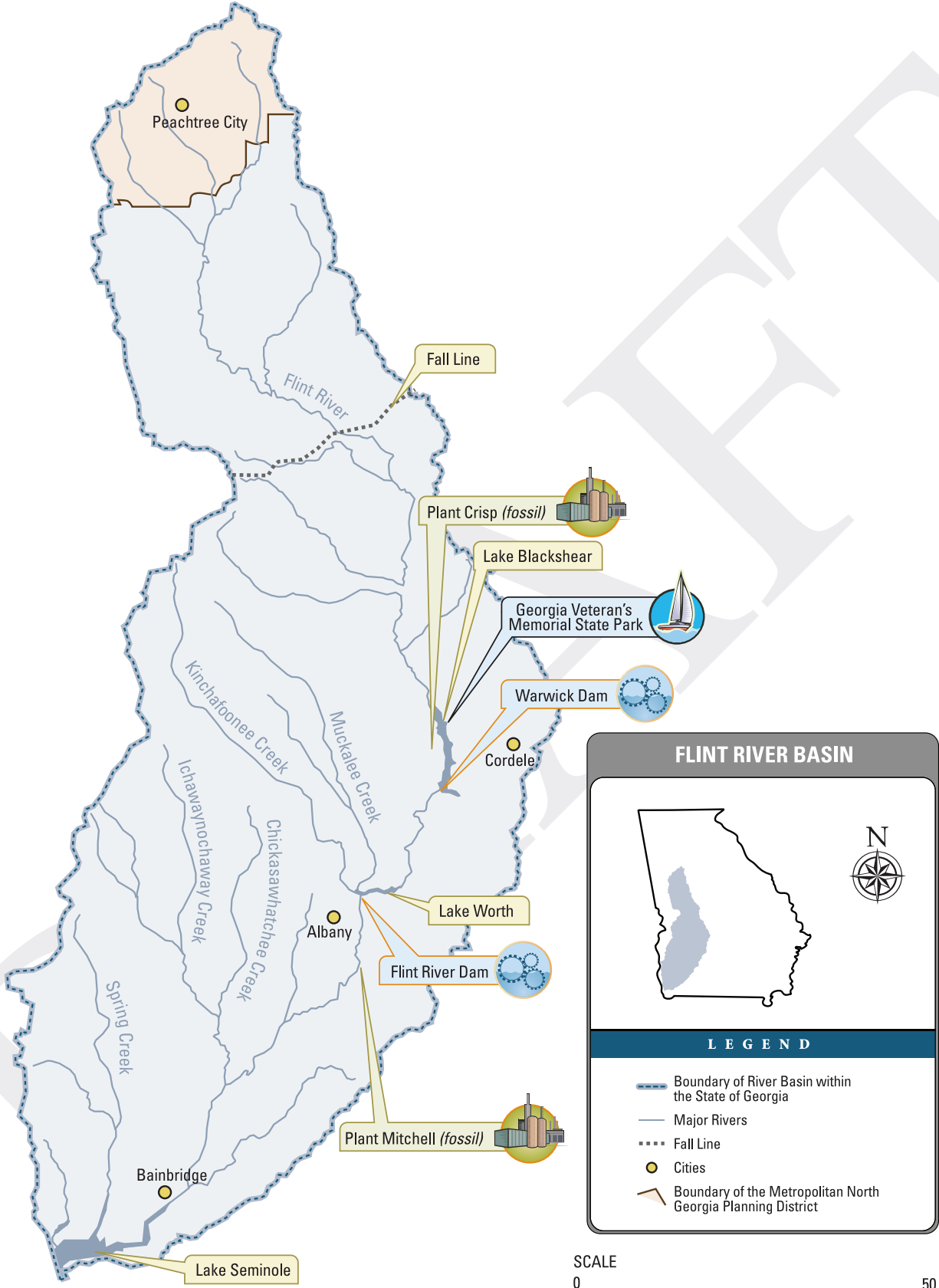
Power generation also represents a significant water use in the basin and accounts for the largest portion of water withdrawals during the winter months. Plant Mitchell in Dougherty County has a generating capacity of close to 250 megawatts. Plant Crisp generates power for Crisp County, including the municipalities of Cordele and Arabi. The plants withdraw an average of 118 mgd, which is returned to the source.

In-Stream Water Uses

A total of 114 facilities have permits to discharge treated wastewater into the surface waters of the Flint River Basin. Over the past decades, Georgia has spent over \$180 million improving the municipal wastewater treatment facilities in the Flint River Basin, and in the 2006 list of impaired waters, only 1% of assessed streams miles were considered impaired by point source contamination.

Non-point source pollution poses a larger problem. The 2006 list of impaired waters classifies 33% of assessed stream miles as impaired due in part to urban runoff and other non-point sources. Water quality is most impacted by urban runoff in the Atlanta and Albany areas. Problems with non-point source pollution will likely grow as the population of the basin increases.

The Flint River Basin supports a wide range of aquatic life. The basin contains 85 species from 19 families. The stretch of the Flint River between Albany and Lake Seminole, where considerable groundwater recharge creates cool areas for fish in the hot summer months, is the only place in Georgia where Gulf strain striped bass are able to reproduce. The Georgia Department of Natural Resources has placed a high priority on protecting this native species and stocks the fish in Lake Blackshear in an effort to create a successful spawning run up the Flint River. The basin is also inhabited by 16 species of turtle, 21 species of salamander, 26 species of frog, and the American alligator, which all depend on the basin's freshwater habitats. Fifteen amphibian and reptile species are rare or endangered, including the Barbour's map turtle and the alligator snapping turtle. During drought conditions, flows in the Flint River Basin can fall to extreme lows that are unable to support aquatic ecosystems.



...Flint River Basin continued

The Flint River and its two reservoirs are heavily used for recreation, especially fishing. Many local businesses rely on the economic activity attracted by major bass tournaments. The 5,850 acre Big Lazar Creek Wildlife Management Area in Talbot County is open to the public for hunting, and includes a 195 acre lake offering high-quality fishing. The waters of the Flint River Basin are also used for tubing, rafting and sight-seeing. Several guide services operate along the river.

Lake Blackshear offers fishing, hiking trails, campgrounds, rental cabins, swimming areas, boating, and golf. Georgia Veteran's Memorial State Park, which encompasses five miles of the lake's shoreline, is one of Georgia's most popular state parks.

The basin has two hydropower dams, Warwick Dam below Lake Blackshear and the Flint River Dam, which do not generate a significant amount of electricity.

The Flint River is only navigable for the few miles between Lake Seminole and Bainbridge. The navigation in the Georgia portion of the channel is dependent on channel depths in the Apalachicola River south of Lake Seminole.

INTERSTATE RIVERS

Chattahoochee River Basin

The Chattahoochee River covers 8,770 square miles, 70 % of which lie in Georgia. The river begins in the Blue Ridge Mountains as a free-flowing trout stream. The first major impoundment on the river is Lake Lanier, which at 38,542 acres is the largest reservoir located wholly in Georgia. Below the lake, the river flows through the most densely populated part of the state before entering the rural areas south of the Fall Line. The river is highly modified. Thirteen different dams are used for a variety of purposes, including hydropower, water supply, and recreation. The Chattahoochee River Basin overlies the crystalline rock, the Cretaceous, Clayton, Claiborne and Floridan aquifers.

The use of water in the Chattahoochee River Basin has been one of the subjects of a water dispute between Alabama, Florida, and Georgia. A future agreement between the states may limit the amount of water communities in Georgia can withdraw from the Chattahoochee and Flint river basins.

Off-Stream Water Uses

The Chattahoochee River is the most utilized drinking water source in the state, and 488 mgd is withdrawn for public supply purposes. The portion of the basin north of Columbus does not have sufficient groundwater resources to support municipal and industrial uses, leaving the state's largest metropolitan area dependent on surface water to meet supply needs. The Chattahoochee River is much smaller than the rivers supporting the country's other major metropolitan areas. In the southern part of the basin, groundwater can meet water supply needs.

Withdrawals for industrial purposes averaged 110 mgd between 1999 and 2004. Approximately 70 mgd of water withdrawn from the Chattahoochee surface waters is used outside of basin boundaries. Agricultural water use constitutes a small portion of total demand in the basin, even in drought conditions, though withdrawals are still significant. Between 1999 and 2004, withdrawals for agricultural purposes averaged 100 mgd during the summer.

Power plants account for approximately 44% of water withdrawals in the basin. Georgia Power operated three fossil fuel plants: McDonough-Atkinson in Cobb County, the Yates plant in Coweta County, and the Wansley Plant in Heard County. Between 1999 and 2004, these facilities withdrew 475 mgd in the winter, and 530 mgd in the summer. These three facilities represent close to 20% of Georgia Power's generating capacity. All but 68 mgd is returned to the source.

The Farley Nuclear Plant near Dothan in Alabama and the Scholz fossil fuel plant in Snead, Florida also use water from the Chattahoochee.

