Savannah River Basin Management Plan 2001

Georgia Department of Natural Resources
Environmental Protection Division

Georgia River Basin Management Planning Vision, Mission, and Goals

What is the VISION for the Georgia RBMP Approach?

Clean water to drink, clean water for aquatic life, and clean water for recreation, in adequate amounts to support all these uses in all river basins in the state of Georgia.

What is the RBMP MISSION?

To develop and implement a river basin planning program to protect, enhance, and restore the waters of the State of Georgia, that will provide for effective monitoring, allocation, use, regulation, and management of water resources.

[Established January 1994 by a joint basin advisory committee workgroup.]

What are the GOALS to Guide RBMP?

1) To meet or exceed local, state, and federal laws, rules, and regulations. And be consistent with other applicable plans.

2) To identify existing and future water quality issues, emphasizing nonpoint sources of pollution.

3) To propose water quality improvement practices encouraging local involvement to reduce pollution, and monitor and protect water quality.

4) To involve all interested citizens and appropriate organizations in plan development and implementation.

5) To coordinate with other river plans and regional planning.

6) To facilitate local, state, and federal activities to monitor and protect water quality.

7) To identify existing and potential water availability problems and to coordinate development of alternatives.

8) To provide for education of the general public on matters involving the environment and ecological concerns specific to each river basin.

9) To provide for improving aquatic habitat and exploring the feasibility of re-establishing native species of fish.

10) To provide for restoring and protecting wildlife habitat.

11) To provide for recreational benefits.

12) To identify and protect flood prone areas within each river basin, and encourage local and state compliance with federal flood plain management guidelines.

[Established January 1994 by a joint basin advisory committee workgroup.]

Savannah River Basin Management Plan 2000

Preface

This report was prepared by the Environmental Protection Division (EPD), Georgia Department Natural Resources (EPD), as required by O.C.G.A. 12-5-520 and as a public information document. It represents a synoptic extraction of the EPD files and, in certain cases, information has been presented in summary form from those files. The reader is therefore advised to use this condensed information with the knowledge that it is a summary document and more detailed information is available in the EPD files.

Comments or questions related to the content of this report are invited and should be addressed to:

Environmental Protection Division
Georgia Department of Natural Resources
Floyd Towers East
205 Butler Street, S.E.
Atlanta, Georgia 30334

Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

Ac	acre
Ac-ft	acre-feet
ACCG	Association of County Commissioners of Georgia
ACF	Apalachicola-Chattahoochee-Flint Basin
ACT/ACF	Alabama-Coosa-Tallapoosa/Apalachicola-Chattahoochee Flint Basin
ADEM	Alabama Department of Environmental Management
AF&PA	American Forest and Paper Association
ARC	Atlanta Regional Commission
ARS	USDA Agricultural Research Service
BMPs	best management practices
BOD	biochemical oxygen demand
CAES	University of Georgia College of Agricultural and Environmental Sciences
CAFO	confined animal feeding operation
Cd	cadmium
CFR	Code of Federal Regulations
COE	U.S. Army Corps of Engineers
CPUE	catch per unit effort (fishing)
CRMP	Chattahoochee River Modeling Project
CRP	Conservation Reserve Program
CRS	Community Rating System
CSGWPP	Comprehensive State Ground Water Protection Plan
CSMTF	Community Stream Management Task Force
CSO	Combined Sewer Overflow
Cu	copper
CWA	U.S. Clean Water Act
DCA	Georgia Department of Community Affairs
DHR	Georgia Department of Human Resources
DNR	Georgia Department of Natural Resources
DO	dissolved oxygen
DOT	Georgia Department of Transportation
DWP	Drinking Water Program
EPA	U.S. Environmental Protection Agency
EPD	Georgia Environmental Protection Division
EQIP	Environmental Quality Incentives Program
E&SC	Erosion and Sedimentation Control Act
FEMA	Federal Emergency Management Agency

FFY	Federal fiscal year
FIP	Forestry Incentives Program
FSA	Farm Service Agency
ft	feet
ft^2/d	square feet per day
ft^3/s	cubic feet per second
gal/m	gallons per minute
GDA	Georgia Department of Agriculture
GEMA	Georgia Emergency Management Agency
GFA	Georgia Forestry Association
GFC	Georgia Forestry Commission
GMA	Georgia Municipal Association
GPC	Georgia Power Company
GPD	gallons per day
gpf	gallons per flush
GPM	gallons per minute
GSWCC	Georgia Soil and Water Conservation Commission
Hg	mercury
HUC	Hydrologic unit code (USGS)
IBI	Index of Biotic Integrity
kg	kilogram
km^2	square kilometer
kW	kilowatt
LAS	land application system for wastewater
LUST	leaking undeground storage tank
LWG	local work groups
MCL	Maximum Contaminant Level for drinking water
meq/l	milliequivalent
mg/l	milligrams per liter
MG	million gallons
MGD	million gallons per day
mi^2	square miles
ml	milliliter
MLMP	Major Lakes Monitoring Project
MLRA	major land resource area
MOA	memorandum of agreement
MOU	memorandum of understanding
MPN	most probable number (for quantification of fecal coliform bacteria)
MSA	Metropolitan Statistic Area
MS4	municipal separate stormwater system
M&I	municipal and industrial
NFIP	National Flood Insurance Program
NOI	notice of intent

NPDES	National Pollution Discharge Elimination System
NPS	nonpoint source
NRCS	Natural Resources Conservation Service of USDA
NSBLD	New Savannah Bluff Lock and Dam
NURE	National Uranium Resource Evaluation
NWI	National Wetlands Inventory (USF&WS)
Pb	lead
PCB	polychlorinated biphenyl
PFA	public fishing area
ppm	parts per million; equivalent to mg/l
RBMP	River Basin Management Planning
RBP	Rapid Bioassessment Protocol
RC&D	Resource Conservation and Development Council
RDC	Regional Development Center
RM	river mile
SCS	Soil Conservation Service (now NRCS)
SMZs	Streamside Management Zones
SOCs	Synthetic Organic Chemicals
SRBA	Savannah River below Augusta
SRS	Savannah River Site
STATSGO	State Soil Geographic Database (USDA)
SWAP	source water assessment program
SWCD	Soil and Water Conservation District
SWPP	source water protection program
TAC	technical advisory committees
TMDL	Total Maximum Daily Load, as specified in the CWA
TTSI	Georgia combined lake trophic state index
UGA	University of Georgia
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USF&WS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USFS	U.S. Forest Service
WET	whole effluent toxicity
WHIP	Wildlife Habitat Incentives Program
WMA	Wildlife Management Areas
WPCA	Water Pollution Control Agency
WPCP	water pollution control plant
WRD	Georgia Wildlife Resources Division
WRP	Wetland Reserve Program
WWTP	wastewater treatment plant
Zn	zinc

µg/l	micrograms per liter
7Q10	7-day average low flow with a once-in-ten-year recurrence interval

Executive Summary

This document presents Georgia's management plan for the Savannah River basin, which is being produced as a part of Georgia's River Basin Management Planning (RBMP) approach. The Georgia Environmental Protection Division (EPD) has developed this plan in cooperation with several other agency partners including the USDA Natural Resources Conservation Commission, Georgia Soil and Water Conservation Commission, Georgia Forestry Commission, U.S. Geological Survey, Georgia Geological Survey, and Georgia Wildlife Resources Division. The RBMP approach provides the framework for identifying, assessing, and prioritizing water resources issues, developing management strategies, and providing opportunities for targeted, cooperative actions to reduce pollution, enhance aquatic habitat, and provide a dependable water supply.

Purpose of the Basin Plan

The purpose of this plan is to provide relevant information on the characteristics of the Savannah River basin, describe the status of water quality and quantity in the Savannah River basin, identify present and future water resource demands, present and facilitate the implementation of water quality protection efforts, and enhance stakeholder understanding and involvement in basin planning.

This Savannah River Basin Management Plan includes strategies to address a number of different basinwide objectives. These include:

- Protecting water quality in lakes, rivers, streams, estuaries, and coastal waters through attainment of water quality standards and support for designated uses;
- Providing adequate, high quality water supply for municipal, agricultural, industrial, environmental, and other human activities;
- Preserving habitat suitable for the support of healthy aquatic and riparian ecosystems;
- Protecting human health and welfare through prevention of water-borne disease; minimization of risk from contaminated fish tissue, and reduction of risks from flooding; and
- Ensuring opportunities for economic growth, development, and recreation in the region.

Achieving these objectives is the responsibility of a variety of state and federal agencies, local governments, business, industry, and individual citizens. Coordination among these many partners can be challenging, and impacts of actions in one locale by one partner on conditions elsewhere in the basin are not always understood or considered. River Basin Management Planning is an attempt to bring together stakeholders in the basin to increase coordination and to provide a mechanism for communication and consideration of actions on a broad scale to support water resource objectives for the entire basin. RBMP provides the framework to begin to understand the consequences of local decisions on basinwide water resources.

This river basin plan will serve as the road map for managing the water resources in the Savannah River basin over the next five years. It contains useful information on the health of the Savannah River basin and recommended strategies to protect the basin now and into the future.

Savannah River Basin Characteristics

The Savannah River basin is located in eastern Georgia where its headwaters originate in the Blue Ridge Province of Georgia, and North and South Carolinas (Figure 2-1). The basin parallels the Georgia and South Carolina border passing through the Piedmont Province and upper and lower Coastal Plains before reaching the Atlantic Ocean. The Savannah River defines the state boundary between Georgia and South Carolina and the river basin is shared with North and South Carolina. The Savannah River basin has an area of 10,577 square miles in which 175 square miles are in southwestern North Carolina, 4,581 square miles are in western South Carolina, and 5,821 square miles are in eastern Georgia.

Water Resources

The surface water resources of the basin are divided into major watersheds or hydrologic units: the Tugaloo River, Upper Savannah River, Broad River, Little River, Middle Savannah River, Brier Creek and Lower Savannah River. There are a number of major reservoirs in the Savannah River Basin in Georgia including the U. S. Army Corps of Engineer reservoirs Hartwell, Richard B. Russell and Clarks Hill and the Georgia Power reservoirs including, Burton, Rabun, and Tugaloo.

Biological Resources

The Savannah River Basin encompasses parts of five major land resource areas (Blue Ridge, Southern Piedmont, Carolina and Georgia Sand Hills, Southern Coastal Plain, and the Atlantic Coast Flatwoods) providing many different ecosystem types. These ecosystems provide habitat for diverse species of aquatic and terrestrial wildlife. Several of the species are currently threatened or endangered.

Population and Land Use Characteristics

More than 523,100 people live in the Savannah River basin. The major population centers include the Cities of Augusta and Savannah. By the year 2050 predictions indicate an increase in population by approximately 60% to 900,000 people.

More than 55 percent of the basin is covered by forests and forestry-related activities account for a major part of the basin's economy. Agriculture is also a significant land use activity supporting a variety of animal operations and commodity production. In general, animal operations are concentrated north of the Fall line and commodity production is concentrated south of the Fall Line. Although the total farmland is declining in the basin livestock and poultry operations are relatively intense in the Savannah River Basin.

Local Governments and Planning Authorities

The local governments in the basin consist of counties and incorporated municipalities. The Savannah basin includes part or all of 27 Georgia counties. These counties are members of four different Regional Development Centers. There are also 98 incorporated municipalities in the basin.

Water Quantity Conditions

Surface water supplies in the basin include water in rivers, ponds, and reservoirs. Surface water is the primary water source in the Piedmont Province of the Savannah River basin. Within the Coastal Plain Province, aquifer yields are higher and groundwater withdrawals are an important part of the total water budget. The Savannah River provides drinking water for nearly 500,000 people by municipal or privately owned public water systems. Georgia's Drinking Water Program oversees 17 community public water systems utilizing surface water and serving 342,410 people and 134 community public water systems utilizing ground water and serving 124,135 people.

The primary demands for water supply in the basin include municipal and industrial use, agricultural use, and recreation. The demand for drinking water is expected to increase in the near future due to average population growth rates. Agricultural water demand in the Savannah River basin is considerable. Future agricultural water demand is expected to increase slightly within the basin.

Water Quality Conditions

The major environmental stressors that impair or potentially threaten water quality in the Savannah River basin include traditional chemical stressors, such as metals and bacterial contamination, as well as less traditional stressors, such as stream channel modifications and alteration of physical habitat.

Significant potential sources of environmental stressors in the basin include point source discharges such as municipal and industrial wastewater, and storm sewers; and nonpoint sources that result from diffuse runoff from urban and rural land uses. Based on EPD's 1998-1999 water quality assessment, nonpoint sources and urban runoff are now the major sources of failure to support designated uses of water bodies in the Savannah River basin.

Point Sources

Point sources are defined as the permitted discharges of treated wastewater to river and tributaries that are regulated under the National Pollutant Discharge Elimination System (NPDES). These permits are issued by EPD for wastewater discharges and storm water discharges.

Municipal discharges. There are currently 18 permitted major municipal wastewater discharges with flows greater than 1 MGD in the Savannah River basin. There are also 35 minor public discharges. EPD monitors compliance of these permits and takes appropriate enforcement action for violations. As of the 1998-1999 water quality assessment, 7 stream segments (totaling 36 miles) were identified in which municipal discharges contributed to a failure to support designated uses. Water quality standards violations in these segments are being addressed through the NPDES permitting process.

Industrial discharges. There are 13 major industrial or Federal wastewater dischargers in the basin and 58 minor industrial dischargers. EPD identified one stream segment (14 miles) where a permitted industrial discharger contributed to a failure to support designated uses. This segment is currently being addressed through the NPDES permitting process.

Permitted storm water discharges. Urban storm water runoff in the Savannah basin has been identified as a source of water quality impairment. Urban runoff which is collected by storm sewers is now subject to NPDES permitting and control. EPD has issued stormwater permits to the Cities of Augusta and Savannah.

Nonpoint Sources

Nonpoint sources of pollution include a variety of pollutants that are carried across the ground with rainwater and are deposited in water bodies. The 1998-1999 water quality assessment results for the Savannah basin indicate that urban and rural nonpoint sources contribute significantly to failure to support designated uses of water bodies. The major categories of nonpoint source pollution in the basin include the following:

- Urban, industrial, and residential sources, which may contribute stormwater runoff, unauthorized discharges, oxygen-demanding waste, oil and grease, nutrients, metals, bacteria, and sediments.
- Agricultural sources, which may contribute nutrients from animal wastes and fertilizers, sediment, herbicides/pesticides, and bacteria and pathogens.
- Forestry activities, which may contribute sediments and herbicides/pesticides.

Support of Designated Uses

Under Georgia regulations, designated uses and associated water quality standards provide goals for water quality protection. EPD assessed the streams and estuaries in the Savannah basin and reported the results in *the Georgia 2000 305(b)/303(d) List.* This assessment indicated that 36 out of 86 stream segments (271 miles) supported uses, and 24 out of 86 (365 miles) partially supported uses, while 26 out of 86 (186 miles) did not support designated uses.

Key Environmental Stressors

The major threats to water quality in the Savannah River basin are summarized below. The 1998-1999 assessment indicates that listings due to exceedences of water quality

standards for fecal coliform bacteria and dissolved oxygen and for fish consumption guidelines were the most commonly listed causes of failure to support designated uses.

Fecal coliform bacteria. Fecal coliform bacteria concentrations contributed to lack of full support on 216 miles, constituting 36 stream segments. Fecal coliform bacteria may arise from point and nonpoint sources, such as wastewater treatment plants, agricultural nonpoint sources, leaking septic systems, and storm water runoff. As point sources have been brought under control in the basin, nonpoint sources have become increasingly important as potential sources of fecal coliform bacteria.

Fish tissue contamination. Fish consumption guidelines for individual fish species are in effect for 9 stream segments (258 miles). The majority of the guidelines for stream segments are the result of mercury. Most of the mercury load is believed to be of natural and atmospheric origin.

Dissolved oxygen. Dissolved oxygen standards were not met in nine streams representing approximately 37 stream miles. A variety of issues contributed to lowered dissolved oxygen concentrations in streams including dams, municipal wastewater treatment plant discharges and nonpoint sources.

Metals. The 1998-1999 water quality assessments indicate few violations of water quality standards for metals. Metals concentrations contributed to lack of full support on four stream segments representing approximately 22 stream miles. The metals are attributed to municipal wastewater treatment plant discharges.

Nutrient loading. Nutrient loading is potentially an important issue in the Savannah River basin. Excess nutrient loads can promote undesirable growth of algae and degradation of water quality. An estuary receives unassimilated nutrients from the watershed upstream. The major sources of nutrient loading in the Savannah basin are agricultural runoff, urban runoff, storm water, and wastewater treatment facilities.

Flow and Temperature Modification. Stream flow and temperature affect the kinds of organisms able to survive in the water body. Stream flow and temperature also affect how much oxygen is available to the organisms. The potential threats to temperature regime in streams of the Ogeechee basin are warming by small impoundments, increases in paved surface area, and the removal of trees which provide shade along stream banks.

Sediment Loading and Habitat Degradation. A healthy aquatic ecosystem requires a healthy physical habitat. One major cause of disturbance to stream habitats is erosion and sedimentation. As sediment is carried into the stream, it can change the stream bottom, and may smother sensitive organisms. Turbidity associated with sediment loading may potentially impair recreational and drinking water uses. Sediment loading is of greatest concern in developing areas and major transportation corridors. The rural areas of the basin are of lesser concern with the exception of rural unpaved road systems, areas where cultivated cropland exceeds 20 percent of the total land cover, and areas in which foresters are not following appropriate management practices.

Strategies for Water Supply

At this time, water quantity appears to be adequate for all uses within the Georgia portion of the Savannah basin, and there are no major new water supply projects proposed. There are, however, several water quantity concerns in the Ogeechee basin which are of significance to decision makers.

Strategies for Water Quality

Water quality in the Savannah River basin is generally good at this time, although problems remain to be addressed and proactive planning is needed to protect water quality into the future. Many actions have already been taken to protect water quality. Programs implemented by federal, state, and local governments, farmers, foresters, and other individuals have greatly helped to protect and improve water quality in the basin over the past twenty years.

The primary source of pollution that continues to affect waters of the Savannah River basin results from nonpoint sources. These problems result from the cumulative effect of activities of many individual landowners or managers. Population is growing every year, increasing the potential risks from nonpoint source pollution. Growth is essential to the economic health of the Savannah River basin, yet growth without proper land use planning and implementation of best management practices to protect streams and rivers can create harmful impacts on the environment.

Because there are many small sources of nonpoint loading spread throughout the watershed, nonpoint sources of pollution cannot effectively be controlled by state agency permitting and enforcement, even where regulatory authority exists. Rather, control of nonpoint loading will require the cooperative efforts of many partners, including state and federal agencies, individual landowners, agricultural and forestry interests, local county and municipal governments, and Regional Development Centers. A combination of regulatory and voluntary land management practices will be necessary to maintain and improve the water quality of rivers, streams, lakes and estuaries in the Savannah River basin.

Key Actions by EPD. The Georgia EPD Water Protection Branch has responsibility for establishing water quality standards, monitoring water quality, river basin planning, water quality modeling, permitting and enforcement of point source NPDES permits, and developing Total Maximum Daily Loads (TMDLs) where ongoing actions are not sufficient to achieve water quality standards. Much of this work is regulatory. EPD is also one of several agencies responsible for facilitating, planning, and educating the public about management of nonpoint source pollution. Nonpoint source programs implemented by Georgia and by other states across the nation are voluntary in nature. The Georgia EPD Water Resources Branch regulates the use of Georgia's surface and ground water resources for municipal and agricultural uses, which includes source water assessment and protection activities in compliance with the Safe Drinking Water Act.

Actions being taken by EPD at the state level to address water quality problems in the Savannah River basin include the following:

- **Watershed Assessments and Watershed Protection Implementation Plans**. When local governments propose to expand an existing wastewater facility, or propose a new facility, EPD requires a comprehensive watershed assessment and development of a watershed protection implementation plan.
- **Total Maximum Daily Loads (TMDLs)**. Where water quality sampling has documented standards violations and ongoing actions are not sufficient to achieve water quality standard within a two year period, a TMDL will be established for a specific pollutant on the specific stream segment in accordance with EPA guidance.
- **Source Water Protection**. Most of the public water supply in the Savannah basin is drawn from surface water. To provide for the protection of public water supplies, Georgia EPD is developing a Source Water Assessment Program in

alignment with the 1996 amendments to the Safe Drinking Water Act and corresponding recent EPA initiatives.

- **Fish Consumption Guidelines**. EPD and the Wildlife Resources Division work to protect public health by testing fish tissue and issuing fish consumption guidelines as needed, indicating the recommended rates of consumption of fish from specific waters. The guidelines are based on conservative assumptions and provide the public with factual information for use in making rational decisions regarding fish consumption.

Key Actions by Resource Management Agencies. Nonpoint source pollution from agriculture and forestry activities in Georgia is managed and controlled with a statewide non-regulatory approach. This approach is based on cooperative partnerships with various agencies and a variety of programs. Agriculture in the Savannah River basin is a mixture of livestock and poultry operations and commodity production. About 15 percent of the basin land area is in agricultural use. Key partners for controlling agricultural nonpoint source pollution are the Soil and Water Conservation Districts, Georgia Soil and Water Conservation Commission, and the USDA Natural Resources Conservation Service. These partners promote the use of environmentally-sound Best Management Practices (BMPs) through education, demonstration projects, and financial assistance.

Forestry is a major part of the economy in the Savannah basin and commercial forest lands represent over 69 percent of the total basin land area. The Georgia Forestry Commission (GFC) is the lead agency for controlling silvicultural nonpoint source pollution. The GFC develops forestry practice guidelines, encourages BMP implementation, conducts education, investigates and mediates complaints involving forestry operations, and conducts BMP compliance surveys.

Key Actions by Local Governments. Addressing water quality problems resulting from nonpoint source pollution will primarily depend on actions taken at the local level. Particularly for nonpoint sources associated with urban and residential development, it is only at the local level that regulatory authority exists for zoning and land use planning, control of erosion and sedimentation from construction activities, and regulation of septic systems.

Local governments are increasingly focusing on water resource issues. In many cases, the existence of high quality water has not been recognized and managed as an economic resource by local governments. That situation is now changing due to a variety of factors, including increased public awareness, high levels of population growth in many areas resulting in a need for comprehensive planning, recognition that high quality water supplies are limited, and new state-level actions and requirements. The latter include:

- Requirements for Watershed Assessments and Watershed Protection Implementation Plans when permits for expanded or new municipal wastewater discharges are requested;
- Development of Source Water Protection Plans to protect public drinking water supplies;
- Requirements for local comprehensive planning, including protection of natural and water resources, as promulgated by the Georgia Department of Community Affairs.

In sum, it is the responsibility of local governments to implement planning for future development which takes into account management and protection of the water quality of rivers, streams, and lakes within their jurisdiction. One of the most important actions that local governments should take to ensure recognition of local needs while protecting water

resources is to participate in the basin planning process, either directly or through Regional Development Centers.

Continuing RBMP in the Savannah River Basin

This basin plan represents one step in managing the water resources in the Savannah basin. EPD, its resource management agency partners, local governments, and basin stakeholders will need to work together to implement the plan in the coming months and years. Additionally, the basin planning cycle provides the opportunity to update management priorities and strategies every five years. The Savannah River basin team and local advisory committee will both be reorganized in late 2001 to initiate the next iteration of the cycle. Agencies and organizations with technical expertise, available resources, and potential implementation responsibilities are encouraged to become part of the basin team. Other stakeholders can stay involved through working with the local advisory committee, and participating in locally initiated watershed planning and management activities. The next scheduled update of the Savannah River basin plan is planned for late 2005.

In This Section

Section 1

Introduction

What Is the Purpose of This Plan?

This document presents Georgia's river basin management plan for the Savannah River, which is being produced as a part of Georgia's River Basin Management Planning (RBMP) approach. The purpose of this plan is to provide relevant information on the Savannah River basin characteristics, describe the status of water quality and quantity in the Savannah River basin, identify present and future water resource demands, present and facilitate the implementation of water protection efforts, and enhance stakeholder understanding and involvement in basin planning.

This plan has been produced by the Georgia Department of Natural Resources Environmental Protection Division (EPD), based on data and information gathered by EPD, other state and federal agencies, universities, utilities, consultants, and environmental groups. A basin team made up of representatives from the Georgia Soil and Water Conservation Commission (GSWCC), the Natural Resources Conservation Service (NRCS), Georgia Department of Natural Resources Wildlife Resources Division (WRD), Georgia Forestry Commission (GFC), and EPD's Water Resources Management Branch, Water Protection Branch, and Geologic Survey Branch compiled the information to generate the plan. The U.S. Geological Survey (USGS) and the EPD Geologic Survey Branch created the majority of the figures in this report using geographic information system technologies.

River Basin Management Planning

RBMP is designed to coordinate management of water quantity and quality within river basins by integrating activities across regulatory and non-regulatory programs. The

RBMP approach provides the framework for identifying, assessing, and prioritizing water resources issues, developing management strategies, and providing opportunities for targeted, cooperative actions to reduce pollution, enhance aquatic habitat, and provide a dependable water supply. RBMP includes opportunities for stakeholders in the State's river basins to participate in developing and implementing river basin management plans. These plans will benefit from the collective experience and combined resources of a variety of stakeholders.

A separate document is available from Georgia EPD that describes the RBMP approach in greater detail.

Initial Efforts for the Savannah River Basin

Begun in 1993, RBMP is a new approach to the management of Georgia's water resources. This is the first river basin management plan produced under RBMP for the Savannah River (Figure 1-1). Under the RBMP approach, the Savannah River plan will be updated every five years. During the first iteration of RBMP in Georgia, much effort and resources are being dedicated to making programmatic changes, building the infrastructure of RBMP, cataloging current water management activities and beginning to coordinate with the many agencies, organizations, and individuals that have a stake in river basin management. As a result, some portions of the RBMP cycle have had to be condensed during this first iteration; in particular, it has not been possible to spend as much effort on developing management strategies as is planned for future iterations. Future iterations of the basin planning cycle will provide a better opportunity for developing new, innovative, and cost-effective strategies for managing water quality and quantity.

What's Inside?

This plan is organized into the following sections:

Executive Summary

The executive summary provides a broad perspective on the condition of the basin and the management strategies recommended to protect and enhance the Savannah River basin's water resources.

1.0 Introduction

The introduction provides a brief description of Georgia's River Basin Management Planning approach, the planning cycle for the Savannah River basin, opportunities for stakeholder involvement, and a description on how to use this document.

2.0 River Basin Characteristics

This chapter provides a description of the basin and its important characteristics, including boundaries, climate, physiography and geology, geochemistry, soils, surface water resources, ground water resources, biological resources, population and land use, local government and jurisdictions, and water use classifications.