In-Stream Water Uses

Before the 1970s, the Chattahoochee River was heavily impacted by untreated wastewater discharges, from municipal and industrial facilities. Parts of the river had little or no aquatic life and posed a threat to human health. Since the 1970s, however, the state has spent over \$500 million upgrading and constructing wastewater treatment plants, and the river and its biological communities have mostly recovered. Currently, 172 facilities discharge into the waters of the basin, and only 3% of the basin streams were classified in the 2006 list of impaired waters because of point source discharges.

Two minimum flow guidelines have been established in the Chattahoochee to ensure that discharged wastewater does not cause water quality problems: 750 cubic feet per second (cfs) at Peachtree Creek and 1,150 cfs at Columbus.

Non-point source pollution is a larger issue in the basin. On the 2006 list of impaired waters, 54% of assessed stream miles are classified as impaired due in part to non-point sources. The most common problem is fecal coliform bacteria contamination. Some areas are also impacted by erosion and sedimentation caused by development, agriculture, and forestry. Lake Lanier and Walter F. George Lake have problems with algae overgrowth due to nutrient loads from runoff. The fish in four of the hydroelectric lakes have elevated levels of PCBs, attributable to non-point sources.

Despite extensive modifications to the river bed, the basin supports a diverse biological community. The basin is home to 104 species of fish, 37 species of salamanders and sirens, 24 species of freshwater turtle, and the American alligator. Nine plant species and 12 animal species are listed for protection by federal or state agencies. The native Gulf strain striped bass are stocked in several portions of the basin, including Lake Harding, Lake Walter F. George, and Lake Seminole, as part of a tri-state effort to protect the species.

Maintenance of suitable aquatic habitats is highly dependent on naturally fluctuating stream flows, and stream flow policies are especially critical in basins such as the Chattahoochee, which has several significant dams. Several species have been impacted by the numerous structures on the main stem of the Chattahoochee River, which can restrict the range of aquatic animals and significantly alter the volume and range of stream flows. The population of the rare Barbour's map turtle, for example, declined significantly after Lake Seminole was created.

Some areas, especially the reservoirs on the Coastal Plain, have experienced an overgrowth in algae and aquatic vegetation. The altered hydraulic conditions, sedimentation and high nutrient input due to suburban and agricultural runoff create conditions that are very favorable to undesirable and introduced plant species. The problem is especially severe in Lake Seminole, where plant growth has covered nearly 80% of the lake's surface.

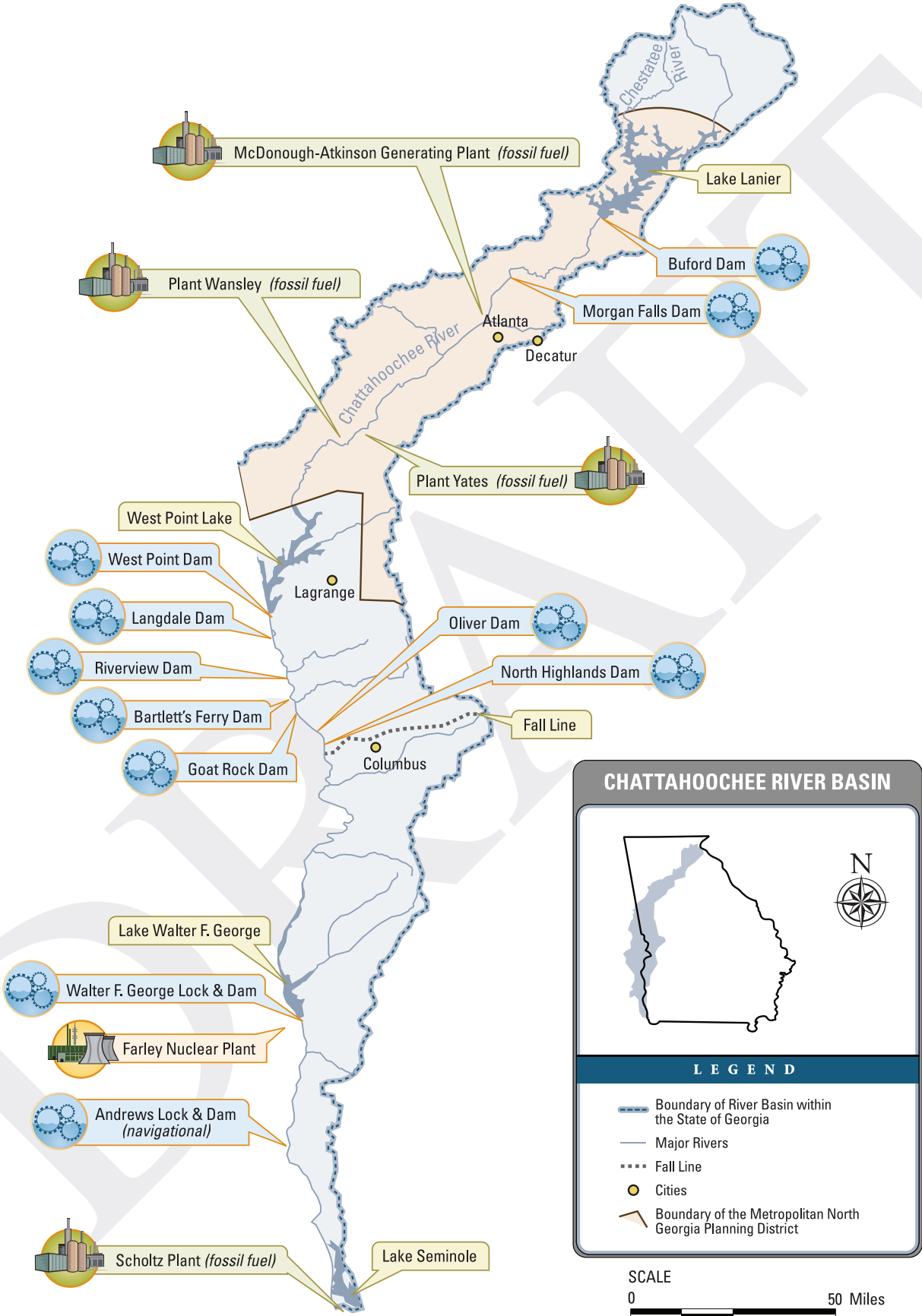
...Chattahoochee River Basin continued

The Chattahoochee River Basin contains some of the most popular recreation areas in the Southeast. The most well-known is Lake Lanier, which receives more than 16 million visitors each year. The Corps of Engineers manages 46 different park areas, and surrounding county and city governments also lease land for local parks. The North Georgia Mountains are a popular destination for people across the region. The mountains contain parts of the Chattahoochee National Forest and numerous state parks, as well as many resort communities, including Helen. A 48-mile segment of the Chattahoochee River in the metro Atlanta area was designated a National Recreation Area in 1978. The series of parks along this stretch provides city residents the opportunity to hike, fish, or picnic along the river.

Fishing opportunities throughout the basin have a vital economic significance to many of Georgia's cities and towns. The mountain tributaries support significant reproducing fish populations, and the Department of Natural Resources stocks streams to the north and south of Lake Lanier with trout. Lake Lanier, West Point Lake and Lake Seminole host major bass tournaments each year which bring large numbers of visitors to local businesses. In addition to supporting natural populations, the Chattahoochee River is home to U.S. Fish & Wildlife's trout hatchery. The hatchery produces approximately 150,000 pounds of trout annually, which is used to stock public lakes and streams around the state.

The Chattahoochee River has been used for hydroelectric power production for over 150 years. The first hydroelectric dam, the Eagle Phenix Dam, was built in 1834, and operated until recently. There are now eleven hydropower facilities on the river. Four hydroelectric facilities are operated by the U.S. Army Corps of Engineers: Buford Dam, below Lake Lanier in northern Gwinnett County, West Point Dam in Troup County, and Walter F. George Lock and Dam and George W. Andrews Lock and Dam near Fort Gaines. Georgia Power operates seven hydroelectric facilities in the basin, including one in Roswell and six in the ten miles just north of Columbus. The facilities have a combined capacity of close to 320 MW, and are vital to meeting peak energy needs during the summer.

The Chattahoochee River is navigable from the mouth of the Apalachicola in Florida up to Columbus. The channel, however, requires considerable maintenance and must be frequently dredged. Since the 1980s, droughts have caused channel depths to drop significantly, and use of the channel has been greatly diminished. Water levels in the Corps of Engineers reservoirs, which are used for both drinking water and recreation, drop when large amounts of water are released into the channel to support navigation.



Coosa River Basin

The Coosa River covers 4,619 square miles, 46% of which lie in Georgia. It begins in northwest Georgia in the mountains of the Blue Ridge Valley and Ridge regions and descends into the rolling hills and plateaus of the Upper Piedmont and Cumberland Plateaus. The basin includes three major storage reservoirs: Carter's Lake, on the Coosawatee, Lake Allatoona, on the Etowah, and Lake Weiss, on the Coosa. Weiss Dam, which creates Lake Weiss, is located in Alabama, but the reservoir extends into Georgia.

The Coosa River Basin overlies the crystalline rock aquifers and the Paleozoic rock aquifers. The use of water in the Coosa River Basin has been one of the subjects of a water dispute between Alabama and Georgia. A future agreement between the states may limit the amount of water communities in Georgia can consume from the Coosa Basin.

Off-Stream Water Uses

The Coosa River is the second most-used source for drinking water in the state. The majority of the water used in the basin comes from surface water sources, though some rural areas and small communities in north Atlanta use groundwater. Cobb County, which lies outside of the basin, transfers 23 million of gallons of water per day (mgd) to meet their water supply needs and later discharges the water into the Chattahoochee River Basin. Several other smaller public water systems outside of the Coosa Basin purchase surface water for public supply purposes. An average of 94 mgd is withdrawn for public supply purposes, and that amount is expected to increase dramatically over the next decades.

Power generation accounts for the largest withdrawals in the basin. Georgia Power operates two coal-fired power plants in the basin: Plant Bowen, on the Etowah River downstream of Lake Allatoona, and Plant Hammond on the Coosa River in Coosa, Georgia. Plant Bowen is the largest power plant in the state. These plants have enough generating capacity to power close to 900,000 homes. The plants withdraw a combined 574 mgd from the Coosa and Etowah rivers for power generation. All but 34 mgd of that water is returned to the source.

Historically, a large amount of water was withdrawn to support the active carpet, poultry processing and paper industries in the area. Water use by the industrial sector has declined, and industrial withdrawals currently represent only about 5% of total withdrawals. Agriculture in the basin is principally animal operations, and does not use significant amounts of water.

In-Stream Water Uses

A total of 131 facilities have permits to discharge treated wastewater into the surface waters of the Coosa River Basin. These facilities are concentrated along the Etowah River and in the Rome area, where the Oostanula and the Etowah flow together. Over the past decades, the state has spent over \$170 million to upgrade

wastewater treatment plants in the basin to decrease the level of pollutants discharged. The 2006 list of impaired waters classifies 13% of assessed stream miles as impaired due to residual contamination from industrial discharges. The principal issue is PCB contamination from a facility in Rome which is undergoing cleanup.

As with the rest of the state, non-point pollution causes more water quality problems than point source pollution. The 2006 list of impaired waters classifies 55% of assessed stream miles as impaired due to urban runoff and rural non-point pollution. The most common problem in the basin is fecal coliform bacteria contamination. Construction and development, especially in the metro Atlanta area, often lead to high nutrient levels and sediment loads. Parts of Carter's Lake and Allatoona Lake have excessive algae growth due to high nutrient levels.

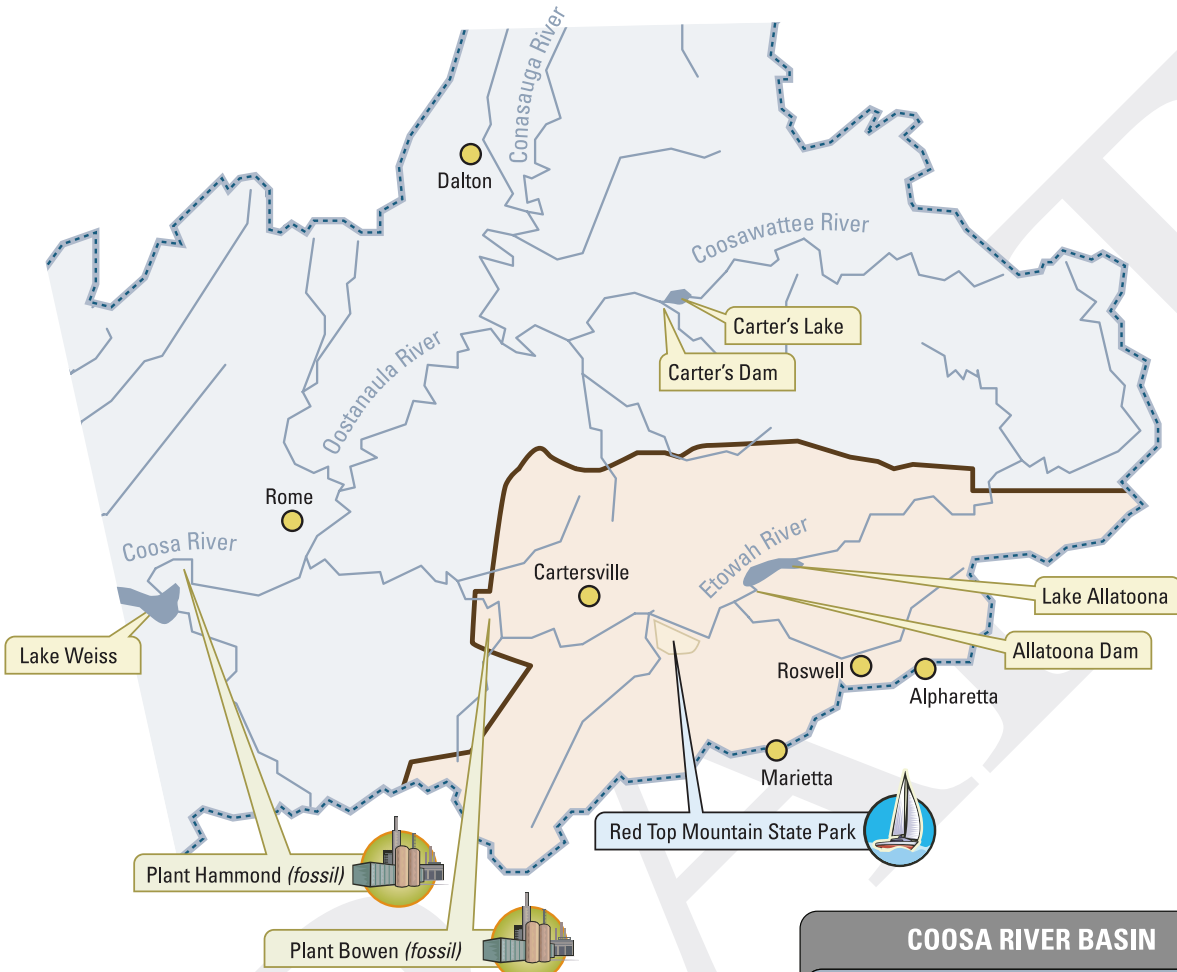
Though the basin supports a wide range of species, many of those native to the river basin are struggling. One study found that a large number of native species have disappeared from the basin in recent decades, including 63% of the snail species. Many of the species still in the basin are threatened or endangered, including 13 fish species and eleven species of mollusc. The Etowah and Conasauga River have the highest numbers of imperiled species. The principal threat to aquatic species in the basin is sedimentation caused by development, poorly designed forestry roads, and certain agricultural practices. Some species are also affected by the highly fluctuating flows below both of the basin's dams.

Parts of the Coosa Basin are used heavily for recreation. The upper part of the basin encompasses the scenic northwest Georgia mountains, which contain a cold-water trout fishery, several creeks and rivers with excellent rafting and canoeing, resort areas, state parks, the Chattahoochee National Forest, and the Cohutta Wilderness.

Lake Allatoona and Carter's Lake are both popular reservoirs for swimming and boating and support good fisheries for walleye, catfish, crappie, and a variety of bass. Allatoona is one of the most-visited Army Corps of Engineers reservoirs in the southeast. A large number of people have second homes in the area, and lake visitors contribute significantly to the local economy.

These lakes are both created by hydroelectric dams operated by the Army Corps of Engineers. The dams have a combined power capacity of 199,400 kW. In the future, power generation at the dams may need to be reduced so the reservoirs can be used to meet agricultural, municipal supply, and recreational needs.

The Coosa River is navigable below Montgomery, Alabama. The current water negotiations between Georgia and Alabama may result in an agreement requiring releases from Georgia's reservoirs to support navigation in Alabama.



COOSA RIVER BASIN

LEGEND

- Boundary of River Basin within the State of Georgia
- Major Rivers
- Cities
- Boundary of the Metropolitan North Georgia Planning District



Tallapoosa River Basin

Only 15% of the Tallapoosa River Basin's 4,680 square miles lies in Georgia. The Tallapoosa eventually joins the Coosa in Alabama to form the Alabama River. There are no major dams in the Georgia portion of the basin. Total mean annual flow at the state line is approximately 960 mgd. The basin overlies the crystalline rock aquifers.