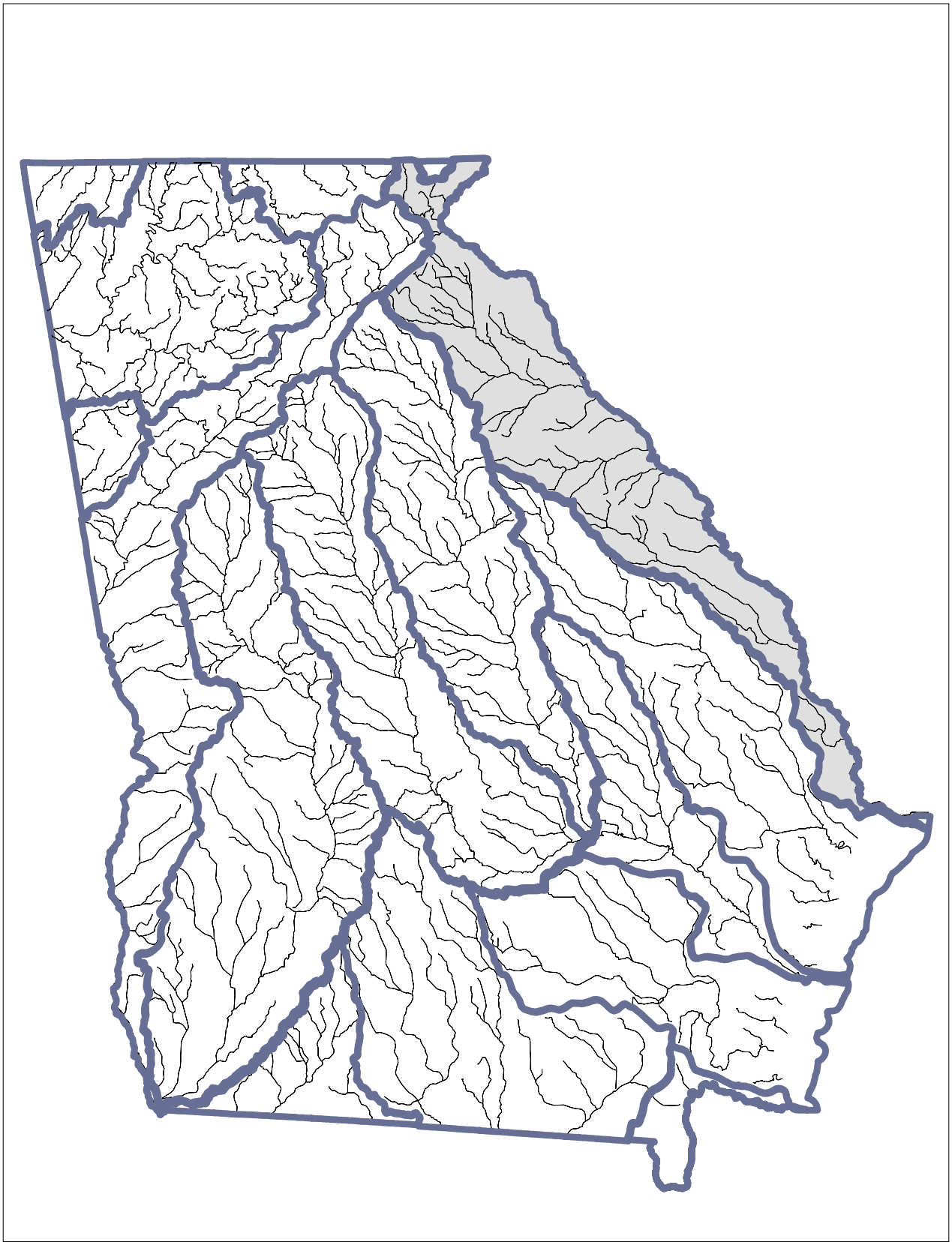

Figure I-1. The Savannah River Basin

3.0 Water Quantity

This chapter describes current surface and ground water availability, as well as forecasts for future demand. This chapter also includes sections on historic, present and possible proposed permitting activities pertaining to water availability.

4.0 Environmental Stressors

This chapter describes the major stressors in the basin that may impair water or habitat quality. The stressors are divided into point sources (i.e., NPDES permitted discharges) and nonpoint sources.

5.0 Assessment

This chapter provides an assessment of water quality and quantity in the streams, lakes, estuaries, and groundwater along with an assessment of the basin's biological integrity. The data sources and analysis techniques for these assessments are also discussed.

6.0 Concerns and Priority Issues

This chapter summarizes and prioritizes the issues of concern that were identified through the assessment in Chapter 5.

7.0 Implementation Strategies

This chapter presents strategies for addressing the issues of concern in the order that they appear on the priority list in Chapter 6 with a description of each issue, goals and objectives of management, overview of alternatives considered, and descriptions of recommended options for implementation.

8.0 Future Issues and Challenges

This chapter discusses long-range goals to set the stage for further improvements in managing water resources and water quality. Due to limited resources (data, time, funding, etc.), some issues will be addressed in future iterations of each basin planning cycle.

Appendices

The appendices contain technical information for those interested in specific details involved in the planning process.

How Do I Use This Plan?

This river basin plan will serve as the road map for managing the water resources in the Savannah River basin. It contains useful information on the health of the Savannah River basin and recommended strategies to protect the basin now and into the future. The document can be used as a reference tool for watershed conditions in the basin, as well as a planning guide for implementing key actions throughout the basin cycle.

Chapter 7 contains the key management strategies that have been identified to address the priority issues and concerns in the basin. The earlier chapters show the reader how

the issues were identified and where the specific stressors in the basin occur. Each chapter in this river basin plan builds upon the previous ones. For example, the recommended management strategies in Chapter 7 were formulated based on the priority concerns identified in Chapter 6. Similarly, the priority issues in Chapter 6 were derived as a result of the assessment in Chapter 5.

Links to Other Chapters

Because issues are discussed across several chapters, an explanatory paragraph at the beginning of chapters 4, 5, 6, and 7 will alert the reader that an issue may be discussed elsewhere. For example, Chapter 4 discusses stressors to the water body from various point and nonpoint sources. Chapter 5 provides an assessment summary of water quality and water quantity based on the sources of environmental stressors. Next, Chapter 6 combines the assessment information from Chapter five to identify priority issues for the development of management strategies. Finally, Chapter 7 provides general goals and strategies to address the most significant existing and future water quality and quantity issues within the Savannah basin.

What Is the Schedule of Activities for the Savannah River Basin?

The schedules of activities for the first two Savannah River basin cycles , i.e., 1996-2001 and 2001-2006, are provided in Figures 1-2 and 1-3. As mentioned earlier, initial scheduling complications and the need to devote resources to development of the RBMP infrastructure have caused the first basin cycle to be somewhat condensed. In the Savannah basin, this has meant that there was not as much time available in the first cycle (1996-2001) to develop management strategies for priority watersheds (step 8) as there will be once the program converges into a long-term rotating cycle (after 2001).

How Do Stakeholders Get Involved in the Basin Planning Process?

A major goal of RBMP is to involve interested citizens and organizations in plan development and implementation. This is intended to improve the identification and prioritization of water quality and quantity problems, maximize the efficient use of resources and expertise, create better and more cost-effective management strategies, and be responsive to stakeholder perceptions and needs. The opportunities for stakeholders to get involved in river basin management planning include the following:

Support the Basin Team

Every basin planning cycle begins with the organization of the basin team. The Savannah River basin team will be reorganizing itself in 2001.

Members of the basin team are from EPD programs and branches, and other interested governmental partners (e.g., the Department of Community Affairs, GFC, GSWCC, NRCS, and WRD). Emphasis is placed on technical knowledge, available resources, and potential implementation responsibilities. Other agencies may act as partners in the RBMP process, contributing resources and expertise, while not being directly involved in Basin Team activities. Support and provide input to the agency that represents your interests.

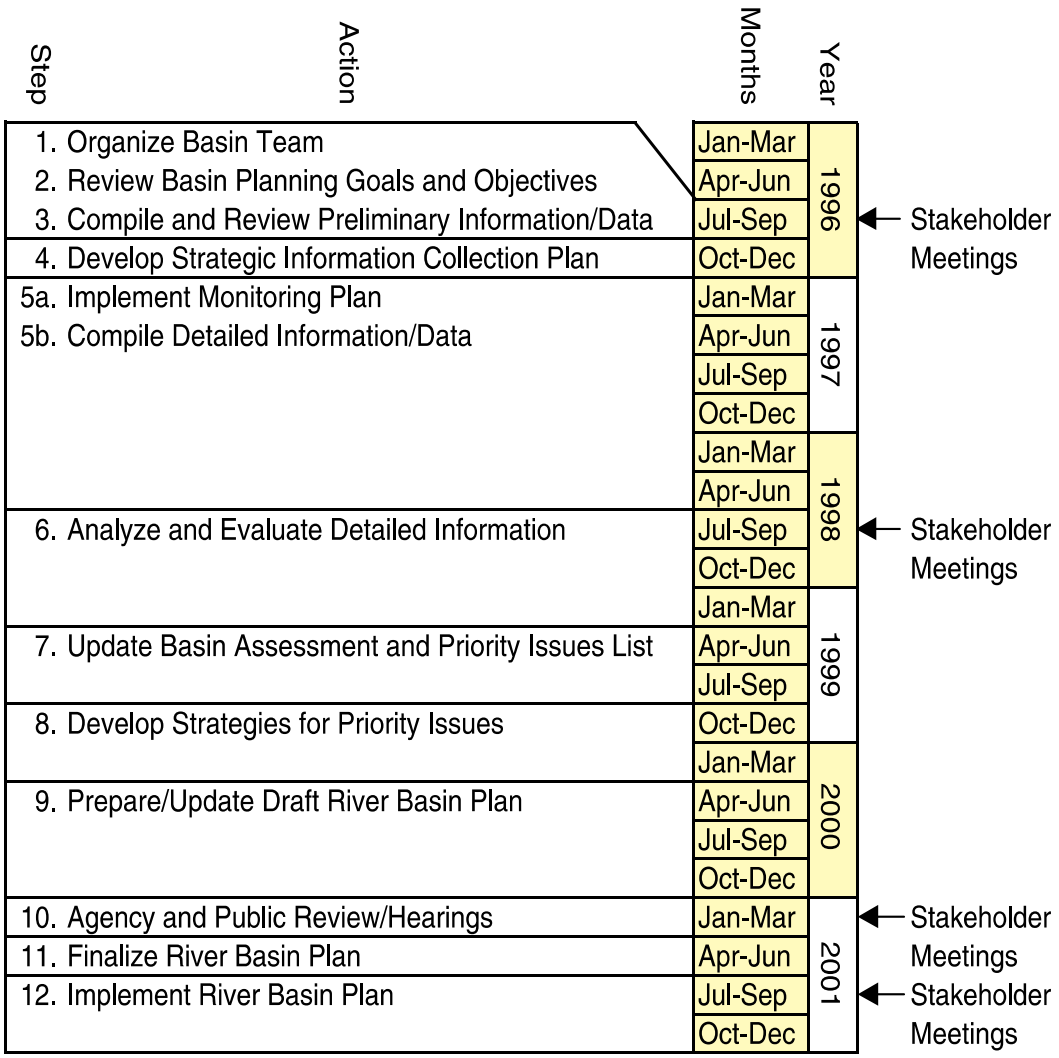

Figure I-2. Savannah River Basin Planning Schedule, 1st Cycle, 1996-2001

Support the Local Advisory Committee

The local advisory committees provide advice and counsel to EPD during river basin management plan development, representing a forum for involving local stakeholders. These local advisory committees form a link between EPD and the regulated community and local watershed interests. The local advisory committee will be reorganized simultaneously with the basin teams.

The committees consist of local people representing a variety of stakeholder interests including local governments, agriculture, industry, forestry, environmental groups, land-owners, and citizens. Committee members and chairs are appointed by the EPD Director following a nomination process at the beginning (step 1) of each river basin planning cycle. The committees meet periodically during the planning cycle, and provide input to EPD in the creation of river basin management plans. Meetings are called at the discretion of the chairman of the local advisory committee, and all meetings are open to the public. Table 1-1 lists the members of the Savannah River Basin Local Advisory Committee serving for the first planning cycle (through March 2001).

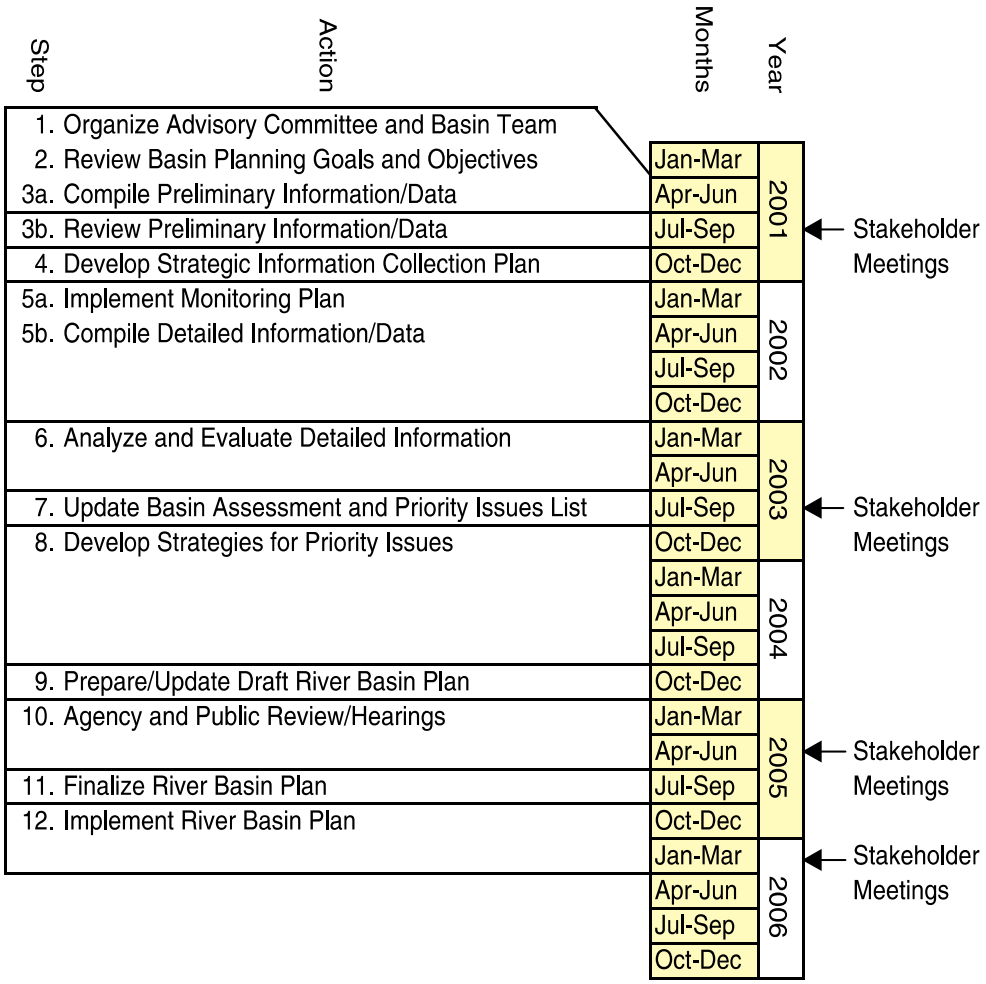

Figure I-3. Savannah River Basin Planning Schedule, 2nd Cycle, 2001-2006

Participate in Stakeholder Forums

While River Basin Advisory Committees operate at the major basin level, there is an opportunity under RBMP for more localized stakeholder forums to play an important role in the creation and implementation of water resources management strategies. Some strategies, such as best management practices (BMPs) to control pollutant runoff from urban, agricultural or forestry areas, are best managed at the city, county, or sub-watershed level. These local forums might already exist in the form of conservation districts or watershed associations, or may be created as an outgrowth of RBMP.

Attend a Stakeholder Meeting

The RBMP approach includes regularly-scheduled stakeholder meetings, which provide the opportunity for the general public to learn about the status of water-related issues and management activities in their river basin, as well as contribute input that can influence basin management planning.

Table I-I. Savannah River Basin Local Advisory Committee Members

Andy Cato
Supervisor-Brier Creek Soil and Water Conservation District, Chair-Savannah River Development RC&D
4843 Story Mill Rd.
Hephzibah, Ga. 30815

Hugh Fulcher
Supervisor- Brier Creek Soil and Water Conservation District
2948 Hwy. #88
Hephzibah, Ga. 30815

Philip Hadarits
US Dept of Agriculture - NRCS
2029 Lumpkin Road
Augusta, Ga. 30906

Dick Fox
Augusta Canal Authority
Augusta Rowing Club
1313 Waters Edge
Augusta, Ga. 30901

Patty Mc Intosh
428 Bull Street
Savannah, Ga. 31401

Leroy Crosby
U.S. Army Corps of Engineers
Box 889
Savannah, Ga. 31401

Jim Daniel
Union Camp Corp.
Box 1391
Savannah, Ga. 31402

Cliff Hargrove
GFC District Forester
1465 Tignall Rd.
Wshiongton, Ga. 30673

Francis Palmer
Georgia Pacific Corp.
US Hwy. 17S
Box 236
Riceboro, Ga. 31323

Amy Hughes
Executive Director
Savannah Area Manufacturers Council
Savannah Area Chamber of Commerce
222 W. Oglethorpe Ave.
Savannah, Ga. 31401

John Hutto
Albion Kaolin
7183 Jonesboro Rd.
Suite 101
Morrow, Ga. 30260

George Beasley
Box 206
Lavonia, Ga. 30553

Jeremy J. Pearson
International Paper
Box 1425
Augusta, Ga. 30903

Jimmy Adams
Farmer/Landowner, Supervisor-Broad River Soil and Water Conservation District
Box 118
Hartwell, Ga. 30643

George Allen
3183 Sisters Ferry Road,
Clyo, Ga.

David Brooks
Hart County Administrator
Box 279
Hartwell, Ga. 30643

Paul Bryan
Screven County Manager
Box 159
Syvania, Ga. 30467

Harry Jue
Water & Sewer Bureau Chief
City of Savannah
Box 1027
Savannah, Ga. 31402

Figures 1-2 and 1-3 show the timing of stakeholder meetings that have been and will be held as part of the Savannah basin RBMP cycles. The first stakeholder meetings have already been held for the current planning cycle. EPD hosted initial stakeholder meetings in Hartwell, Evans and Savannah in late 1996 to invite and encourage stakeholder input early in the planning process for the Savannah River basin. Monitoring in the Savannah River basin was extended through 1998. The data were assessed in 1999 and waters not meeting water quality standards were public noticed in February, 2000. This work along with priority issues was presented to and discussed with the Local Advisory Committee in March 2000. Draft strategies to address priority issues were presented to and discussed with the Local Advisory Committee June, 2000. Due to the extended monitoring program and compressed schedules for problem listing and strategy development, the second set of stakeholder meetings were not held. A third group of stakeholder meetings—to give stakeholders the opportunity to review this river basin management plan was held in March 2001. A public hearing to receive formal comments on this draft plan was also held in March 2001. A fourth group of meetings in mid-2001 will give stakeholders a chance to discuss implementation of management strategies. The next set of stakeholder meetings after the implementation phase of the first cycle is planned for mid to late 2001, providing stakeholders an opportunity to be involved in the planning for the next cycle of RBMP in the Savannah basin. The dates of ensuing stakeholder meetings are indicated in Figure 1-3.

What's Next?

This draft plan will be reviewed by governmental partners, the Savannah River Basin Advisory Committee, and the public. Public meetings will be held to solicit comments and recommendations regarding the river basin management plan. Following the review, appropriate modifications will be made to the plan, and the final plan will be submitted for review and acceptance by the Board of the Georgia Department of Natural Resources. After approval and an initial implementation period, partners will enter into the next 5-year cycle iteration to evaluate and update the plan as necessary.

In This Section

- River Basin Description
- Population and Land Use
- Local Governments and Planning Authorities
- Water Use Classifications

Section 2

River Basin Characteristics

This section describes the following major characteristics of the Savannah River basin:

- *River basin description* (Section 2.1): the physical features and natural processes of the basin.
- *Population and land use* (Section 2.2): the sociological features of the basin, including the types of human activities that might affect water quality and water resource use.
- *Local governments and planning authorities* (Section 2.3): identification and roles of the local authorities within the basin.
- *Water use classifications* (Section 2.4): description of water use classification and baseline goals for management of waters within the basin as defined in the state regulatory framework.

2.1 River Basin Description

This section describes the important geographical, geological, hydrological, and biological characteristics of the Savannah River basin.

The physical characteristics of the Savannah River basin include its location, physiography, soils, climate, surface water and ground water resources, and natural water quality. These physical characteristics influence the basin's biological habitats and the ways people use the basin's land and water resources.

2.1.1 River Basin Boundaries

The Savannah River basin is located in eastern Georgia where its headwaters originate in the Blue Ridge Province of Georgia, and North and South Carolinas (Figure 2-1). The basin parallels the Georgia and South Carolina border passing through the Piedmont Province and upper and lower Coastal Plains before reaching the Atlantic

Figure 2-I. Location of the Savannah River Basin

Ocean. The Savannah River defines the state boundary between Georgia and South Carolina and the river basin is shared with North and South Carolina. The Savannah River basin has an area of 10,577 square miles in which 175 square miles are in southwestern North Carolina, 4,581 square miles are in western South Carolina, and 5,821 square miles are in eastern Georgia.

The U.S. Geological Survey (USGS) has divided the Savannah River basin into seven subbasins or Hydrologic Unit Codes (HUCs; see Table 2-1), within Georgia. These HUCs are referred to repeatedly in this report to distinguish conditions in different parts of the basin. Figure 2-2 shows the location of these subbasins and the associated counties within each subbasin.

Table 2-I. Hydrologic Unit Codes (HUCs) of the Savannah River Basin in Georgia

03060102	Tugaloo River
03060103	Upper Savannah River
03060104	Broad River
03060105	Little River
03060106	Middle Savannah River
03060108	Brier Creek
03060109	Lower Savannah River

2.I.2 Climate

The Savannah River basin is characterized by mild winters and hot summers in the lower portions, and cold winters and mild summers in the mountain area. Mean annual precipitation ranges from 40 to 80 inches per year. Precipitation occurs chiefly as rainfall, and to a lesser extent, as snowfall. Rainfall is fairly evenly distributed throughout the year, but a distinct dry season occurs from mid-summer to late fall. Rainfall is usually greatest in March and least in October. The mean annual temperature is about 65 degrees Fahrenheit.

2.I.3 Physiography, Geology, and Soils

Physiography

The Savannah River basin contains parts of the Blue Ridge, Piedmont and Coastal Plain physiographic provinces, which extend throughout the southeastern United States. Similar to much of the Southeast, 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 northernmost part of the Savannah River basin is within the Blue Ridge Province where the headwaters arise. Less than one percent of the basin lies within the Blue Ridge Province. The Blue Ridge Province is dominated by rugged mountains and ridges that range in altitude from 3,000 to 3,500 feet (ft). Runoff is quite rapid because of the steep terrain and steep stream gradients in this province. The boundary between the Blue Ridge and the Piedmont is defined by a sharp change in slope at an altitude of approximately 1,700 ft.

The Blue Ridge and Piedmont provinces are underlain by mostly Precambrian as well as early Paleozoic crystalline rocks that include a wide variety of schists, gneisses, amphibolites, phyllites and granites. Less extensive outcrops of quartzites are also present. The area is characterized by numerous inactive fault zones and joint patterns

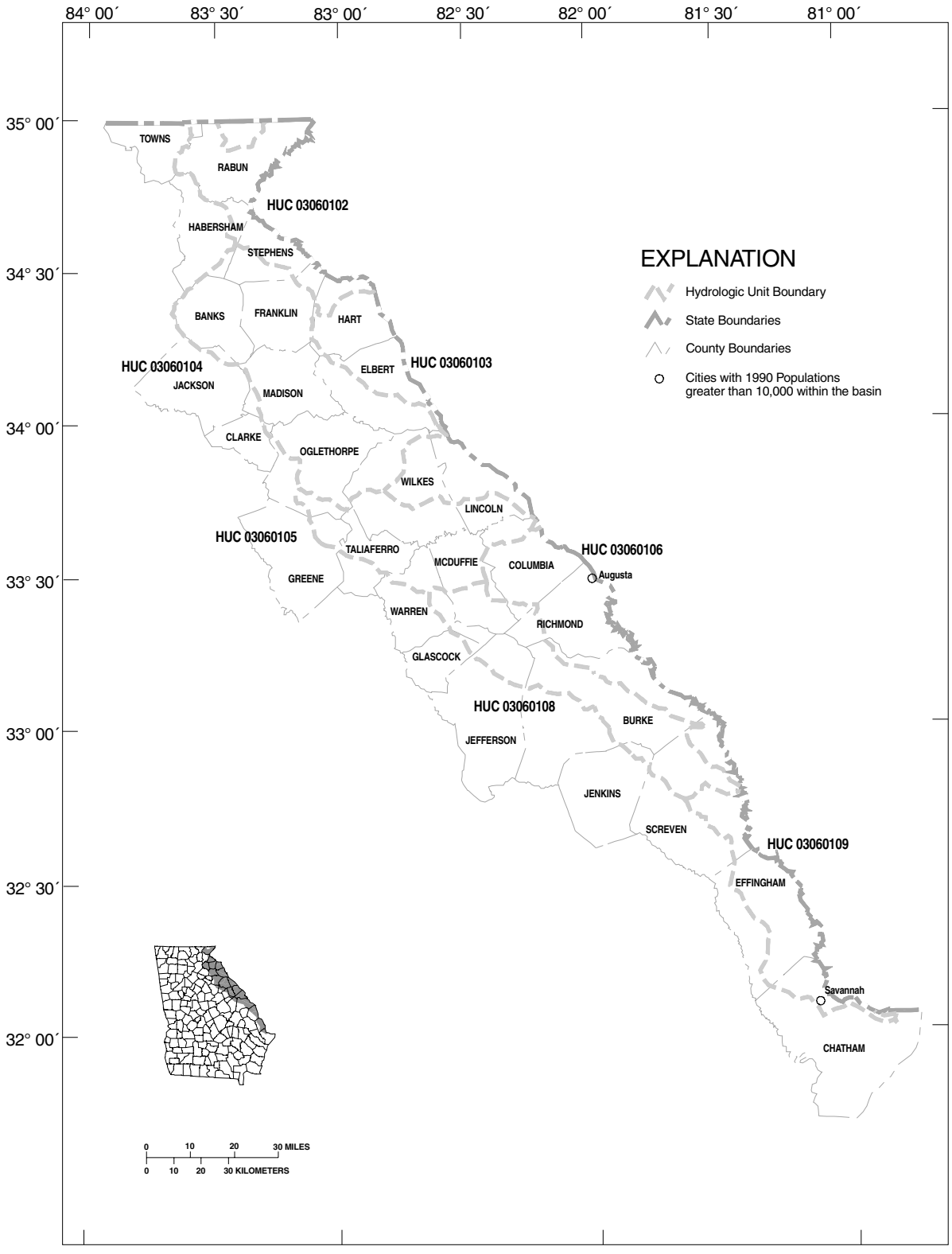

Figure 2-2. Hydrologic Units and Counties of the Savannah River Basin

within the rocks that dictate the surface stream patterns and ground water resources. The crystalline rocks typically are overlain by a porous, residual soil generally known as saprolite.

The Fall Line is the boundary between the Piedmont and Coastal Plain provinces. This boundary approximately follows the contact between older crystalline metamorphic rocks of the Piedmont Province and the younger unconsolidated Cretaceous and Tertiary sediments of the Coastal Plain Province. As implied by the name, streams flowing across the Fall Line can undergo abrupt changes in gradient, which are marked by the presence of rapids and shoals. Geomorphic characteristics of streams differ between the Piedmont and Coastal Plain provinces. In the Coastal Plain, streams typically lack the riffles and shoals common to streams in the Piedmont and exhibit greater floodplain development and increased sinuosity.

Geology

The Savannah River basin is located within three physiographic provinces: the Blue Ridge, Piedmont and the Coastal Plain provinces. The Blue Ridge and Piedmont provinces, which constitute approximately 60 percent of the Savannah River basin, are underlain by crystalline metamorphic and igneous rocks. The metamorphic rocks originally were sedimentary, volcanic, and igneous plutonic rocks that have been altered by several stages of regional metamorphism as well as several episodes of granite intrusion. The majority of the exposed rocks of the Savannah River basin consist of several types of gneiss, largely made up of biotite gneiss, granite gneiss, and amphibolite. Granites are locally important in the basin as are metasedimentary rocks such as metagraywackes, quartzites, and schists. Less than 0.1 percent of the Savannah River basin is occupied by ultramafic rock units.