Off-Stream Water Uses

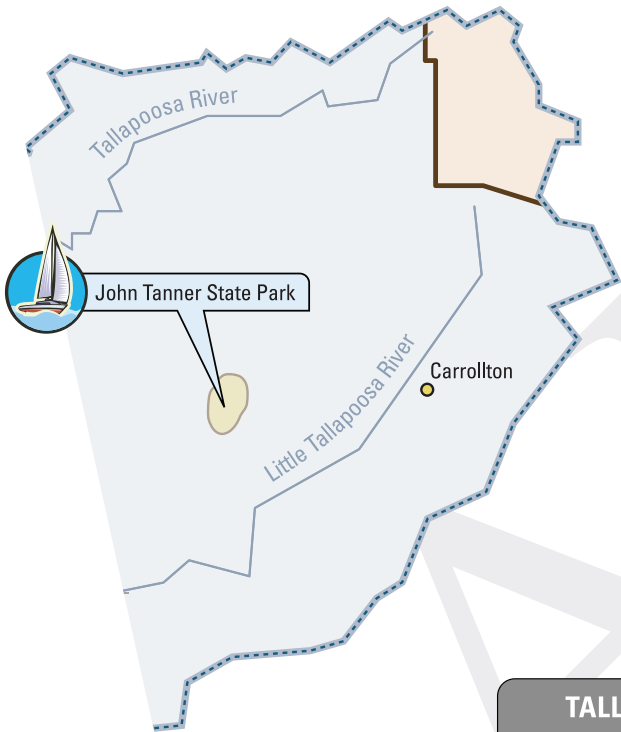
The only significant off-stream use in the basin is public supply, which accounts for approximately 10 mgd of water withdrawals. The amount of water necessary to meet public supply needs is expected to increase to 25 mgd by 2020, driven by population growth. The surface waters of the Tallapoosa are unable to meet this level of demand during periods of drought. The West Georgia Regional Water Authority was formed to address long-term water supply challenges for the region, and a reservoir was proposed for the Tallapoosa Basin, which would be used to supply water for the Tallapoosa, and portions of the Chattahoochee and Coosa basins. Ongoing negotiations with Alabama have stalled plans to build the reservoir.

In-Stream Water Uses

A relatively small amount of wastewater is discharged in the Tallapoosa River Basin. The 2006 list of impaired waters included two stream segments totaling four miles in the basin with elevated levels of copper due to an industrial point source. Non-point source pollution poses a larger problem and the 2006 list of impaired waters classifies 45% of the assessed stream miles as impaired by urban and rural runoff. The most prevalent problem in the basin is fecal coliform bacteria. Three segments have impaired biological communities due to sedimentation, nutrients and other water quality issues which emanate from urban and agricultural runoff.

The Tallapoosa Basin is home to 72 species of fish, 12 species of amphibian, and at least 3 riparian reptiles. Six species of fish have been listed as endangered, threatened or rare by the state, and several amphibians are considered of special concern by the Georgia Natural Heritage Program. The basin includes several secondary trout waters—streams where stocked trout will survive but will not reproduce. The streams of the basin also support a high-quality bass fishery, though it is not currently heavily utilized by fisherman.

John Tanner State Park in western Carroll County, which includes two small lakes, offers swimming, boating, fishing, camping, hiking trails, picnic shelters, and rental cottages.



TALLAPOOSA RIVER BASIN

LEGEND

- Boundary of River Basin within the State of Georgia
- Major Rivers
- Cities
- Boundary of the Metropolitan North Georgia Planning District

SCALE
0

50 Miles

Ochlockonee River Basin

The Ochlockonee River Basin covers 6,330 square miles, 23% of which lies in Georgia. The basin is located between the Flint and Suwannee River basins, with its headwaters in Worth County. The Aucilla River and Wards Creek watersheds are included in this basin, even though each discharges its waters separately and never joins with the Ochlockonee River. The average annual flow of the Ochlockonee is an estimated 850 cubic feet per second (cfs) at the state line. Groundwater in the Ochlockonee River Basin is supplied by the Floridan aquifer.

Off-Stream Water Uses

Irrigation is the principal water use in the basin. Withdrawals for agricultural purposes are 172 mgd in the summer, and 20 mgd in the winter. About a third of the water used for irrigation is taken from surface water sources, with the rest supplied by groundwater. The area is largely rural and only 12 mgd is withdrawn to support public supply and industrial uses. This water is taken almost exclusively from groundwater.

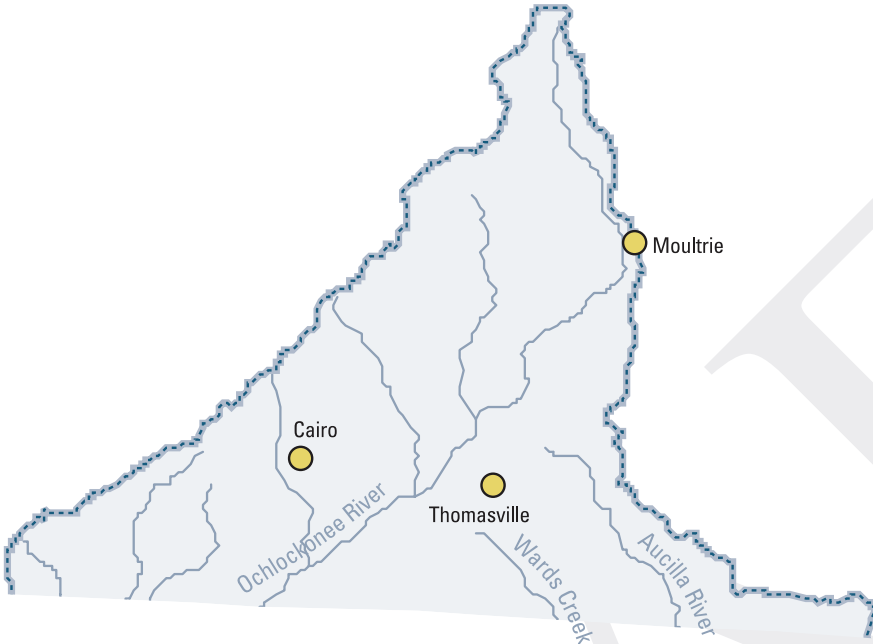
In-Stream Water Uses

A total of 16 facilities have permits to discharge treated wastewater into the surface waters of the Ochlockonee River Basin. The 2006 list of impaired waters classifies 11% of assessed stream miles as impaired due to point sources contamination. Fish in one reach of the Ochlockonee below Moultrie have elevated levels of mercury.

The major non-point pollution concerns for the surface waters within the Ochlockonee River Basin are fecal coliform bacteria, erosion and sedimentation, low dissolved oxygen, and fish consumption guidelines due to mercury contamination. The 2006 list of impaired waters classifies 98% of assessed stream miles as impaired by non-point sources.

The Ochlockonee River Basin has a high percentage of game fish species, including redbreast sunfish, largemouth bass and channel catfish. Several species listed as rare in Georgia, such as the Suwannee bass, Bannerfin shiner and Spotted bullhead occur in the Ochlockonee River Basin. The aquatic communities in the basin have been impacted by sedimentation related to agricultural activities.

The Ochlockonee River Basin is home to a wide variety of recreational activities, including boating, fishing, picnicking, swimming, and more. The Ochlockonee supports a heavily used fishery and is especially popular with bank anglers. Most of the fishing occurs in late spring when water levels fall after the high flows of winter and early spring.



OCHLOCKONEE RIVER BASIN

LEGEND

- Boundary of River Basin within the State of Georgia
- Major Rivers
- Cities
- Boundary of the Metropolitan North Georgia Planning District



Upper Tennessee River Basin

Only 6% of the 21,390 square miles of the Upper Tennessee River Basin lies within the state of Georgia. The entire basin drains 21,390 square miles in the states of Tennessee, North Carolina, Virginia and Georgia. The Georgia portions include several watersheds: Chickamauga Creek and its tributaries in the counties of Catoosa, Walker and Whitfield counties, the headwaters of the Hiwassee and Nottely Rivers in Towns and Union Counties, and the Toccoa River in Fannin County. All of these streams flow north across the state line.

The Georgia portion of the basin includes three major Tennessee Valley Authority impoundments: the Chatuge Reservoir, which is formed by a dam across the state border in North Carolina, the Nottely Reservoir, and Lake Blue Ridge. The principal population centers are the towns of Hiwassee, Blairsville, and Blue Ridge. The mountainous area is rural and heavily forested. The basin overlies north Georgia's crystalline rock aquifers and northwest Georgia's Paleozoic aquifers.

Off-Stream Water Uses

Only a small amount of water is withdrawn in the basin. The Tennessee River Basin supplies drinking water to the cities of Hiwassee, Blairsville, and Blue Ridge and supports rubber and textile manufacturing operations. Total public supply and industrial withdrawals between 1999 and 2004 averaged 19 mgd. Most areas use groundwater for public supply. Agriculture in the basin is dominated by livestock operations, which do not represent a significant water use.

In-Stream Water Uses

A total of 36 facilities have permits to discharge treated wastewater into the surface waters of the Tennessee River Basin. No stream segments are listed as impaired by point source discharges on the 2006 list of impaired waters. However, 50% of assessed stream miles are impaired due to non-point sources. The most prevalent problem in the basin is fecal coliform bacteria, which can emanate from both urban and agricultural runoff. In addition, water quality in the Chatuge and Nottely reservoirs has been rated as poor by the TVA in the past several years, due principally to non-point source pollution. Twenty-three stream segments have impaired fish communities due to erosion and sedimentation which can originate with both agricultural areas and new development and construction.

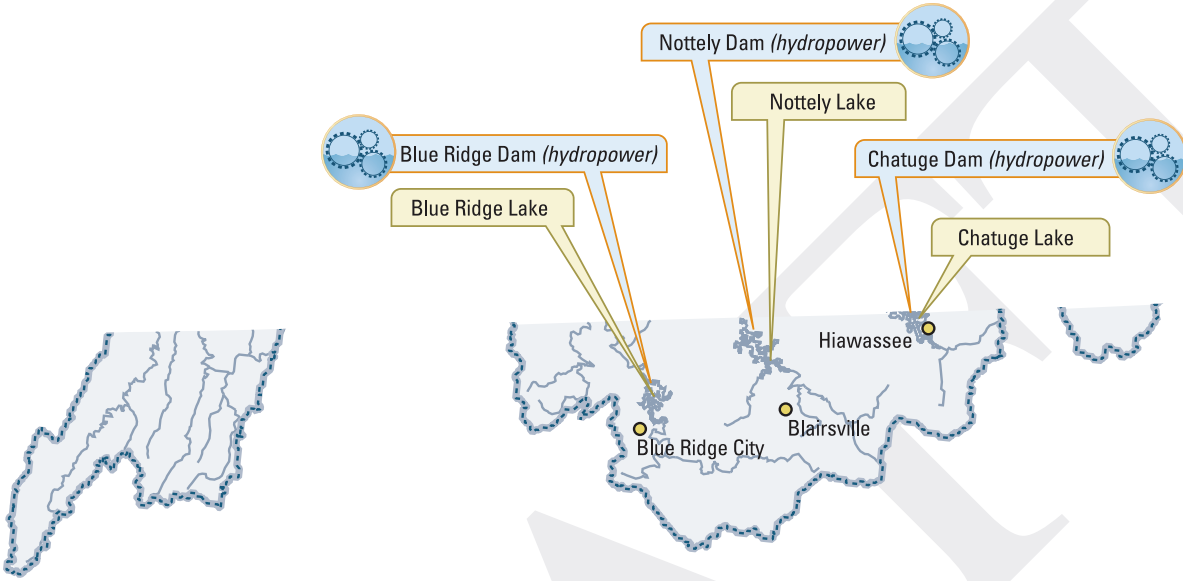
The Upper Tennessee River Basin has one of the most diverse biological communities in North America. Approximately 68% of all freshwater fish species in the Southeast can be found in the basin. The basin waters also support high-quality trout fisheries for both wild and stocked fish. The U.S. Fish & Wildlife Service operates a hatchery on a tributary to the Toccoa River which raises 324,000 rainbow trout annually for distribution to federal waterways, as well as several endangered and threatened species.

Lake Chatuge and Nottely have not supported a healthy diversity of species in recent years, though they are able to support populations of several species of recreational importance, especially bass and catfish. In addition, the water below the TVA dams has contained low levels of dissolved oxygen and has been unable to support healthy ecosystems. The TVA has made improvements in their dams to try and address oxygen levels. Flow policies have also been changed, so that a minimal flow is maintained even when the dam is not being operated for power generation.

The area is heavily used for recreation. The reservoirs and streams throughout the Tennessee Basin, especially the high-quality trout streams, are a draw for fishermen across the region. Kayakers and canoers visit the Toccoa River when the Blue Ridge Dam is releasing water, and Nottely Reservoir has campgrounds and a beach. The basin in Georgia also includes significant parts of the Chattahoochee National Forest, popular with campers and hikers. The entire mountain region supports several resort communities.

The three TVA hydropower plants in the Georgia portion of the Tennessee Basin have a relatively small combined generating capacity of approximately 47 megawatts.

There is no commercial navigation in the Georgia portion of the Tennessee River Basin, though there are navigable portions in Tennessee.



TENNESSEE RIVER BASIN

Legend:

- Boundary of River Basin within the State of Georgia
- Major Rivers
- Cities
- Boundary of the Metropolitan North Georgia Planning District



Savannah River Basin

The Savannah River Basin covers 10,577 square miles, 55% of which lie in Georgia. The headwaters of the Savannah River Basin rise in the Blue Ridge Mountains in the northeast corner of Georgia and across the state borders in North and South Carolina. The Tallulah River flows through six different hydroelectric facilities and their associated impoundments. It joins the Chattooga River in Lake Tugaloo, another hydroelectric lake. The Tugaloo River joins South Carolina's Seneca River in Lake Hartwell, the first of three Corps of Engineers Lakes. The Corps of Engineers also manages Lake Richard B. Russell and Clarks Hill Lake (also known as J. Strom Thurmond Lake).

The basin overlies five major aquifer systems: crystalline rock, the Cretaceous, the Gordon, the Brunswick, and the Floridan. Groundwater quality is threatened in the Savannah area, where intensive pumping has caused saltwater to intrude into the aquifer. Groundwater problems affect water supply decisions in the future, especially as the area's population expands.

Off-Stream Water Uses

Two of Georgia's largest cities lie in the Savannah Basin: Augusta and Savannah. More than 20% of water withdrawn in the basin is used for public supply purposes. Most of this water is withdrawn from surface water sources. Augusta and Savannah both use a combination of surface water and groundwater to meet municipal supply needs. Approximately the same amount of water is used to support industrial operations along the river. The largest industrial users in the basin are paper and chemical manufacturing operations. Agriculture represents a relatively small water use in the basin, though the basin does support 53,000 irrigated acres below the Fall Line.

The largest off-stream water use is power generation which accounts for 336 mgd of water withdrawals. Two fossil-fuel plants and one nuclear power plant are located in the Georgia portion of the basin and represent more than 3,000 megawatts of generating capacity, enough to power 660,000 homes. The fossil fuel plants are Plant Kraft in Port Wentworth near Savannah and Plant McIntosh in Rincon. Plant Vogtle, in Waynesboro, is a nuclear facility. Plant Vogtle consumes approximately 43 mgd per day.

In-Stream Water Uses

A total of 173 facilities have permits to discharge treated wastewater into the surface waters of the Savannah River Basin. In the past decades, the state has spent \$136 million upgrading the treatment facilities in the Savannah River Basin, and pollutants emanating from these sources have been greatly reduced. The 2006 list of impaired waters classifies 6% of assessed stream miles as impaired due in part to municipal discharges. Industrial discharges contributed to the impairment of one 14 mile-long segment of Eastanollee Creek, a tributary to Lake Hartwell, which has elevated levels of metals.

Non-point source pollution contributes more to water quality problems. The 2006 list of impaired waters classifies 47% of assessed stream miles as impaired by non-point source pollution. The most prevalent problem is fecal coliform bacteria, which can be caused by urban and agricultural runoff. Sedimentation and oxygen-demanding loads are also significant problems in the basin.

The Savannah Basin is home to 108 species of fish and supports significant wetland areas in the southern part of the basin. The U.S. EPA, The South Carolina Department of Health and Environmental Control, and the EPD are developing a revised dissolved oxygen standard for the Savannah Harbor that will protect aquatic communities. The Army Corps of Engineers is also studying the harbor and developing strategies to address dissolved oxygen and salinity issues related to deepening the harbor.