Coastal Plain sediments are constitute approximately 40 percent of the Savannah River basin. Approximately 80 percent of the sediments are sands and clays. The rest include calcareous sediments and Quaternary alluvium. The Coastal Plain sediments overlap the southern edge of the Piedmont Province at the Fall Line and those sediments nearest to the Fall Line are Cretaceous to Eocene in age. They are dominantly terrestrial to shallow marine in origin and consist of sand, kaolinitic sand, kaolin, and pebbly sand. These sediments host the major kaolin deposits in Georgia with many of these deposits found within the Savannah River basin.

Much of the southeastern Piedmont is covered by deeply weathered bedrock called saprolite. Average saprolite thickness in the Piedmont rarely exceeds 20 meters, but the thickness can vary widely within a short distance. A considerable amount of ground water flows through the saprolite and recharges streams in the Piedmont. Saprolite is easily eroded when covering vegetation and soil are removed. Extensive erosion of soil and saprolite caused by agricultural practices during the 1800s and early 1900s contributed a vast quantity of sediment into stream valleys, choking the streams and raising the streams base level. As conservation practices stabilized erosion, streams began to reestablish grade and cut into the thick accumulations of sediments, remobilizing them into the major rivers and eventually into reservoirs.

Soils

The Savannah River watershed in Georgia crosses 5 Major Land Resource Areas (MLRA's) (Figure 2-3). Soils vary widely across the watershed, ranging from nearly level to very steep, from shallow to very deep, from excessively drained to very poorly drained, and from sandy to clayey. There are some general trends with soils across the watershed. Going from north to south, degree of slope decreases, water tables are generally higher, and soil textures go from loamy in the Blue Ridge, to clayey in the

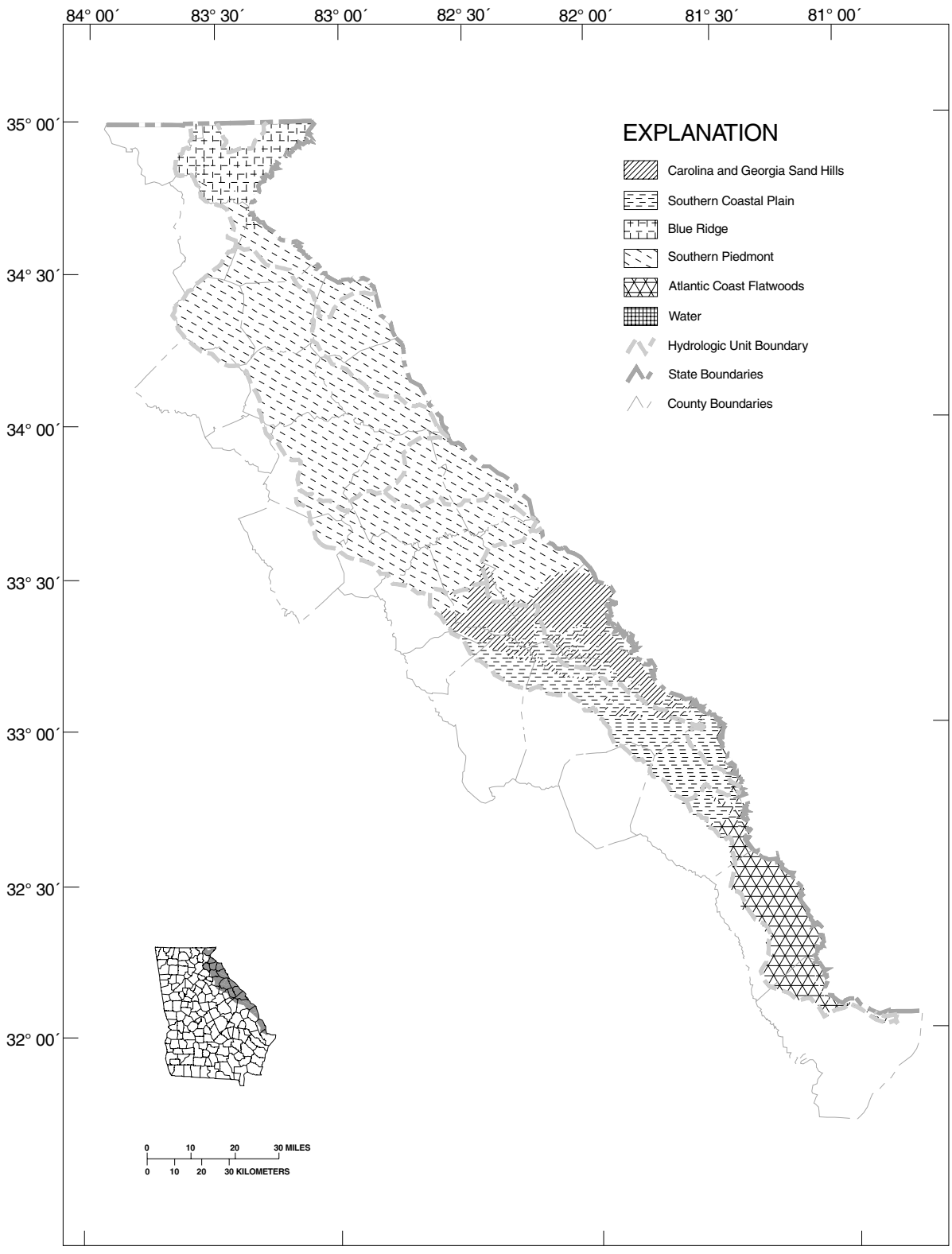

Figure 2-3. Major Land Resource Areas in the Savannah River Basin

Southern Piedmont, to sandy or sandy over loamy in the Sand Hills, Coastal Plain, and Atlantic Coast Flatwoods.

About 6 percent of the watershed is in the Blue Ridge MLRA. Most of the soils in this area formed from weathered granite, gneiss, and schist. These are the steepest soils in the watershed, with slopes in most areas ranging from 25 to 60 percent. Soils on the steeper slopes and higher elevations are commonly loamy throughout, are brown to yellowish red, and are shallow or moderately deep to bedrock. Deep to very deep, red clayey soils are common in less sloping areas at lower elevations.

About 60 percent of the watershed is in the Southern Piedmont MLRA. Most of the soils in this region are very deep, well drained, red clayey soils that formed from felsic, high grade metamorphic or igneous rocks. There is a significant area in the central part of this region that contains soils formed from intermediate and mafic crystalline rocks. These soils have slower permeability and are less acid than typical Piedmont soils. Also significant is an area in the lower portion of the Piedmont that has soils formed from Carolina slate. These soils are still clayey, but have a higher silt content than typical Piedmont soils.

About 8 percent of the watershed is in the Carolina and Georgia Sand Hills MLRA. Soils in this area formed primarily in sandy and loamy marine sediments, which occasionally overlie residual Piedmont materials. There are two major groups of soils in this area. One group consists of deep sands ranging from 40 to more than 80 inches deep. The other group consists primarily of soils that have a sandy surface and a loamy subsoil, often exhibiting dense or brittle properties. Soils in this MLRA are generally less developed than soils in other parts of the watershed.

About 17 percent of the watershed is in the Southern Coastal Plain MLRA. Soils in this part of the watershed are more variable than in other parts, particularly with regards to textures and water table depths. Typically, soils have a sandy surface layer that orderlies a red to yellow, loamy subsoil. The depth of the sandy surface is quite variable. Soils in this region are on more gently sloping landforms than in previously mentioned MLRA's. There is a continuum of soils ranging from well drained soils on ridges and hillsides to poorly drained soils in depressions and along drainageways.

About 9 percent of the watershed is in the Atlantic Coast Flatwoods MLRA. Landforms in this part of the watershed are nearly level. Water tables are generally closer to the surface in this area than in other parts of the watershed. Typically, soils have a sandy surface layer that is 20 to 40 inches deep over a loamy subsoil. This varies considerably, however. Characteristic of part of this MLRA are sandy soils that have an accumulation of an organic matter-aluminum complex.

2.1.4 Surface Water Resources

The Chattooga and Tallulah Rivers join in the Savannah River headwaters to form the Tugaloo River. Further downstream near Hartwell, Georgia, the Tugaloo River joins with the Seneca River from South Carolina to form the Savannah River. From here the Savannah River flows southeasterly to the Atlantic Ocean. Other significant basin features within Georgia are the three major tributaries, Broad and Little Rivers, and Brier Creek that flow into the Savannah River and are located entirely within Georgia. Also located along the Tallulah, Tugaloo, and Savannah Rivers are several hydroelectric facilities and their associated impoundments. Finally, at the terminus of the river is the Savannah River harbor.

The Savannah River, which is approximately 300 miles long, is the most extensively used surface water resource in the basin. It is fed by many moderate-sized tributaries, some of which have drainage areas greater than 200 square miles and are significant

surface water resources in their own right. The major impoundments in the basin are Hartwell Lake, Richard B. Russell Lake, and Clarks Hill Lake, all Corps of Engineers reservoirs. Hartwell Lake is a 56,000 acre reservoir located at the confluence of Tugaloo River and Seneca River. Richard B. Russell Lake is a 26,000 acre reservoir just downstream from Hartwell Lake. Clarks Hill Lake is a 70,000 acre reservoir on the Savannah River northwest of Augusta.

The topography varies from elevation 5,500 feet at the headwaters of the Tallulah River, to about 1,000 feet in the rolling and hilly piedmont province, descending to around 200 feet at Augusta, Georgia, and from the gently rolling to the nearly flat coastal plain province from Augusta to the Atlantic Ocean.

Runoff averages about 15 inches annually over the entire drainage area. Runoff at Augusta, Georgia, averages about 19 inches.

Following are descriptions of each of the bodies of water mentioned. Stream networks within each of the HUCs are shown in Figures 2-4 through 2-10.

Chattooga River

The Chattooga River originates on the crest of the Blue Ridge in the mountains of North Carolina. It flows southward through the mountains for 10 miles in North Carolina, and then continues for 40 miles as the boundary between Georgia and South Carolina before ending in Lake Tugaloo. This is one of the longest and largest free-flowing mountain streams in the Southeast. The Tallulah River originates in southwestern North Carolina and flows south into Georgia. Along the river are several Georgia Power hydroelectric facilities including Burton, Mathis, Nacoochee, Rabun, Tallulah Falls, and Terrora . Like the Chattooga River, the Tallulah River flows into Lake Tugaloo, another Georgia Power hydroelectric facility reservoir. The Tugaloo River begins below the confluence of the Chattooga and Tallulah Rivers. The Tugaloo River flows into Lake Hartwell where it joins with the Seneca River from South Carolina to form the Savannah River.

Upper Savannah River

The upper Savannah River is dominated by two U.S. Army Corps of Engineers reservoirs, Lake Hartwell Reservoir and Clarks Hill Lake. These reservoirs are used for hydroelectric power generation, flood control, recreation, flow regulation, and fish and wildlife. The Broad River flows into the headwaters of Clarks Hill Lake, while the Little River flows into the downstream reach of the reservoir and becomes an arm of the reservoir.

Broad River

The headwaters of the Broad River, the North and Middle Forks, begin in the Chattahoochee National Forest in Banks, Habersham, and Stephens counties. The river flows generally southeast before terminating in Clarks Hill Lake. The Broad River basin is approximately 1500 square miles and is located primarily in the Piedmont Province.

Little River

The Little River basin is an approximately 765 square mile watershed located midway in the basin. The Little River flows east to slightly northeast to the Savannah River. It joins the Savannah River in Clarks Hill Lake. The backwater from the lake extends far up into the Little River creating an arm of the lake.