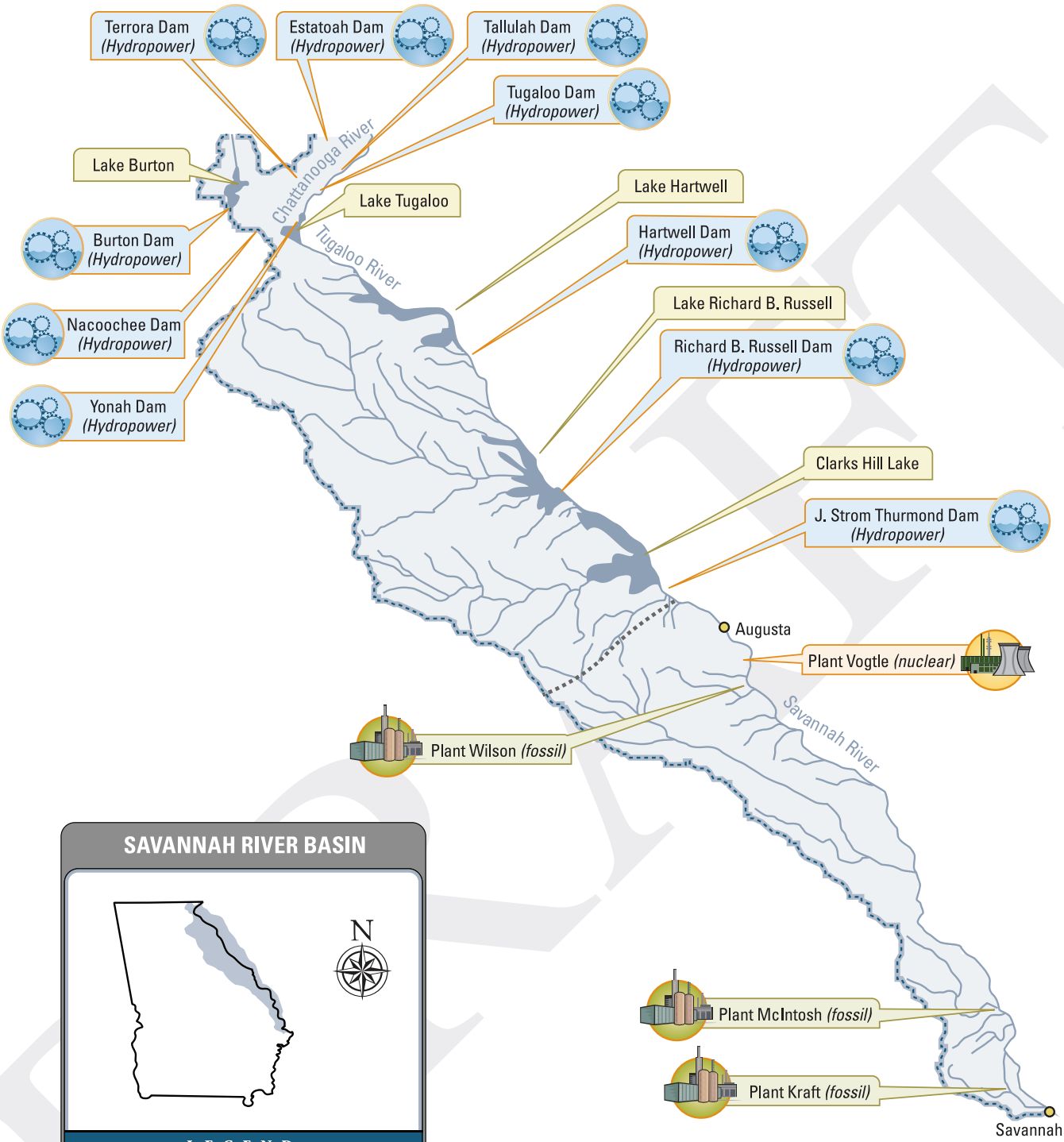
The Savannah River Basin hosts a wide variety of recreational activities. The Chattooga River in the upper basin is listed by the federal government as a "Wild and Scenic River," and is popular with canoers, rafters, fisherman and hikers. The Georgia Power lakes in the mountains are a popular place to build summer homes and are a destination for boaters and fisherman. Moccasin Creek State Park, along the shores of Lake Burton, offers fishing and boat rental.

The hydroelectric impoundments in the mountains and the three reservoirs on the main stem all support good fisheries for a wide range of sport fish. The three major Army Corps of Engineers reservoirs draw 21 million visitors annually. The ability of all three lakes to support recreational activities depends on water management priorities; as well as providing recreation opportunities, the lakes are also used for flood control, water quality management downstream, and peak power generation.

Tallulah Gorge State Park surrounds one of the deepest canyons in the eastern United States, and has drawn sightseers since the turn of the century. Georgia Power periodically releases water from their hydroelectric lakes to show visitors the waterfalls that existed before the dams were built along the Tallulah River, as well as giving experienced kayakers the chance to experience the river's rapids.

Georgia Power operates six hydroelectric dams on the Tallulah River, as well as a hydroelectric facility below Lake Tugaloo. The smaller upstream dams have very limited capacity, with a combined capacity of 167 megawatts. The Army Corps of Engineers operates three hydroelectric facilities below each major reservoir. These facilities have a combined generating capacity of 1,638 megawatts.

The Savannah River was once navigated between Savannah and Augusta, but the river is now rarely used for commercial navigation. The Port of Savannah continues to be an important shipping port. The Corps of Engineers is currently studying a harbor expansion project which would allow larger ships further into the harbor.



SAVANNAH RIVER BASIN

LEGEND

- Boundary of River Basin within the State of Georgia
- Major Rivers
- Fall Line
- Cities
- Boundary of the Metropolitan North Georgia Planning District



Suwannee River Basin

The Suwannee River Basin covers 10,000 square miles, 56% of which lies in Georgia. The basin is located in south-central Georgia, in between the Flint and Satilla River basins. In Georgia, the basin includes three major streams: the Withlacoochee, the Alapaha, and the Suwannee rivers. These rivers join south of the Georgia-Florida border. The basin also includes a portion of the Okefenokee Swamp, a vast peat-filled bog inside a huge, saucer-shaped depression that was once part of the ocean floor. Approximately 20% of the Suwannee River Basin is covered by wetlands. Groundwater in the basin is supplied by the Floridan aquifer.

Off-Stream Water Uses

The basin supports 416,000 irrigated acres, and agriculture is the principal water use in the Suwannee River Basin. Between 1999 and 2004, withdrawals for irrigation averaged 22 mgd in the winter and 375 mgd in the summer. Water in the basin supports the cities of Valdosta, Tifton, and Moultrie, and public supply is the largest water use during the winter. Approximately 33 mgd is withdrawn for public supply purposes. Almost all of the water withdrawn in the basin is taken from the Floridan aquifer.

In-Stream Water Uses

A total of 61 facilities have permits to discharge treated wastewater into the surface waters of the Suwannee River Basin. Over the past several decades, Georgia has invested more than \$12.5 million in upgrading the treatment facilities in the Suwannee River Basin. These upgrades have resulted in significant improvements in water quality below wastewater treatment plant outfalls. The 2006 list of impaired waters classifies only 2% of assessed stream miles as impaired due to fecal coliform bacteria from municipal discharges.

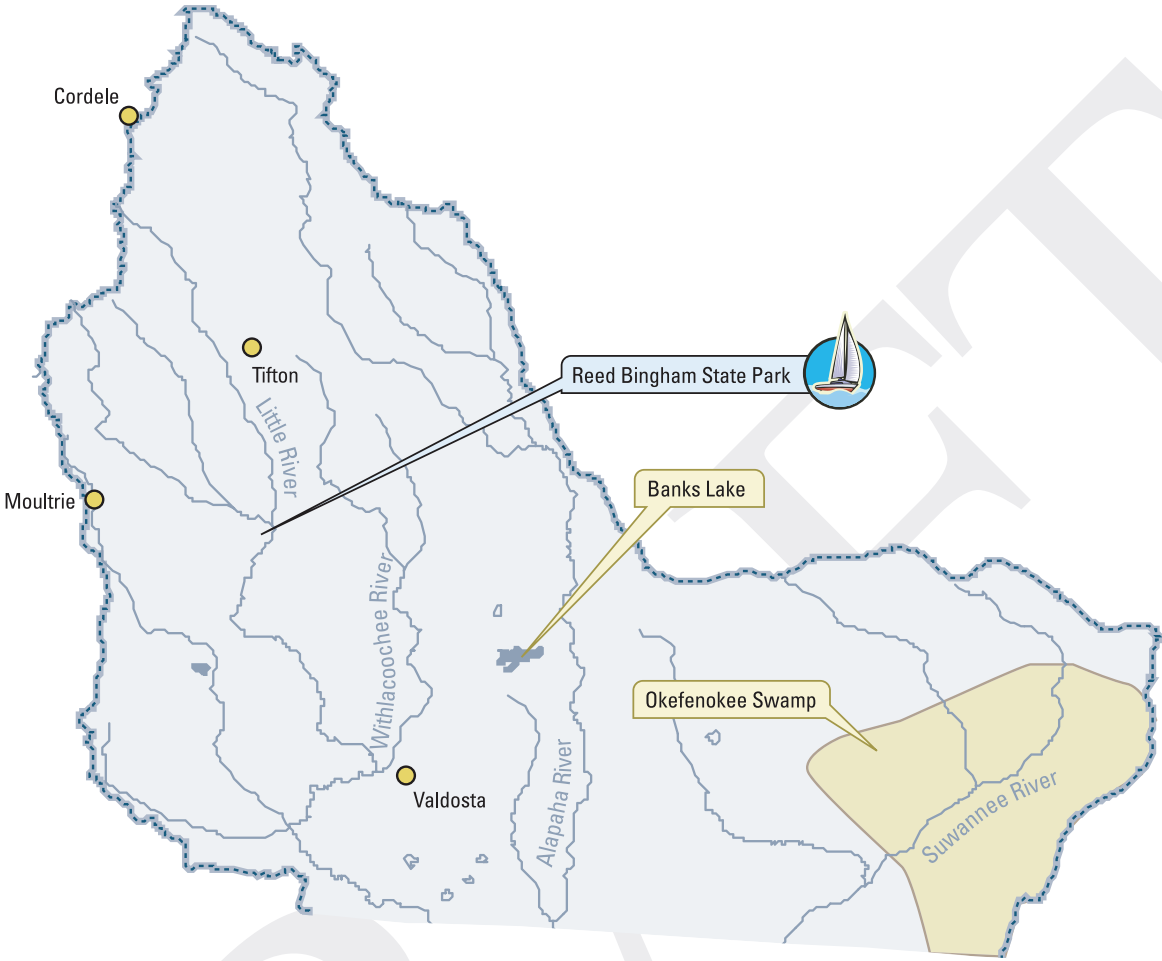
Non-point source pollution is a larger issue in the basin. The 2006 list of impaired waters classifies 66% of assessed stream miles as impaired due to non-point source contamination. The most prevalent problem in the basin is low levels of dissolved oxygen. Many segments also have high levels of fecal coliform bacteria from urban and agricultural runoff. The fish in eight stream segments have elevated levels of mercury in their tissues. Reed Bingham Lake in Colquitt and Cook counties and Banks Lake also have elevated mercury levels resulting from non-point source contamination.

Acidic waters, low alkalinity, and extreme variation in flow limit the fish populations in the basin, though there are populations of catfish, topminnows, sunfish, and Suwannee bass. A large variety of other species can also be found in and around the surface waters of the Suwannee River basin, especially in the Okefenokee Swamp. The swamp is a unique habitat and is home to 233 species of birds, 49 species of mammals, 64 species of reptiles and 37 species of amphibians, including otters, water moccasins, the once-endangered American alligator, the Sandhill crane, osprey, anhinga (water turkey), great blue heron, yellow crowned night heron, great egret, white ibis and the endangered wood stork. There are also at least 621 species of plants found in the Okefenokee Swamp. Other parts of the basin also support wetland habitats.

There are a large number of state and local parks for recreational activities within this basin, mainly due to the presence of the Okefenokee Swamp. Approximately 400,000 people per year visit the Okefenokee National Wildlife Refuge (NWR), which was established in 1936. The swamp offers excellent fishing, and several parks offer boat and canoe rentals, guided boat tours and campgrounds. Banks Lake in Lanier County also supports a smaller National Wildlife Refuge.

The Reed Bingham State Park is located 6 miles west of Adel, Georgia, and is 1,613 acres. The park surrounds a 375-acre lake that has become a major boating and water-skiing attraction. The park offers a swimming beach and three boat ramps. Activities offered for recreational surface water use include boating, canoe rentals, a fishing dock, and fishing boat rentals.

The waters of the basin support fisheries for chain pickerel, warmouth, largemouth bass, bluegill, topminnow, sunfish, catfish and crappie.



SUWANNEE RIVER BASIN

LEGEND

- Boundary of River Basin within the State of Georgia
- Major Rivers
- Cities
- Boundary of the Metropolitan North Georgia Planning District



St. Marys River Basin

The St. Marys River Basin covers 1300 square miles, 59% of which lie in Georgia. The St. Marys River is a blackwater stream that flows north and east, forming the border between southeast Georgia and northeast Florida. In addition to the St. Marys River, the major streams within the basin include the North Prong St. Marys River and Spanish Creek. Groundwater in the basin is supplied by the Floridan and Brunswick aquifers.

Off-Stream Water Uses

The basin supports some agriculture and the cities of St. Marys, Folkston and Kingsland. Only 1.5 mgd is withdrawn in the winter, and 2 mgd in the summer. That number is expected to increase slightly as the population grows.

In-Stream Water Uses

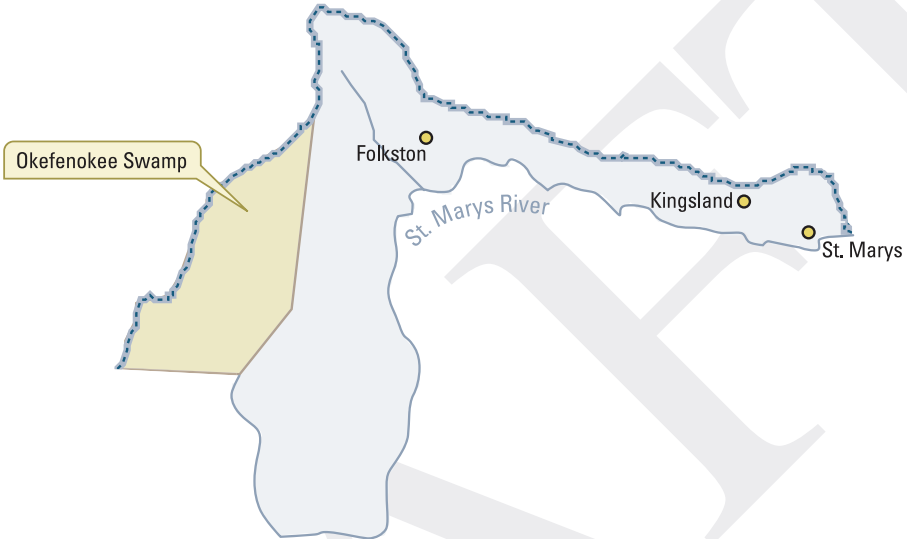
A total of 8 facilities have permits to discharge treated wastewater into the surface waters of the St. Marys River Basin. Over the past several decades, Georgia has invested more than \$12.5 million in upgrading the treatment facilities in the St. Marys River Basin. The 2006 list of impaired waters does not classify any streams as impaired by point source discharges. Non-point sources pose more of a problem. In the assessment, 98% of assessed stream miles were found to be impaired due to non-point source contamination. One segment has low levels of dissolved oxygen. One 55 mile segment has elevated levels of mercury.

The river is well-known for its many landmarks, and for its near-natural conditions. While acidic waters, low alkalinity, and extreme variation in flow limit the productivity of fish populations within the basin, it is still home to large families of sunfish, minnows and catfishes. In addition to fish species, the marshlands of the St. Marys River Basin are home to gopher tortoises, fiddler crabs, herons and other coastal and riparian species. The basin includes portions of the Okefenokee Swamp, a unique ecosystem that is home to 233 species of birds, 49 species of mammals, 64 species of reptiles and 37 species of amphibians.

Recreational activities in the St. Marys River Basin include boating, swimming, camping, fishing, and other activities. There are good fishing opportunities for largemouth bass, redbreast sunfish, bluegill, warmouth, crappie, and several catfish species throughout the St. Marys River and its tributaries.

Approximately 400,000 people per year visit the Okefenokee National Wildlife Refuge (NWR), which was established in 1936. The swamp offers excellent fishing, and several parks offer boat and canoe rentals, guided boat tours and campgrounds.

The St. Marys dock serves as a riverboat access point to Cumberland Island. Nearby, the Crooked River State Park offers cottages near the river, a nature trail through maritime forest and salt marsh, a boat ramp which is popular with anglers, kayaking and boating.



ST. MARYS RIVER BASIN

LEGEND

- Boundary of River Basin within the State of Georgia
- Major Rivers
- Cities
- Boundary of the Metropolitan North Georgia Planning District



GEORGIA'S AQUIFER SYSTEMS

Most of the Earth's surface is underlain by groundwater, which collects in pores and cracks in rocks. Layers of rock that can produce water when pumped are referred to as aquifers. The reliability and productivity of groundwater aquifers depend on a wide variety of variables, including how easily water can pass through the rocks (permeability), the size and number of openings in the rock (porosity), the rate of leakage from adjacent geologic units, and the rate at which the water in the rocks is replenished by precipitation and its connections to surface water sources and recharge areas. Aquifers can be confined, meaning they lie under impermeable geologic layers which prevent infiltration by water from the surface except in isolated recharge zones. Unconfined aquifers are not separated from the surface by these confining units and are more likely to fluctuate in response to precipitation or drought and are more susceptible to contamination from the surface.

Paleozoic Aquifers

Limestone in the Valley and Ridge and Appalachian Plateau provinces contains a widely variable system of disconnected aquifers that are very close to the ground surface. In many areas, these aquifers can be highly productive, yielding thousands of gallons per minute (gpm).

These aquifers are small and disconnected, and large amounts of pumping can cause significant drops in groundwater levels. Because of their proximity to the surface, groundwater levels are often strongly affected by drought conditions, and groundwater pumping can have a direct impact on stream flows in the Coosa River Basin. When groundwater levels are drawn down because of drought or groundwater withdrawals, sinkholes may develop.

Crystalline Rock Aquifers

Most of the Piedmont and Blue Ridge portions of the state are underlain by crystalline rock aquifers, which do not yield sufficient water to support municipal uses except for some small cities. The large cities across this region, including the bulk of the metropolitan Atlanta area, rely on surface water. These aquifers are unconfined, and groundwater levels vary considerably in response to rainfall.

Cretaceous Aquifers

The Cretaceous aquifer system runs across the state directly adjacent to the Fall Line, the northern edge of the Coastal Plain. This aquifer system comprises the Providence aquifer in southwest Georgia and the Dublin - Midville aquifers in east-central Georgia. Most parts of the aquifer are prolific water producers and can yield a typical range of 50 to 1200 gpm. Pumping from portions of the Cretaceous aquifer can have direct impact on stream flows in several river basins.

Claiborne Aquifer

The Claiborne is located in the southwest part of the state, where it is heavily used for water supply. The Claiborne is also used for industrial and municipal supply in Dougherty, Crisp and Dooly counties, and provides irrigation water for the northern part of the Dougherty Plain. Groundwater levels fluctuate throughout the year.