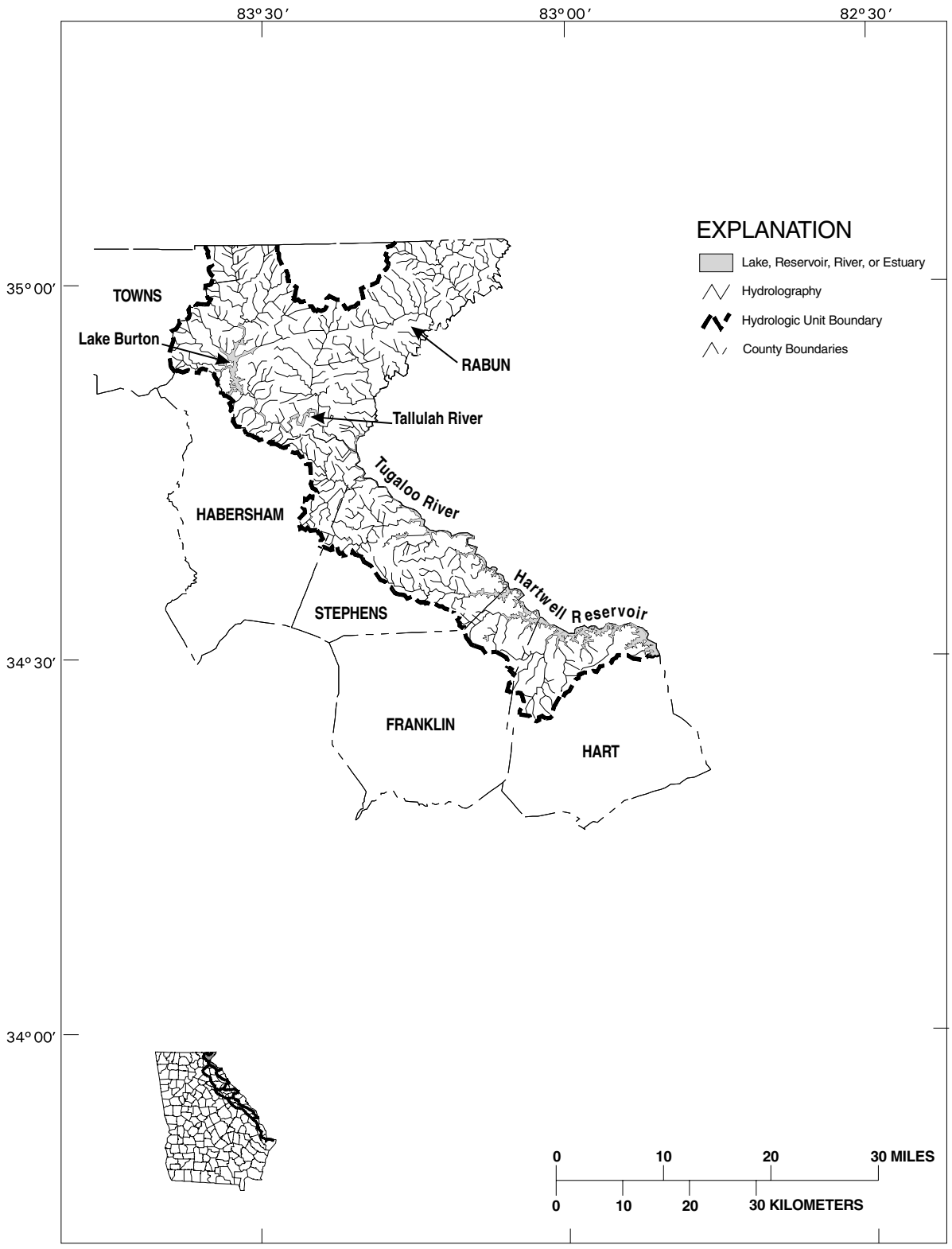

Figure 2-4. Hydrography, Savannah River Basin, HUC 03060102

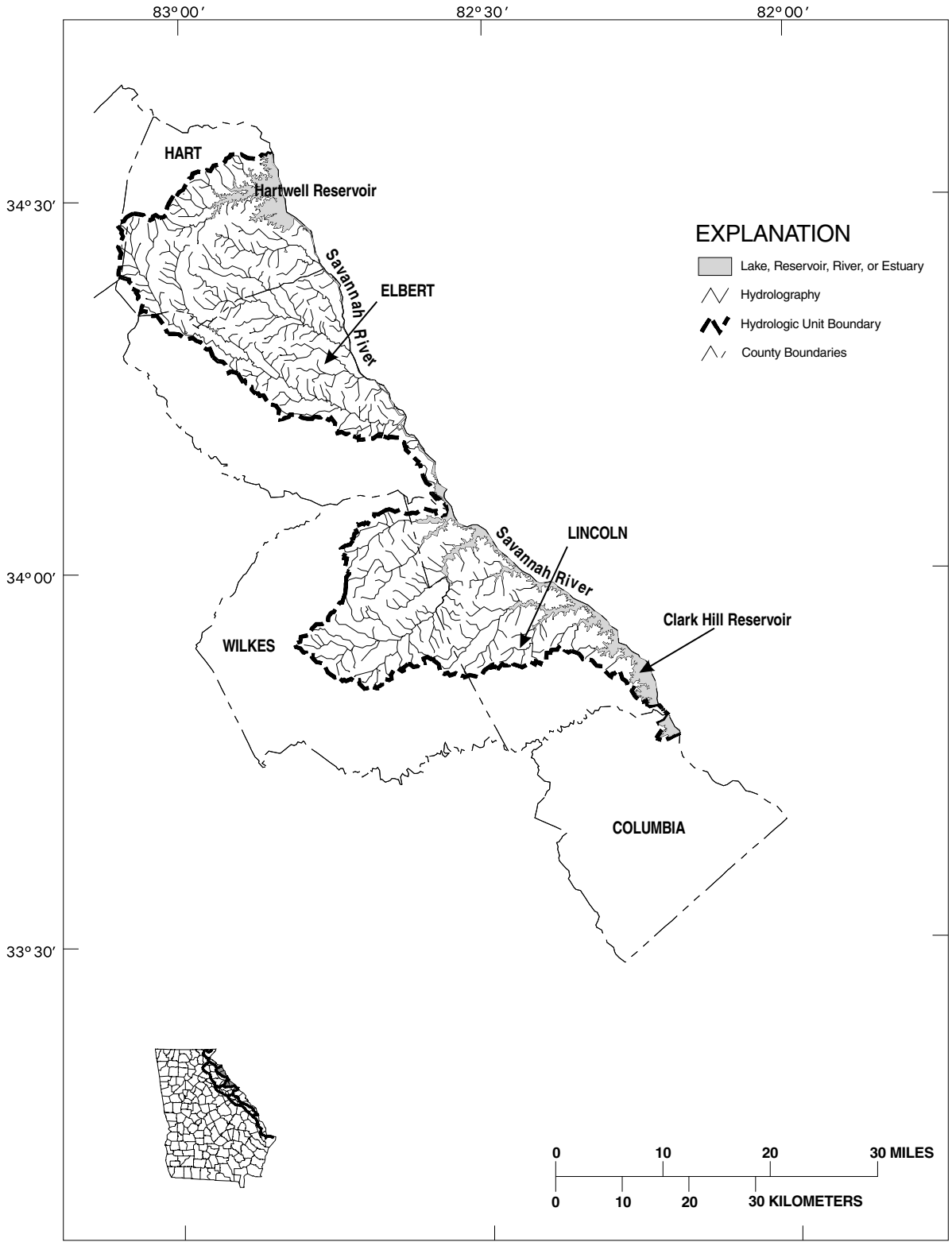

Figure 2-5. Hydrography, Savannah River Basin, HUC 03060103

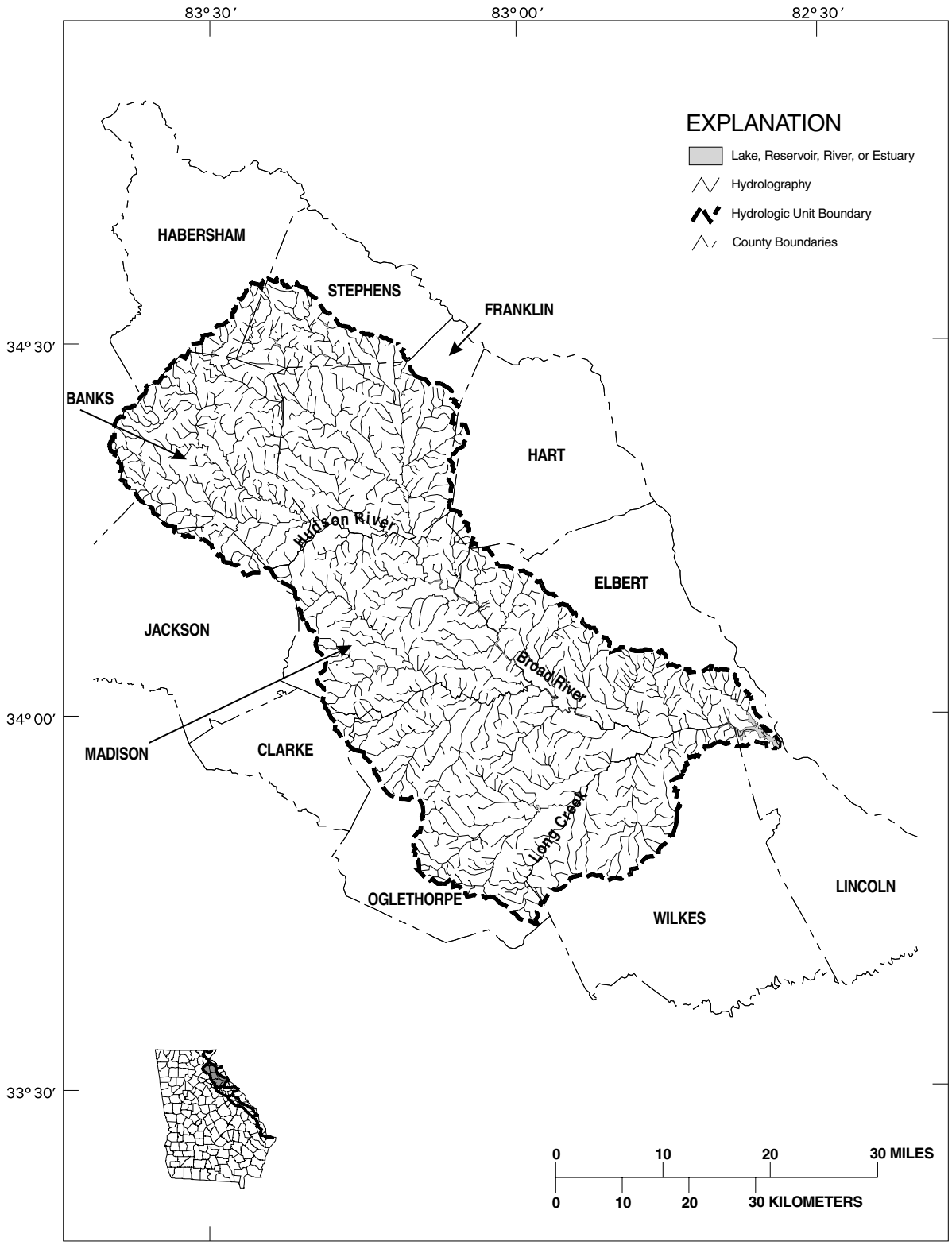

Figure 2-6. Hydrography, Savannah River Basin, HUC 03060104

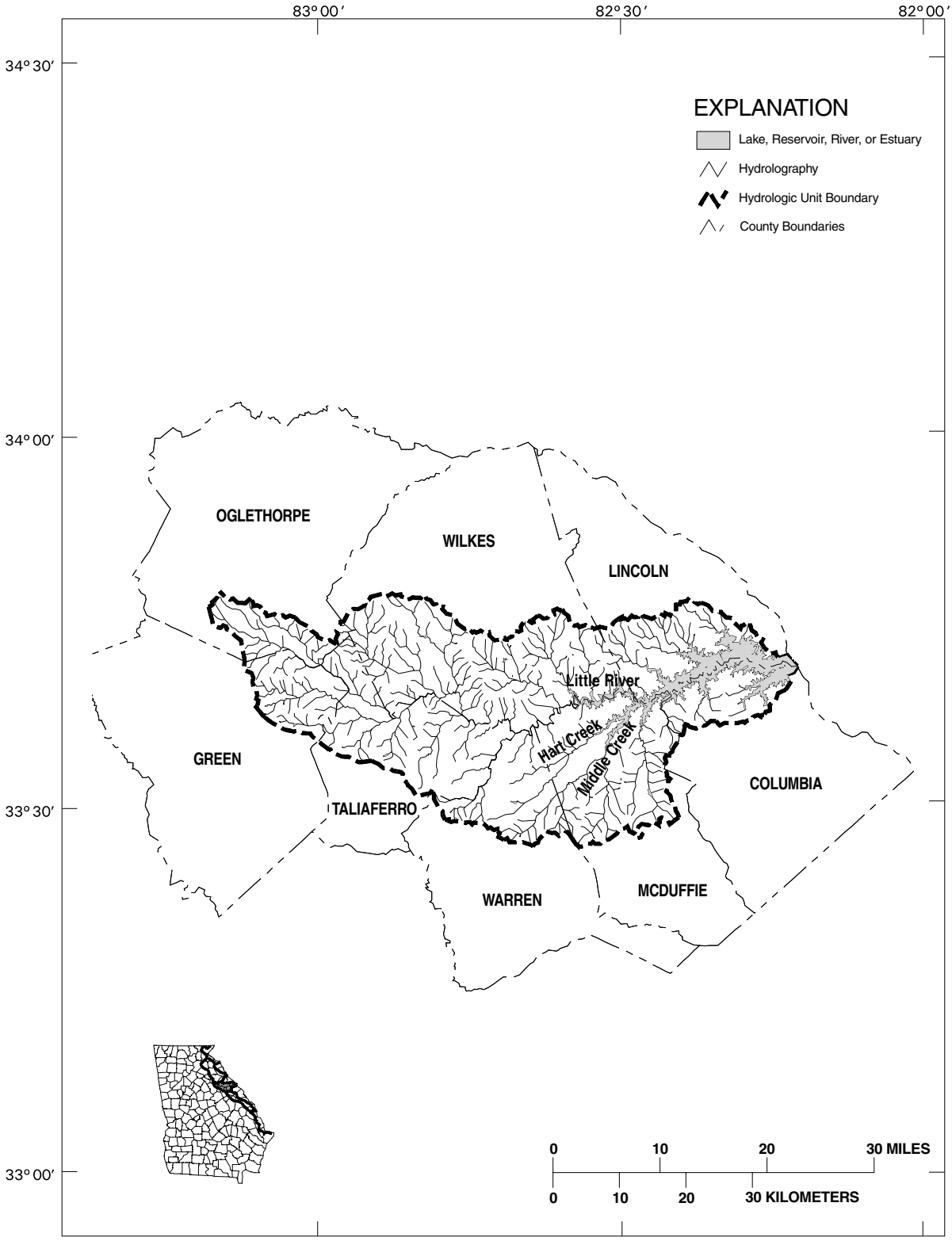

Figure 2-7. Hydrography, Savannah River Basin, HUC 03060105

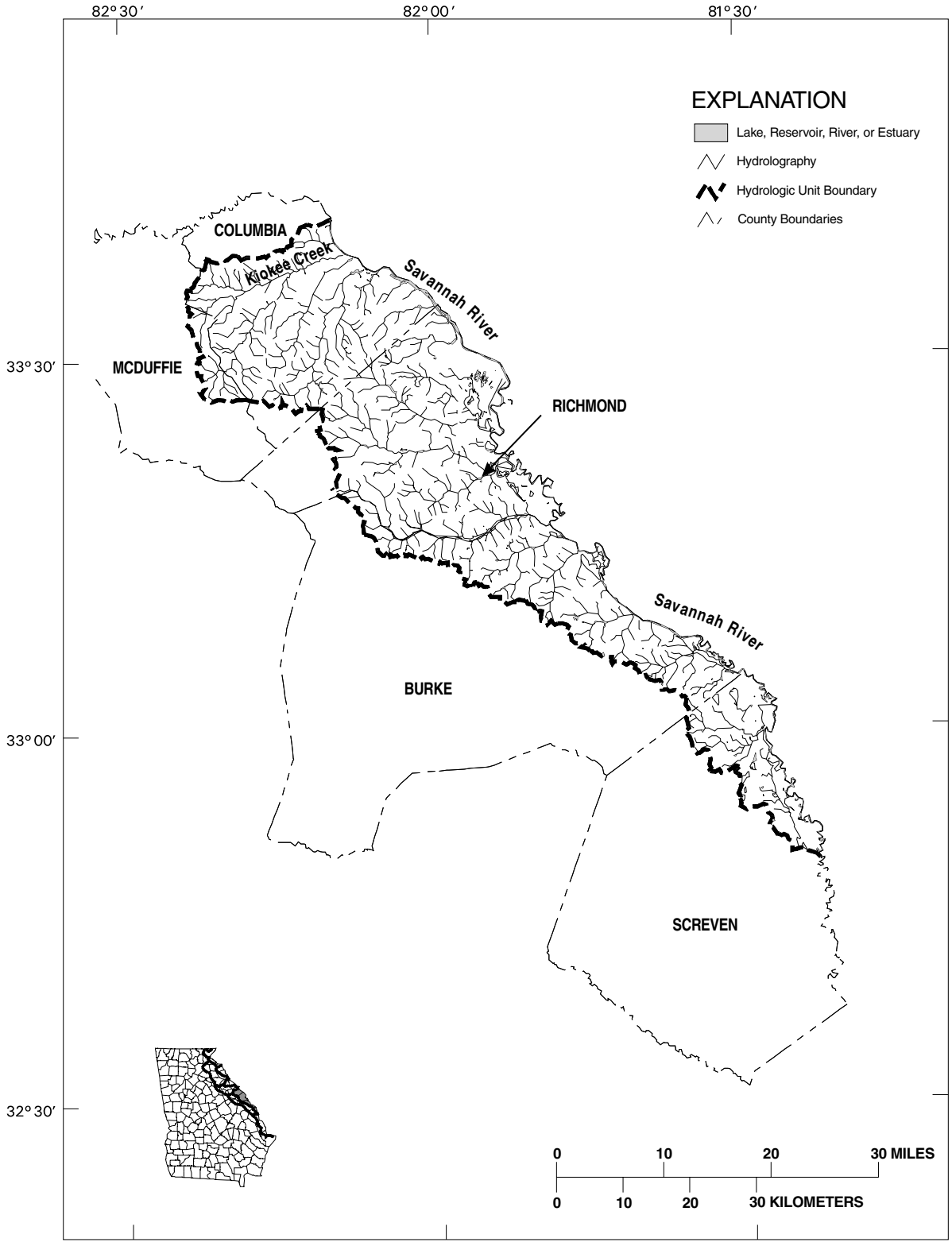

Figure 2-8. Hydrography, Savannah River Basin, HUC 03060106

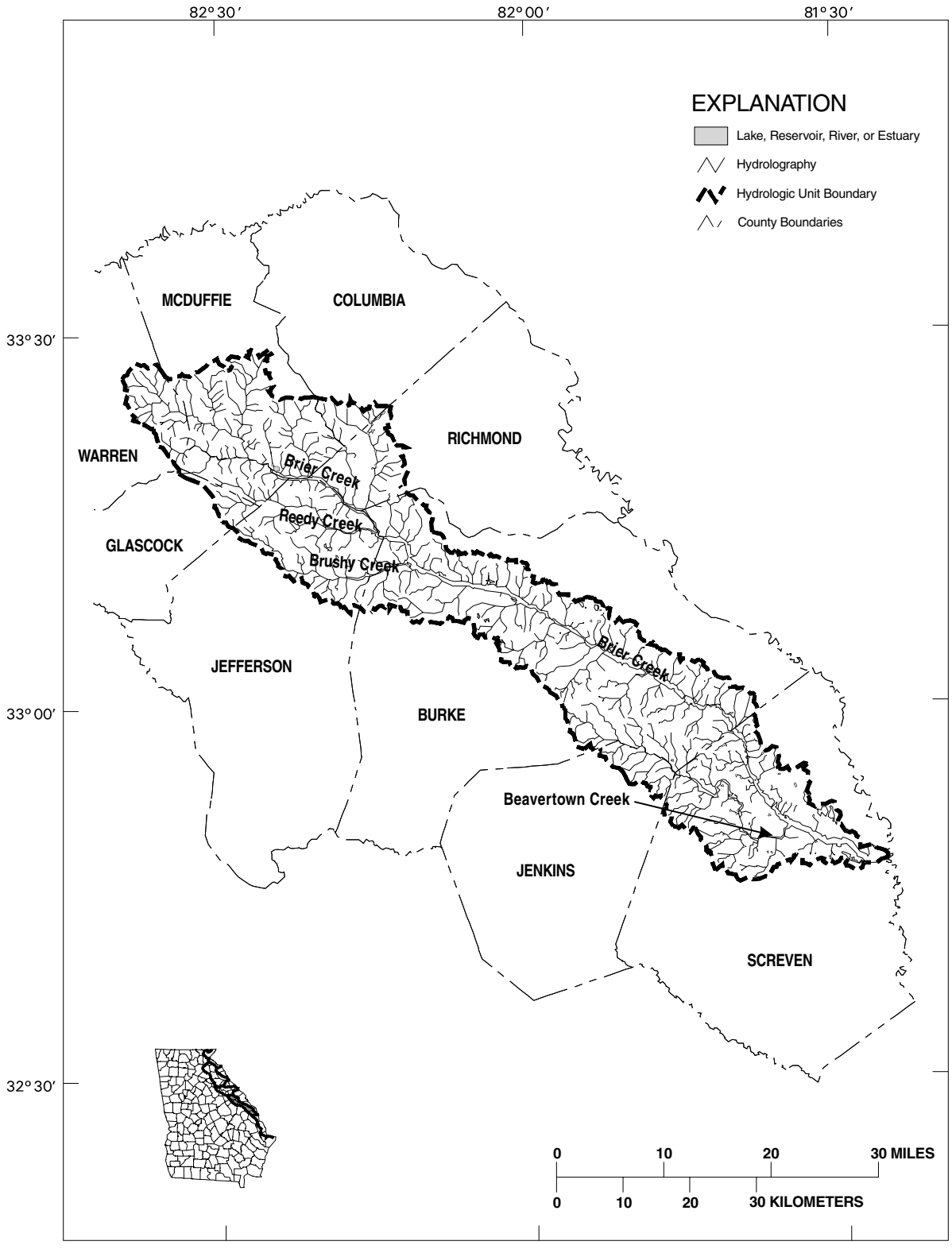

Figure 2-9. Hydrography, Savannah River Basin, HUC 03060108

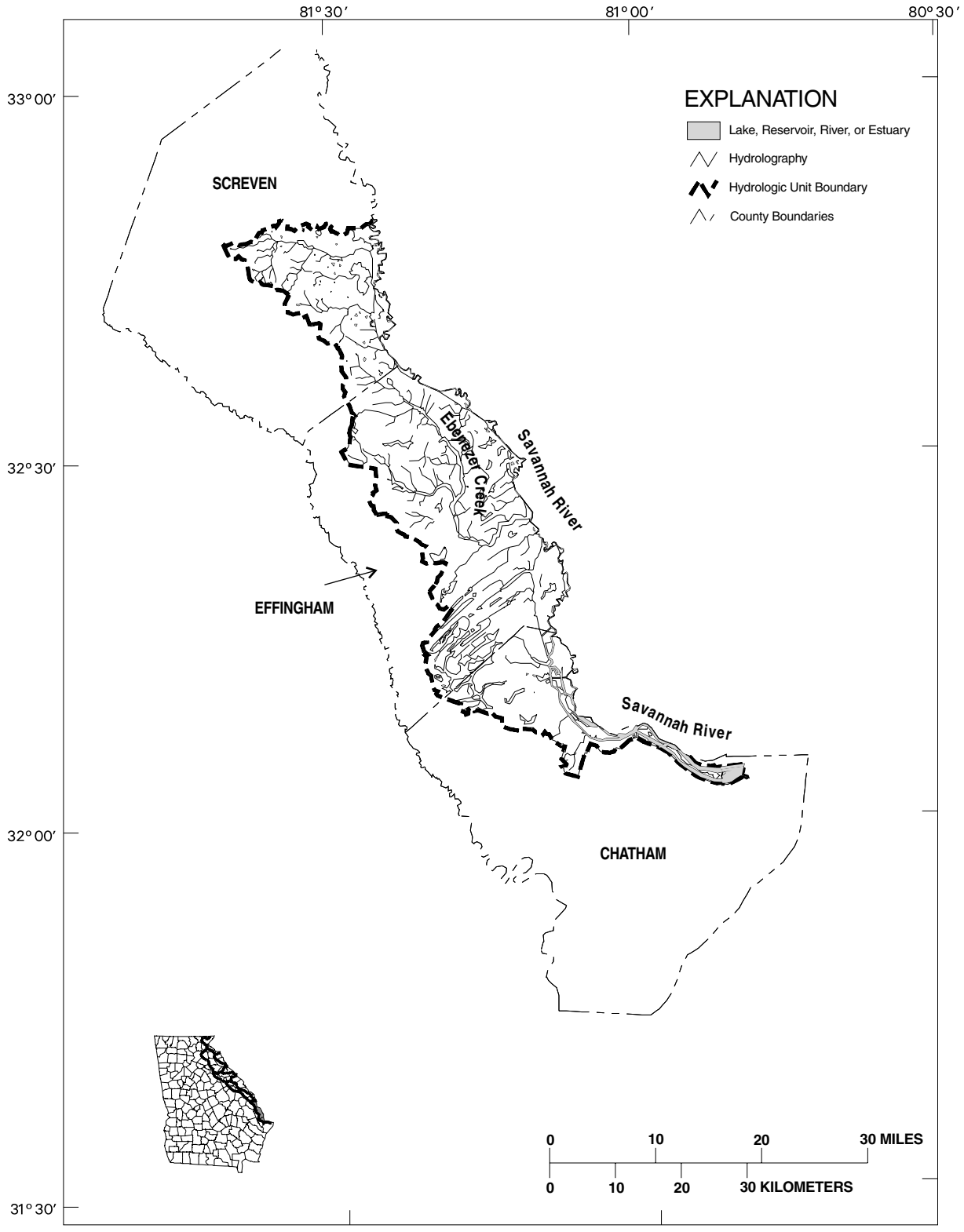

Figure 2-10. Hydrography, Savannah River Basin, HUC 03060109

Middle Savannah River

The middle section of the Savannah River begins downstream of Clarks Hill Dam and ends at Brier Creek. Located partially in the Piedmont Province, but predominately in the upper Coastal Plains, this section of the Savannah River contains the Stevens Creek Reservoir and is fed by numerous small tributaries. It is in this section of the Savannah River that wide flood plains and wetlands begin to emerge.

Brier Creek

Brier Creek is a very long and slender basin with a watershed area of approximately 840 square miles. The creek is characterized by low stream slopes and extensive flood plain and wetland areas.

Lower Savannah River

The lower Savannah River is characterized by black water streams and extensive wetland areas. The Savannah Harbor is a major shipping port and the subject of many studies involving past, present, and future modifications to the harbor.

Reservoirs

There are several large dams on the Savannah River and its tributaries that are used for hydropower generation. U.S. Army Corps of Engineers projects on the Savannah River include Hartwell and Clarks Hill. Georgia Power projects include Burton, Mathis, Nacoochee, Rabun, Tallulah Falls, Terrora, Tugaloo, and Yona. South Carolina Electric and Gas Company also operate the Stevens Creek facility on the Savannah.

The Hartwell Lake project is on the upper Savannah River, 89 miles above Augusta, Georgia, and 7 miles below the confluence of the Tugaloo and Seneca Rivers, which form the Savannah River. Hartwell is the second flood control project built in the Savannah River basin. Construction of the dam was completed in 1963 and spans 18,000 feet. Drainage area above the dam is 2,088 square miles. The area at top of summer conservation pool is (elevation 660 feet msl) - 55,950 acres. Flood control storage is 193,000 acre-feet. Total storage capacity is 2,843,000 acre feet.

The Richard B. Russell project is located on the upper Savannah River, 30 miles downstream from Hartwell Dam and 37 miles upstream from Clarks Hill Dam. Permanent filling of the reservoir began in October 1983 and reached full pool level of 26,650 acres at elevation 475 msl in December 1984. The drainage area above the dam is 2,837 square miles. The area at top of summer conservation pool (Elv. 475 feet msl) is 26,650 acres. Total storage capacity is 1,026,244 acre feet.

The Clarks Hill project is located on the Savannah River, 22 miles above Augusta, Georgia. Thurmond is the first flood control project built in the Savannah River basin. Construction of the dam was completed in 1954 and spans 5, 680 feet. Drainage area above the dam is 6,144 square miles. The area at top of summer conservation pool elevation 350 feet msl is 70,000 acres. Total storage capacity is 2,900,000 acre-feet.

2.I.5 Ground Water Resources

The geology of the Savannah River basin determines the ground water characteristics of the area. Generalized outcrop areas of major aquifers for the Savannah River basin are shown in Figure 2-11. In the Savannah River basin, groundwater occurrence is related to two distinct physiographic provinces. Abundant groundwater supplies are concentrated in

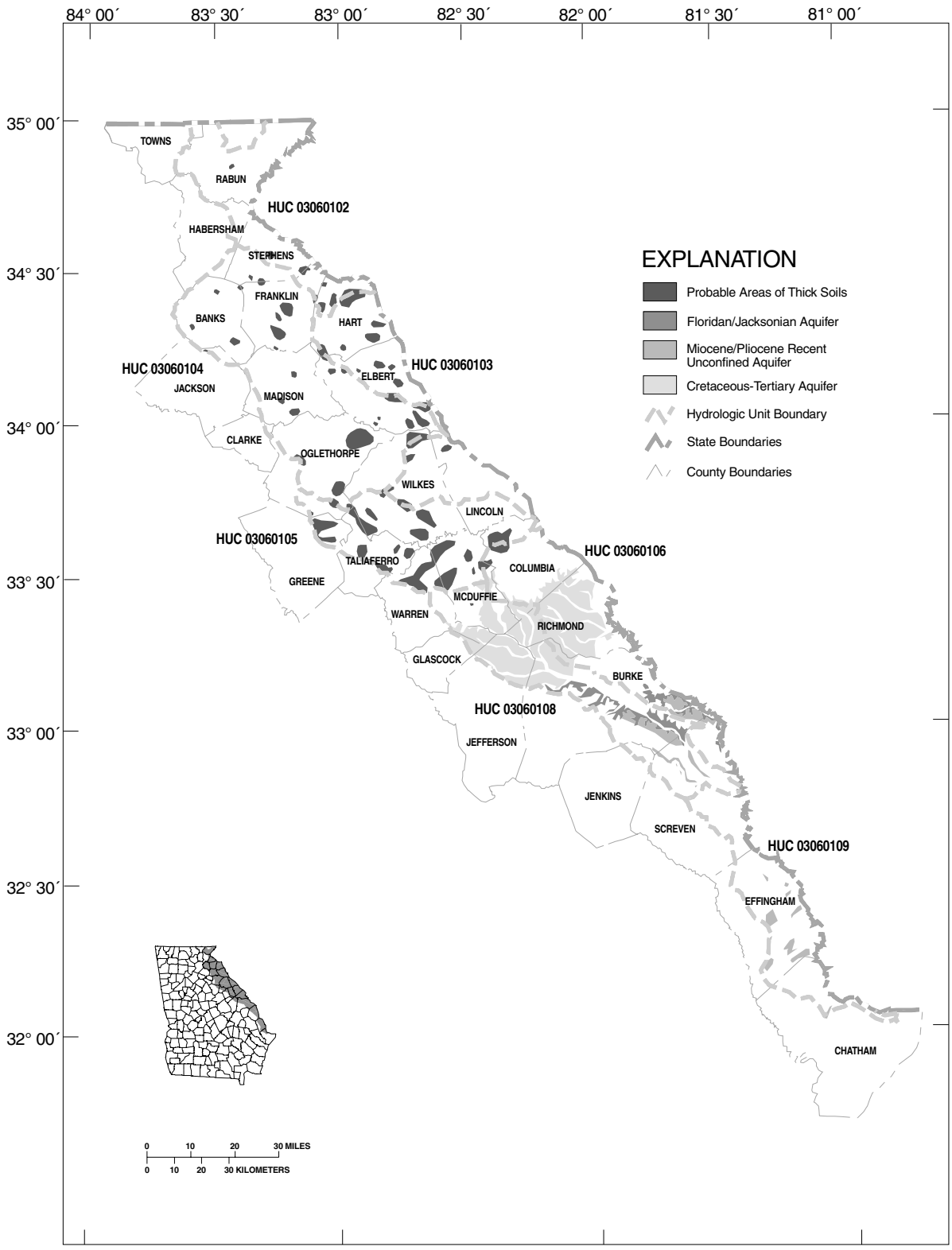

Figure 2-II. Hydrogeologic Units Underlying the Savannah River Basin

the lower half of the basin in the Coastal Plain province. Traveling south in the basin, the areas are as follows:

Crystalline rock aquifers

In the upper half of the basin, from Rabun County south to the Fall Line at Augusta, the crystalline rock formations that underlie the Piedmont province greatly restricts groundwater availability. Some studies have shown that there may be contact zones, fractures, and shear planes capable of producing water yields as high as 400 GPM in the Piedmont, though the common range of production is nearer 50 GPM or less. Some wells have found on the on the order of 1 GPM. Techniques for locating those reliable sources have improved greatly over the past 10 years, and will likely continue to do so.

Cretaceous sand aquifers

The Cretaceous Sand Aquifer system, located along the northern edge of the Coastal Plain, outcrops in a band of terrain about 40 miles wide across the central part of the basin, mainly in Jefferson, Richmond and Burke Counties, are part of the Kaolin Belt of Georgia. Dewatering operations at the clay pits, plus the extensive amount of process water necessary for processing the kaolin can lead to localized drawdowns within the Cretaceous Aquifer. This can mean some domestic wells or other operations can lose the use of their wells. Generally the kaolin companies then redrill or deepen the wells to provide water to the impacted folks. The Cretaceous Aquifer is made up of the Dublin-Midville aquifers, a clastic aquifer containing water in sandy intervals. Overlying this is the Gordon Aquifer, a thin sand and shale unit of Eocene age. The Cretaceous Aquifer consists of interbedded sands and clays that begin at the Fall Line and is as thick as several hundred feet farther to the south. Groundwater occurs in the pore spaces of the somewhat unconsolidated sand layers, which are composed of largely angular to subangular quartz grains. The interbedded clay layers act as confining beds causing the deeper groundwater to occur under artesian conditions. Well yields in the portions of the Cretaceous Sand Aquifer underlying the river basin have been found to exceed 1000 GPM. Recharge occurs through the sandy soil in the outcrop area. In the central portion of the basin this unit is seen as one single aquifer and can be called either the Cretaceous Aquifer or the Dublin-Midville Aquifer. As you move to the south, an intervening clay layer becomes apparent, and divides the Aquifer into two distinct units. Below is the Midville Aquifer of definite Cretaceous age. Overlying the confining shale unit is the Dublin Aquifer, which is of Cretaceous - Early Tertiary age.

Gordon aquifer

The Gordon Aquifer system, of Eocene age, overlies the Cretaceous Sand Aquifer in the Coastal Plain portion of the basin, and consists of saturated permeable sands. It is confined above and below by clay-rich layers, and ranges in thickness from about 20 feet in Richmond County to about 150 feet to the south. Generally well yields of up to 500 GPM are possible in the southern portions of the basin. Gordon Aquifer recharge occurs mainly through the outcrop areas in Jefferson and Richmond Counties.

Floridan aquifer

The Floridan Aquifer underlies the rest of the southern portion of the basin. The aquifer is overlain by about 25-125 feet of sandy clay residuum derived from chemical weathering of the underlying rock. The total thickness of the Floridan Aquifer in the basin ranges from a few tens of feet in the north to more than 400 feet in the extreme southern portion of the basin. Clastic grains of sand and shale comprise the main units in

the northern portions of this aquifer, while to the south the aquifer consists of three thick beds of limestone (i.e., Tampa limestone, Suwannee limestone, and Ocala limestone). Well yields can range from about 40 GPM in the north to more than 10,000 GPM in the thickest, southern most portions of the Floridan Aquifer. The Floridan serves as the main aquifer from Burke County to the coast.

2.1.6 Biological Resources

The Savannah River basin supports a diverse and rich mix of terrestrial and aquatic habitats and is home to a number of federally and state-protected species. The basin encompasses parts of five major land resource areas, with a wide range of elevations and slopes, providing many different habitat types. The northern part of the basin is managed as a part of the Chattahoochee National Forest, which includes a number of wilderness and wildlife management areas. Some of the important biological resources of the basin are summarized below.

Terrestrial Habitats

The headwaters of the Savannah River Basin lie in Bailey's Southeastern Mixed Forest Province of the Subtropical Division, an ecoregion known for its mild winters and hot, humid summers (Bailey, 1995). Characteristic climax vegetation consists of medium-tall to tall forests of broadleaf deciduous and needleleaf trees. Loblolly pine, shortleaf pine, and other southern yellow pine species comprise at least 50 percent of the forest cover, and include associations of oak, hickory, sweetgum, blackgum, red maple, and winged elm. Other vegetation common to this area includes grasses, such as bluestem, panicums, and longleaf uniola, as well as dogwood, viburnum haw, blueberry, American beautyberry, youpon, and numerous woody vines (Bailey, 1995).

The southern portion of the Savannah River basin lies in the Outer Coastal Plain Mixed Forest Province (Bailey, 1995). This is a temperate rainforest (or temperate evergreen forest or laurel forest) ecoregion characterized by having fewer species and larger populations of individual species than equatorial or tropical rainforests. Common species include evergreen oaks and species of the laurel and magnolia families. Typically these habitats include a well-developed lower stratum of vegetation consisting of tree ferns, small palms, shrubs, and herbaceous plants. At the higher elevations, the trunks and branches of trees are often covered in moss. At the lower elevations, trees such as Evangeline oaks, baldcypress and others are covered by the epiphyte commonly known as Spanish moss (Bailey, 1995).

The extensive coastal marshes and interior swamps characteristic of Georgia's coastal region are dominated by gum and cypress. The upland areas are covered by subclimax pine forests, which have an understory of grasses and sedges referred to as savannas. Undrained shallow depressions in savannas form upland bogs or pocosins, in which evergreen shrubs predominate.

Terrestrial Fauna

The Savannah River basin supports a wide diversity of wildlife. The species found throughout the basin vary with the age and stocking of timber stands, percent of deciduous trees, proximity to openings, and presence of bottom-land forest types (Bailey, 1995).

White-tail deer and cottontail rabbits are widespread, fox squirrels are common in deciduous uplands, and gray squirrels are common along drainages. Other common mammals include fox, raccoon, oppossums, flying squirrels, and numerous ground-dwelling rodents.

The primary game birds are the bobwhite quail, eastern wild turkey, and the mourning dove. The most common bird species found in the mature forests include the pine warbler, cardinal, summer tanager, Carolina wren, ruby-throated hummingbird, blue jay, hooded warbler, eastern towhee, and tufted titmouse. The red-cockaded woodpecker, a federally-listed endangered species, is found in mature longleaf pine habitats.

Common reptiles include the cottonmouth, copperhead, rough green snake, rat snake, coachwhip, and speckled kingsnake, numerous lizards and salamanders, and the American alligator.

Aquatic Fauna

Fish Fauna

The Savannah River basin drains over 25,900 km2 (10,000 square miles) of Georgia, North Carolina and South Carolina. The Savannah River forms near Hartwell, Georgia at the confluence of the Seneca and Tugaloo Rivers, and flows southeasterly for 476 km until emptying into the Atlantic Ocean near Savannah, Georgia (Schmitt and Hornsby 1985). The Keowee river and Twelve Mile Creek are the major headwaters streams of the Seneca River. The Tugaloo River is formed by the union of the Tallulah and Chattooga Rivers. These headwater streams originate on the southern slopes of the Blue Ridge Mountains in North Carolina and Georgia.

The diverse fish fauna of the Savannah River basin includes 108 species representing 36 families. Many of the species are in the minnow family Cyprinidae. The largest group of species belongs to the sucker family Catostomidae. The Savannah River basin is dominated by a warm-water fishery. Warm-water species of recreational importance include largemouth bass, chain pickerel, black crappie, channel catfish, striped bass, hybrid (white x striped) bass, white bass, American shad, bluegill, redear sunfish, and redbreast sunfish.

Fisheries

The fish communities of the headwater streams, the Chattooga and Tallulah River systems, change rapidly from coldwater to warmwater species in response to decreasing elevations and increasing water temperatures. Fish populations in the mountain streams are often limited in productivity by naturally low alkalinity, high gradients, flow extremes, and, for coldwater species, high summer water temperatures. Total fish biomass in the upper Savannah basin typically ranges from 27 to 134 lbs/acre and is dominated by the minnow (Cyprinidae) and sucker (Catastomidae) families.

The lower reaches of the Tallulah River and Chattooga River are impounded by a series of hydroelectric dams. The fish fauna within these Savannah River tributary reservoirs is composed of both coolwater and warmwater species. Sunfish (Centrarchidae) and minnows (Cyprinidae) account for nearly one half of the species diversity. In the upper Savannah River basin, at least 50 species of fish representing 11 families have been documented (Table 2-2). Reservoir fish biomass typically ranges from 40 to 120 lbs/acre (Table 2-3).

The two primary species representing the Catostomids in the Savannah River basin are spotted sucker and silver redhorse. Even though suckers are not highly prized by most fishermen, they are ecologically important because they often account for the majority of fish biomass in Georgia streams. In a 1985 survey conducted by the fisheries section of the Georgia Department of Natural Resources on the Savannah River, spotted suckers comprised 21 percent of the total sample by weight. Other families with large numbers of species are the sunfish (Centrarchidae) and the catfish (Ictaluridae) families.