Gordon Aquifer

The Gordon aquifer is also a significant source of water for municipal supply, industrial, and agricultural use in east-central Georgia. Levels of water in the Gordon fluctuate throughout the year and are influenced by precipitation levels.

Clayton Aquifer

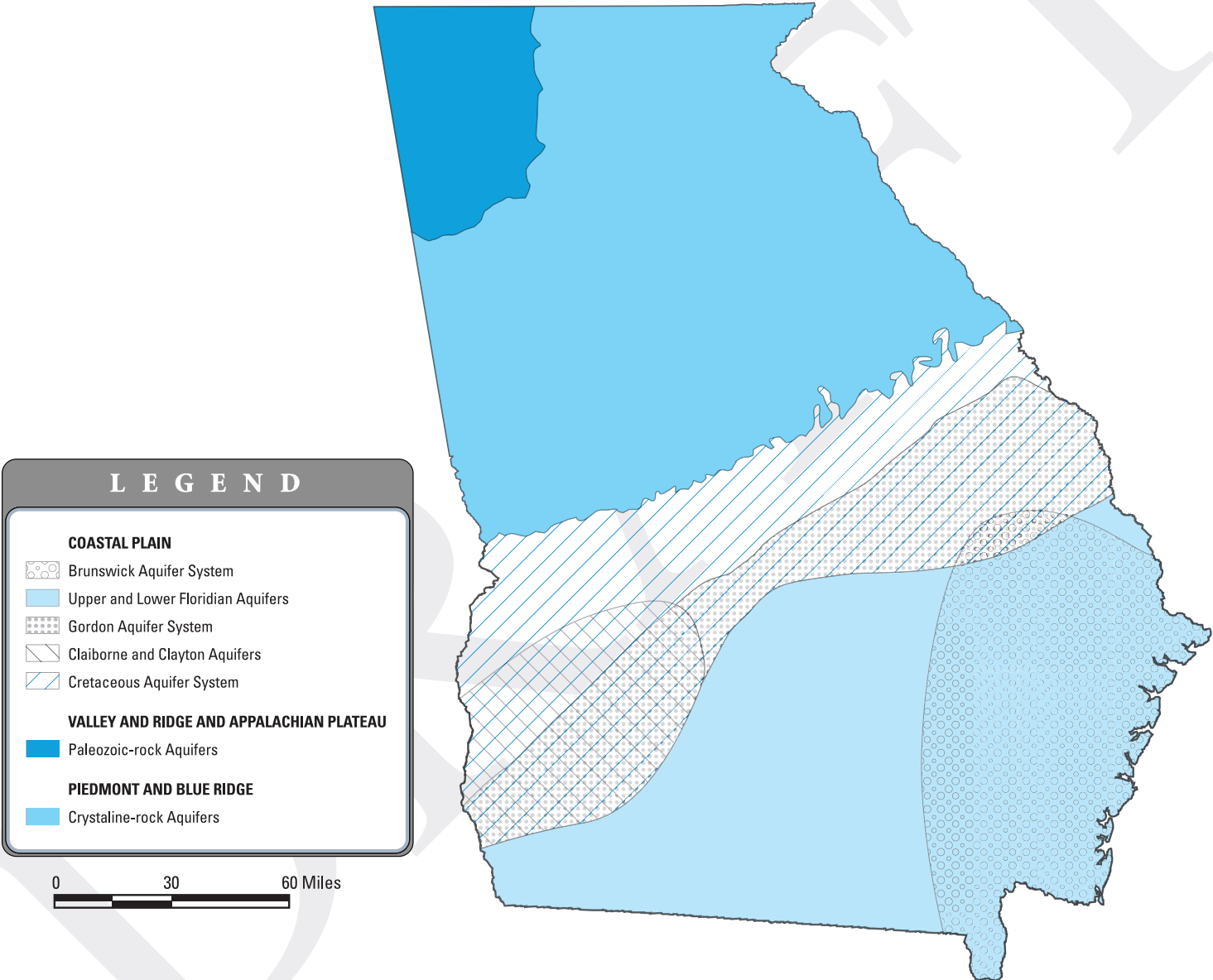
The Clayton aquifer underlies part of the southwestern corner of the state, near the city of Albany. The aquifer stretches under portions of the Chattahoochee and Flint river basins and lies under the Claiborne aquifer. Though the aquifer is relatively small, it serves as a major source of water for irrigation and municipal supply, and it is able to produce a typical range of 250 to 600 gallons per minute.

The Clayton aquifer refills slowly, and extensive pumping has had a significant effect on groundwater levels. Levels have declined since the first supply wells were installed, but have declined steeply as irrigation in the area has grown. Because the aquifer is replenished so slowly, groundwater levels would not recover even if changes were made in withdrawal volumes. A moratorium was placed on new groundwater withdrawal permits in the mid-1990s.

Brunswick Aquifers

The upper and lower Brunswick aquifers are found under a large portion of the southeastern corner of Georgia. Across their reach, the aquifers overlie the highly productive Floridan aquifer. The Brunswick aquifers can produce as much as 180 gpm, but typical yields are in the range of 10 to 30 gpm.

The Brunswick aquifers have historically served as supplementary water sources for the Brunswick and Savannah metropolitan areas. However, as restrictions are placed on pumping water from the Floridan aquifer due to saltwater intrusion, more industries and municipalities may turn to wells that tap the Brunswick aquifers.



Floridan Aquifer

The Floridan Aquifer underlies a significant portion of Georgia's coastal plain, as well as areas of South Carolina, Alabama, Mississippi and the entire state of Florida. The 100,000 square mile aquifer is one of the most productive in the world, and the principle source of groundwater in Georgia. In Georgia, the Floridan Aquifer system is divided into the Upper Floridan and the Lower Floridan.

The northern edge of the aquifer is the thinnest. Toward the southeast, it thickens to a maximum of 1700 ft. The aquifer system is generally confined, but is semi-confined to unconfined near Valdosta and in areas in the Dougherty Plain. The aquifer has significant hydrologic connection to the surface waters of the Chattahoochee and Flint river basins, and groundwater levels have an effect on stream flows. The Floridan aquifer has been used to supply municipal water for more than 100 years. However, the amount of water used has increased notably due to the expansion of irrigation, population, industry, and mining.

In recent years, cities and industries in the coastal area have pumped less water from the Floridan aquifer as they have become more efficient and moved towards surface water sources. The population in the area is growing quickly, however, and water needs in the coastal area will likely increase.

Deep cones of depression have formed in the aquifer in the areas surrounding Brunswick, Savannah, Jesup, Riceboro, and St. Marys as well as some neighboring areas in South Carolina and Florida. Over time, saltwater has begun to intrude into the aquifer from the ocean in the Savannah area and from a deep pool of salt water in the Brunswick area. Some wells in Brunswick and near Hilton Head had to be abandoned due to high salt content. The cone of depression in St. Marys recovered after pumping was greatly reduced.

EPD suspended new groundwater withdrawal permitting for a period of time in the coastal area. Recently, the EPD has implemented a new strategy to reduce the amount of water withdrawn from the Upper Floridan aquifer with Chatham and Effingham counties by mandating more aggressive conservation practices across all water use sectors and encouraging the reuse of highly treated wastewater.

The heavy agricultural use of the aquifer in the southwestern part of the state, especially the 15-county area known as the Dougherty Plain, has caused groundwater levels to decline in some places. This part of the Floridan aquifer has a hydrologic connection with the surface waters, meaning that withdrawals from groundwater wells can affect the level of streams and rivers in both the lower Flint and Chattahoochee river basins. Water levels are also declining in Tift and Cook counties in south central Georgia. The 2006 Flint River Basin Regional Water Development and Conservation Plan is an attempt to address this issue, among others.

Surficial Aquifers

Shallow surficial aquifers exist throughout the state, principally in the Coastal Plain. These aquifers are generally unconfined, and water levels generally rise quickly during wet periods but can drop considerably during periods of drought. Pumping in these aquifers can have significant impact on the flows in surface water.

These aquifers are used locally for domestic supply and livestock operations. As part of the concerted effort to reduce the amount of water withdrawn from the Floridan aquifer, surficial aquifers in the coastal region have been considered as a possible supplemental supply.

| WITHDRAWALS IN MILLIONS OF GALLONS PER DAY (2000) | | | | | | |
|--|----------------------|-------------------|----------------------------|---------------------|-----------------------|---------------|
| | Public Supply | Industrial | Domestic/Commercial | Agricultural | Thermoelectric | Totals |
| Paleozoic Limestone | 24 | 12 | 7 | 3 | 0 | 47 |
| Crystalline Rock | 20 | 3 | 60 | 11 | <1 | 93 |
| Cretaceous | 58 | 68 | 11 | 90 | 0 | 220 |
| Claiborne and Gordon | 23 | 2 | 6 | 120 | 1 | 145.5 |
| Clayton | 10 | 8 | 1 | 92 | 0 | 113 |
| Brunswick | 3.7 | * | * | * | * | 3.7 |
| Floridan | 142 | 205 | 45 | 426 | 3 | 819 |

* Data not available

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