Table 2-2. List of Fishes Captured in Fisheries Surveys of Savannah River Tributaries in Association with FERC Relicensing (Georgia Power 1990) and From GADNR Fish Surveys

Scientific Name	Common Name
Family: Lepisosteidae	Gars
Lepisosteus osseus	Longnose Gar
Family: Clupeidae	Herrings
Dorosoma cepedianum	Gizzard Shad
Dorosoma petenense	Threadfin Shad
Alosa aestivalis	Blueback Herring
Family: Salmonidae	Trouts
Oncorynchus mykiss	Rainbow Trout
Salmo trutta	Brown Trout
Salvelinus fontinalis	Brook Trout
Family: Esocidae	Pikes
Esox niger	Chain Pickerel
Family: Cyprinidae	Carps and Minnows
Campostoma anomalum	Central Stoneroller
Cyprinus carpio	Common Carp
Hybopsis rubrifrons	Rosyface Chub
Nocomis leptocephalus	Bluehead Chub
Notemigonus chrysoleucas	Golden Shiner
Notropis galacturus	Whitetail Shiner
Notropis hudsonius	Spottail Shiner
Notropis lutipennis	Yellowfin Shiner
Notropis niveus	Whitefin Shiner
Notropis zonistius	Bandfin Shiner
Family: Catostomidae	Suckers
Hypentelium nigricans	Northern Hogsucker
Minytrema melanops	Spotted Sucker
Moxostoma anisurum	Silver Redhorse
Moxostoma erythrurum	Golden Redhorse
Moxostoma robustum	Robust Redhorse
Moxostoma rupiscartes	Striped Jumprock
Family: Ictaluridae	Catfishes
Ictalurus brunneus	Snail Bullhead
Ictalurus catus	White Catfish
Ictalurus nebulosus	Brown Bullhead
Ictalurus platycephalus	Flat Bullhead
Ictalurus punctatus	Channel Catfish
Noturus insignis	Margined Madtom
Family: Cottidae	Sculpins
Cottus bairdi	Mottled Sculpin
Family: Percicthyidae	Temperate Basses
Morone chrysops	White Bass
Morone saxatilis	Striped Bass
Morone saxatilis x M. chrysops	Hybrid Bass

Scientific Name	Common Name
Family: Centrarchidae	Sunfishes
Lepomis auritus	Redbreast Sunfish
Lepomis cyanellus	Green Sunfish
Lepomis gulosus	Warmouth
Lepomis macrochirus	Bluegill
Lepomis microlophus	Redear Sunfish
Micropterus coosae	Redeye Bass
Micropterus dolomieui	Smallmouth Bass
Micropterus punctulatus	Spotted Bass
Micropterus salmoides	Largemouth Bass
Pomoxis annularis	White Crappie
Pomoxis nigromaculatus	Black Crappie
Family: Percidae	Perches
Etheostoma fusiforme	Swamp Darter
Etheostoma inscriptum	Turquoise Darter
Perca flavescens	Yellow Perch
Percina nigrofasciata	Blackbanded Darter
Stizostedion vitreum	Walleye

Table 2-3. Creel Statistics for the Savannah River Tributary Reservoirs Located in Georgia and for Lake Hartwell

Creel Statistic	Burton	Seed	Rabun	Tallulah Falls	Tugaloo	Yonah	Hartwell
Total Biomass (lb./ac)	56	77	45	----	52	----	104
Fishing Effort (hr.)	52,737	11,851	15,359	----	21,575	11,546	584,447
Fish Harvest (no.)	47,940	15,964	11,867	----	29,601	4,765	243,750
Fish Harvest (lb.)	18,772	4,814	4,167	----	9,095	2,410	682,081
Mean Success Rate (fish/hr.)	0.91	1.35	0.77	----	1.37	0.41	0.42
Most Fished-For	Bass	Bass	Bass	----	Bass	Bass	Bass
% of Total Effort	72.4%	34.8%	50.1%		15.7%	38.0%	54.0%
% of Total Harvest	25.8%	1.4%	18.9%		13.6%	21.4%	39.7%
Most Abundant	Bream	Perch	Bream	----	Bream	Bream	Bass
% of Total Harvest	40.3%	60.4%	54.2%		45.2%	56.1%	39.7%

a Creel statistics from Georgia DNR 10-month creel surveys.
b Lake Hartwell creel statistics from South Carolina DNR 12-month creel surveys.
c Total biomass estimates obtained from Georgia DNR cove rotenone samples.

Minnows are small fish that can be seen darting around in streams that are only a few feet wide. Other families with large number of species are the sunfish and black bass family, the sucker family, and the catfish family. Species that have the largest number of individuals living in streams typically are minnows and suckers. These species are often not well known because unlike bass, sunfish, and catfish, people do not fish for them, although certain minnows may be used as bait. Minnows have an important role in the aquatic food chain as prey for larger fish, snakes, turtles, and wading birds.

Suckers can grow to more than one foot long and are named for their down-turned mouths, which they use to vacuum food from stream bottoms. Although suckers are not popular game fish, they are ecologically important because they often account for the largest fish biomass in streams.

Both wild and stocked rainbow trout and brown trout are the principal sport fishes in the upper reaches of both the Tallulah and Chattooga River systems. Several extreme headwater areas contain reproducing populations of native brook trout. Georgia DNR trout stocking records from 1998 indicated that 14 streams in the upper Savannah basin were stocked with approximately 203,200 catchable trout. The majority of this stocking was done in Rabun County. Deepwater releases from Lake Hartwell also provide a tailwater trout fishery, but low dissolved oxygen levels in the tailrace during the summer limit the potential carrying capacity for trout and subsequent fishery.

Mainstream and Tributary Reservoirs

Mainstream Reservoirs

Three large, mainstream impoundments are located on the Savannah River. From an upstream to downstream direction, these include lakes Hartwell, Richard B. Russell, and Clarks Hill. The sport fisheries of these impoundments are dominated by largemouth bass, crappie, catfish, and hybrid bass. Hybrid bass and striped bass are produced at Richmond Hill State Fish Hatchery and stocked as fingerlings into these and other Georgia reservoirs.

Richard B. Russell Lake is a 26,650-acre U.S. Army Corps of Engineers reservoir on the Savannah River in Elbert and Hart counties, Georgia and Abbeville and Anderson counties, South Carolina. Impounded in 1985, this near oligotrophic piedmont reservoir has good fisheries for largemouth bass, black crappie, channel catfish, and bluegill. The dam and lake are authorized for fish and wildlife management, flood control, hydropower, navigation, recreation, water quality, and water supply.

There are several lakes within the Savannah River basin that provide excellent habitat for various freshwater fisheries. The Wildlife Resources Division owns and manages McDuffie Public Fishing Area and Fish Hatchery, a series of 48 ponds on tributaries of the Savannah River in McDuffie County. The 13 ponds, encompassing 125.7 acres, open to public fishing offer excellent fishing for bluegill, channel catfish, and largemouth bass. The hatchery ponds are used to raise largemouth bass, bluegill, redear sunfish, channel catfish, striped bass, and robust redhorse for use in public and private waters management. This multi use facility provides wildlife education through McDuffie Environmental Education Center.

Clarks Hill Lake is a 71,535-acre U.S. Army Corps of Engineers reservoir on the Savannah River in Columbia, Elbert, Lincoln, McDuffie, and Wilkes counties, Georgia and Abbeville and McCormick counties, South Carolina. Impounded in 1952, the dam and lake are authorized for fish and wildlife management, flood control, hydropower, navigation, recreation, water quality, and water supply. This near oligotrophic piedmont reservoir has good fisheries for largemouth bass, black crappie, channel catfish, striped bass, hybrid (white x striped) bass, redear sunfish, and bluegill.

There are approximately six miles of shoal habitat and three lowhead dams in the 36-mile stretch of the Savannah River immediately below Clarks Hill Dam. Just upstream of the Augusta shoals, river water is partially diverted into the Augusta Canal. Water in the canal, used for power and water supply, feeds back into the Savannah River at various locations. This section of the Savannah River and Augusta Canal support good fisheries for bluegill, redear sunfish, redbreast sunfish, largemouth bass, chain pickerel, channel catfish, hybrid (white x striped) bass, yellow perch, and migrating American shad. The state endangered robust redhorse, once thought to be extinct, was found in the Savannah River shoals in 1997. Prior to 1997 the Oconee River basin had the only known native population of this endangered sucker. Robust redhorse stockings are currently directed at the Broad River, a major tributary of the Savannah River.

The portion of the Savannah River below Augusta (SRBA) contains a vital sport fishery dominated by largemouth and striped bass, redbreast sunfish, bluegill and redear sunfish. Other species of lesser importance are channel and white catfish, black crappie and American shad. Striped bass stocks declined precipitously beginning in the mid 1980's due to saltwater encroachment on lower river spawning areas resulting from harbor improvement projects. Striped bass are spawned and raised to intermediate size at Richmond Hill Hatchery for stocking in SRBA each year in an effort to replenish depleted stocks and return them to historical structure and density. The Corps of Engineers and DNR are currently partnering in a Section 1135 environmental restoration project to improve Savannah Back River spawning habitat.

Tributary Reservoirs

Six tributary reservoirs, ranging from 63 to 2,875 acres in size, are located in the Georgia portion of the upper Savannah basin (Table 2-4). From an upstream to downstream direction, these include lakes Burton, Seed, Rabun, Tallulah Falls, Tugalo, and Yonah. The sport fisheries of these impoundments are dominated by sunfish, primarily largemouth bass, spotted bass, and bluegill, and yellow perch (Table 2-2). Other less important sport fishes include black crappie, white catfish, channel catfish, walleye, and white bass. Significant fisheries management effort in lakes Burton, Seed, and Rabun is directed toward establishing and maintaining walleye populations. To date, efforts to develop a self-sustaining walleye population have experienced limited success due to increased sedimentation within walleye spawning areas that are located in tributary streams and tailwater areas (Rabern, 1989). Efforts to maintain walleye populations are currently directed at fingerly stocking (Rabern, 1998).

Table 2-4. Physical Characteristics of Savannah River Tributary Reservoirs in Georgia and for Lake Hartwell

Feature	Burton	Seed	Rabun	Tallulah Falls	Tugalo	Yonah	Hartwell
Area (ac.)	2,875	240	834	63	597	325	56,000
Feature Shoreline Length (miles)	62	13	25	3.6	18	9	962
Reservoir Length (miles)	9.5	4.5	9.5	3	5	2.5	41
Area (ac.) Maximum Depth (ft.)	125	48	99	115	142	80	180
Mean Depth (ft.)	----	----	----	----	----	----	46
Shoreline Length (miles) Volume (ac.-ft.)	108,000	8,250	31,250	2,450	43,000	10,200	2,843,000
Elevation (msl)	1,867	1,753	1,690	1,500	892	744	660
Reservoir Length (miles) Drainage Area (miles2)	118	136	151	1860	464	470	10,579
Generating Capacity (MW)	8.3	5.2	15.1	63.4	45.5	24.2	87.5
Maximum Depth (ft.) Impoundment Date	1919	1926	1925	1912	1922	1925	1962

Threatened and Endangered Species

There are 18 federally-listed species in the Savannah River basin—five are federally-threatened and 13 are federally-endangered. In addition, there are 55 species that are either state-listed or of special concern. Of these state-listed species, 20 are threatened, 21

are endangered, 10 are considered rare, and 4 are listed as unusual and deserving of special consideration.

2.2 Population and Land Use

2.2.1 Population

As of 1995, there were 523,100 people in the Savannah River basin (DRI/McGraw-Hill, 1996). Population distribution in the basin at the time of the 1990 census by census blocks is shown in Figure 2-12. By the year 2050, this will have increased by almost 60 percent to 900,000 people. It is estimated that the Savannah Basin will become home to a growing share of Georgia's elderly. The region's coastal location will enable it to attract a growing retirement community, and will provide rising demand for age-friendly products and services.

2.2.2 Employment

The Georgia portion of the Savannah River basin supported 210,000 jobs in 1995, dominated by a variety of trade, service, government, and manufacturing interests.

Over the last two decades, as employment in Georgia grew at an average annual rate of 3.0 percent, employment growth in Savannah fell behind at 2.7 percent, leading to a decline in Savannah's share of the state nonfarm employment from its 7.2 percent in 1975. The situation is unlikely to improve over the next 25 years, as a decline to by .5 percent of state employment over the next five years is not expected to post a turn-around until well into the 2000 century. By 2050, as Savannah's employment growth exceeds that state average, the county's share of state employment is expected to rise to 6.8 percent.

Over the last 20 years, the manufacturing sector has managed to create only 4,800 jobs in the Savannah River basin. The durables sector created 4,700 of these jobs, leaving the food processing industry to post a net decline in employment of 600 positions, and the textiles industry to lose 1,500 jobs. Stronger job creation was noted in the paper industry, which now employees 1,700 more people than two decades ago. In reality with 84,00 new jobs in Savannah since 1975, the manufacturing sector can be seen to have contributed very little. In fact, the poor showing in job creation in Savannah falls behind the state average, taking the region from 8.9 percent of Georgia's manufacturing employment in 1975, to 7.8 percent in 1995. Where job creation has arisen over the last two decades, has been in the services sector. This growth has been led by a substantial rise in the community, business and personal services sector, which over the last decade posted an average annual growth rate of 5.9 percent. The trade sector sat far behind, as its employment grew on average 4.1 percent per annum, followed by transportation, communications and utilities at 3.5 percent a year. Although growth in employment in Savannah's trade and transportation, communication and services sector out paced the state over the last 20 years, the relatively slow growth in the government and finance, insurance and real estate sectors managed to drop Savannah's share of state employment in services from 6.5 percent in 1975 to 6.2 percent in 1995. Over the next 25 years, Savannah's share of employment in Georgia's services sector is expected to remain fairly constant. By 2050, however, the region's share of state employment in services will have advanced to 6.7 percent, as growth in most of Savannah's services industries out paces the state average. The services sector is expected to benefit from an above state average increase in the over-65 population which will provide considerable demand for services.

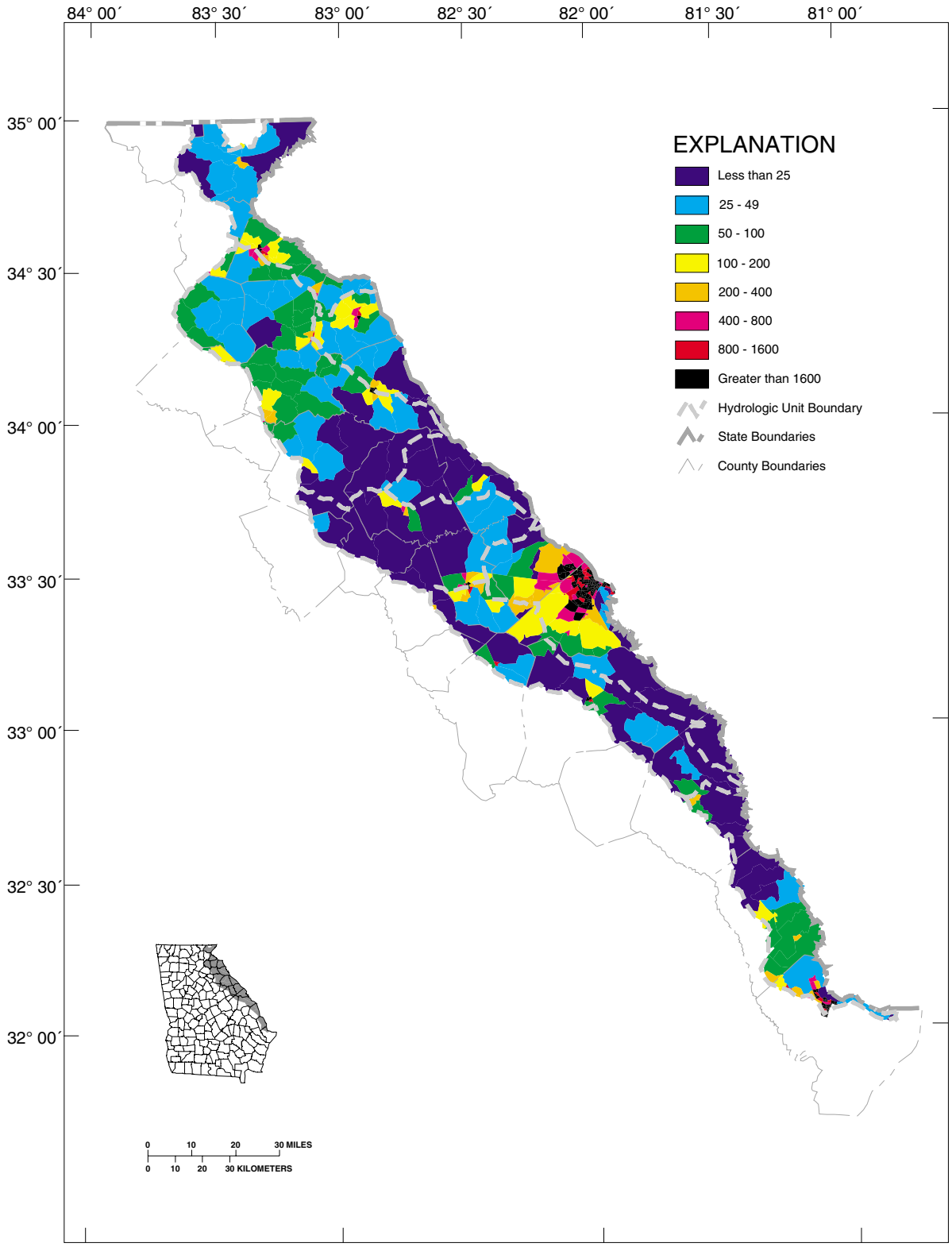

Figure 2-12. Population Density in the Savannah River Basin, 1990

Consistent with its share of state population, 7.5 percent of occupied housing units in Georgia are located in Savannah. The region actually has an above average share of the single housing units in the state, accounting for 8.0 percent of all single units in Georgia. Over the next 25 years, there will be little discernible difference in the rate of construction of single and multiple units in Savannah. Once the baby-boom generation moves into their retirement years, there will be a rising demand for the lower maintenance multi-family housing dwellings. Although there is expected to be a shift in the composition of the housing stock in Savannah over the 2020-to-2050 period, the amount of housing stock will reflect the general increase in the region's population. (DRI McGraw Hill, 1996).

2.2.3 Land Cover and Use

Land use/land cover classification was determined for the Savannah River Basin based on high-altitude aerial photography for 1972-76 (U.S. Geological Survey, 1972-78). Subsequently in 1991 land cover data were developed based on interpretation of Landsat TM satellite image data obtained during 1988-90, leaf-off conditions. These two coverages differ significantly. Aerial photography allows identification of both land cover and land uses. Satellite imagery, however, detects primarily land cover, and not land use, such that a forest and a wooded subdivision may, for instance, appear similar. Satellite interpretation also tends to be less accurate than aerial photography.

The 1972-76 classification (Figures 2-13 through 2-19) indicates that 69 percent of the basin land areas was forest, 18 percent agriculture, 9 percent wetlands, and 2 percent urban.

The 1988-90 land cover interpretation showed 56.9 percent of the basin in forest cover, 8.9 percent in wetlands, 2.1 percent in urban land cover, and 8.8 percent in agriculture (Figures 2-20 through 2-26). Statistics for 15 landcover classes in the Georgia portion of the Savannah basin for the 1988-90 coverage are presented in Table 2-5 (GA DNR, 1996).

Forestry

Forestry is a major part of the economy within the basin. Markets for forest products afford landowners excellent investment opportunities to manage and sell their timber, pine straw, naval stores, etc., products. Statewide, the forest industry output for 1997 grew to approximately $19.5 billion dollars. The value added by this production, which includes wages, profits, interest, rent, depreciation and taxes paid into the economy reached a record high $9.3 billion dollars. Georgians are benefitted directly by 177,000 job opportunities created by the manufacture of paper, lumber, furniture and various other wood products as well as benefitting the consumers of these products. Other benefits of the forest include hunting, fishing, aesthetics, wildlife watching, hiking, camping and other recreational opportunities as well as providing important environmental benefits such as clean air and water and wildlife habitat.

According to the US Forest Service's Forest Statistics for Georgia, 1989 report (Thompson, 1989), there is approximately 2,420,300 acres of commercial forest land in the basin. Private landowners account for 64 percent of the commercial forest ownership while the forest industry companies account for 23 percent. Governmental entities account for about 13 percent of the forest land. Figure 2-27 depicts silvicultural land use in the Savannah basin. Forestry acreage in the Savannah River basin is summarized in Table 2-6.

The pine type is composed of 315,900 acres of planted pine and 705,100 acres of natural pine stands.

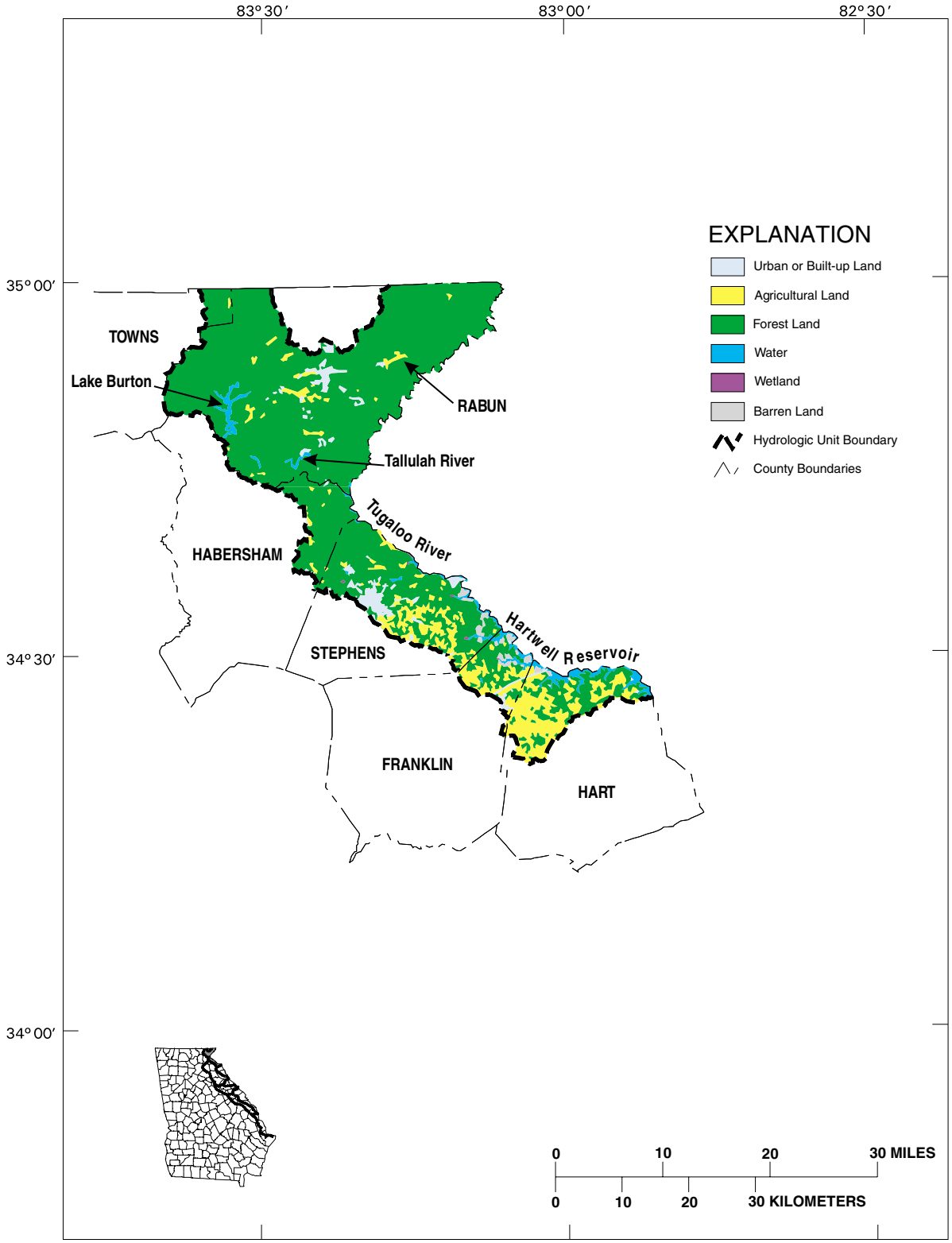

Figure 2-13. Land Use, Savannah River Basin, HUC 03060102, USGS 1972-76 Classification Updated with 1990 Urban Areas

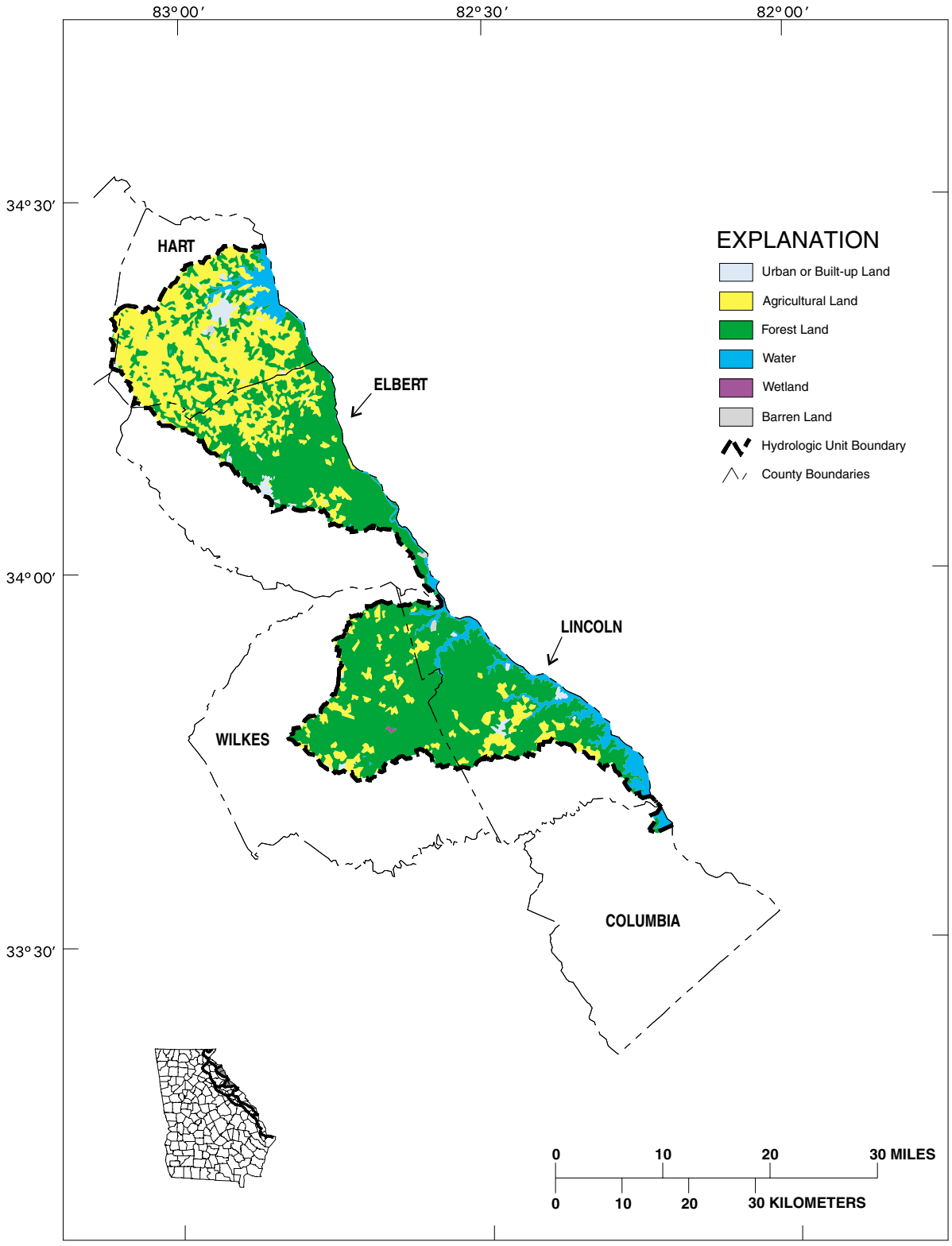

Figure 2-14. Land Use, Savannah River Basin, HUC 03060103, USGS 1972-76 Classification Updated with 1990 Urban Areas

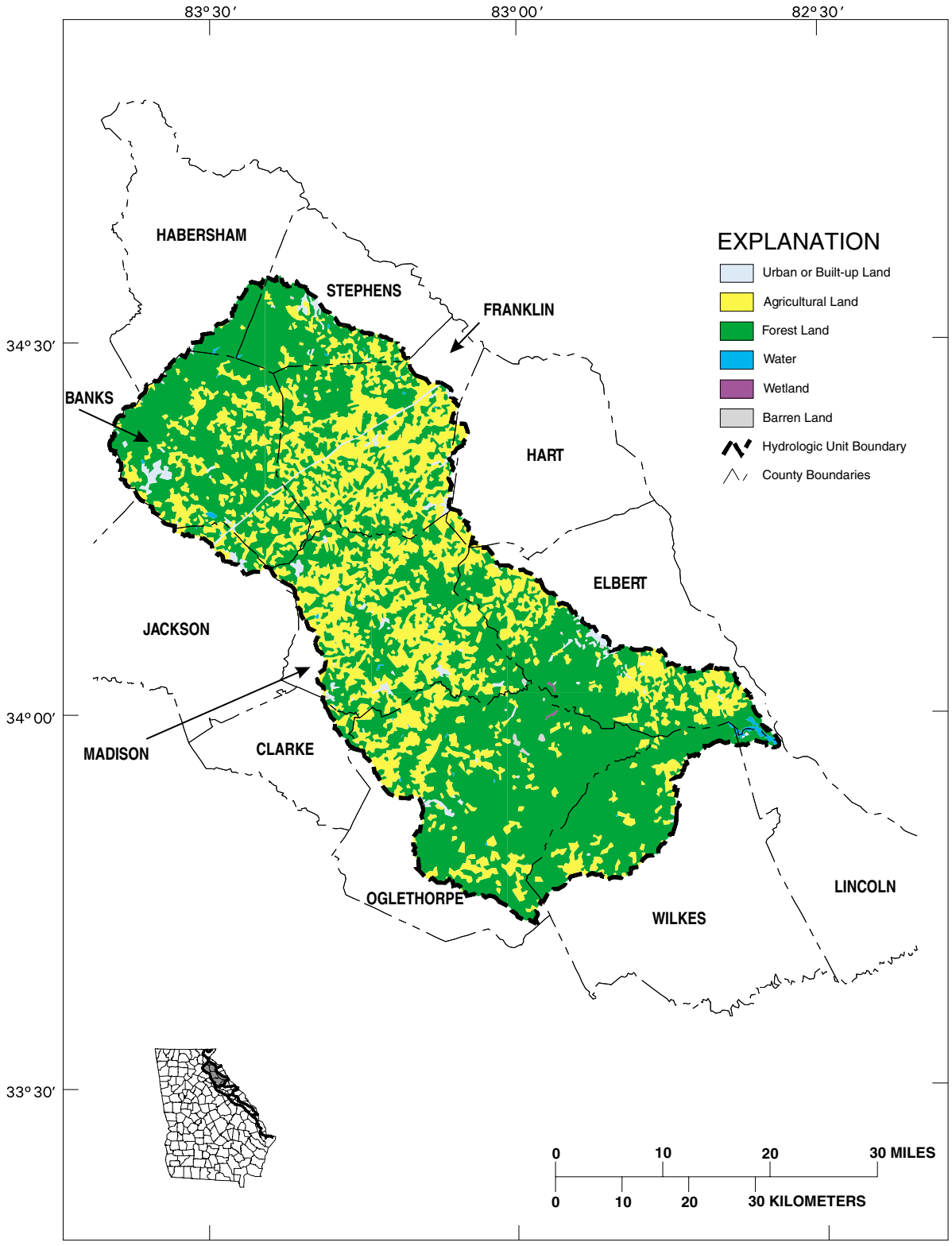

Figure 2-15. Land Use, Savannah River Basin, HUC 03060104, USGS 1972-76 Classification Updated with 1990 Urban Areas

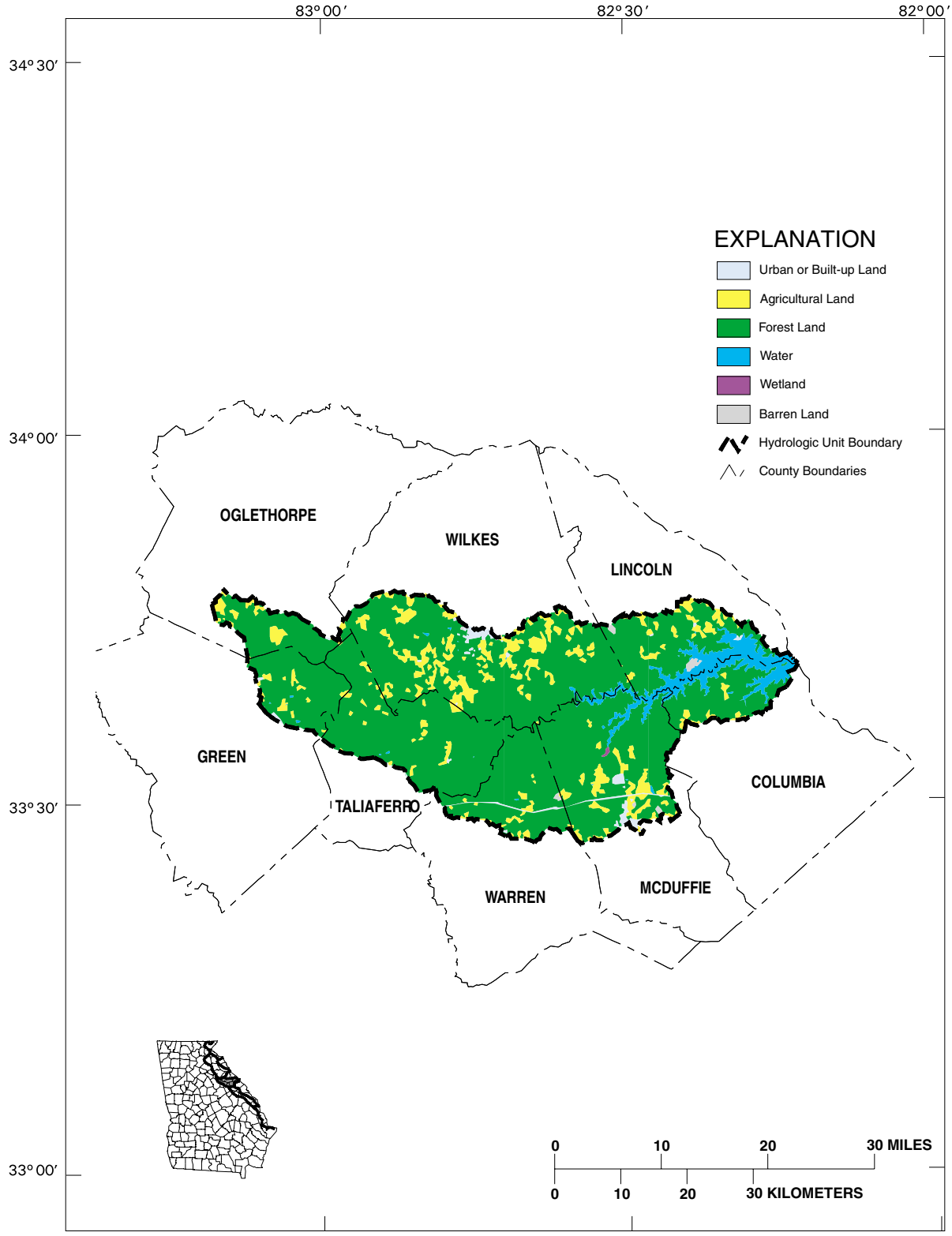

Figure 2-16. Land Use, Savannah River Basin, HUC 03060105, USGS 1972-76 Classification Updated with 1990 Urban Areas

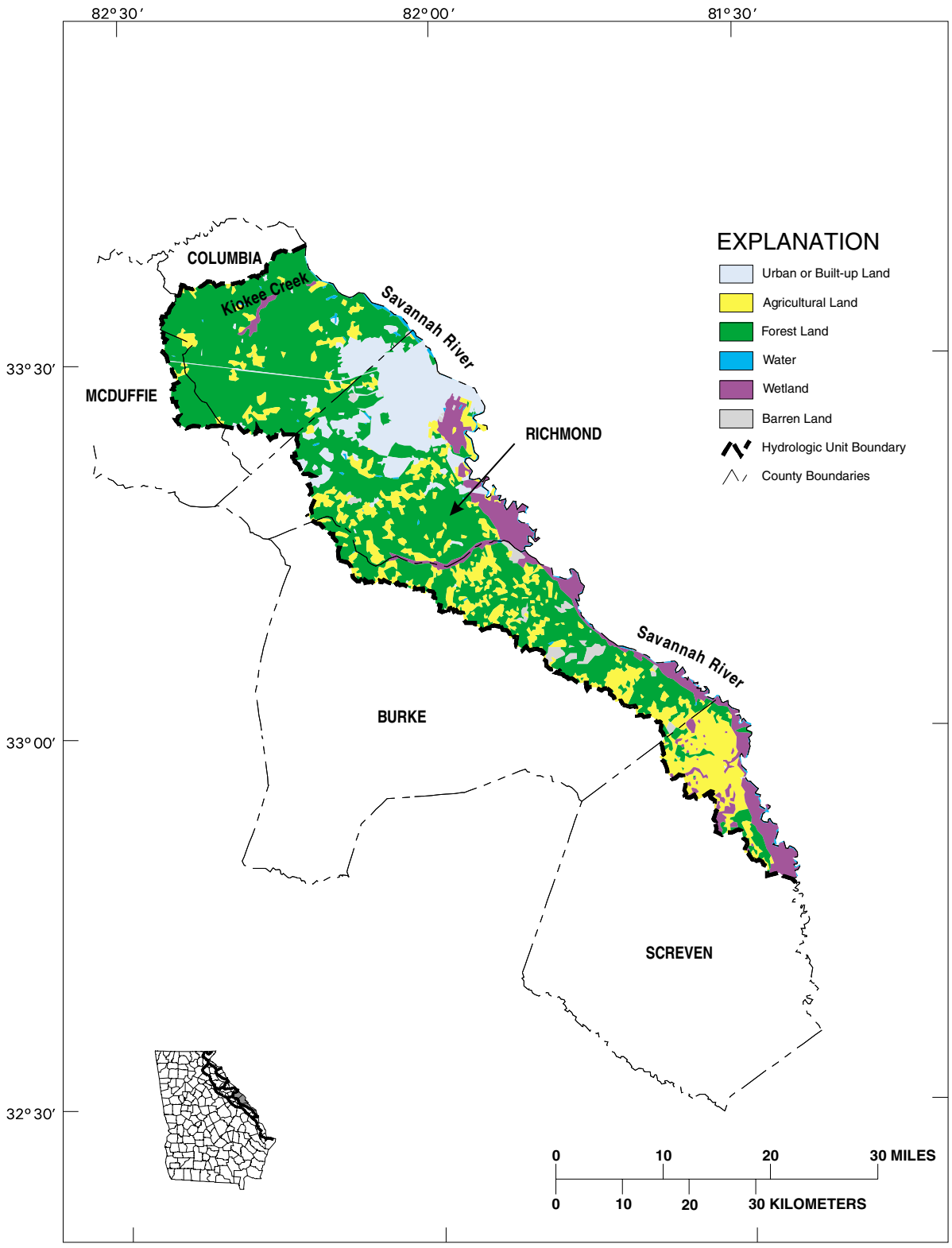

Figure 2-17. Land Use, Savannah River Basin, HUC 03060106, USGS 1972-76 Classification Updated with 1990 Urban Areas

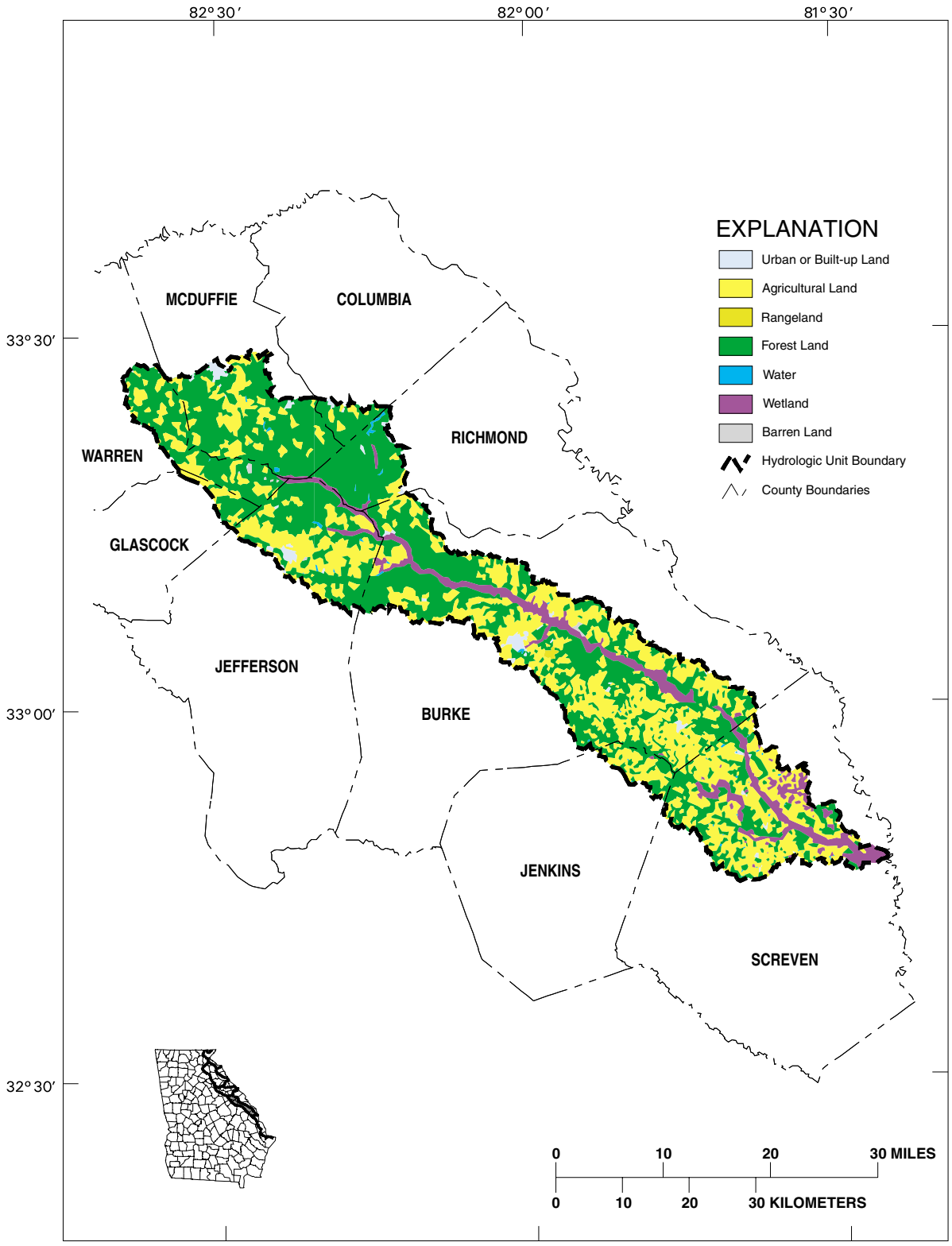

Figure 2-18. Land Use, Savannah River Basin, HUC 03060108, USGS 1972-76 Classification Updated with 1990 Urban Areas

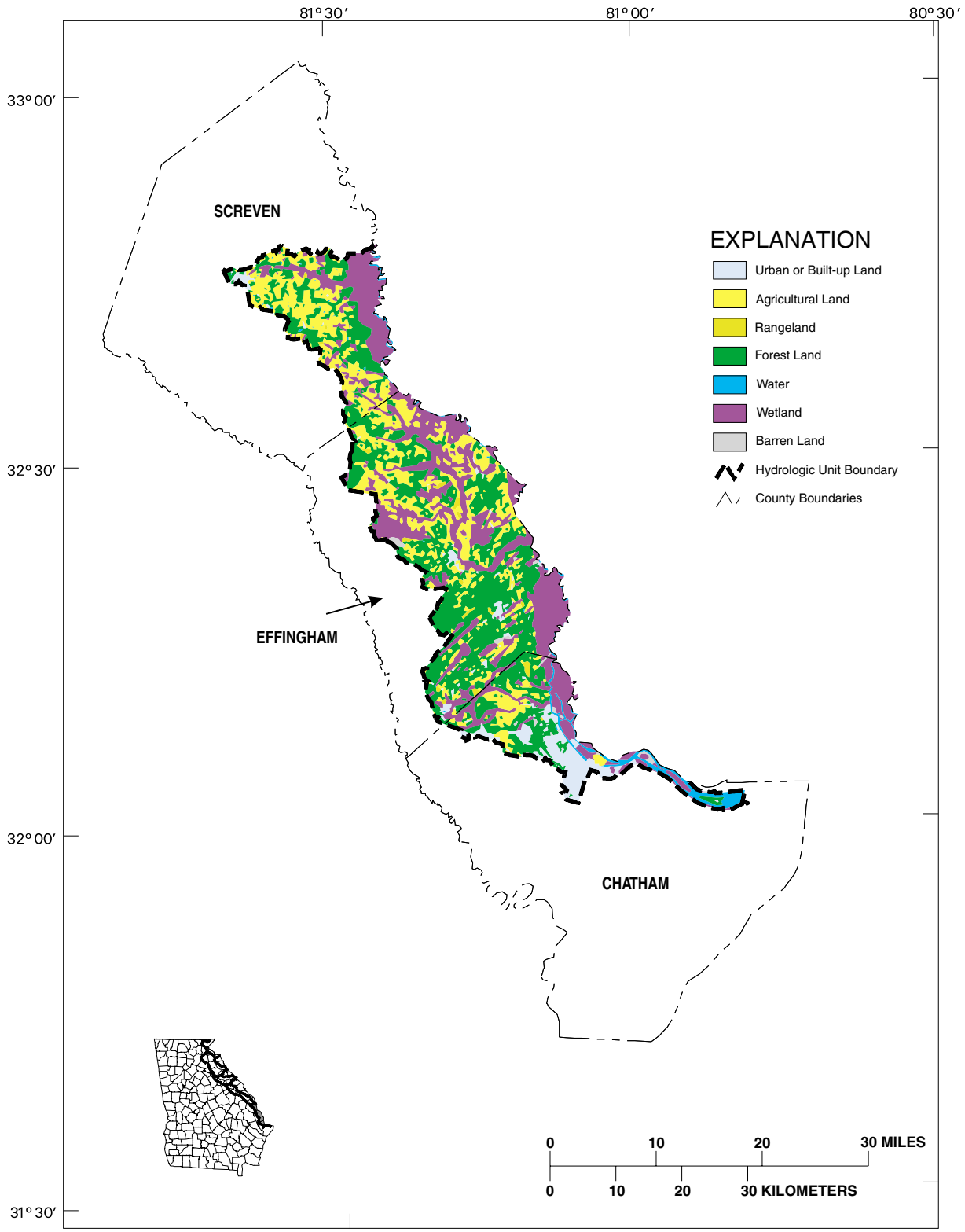

Figure 2-19. Land Use, Savannah River Basin, HUC 03060109, USGS 1972-76 Classification Updated with 1990 Urban Areas

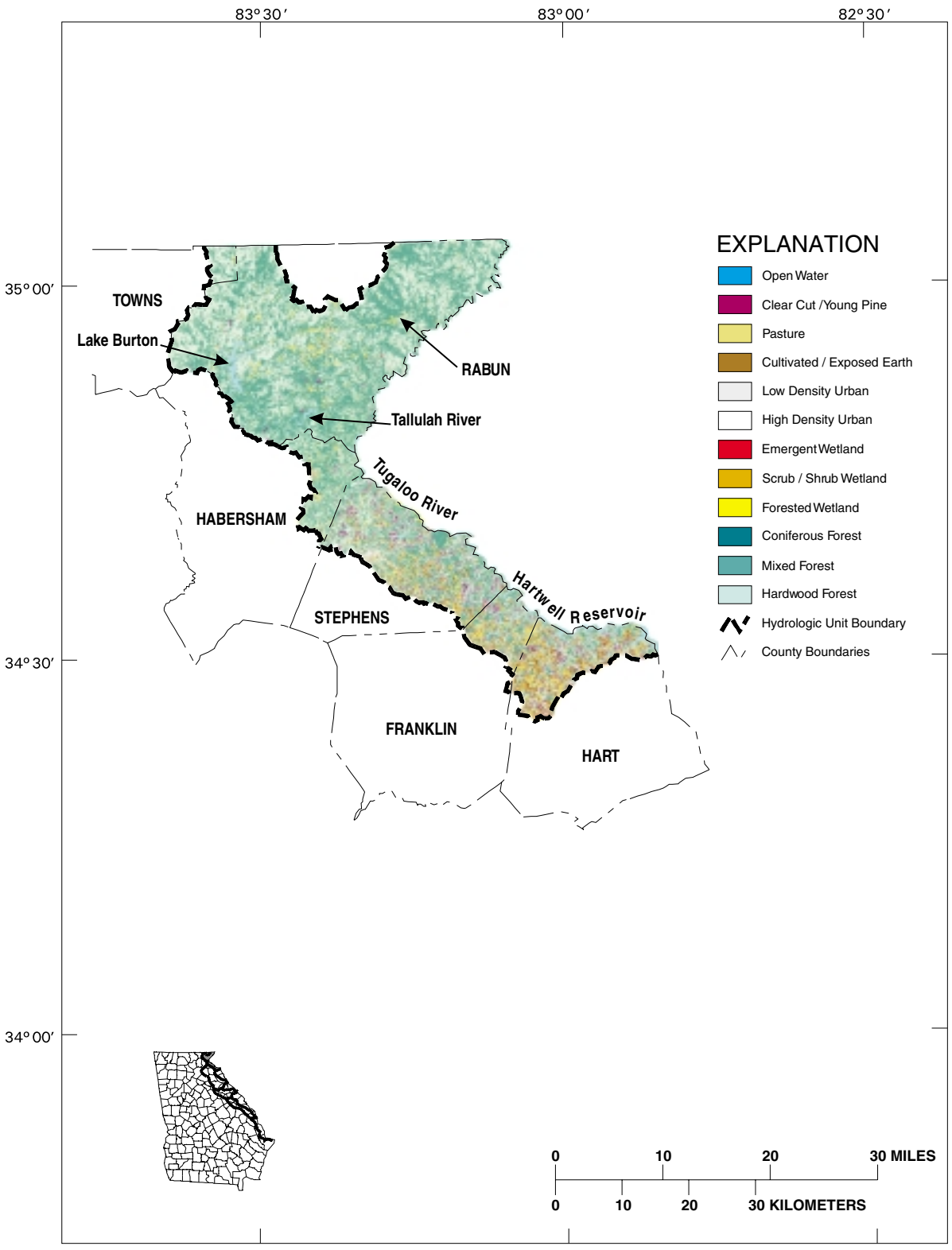

Figure 2-20. Land Cover 1990, Savannah River Basin, HUC 03060102

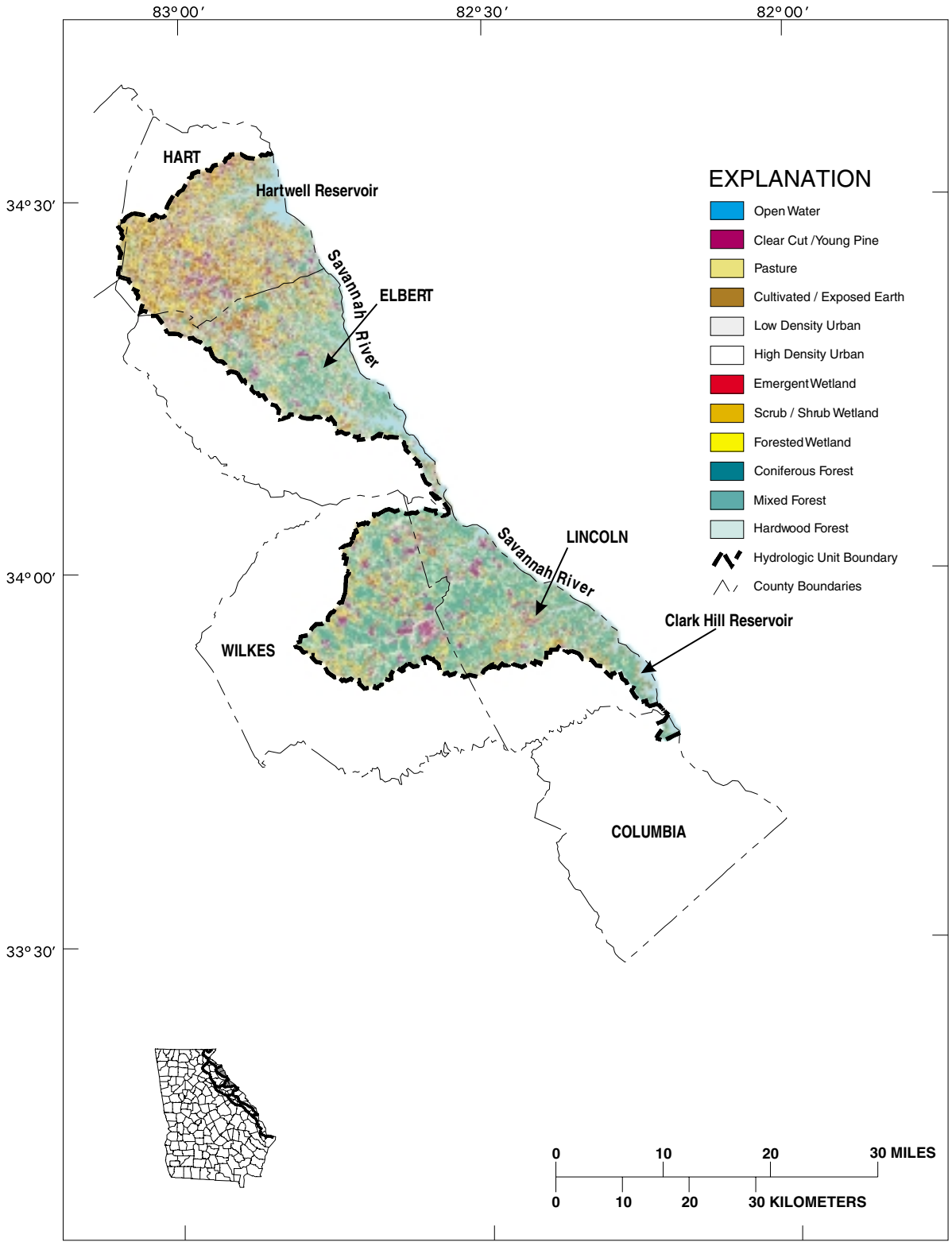

Figure 2-21. Land Cover 1990, Savannah River Basin, HUC 03060103

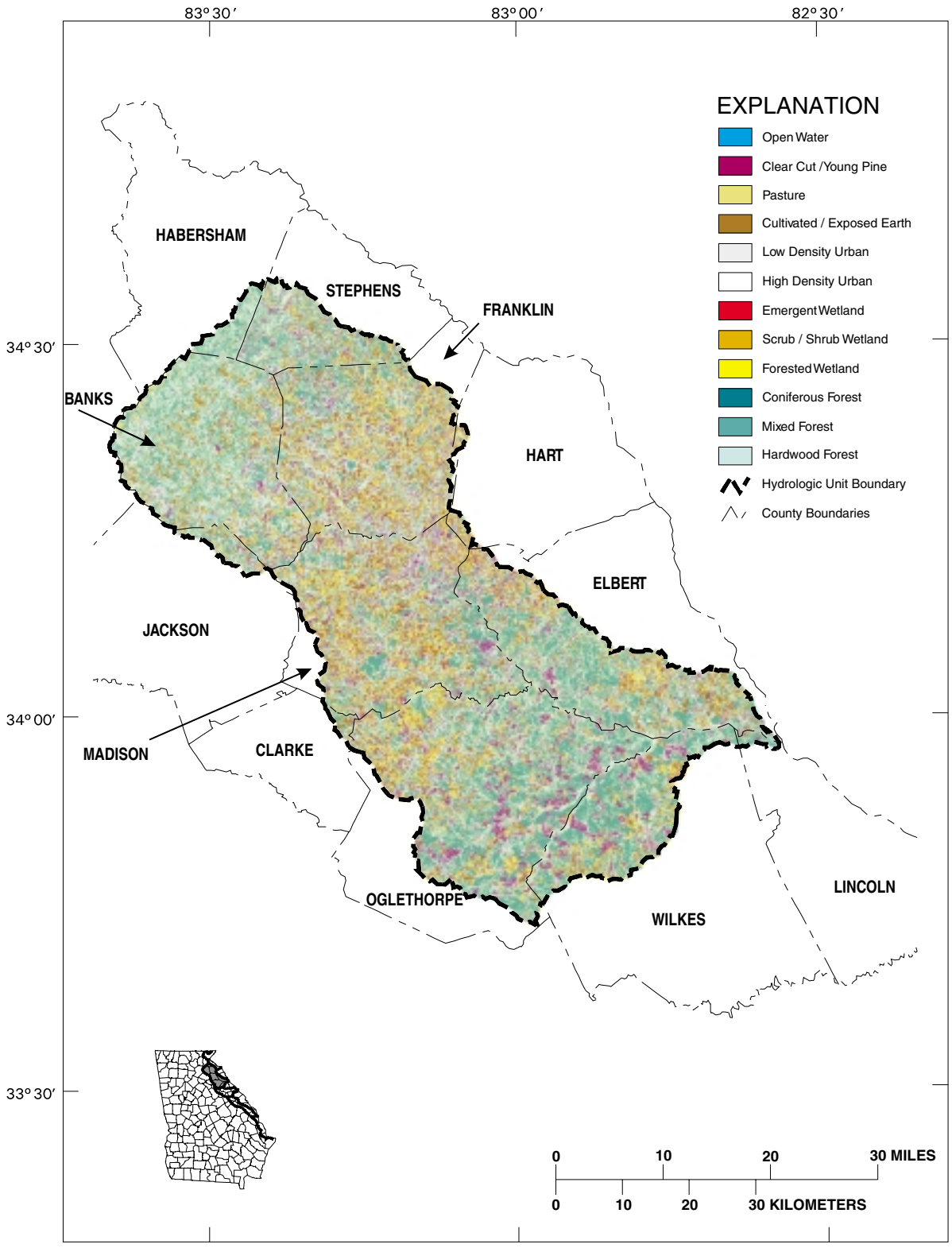

Figure 2-22. Land Cover 1990, Savannah River Basin, HUC 03060104

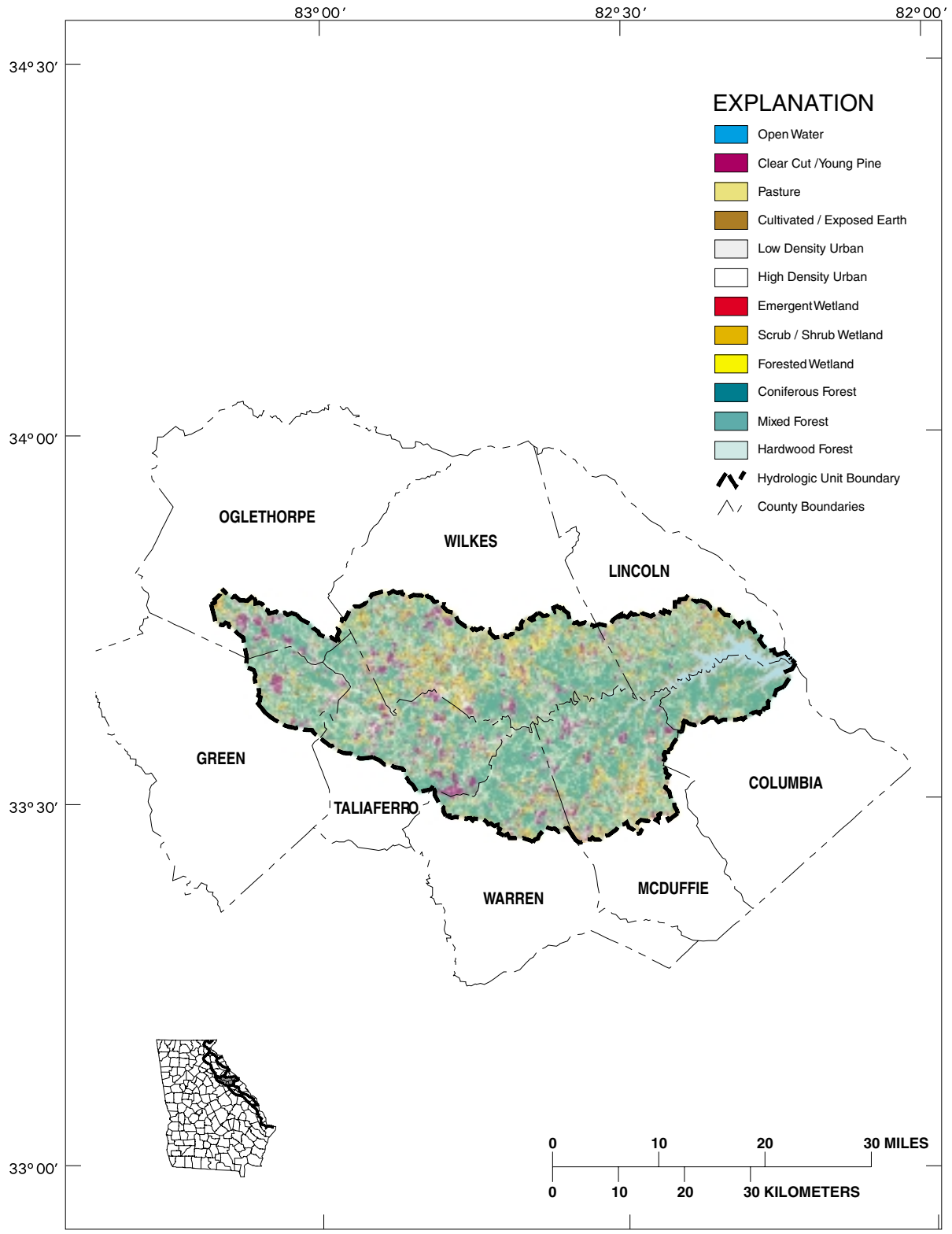

Figure 2-23. Land Cover 1990, Savannah River Basin, HUC 03060105

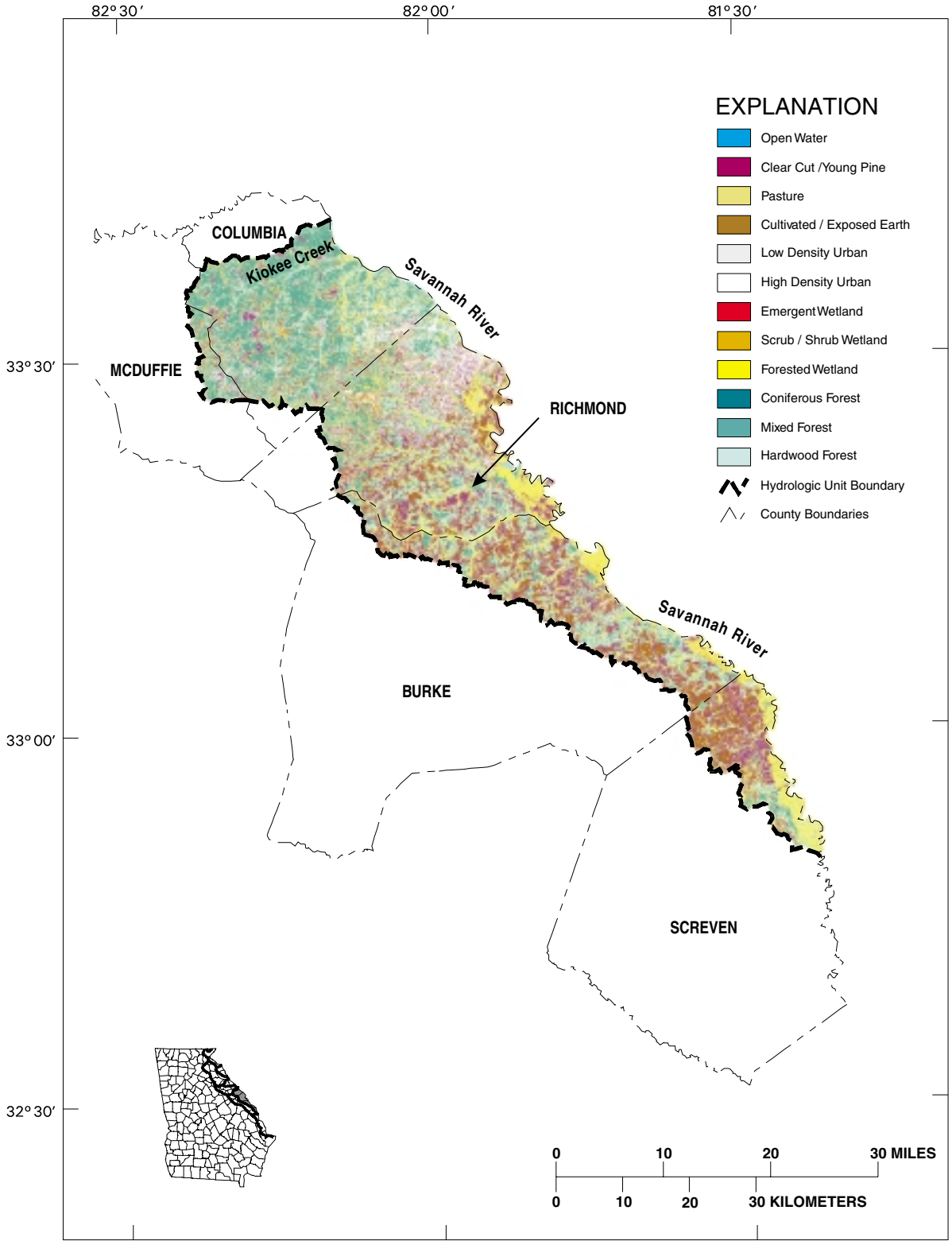

Figure 2-24. Land Cover 1990, Savannah River Basin, HUC 03060106

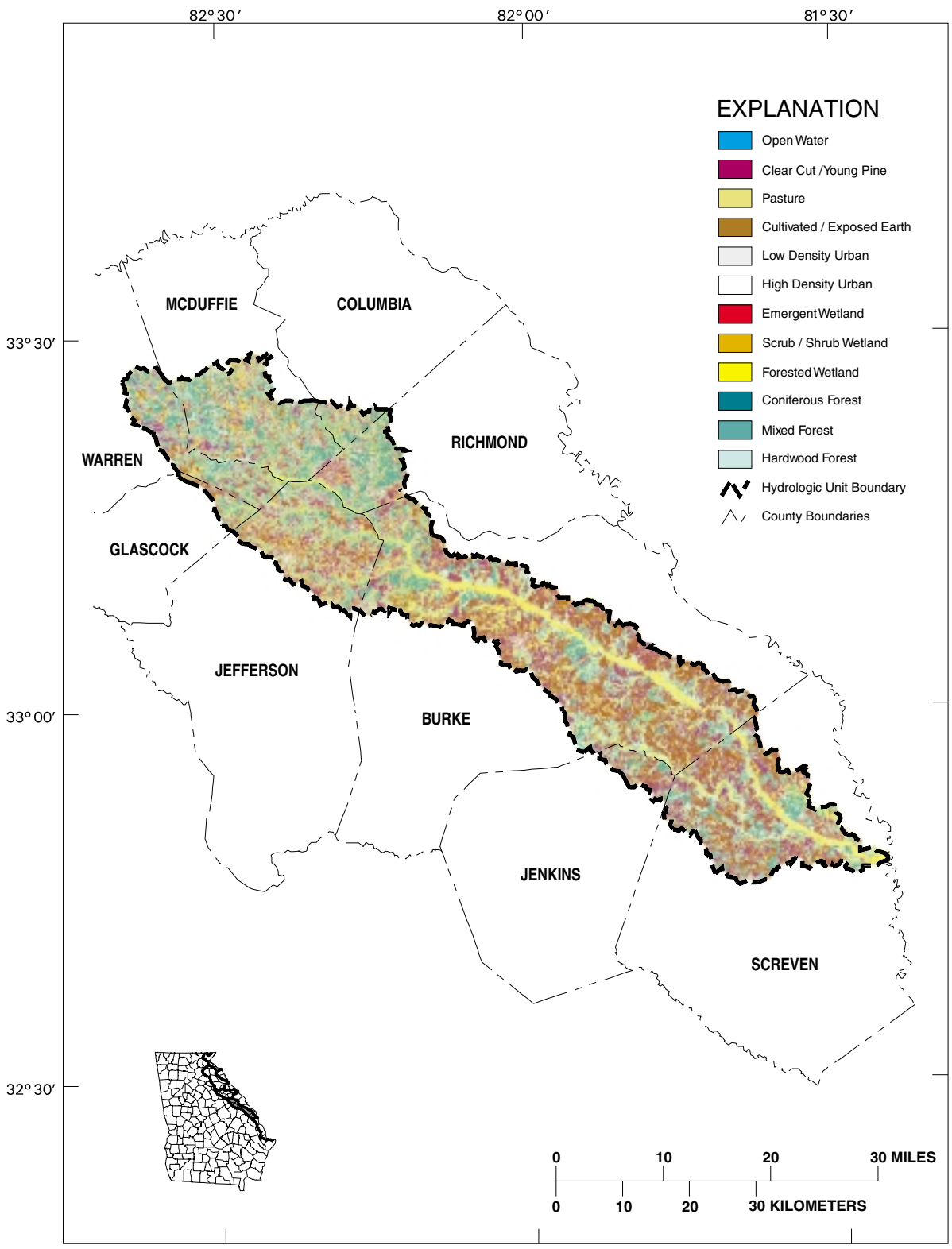

Figure 2-25. Land Cover 1990, Savannah River Basin, HUC 03060108

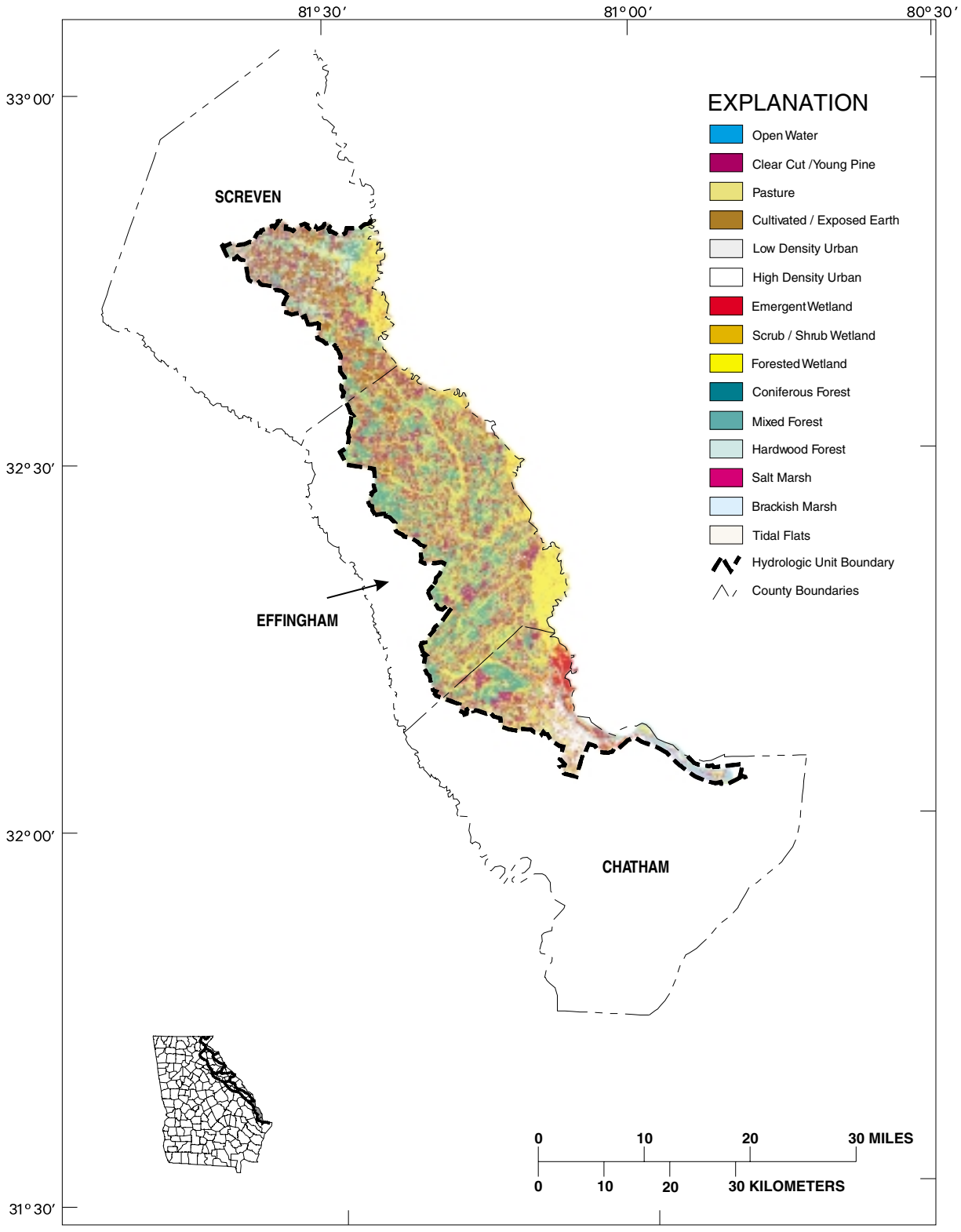

Figure 2-26. Land Cover 1990, Savannah River Basin, HUC 03060109

Table 2-5. Land Cover Statistics for the Savannah Basin

Class Name	%	Acres
Open Water	2.1	76,464.0
Clear Cut/Young Pine	11.7	431,685.9
Pasture	9.2	336,547.8
Cultivated/Exposed Earth	8.8	323,285.1
Low Density Urban	1.5	55,855.1
High Density Urban	0.6	21,404.1
Emergent Wetland	0.5	17,908.3
Scrub/Shrub Wetland	0.5	16,434.4
Forested Wetland	7.9	289,074.6
Coniferous Forest	21.0	771,403.5
Mixed Forest	18.0	663,618.0
Hardwood Forest	17.9	656,838.3
Salt Marsh	0.1	1,869.6
Brackish Marsh	0.0	1,500.5
Tidal Flats/Beaches	0.0	387.5
Total	*99.8*	*3,664,276.70*

Agriculture

Agriculture in the Savannah River basin is a varied mixture of animal operations and commodity production. In general, animal operations are concentrated north of the Fall Line and commodity production is concentrated south of the Fall Line.

Total farmland in the basin, approximately 797,183 acres (Figure 2-28), has declined rather steadily since 1982. Almost 75 percent of the farmland is in pasture. The remaining 25 percent is dedicated to growing cotton, peanuts, tobacco, and small grain [wheat, sorghum, soybean, millet]. Commodity producers applied an averaged of 7.25 inches per acre of supplemental irrigation to over 32,000 acres during 1995. Burke and Jefferson Counties contain the largest number of irrigated acreage in the basin. Irrigation application, along with the number of acres actually harvested among these crops, varies from year to year in response to market conditions, government subsidy and conservation programs, and weather.

Livestock and poultry production is relatively intense in the Savannah River basin. Approximately 202,000 head of cattle, 83,000 head of swine, and 265,000,000 broilers and layers are raised on animal operations in the basin (Table 2-7). Poultry production is especially intense in Banks, Franklin, Hart, Madison , Oglethorpe, and Stephens Counties; with Banks, Franklin, and Madison Counties ranking among the top ten poultry producing counties in Georgia. With respect to cattle production, Franklin, Hart, Madison, and Wilkes Counties collectively are raising over 97,000 head of cattle ranking them among Georgia's top ten cattle producing counties. Oglethorpe County leads the basin with approximately 31,000 head of swine, which ranks them 5th in the state.

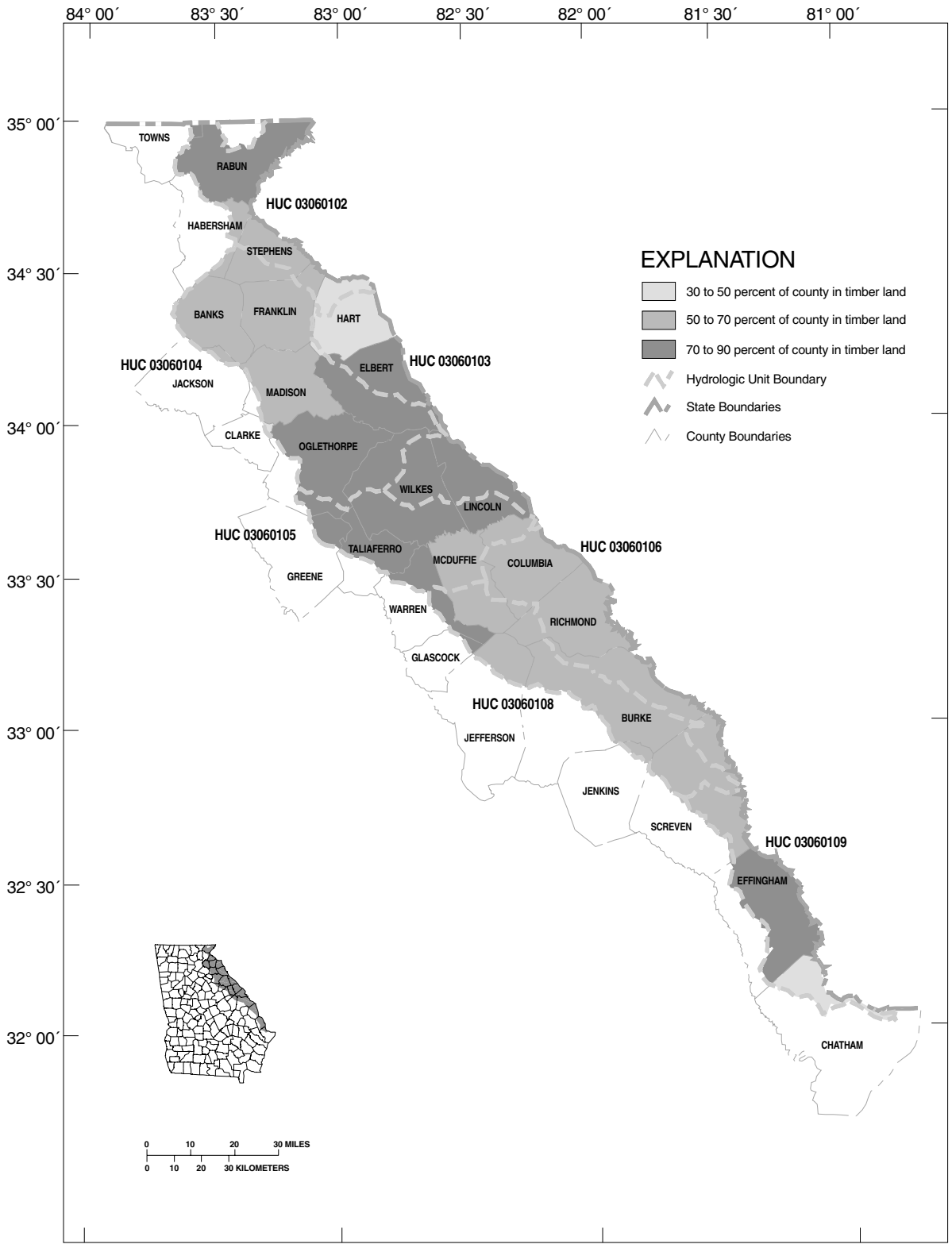

Figure 2-27. Silvicultural Land in the Savannah River Basin

Table 2-6. Forestry Acreage in the Savannah River Basin

County	Commercial Forest	Pine	Oak-pine	Upland Hardwood	Lowland Hardwood
Banks	95,100	33,900	17,200	44,000	0
Burke	210,700	64,000	28,800	67,200	50,700
Chatham	18,900	9,000	6,100	3,700	0
Clarke	800	0	0	800	0
Columbia	135,200	79,900	26,300	23,700	5,500
Effingham	161,100	89,100	8,400	29,300	34,300
Elbert	152,500	67,000	20,300	60,400	4,700
Franklin	78,200	29,100	10,600	38,500	0
Glascock	4,600	4,600	0	0	0
Greene	37,800	23,600	3,100	11,100	0
Habersham	94,800	22,600	24,700	47,400	0
Hart	54,200	8,700	3,700	41,900	0
Jackson	12,300	0	4,100	8,200	0
Jefferson	15,900	4,000	0	4,000	7,900
Jenkins	13,600	5,000	0	2,900	5,800
Lincoln	105,300	55,800	28,500	21,000	0
Madison	97,300	35,600	19,400	38,400	3,900
McDuffie	108,500	63,100	6,600	23,000	15,900
Oglethorpe	182,000	106,100	3,400	56,500	16,000
Rabun	172,000	57,700	42,700	71,700	0
Richmond	114,500	41,300	15,700	33,100	24,400
Screven	132,000	46,100	15,300	36,300	34,600
Stephens	77,400	25,800	12,500	39,200	0
Taliaferro	59,000	21,700	26,500	10,800	0
Warren	60,400	37,300	9,100	14,200	0
Wilkes	225,900	21,100	41,600	51,400	11,700
Total	*2,420,300*	*1,051,800*	*374,700*	*778,600*	*215,200*

2.3 Local Governments and Planning Authorities

Many aspects of basin management and water quality protection depend on decisions regarding zoning, land use, and land management practices. These are particularly important for the control of nonpoint pollution—pollution that arises in storm water runoff from agriculture, urban or residential development, and other land uses. The authority and responsibility for planning and control of these factors lies with local governments, making local governments and jurisdictions important partners in basin management.

The Department of Community Affairs (DCA) is the state's principal department with responsibilities for implementing the coordinated planning process established by the Georgia Planning Act. Its responsibilities include promulgation of minimum standards for preparation and implementation of plans by local governments, review of local and regional plans, certification of qualified local governments, development of a state plan, and provision of technical assistance to local governments. Activities under the planning Act are coordinated with the Environmental Protection Division (EPD), Regional Development Centers, and local governments.

2.3.1 Counties and Municipalities

Local governments in Georgia consist of counties and incorporated municipalities. As entities with constitutional responsibility for land management, local governments have a significant role in the management and protection of water quality. The role of local

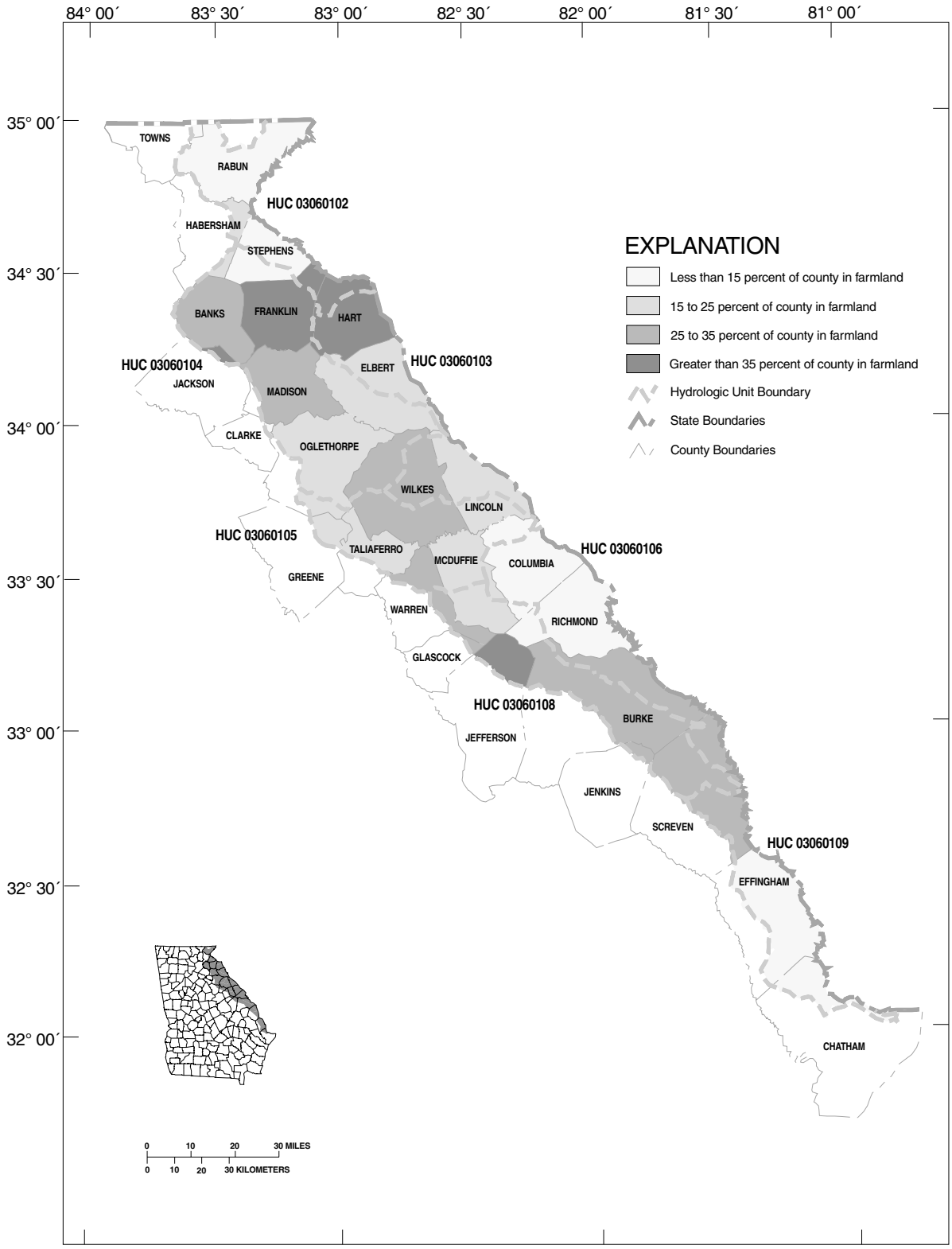

Figure 2-28. Agricultural Land in the Savannah River Basin

Table 2-7. Agricultural Operations in the Savannah River Basin (data supplied by NRCS)

Element	Watershed 3060102	Watershed 3060103	Watershed 3060104	Watershed 3060105	Watershed 3060106	Watershed 3060108	Watershed 3060109	Savannah Basin Total
Acres	374,196	454,239	938,483	493,132	366,638	500,462	380,984	3,508,134
Number of Farms (1992)	498	725	2,185	456	263	381	202	4,710
Number of Dairies (1997)	2	12	13	17	3	9	1	57
Dairy Cattle (Head 1997)	432	2,518	2,716	2,977	651	1,803	53	11,150
All Cattle and Calves (Head 1997)	17,443	38,023	87,486	26,073	10,428	16,754	5,596	201,803
Hogs and Pigs (Head 1997)	4,620	12,632	43,365	11,180	1,804	3,646	5,648	82,895
Boilers (thousands, 1997)	37,308	23,640	201,002	2,749	-	-	-	264,699
Layers (thousands, 1997)	159	193	3,887	402	-	19	-	4,660
Irrigated Acres (1995)	1,255	3,345	1,229	388	7,439	15,756	3,075	32,487
Irrigated Water Use (MGD 1995)	0.44	1.35	1.05	2.32	3.28	6.99	2.11	17.54
Harvested Cropland (Acres 1992)	10,586	24,733	43,414	1,439	31,632	60,206	21,087	193,097
Total Agriculture Acres (1989-1997)	48,233	119,475	237,965	86,607	82,703	161,603	60,597	797,183

governments includes enacting and enforcing zoning, storm water and development ordinances; undertaking water supply and wastewater treatment planning; and participating in programs to protect wellheads and significant ground water recharge areas. Many local governments are also responsible for operation of water supply and wastewater treatment facilities.

The Savannah River basin includes part or all of 27 Georgia counties (Table 2-8 and Figure 2-2); however, only 10 are entirely within the basin, and 9 counties have a small fraction (<20 percent) of their land area within the basin. Thus there are a total of 18 counties with significant jurisdictional authority in the basin. Municipalities or cities are communities officially incorporated by the General Assembly. Georgia has more than 530 municipalities. Table 2-9 lists the municipalities in the Savannah River basin.

Table 2-8. Georgia Counties in the Savannah River Basin

Counties Within the Entire Savannah River Basin	Counties Partially Within the Savannah River Basin	Counties With Less Than 20% Area Within the Basin
Banks, Columbia, Elbert, Franklin, Hart, Lincoln, McDuffie, Richmond, Stephens, Wilkes	Burke, Effingham, Madison, Oglethorpe, Rabun, Screven, Taliaferro, Warren	Chatham, Clark, Glascock, Greene, Habersham, Jackson, Jefferson, Jenkins, Towns

Table 2-9. Georgia Municipalities in the Savannah River basin

HUC 03060102				
Clayton	Satolah	Tiger	Tree	Wiley
Lakemount	Tallulah Falls	Toccoa	Turnerville	
HUC 03060103				
Chennault	Floral Hill	Montevideo	Tignal	
Danburg	Hartwell	Ruckersville	Washington	
Elberton	Lincolnton	Sybert		
HUC 03060104				
Alto	Cauthen	Fort Lamar	Lavonia	Pocataligo
Avalon	Colbert	Fortsonia	Lexington	Point Peter
Aversville	Comer	Franklin Springs	Martin	Royston
Baldwin	Danielsville	Goss	Middleton	Sandycross
HUC 03030105				
Bairdstown	Cedar Rock	Mesena	Philomath	Sharon
Barnett	Crawfordville	Metasville	Rayle	Thomson
Cadley	Leathersville	Norwood	Raytown	
HUC 03060106				
Appling	Evans	Greens Cut	Martinez	
Augusta	Girard	Grovetown	McBean	
Bath	Gracewood	Hephzibah	Pumpkin Center	
HUC 03060108				
Alexander	Camak	Hilltonia	Millhaven	Waynesboro
Avondale	Campania	Keysville	Sanit Clair	Wrens
Blythe	Dearing	Lewis	Sardis	Zebina
Boneville	Harlem	Matthews	Stellaville	
HUC 03060109				
Blanford	Meinhard	Rincon	Shawnee	Sylvania
Clyo	Monteith	Savannah	Springfield	
Garden City	Port Wentworth	Savannah	Stillwell	

2.3.2 Regional Development Centers

Regional Development Centers (RDCs) are agencies of local governments, with memberships consisting of all the cities and counties within each RDC's territorial area. There are currently 17 RDCs in Georgia. RDCs facilitate coordinated and comprehensive planning at local and regional levels, assist their member governments with conformity to minimum standards and procedures, and can have a key role in promoting and supporting management of urban runoff, including watershed management initiatives. RDCs also serve as liaisons with state and federal agencies for local governments in each region. Funding sources include members' dues and funds available through DCA. Table 2-10 summarizes the RDCs and the associated counties within the Savannah River basin.

2.4 Water Use Classifications

2.4.1 Georgia's Water Use Classification System

The Board of Natural Resources was authorized through the Rules and Regulations for Water Quality Control promulgated under the Georgia Water Quality Control Act of

Table 2-I0. Regional Development Centers in the Savannah River Basin

Regional Development Center	Member Counties with Land Area in the Savannah Basin
Central Savannah	Burke, Columbia, Glascock, Jefferson, Jenkins, Lincoln, McDuffie, Richmond, Screven, Taliaferro, Warren, Wilkes
Coastal Georgia	Chatham, Effingham
Georgia Mountains	Banks, Franklin, Habersham, Hart, Rabun, Stephens, Towns
Northeast Georgia	Clarke, Elbert, Green, Jackson, Madison, Oglethorpe

1964, as amended, to establish water use classifications and water quality standards for the surface waters of the state.

The water use classifications and standards were first established by the Georgia Water Quality Control Board in 1966. Georgia was the second state in the nation to have its water use classifications and standards for intrastate waters approved by the federal government in 1967. For each water use classification, water quality standards or criteria were developed which established a framework to be used by the Water Quality Control Board and later the Environmental Protection Division in making water use regulatory decisions.

The water use classification system was applied to interstate waters in 1972 by the EPD. Georgia was again one of the first states to receive federal approval of a statewide system of water use classifications and standards. Table 2-11 provides a summary of water use classifications and criteria for each use.

Table 2-II. Georgia Water Use Classifications and Instream Water Quality Standards for Each Use

	Bacteria (fecal coliform)		Dissolved Oxygen (other than trout streams)[2]		pH	Temperature (other than trout streams)[2]	
Use Classification[1]	30-Day Geometric Mean[3] (no/100 ml)	Maximum (no./100ml)	Daily Average (mg/l)	Minimum (mg/l)	Std. Units	Maximum Rise above Ambient (°F)	Maximum (°F)
Drinking Water requiring treatment	1,000 (Nov-April) 200 (May-October)	4,000 (Nov-April)	5.0	4.0	6.0-8.5	5	90
Recreation	200 (Freshwater) 100 Coastal)	--	5.0	4.0	6.0-8.5	5	90
Fishing Coastal Fishing[4]	1,000 (Nov-April) 200 (May-October)	4,000 (Nov-April)	5.0	4.0	6.0-8.5	5	90
Wild River	No alteration of natural water quality						
Scenic River	No alteration of natural water quality						

[1] *Improvements in water quality since the water use classifications and standards were originally adopted in 1972 provided the opportunity for Georgia to upgrade all stream classifications and eliminate separate use designations for "Agriculture", "Industrial", "Navigation", and "Urban Stream" in 1993.*

[2] *Standards for Trout Streams for dissolved oxygen are an average of 6.0 mg/l and a minimum of 5.0 mg/l. No temperature alteration is allowed in Primary Trout Streams and a temperature change of 2°F is allowed in Secondary Trout Streams.*

[3] *Geometric means should be "based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours." The geometric mean of a series of N terms is the Nth root of their product. Example: the geometric mean of 2 and 18 is the square root of 36.*

[4] *Standards are same as fishing with the exception of dissolved oxygen which is site specific.*

Congress made changes in the CWA in 1987 that required each state to adopt numeric limits for toxic substances for the protection of aquatic life and human health. To comply with these requirements, the Board of Natural Resources adopted 31 numeric standards for protection of aquatic life and 90 numeric standards for the protection of human health. Appendix B provides a summary of toxic substance standards that apply to all waters in Georgia. Water quality standards are discussed in more detail in Section 5.2.1.

In the latter 1960s through the mid-1970s there were many water quality problems in Georgia. Many stream segments were classified for the uses of navigation, industrial, or urban stream. Major improvements in wastewater treatment over the years have allowed the stream segments to be raised to the uses of fishing or coastal fishing which include more stringent water quality standards. The final two segments in Georgia were upgraded as a part of the triennial review of standards completed in 1989. All of Georgia's waters are currently classified as either fishing, recreation, drinking water, wild river, scenic river, or coastal fishing.

2.4.2 Water Use Classifications for the Savannah River Basin

Waters in the Savannah River basin are classified as either fishing, recreation, drinking water, or wild and scenic or coastal fishing. Most of the waters are classified as fishing. Those waters explicitly classified in Georgia regulations are shown in Table 2-12; all waters not explicitly classified are classified as fishing. A number of waters in the northern portion of the Savannah River basin are also designated as primary or secondary trout streams, as shown in Table 2-13. Primary trout streams are defined as streams containing naturally-reproducing populations of brook trout, brown trout, and/or rainbow trout, while secondary trout streams contain no naturally-reproducing trout populations but are capable of sustaining stocked trout throughout the year.

Table 2-I2. Savannah River Basin Waters Classified in Georgia Regulations[1]

Waterbody	Segment Description	Use Classification
Chattooga River	Georgia-North Carolina State Line to Tugaloo Reservoir	Wild and Scenic
West Fork Chattooga	Confluence of Overflow Creek and Clear Creek to confluence with Chattooga River (7.3 mi.)	Wild and Scenic
Tallulah River	Headwaters of Lake burton to confluence with Chattooga River	Recreation
Tugaloo River	Confluence of Tallulah and Chattooga Rivers to Yonah Lake Dam	Recreation
Savannah River	Highway 184 to Clarks Hill dam (Mile 238)	Recreation
Savannah River	Clarks Hill Dam (Mile 238 to Augusta, 13th Street Bridge	Drinking Water
Savannah River	US Highway 301 Bridge (Mile 129) to Seaboard Coastline RR Bridge (Mile 27.4)	Drinking Water
Savannah River	Seaboard Coastline RR Bridge (Mile 27.4) to Fort Pulaski (Mile 0)	Coastal Fishing
Savannah River	Fort Pulaski (Mile 0) to Open Sea and all littoral waters of Tybee Island	Recreation

[1] Rules and Regulations for Water Quality Control, Chapter 391-3-6(13). Waters within the Savannah River basin not explicitly classified and listed above are classified as Fishing.

Table 2-I3. Savannah River Basin Waters Designated as Trout Streams

County	Classification	Segment Description
Habersham	Primary	Middle Fork Broad River watershed from the USFS Route 92-B bridge in Stephens County
	Primary	Panther Creek watershed
	Secondary	Davidson Creek watershed
	Secondary	Middle Fork Broad River tributaries flowing into designated Secondary Trout water in Stephens County
	Secondary	Nancytown Creek watershed upstream from Nancytown Lake
	Secondary	North Fork Broad River watershed
	Secondary	Toccoa Creek watershed
Rabun	Primary	Chattooga River - all tributaries
		Tallulah River watershed upstream from the river's confluence with Lake Burton
	Primary	Bad Creek watershed (flows into Tugaloo Lake)
	Primary	Bad Branch watershed (flows into Seed Lake)
	Primary	Worse Creek watershed (flows into Tugaloo Lake)
	Primary	Bridge Creek watershed
	Primary	Crow Creek watershed (flows into Seed Lake; includes Slick Shoal Creek)
	Primary	LaCounts Creek watershed (flows into Seed Lake)
	Primary	Seals Creek watershed (flows into Seed Lake)
	Primary	Flat Creek watershed
	Primary	Fall Branch watershed
	Primary	Joe Creek watershed
	Primary	Dicks Creek watershed (flows into Lake Burton; includes Goldmine Branch)
	Primary	Moccasin Creek watershed
	Primary	Timpson Creek watershed
	Primary	Popcorn Creek watershed
	Primary	Wildcat Creek watershed
	Primary	Tiger Creek watershed
	Secondary	Chattooga River from Big Bend Falls downstream to the mouth of Warwoman Creek
Stephens	Primary	Middle Fork Broad River watershed upstream from the USFS Route 92-B bridge
	Primary	Panther Creek watershed upstream from the mouth of Davidson Creek
	Secondary	Davidson Creek watershed
	Secondary	Little Toccoa Creek watershed
	Secondary	Middle Fork Broad River watershed upstream from NRCS flood control structure #44 to USFS Route 92-B bridge
	Secondary	North Fork Broad River watershed upstream from NRCS flood control structure #1
	Secondary	Panther Creek watershed downstream from the mouth of Davidson Creek
	Secondary	Toccoa Creek upstream from Toccoa Falls

References

Burch, J.B. 1973. Freshwater Unionacean Clams (Mollusca: Pelycypoda) of North America. Identification Manual Number 11. U.S. Environmental Protection Agency, Washington, DC.

Carter, R.F., and H.R. Stiles. 1983. Average Annual Rainfall and Runoff in Georgia, 1941-1970. Hydrologic Atlas 9, U.S. Geological Survey.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe, 1979. Classification of wetlands and deepwater habitats of the United States: U.S. Fish and Wildlife Service, FWS/OBS-79/31.

GA DNR. 1996. Water Quality in Georgia, 1994-1995. Georgia Department of Natural Resources, Environmental Protection Division, Atlanta, Georgia.

Georgia Game and Fish. 1966. Savannah River Fish Population Studies, June and October 1966 (unpublished).

Heath, R.C. 1989. The Piedmont ground-water system. pp. 1-13 in Daniel, C.C. III, R.K. White, and P.A. Stone, Ground Water in the Piedmont, Proceedings of a Conference on Ground Water in the Piedmont of the Eastern United States. Clemson University, Clemson, South Carolina.

Hobbs, H.H. 1981. The Crayfishes of Georgia. Smithsonian Contributions to Zoology, Number 318.

Miller, J.A. 1990. Ground Water Atlas of the United States—Segment 6—Alabama, Florida, Georgia, and South Carolina. Hydrologic Investigations Atlas 730-G. U.S. Geological Survey. 730-G. U.S. Ge.

Neves, R.J., A.E. Bogan, J.D. Williams, S.A. Ahlstedt, and P.W. Hartfield. 1997. Status of aquatic molluscs in the southeastern United States: A downward spiral of diversity. Pages 43-85 in G.W. Benz and D.E. Collins, editors, Southeastern Aquatic Fauna in Peril: The Southeastern Perspective. Special Publication 1, Southeast Aquatic Research Institute. Lenz Design and Communication, Decatur, Georgia.

Peck, M.F., C.N. Joiner, and A.M. Cressler. 1992. Ground-Water Conditions in Georgia, 1991. Open-File Report 92-470. U.S. Geological Survey.

Schneider, W.J., E. Friel, G.C. Meyere, B.M. Wilmoth, H.E. LeGrand, C.R. Collier, G.W. Whetstone, H.C. Barksdale, and J.W. Wark. 1965. Water Resources of the Appalachian Region, Pennsylvania to Alabama. Hydrologic Investigations Atlas HA-198. U.S. Geological Survey.

Watters, G.T. 1994. An annotated bibliography of the reproduction and propagation of the Unionoidea. *Ohio Biological Survey, Miscellaneous Contributions*, 1: 1-158.

Williams, J.D., M.L. Warren, K.S. Cummings, J.L. Harris, and R.J. Neves. 1992. Conservation status of freshwater mussels of the United States and Canada. *Fisheries*, 18(9): 6-22.

Williamson, G.K., and R.A. Moulis. 1994. Distribution of Amphibians and Reptiles in Georgia. Savannah Science Museum, Inc. Savannah, Georgia.

In This Section

- Drinking Water Supply
- Surface Water Quantity
- Ground Water Quantity

Section 3

Water Quantity

This section addresses water quantity issues (availability and use), while water quality in the Savannah basin is the subject of Section 4. Water use in the Savannah River Basin is measured by estimates of freshwater withdrawn from groundwater and surface water. Uses of water include both consumptive and nonconsumptive uses.

Surface water is the primary water source in the Piedmont Province of the Savannah River basin because ground water yields from crystalline rock aquifers tend to be low. Within the Coastal Plain province, aquifer yields are higher and ground water withdrawals are an important part of the total water budget. Although most public-supply withdrawals in the Piedmont Province are from surface-water sources, with the exception of counties near or immediately below the Fall Line, most public-supply water in the Coastal Plain comes from ground water sources. The Floridan aquifer system supplied most of the ground water used in the basin in 1990, followed by the Claiborne, Clayton, Piedmont crystalline rock, and the Providence aquifer systems. As previously mentioned, the two sources of supply are not independent, because ground water discharge to streams is important in maintaining dry-weather flow. Thus, withdrawal of ground water can, under certain conditions, also result in reduction in surface water flow.

Surface water use in the Savannah River basin is expected to increase in the near future, due to a population increase in the basin and a generally favorable employment outlook. Augusta-Richmond County is the largest municipal (50 mgd) permittee in the Savannah basin with the Augusta Canal as the source. The Savannah Electric and Power Company is the largest industrial (174.0 mgd) permittee in the basin with the Savannah River as the source.

In the following sections, water availability is discussed from a number of viewpoints. First, the important topic of drinking water is presented, which includes both surface and ground water supplies. Then, general surface water availability is presented, followed by ground water availability.

3.1 Drinking Water Supply

3.1.1 Drinking Water Supplies in the Savannah River Basin

The Savannah River basin provides drinking water for nearly 500,000 people in the state of Georgia by municipal or privately owned public water systems. A public water system pipes water for human consumption and has at least 15 service connections or regularly serves at least 25 individuals 60 or more days out of the year. Public water system sources include surface water pumped from rivers and creeks or ground water pumped to the surface from wells or naturally flowing from springs. There are three different types of public water systems: community, non-community non-transient, and non-community transient.

Types of Public Water Systems

A community public water system serves at least 15 service connections used by year round residents or regularly serves at least 25 year-round residents. Examples of community water systems are municipalities, such as cities, counties, and authorities which serve residential homes and businesses located in the areas. Other types of community public water systems include rural subdivisions or mobile home parks which have a large number of homes connected to a private public water system, usually a small number of wells.

A non-community non-transient public water system serves at least 25 of the same persons over six months per year. Examples of non-community non-transient systems are schools, office buildings, and factories which are served by a well.

A non-community transient public water system does not meet the definition of a non-community non-transient system. A non-community transient public water system provides piped water for human consumption to at least 15 service connections or which regularly serves at least 25 persons at least 60 days a year. Examples of a non-community transient are highway rest stops, restaurants, motels, and golf courses.

Private domestic wells serving individual houses are not covered by the state's public water system regulations. However, the regulations for drilling domestic wells are set by the Water Well Standards Act and the local health department is responsible for insuring water quality.

In the Savannah River basin there are 17 community public water systems utilizing surface water and serving 342,410 people and 134 community public water systems utilizing ground water and serving 124,136 people (Table 3-1). The locations of surface water intakes within each of the Hydrologic Units of the Savannah River basin are shown in Figures 3-1 through 3-7.

3.1.2 Drinking Water Demands

Over the next few years there will be an increase in the withdrawal of surface water to be used for drinking water from the Savannah River Basin. Two of the largest and expanding urban areas, Augusta-Richmond County and Savannah, currently utilize both ground water and surface water for drinking water uses. Currently the Savannah "Industrial and Domestic" intake (on Abercorn Creek part of the Savannah River) and water system are serving mainly industries in the Chatham County area. However since Chatham County is one of the four "cap" counties targeted for reduce groundwater usage due to saltwater intrusion, the use of surface water for drinking water will be increasing. Currently Savannah is in the process of expanding the surface water plant and capacity of

Table 3-I. Community Public Water Systems in the Savannah River Basin

Drinking Water Permit Number	Water System Name	County
HUC 03060102		
GA1190003	Lavonia	Franklin
GA1470055	Paradise Pt-Chateau Estate	Hart
GA1470056	Paradise Pt-Reed Creek Subdivision	Hart
GA1470057	Paradise Pt-Reed Creek Point	Hart
GA1470058	Paradise Pt-Vickery Point	Hart
GA2410001	Tallulah Falls	Rabun
GA2410033	Screamer Mountain Subdivision	Rabun
GA2410097	Covecrest Subdivision	Rabun
GA2410118	Clayton-Rabun Co. Authority	Rabun
GA2410119	Laurel Ridge Subdivision	Rabun
GA2410120	Sandy Ford Subdivision	Rabun
GA2570001	Toccoa	Stephens
GA2570011	Toccoa Falls College	Stephens
GA2570020	Toccoa Falls College Mobile Home Park	Stephens
GA2570026	Mill Bridge Mobile Home Park	Stephens
GA2570029	Lake Harbor Shores Subdivision	Stephens
HUC 03060103		
GA1050001	Elberton	Elbert
GA1050036	Beaverdam Mobile Home Park	Elbert
GA1470000	Hartwell	Hart
GA1470008	Bowersville	Hart
GA1470009	Paradise Pt-Tahoe/York Subdivision	Hart
GA1470051	Sanders Mobile Home Park	Hart
GA1470052	Paradise Pt-McMullen Subdivision	Hart
GA1470053	Paradise Pt-Milltown Point	Hart
GA1470060	Bamboo Point Subdivision HOA	Hart
GA1810000	Lincolnton	Lincoln
GA1810002	Montego Point	Lincoln
GA1810038	Lincoln County Water System	Lincoln
GA3170001	Tignall	Wilkes
HUC 03060104		
GA0110000	Homer	Banks
GA0110001	Maysville	Banks
GA0110026	Banks Co Structure #11	Banks
GA1050000	Bowman	Elbert
GA1050009	Whispering Pines Mobile Home Park	Elbert
GA1050012	Heardmont Healthcare Center	Elbert
GA1050013	Nancy Hart Memorial Medical Ct	Elbert
GA1050034	Northwood Hills Subdivision	Elbert
GA1050038	Shadylane Mobile Home Park	Elbert
GA1190000	Canon	Franklin
GA1190001	Carnesville	Franklin
GA1190002	Franklin Springs	Franklin
GA1190004	Royston	Franklin
GA1190046	Springwater Mobile Home Park	Franklin
GA1190051	Franklin County Water System	Franklin
GA1190052	Nails Creek Crossing	Franklin
GA1570001	Commerce	Jackson
GA1950000	Carlton	Madison
GA1950001	Colbert	Madison
GA1950002	Comer	Madison
GA1950003	Danielsville	Madison

Drinking Water Permit Number	Water System Name	County
GA1950004	Ila	Madison
GA1950006	Brown Brothers Farm Subdivision	Madison
GA1950009	Tranquility Forest Mobile Home Park	Madison
GA1950011	Westbrook Trailer Park	Madison
GA1950012	Hidden Forest Subdivision	Madison
GA1950015	Morningside Village Trailer Park	Madison
GA1950043	Madison Acres Subdivision	Madison
GA1950045	Apple Acres-Kingston-Gatewood	Madison
GA1950047	Ray`s Mobile Home Park	Madison
GA1950049	Patterson Place/McCellan Court	Madison
GA1950052	W & R Farms Subdivision	Madison
GA1950056	Strickland`s Mobile Home Park	Madison
GA2210000	Crawford	Oglethorp
GA2210001	Lexington	Oglethorp
GA2210004	Arnoldsville	Oglethorp
GA2210049	Wolfskin Subdivision	Oglethorp
GA2570000	Martin	Stephens
GA3170000	Rayle Water Association	Wilkes
HUC 03060105		
GA0730001	Grovetown	Columbia
GA0730002	Harlem	Columbia
GA0730077	Lake Crossing Health Center	Columbia
GA1330002	Union Point	Greene
GA1330004	Woodville	Greene
GA2210002	Maxeys	Oglethorp
GA3010000	Camak	Warren
GA3010004	Norwood	Warren
GA3170002	Washington	Wilkes
HUC 03060105 and 03060106		
GA0730000	Columbia County	Columbia
GA1890001	Thomson-McFuffie Co Water & Sewage	McDuffie
HUC 03060106		
GA0730010	Martinez Water Assoc.	Columbia
GA0730017	Windy Acres Mobile Home Park	Columbia
GA2450000	Augusta-Richmond Co Watr System	Richmond
GA2450002	Hephzibah	Richmond
GA2450011	Plantation Acres Mobile Home Park, LLC	Richmond
GA2450014	Mars Trailer Park	Richmond
GA2450016	Mobile Home Country Club	Richmond
GA2450017	Hephzibah-Oakridge	Richmond
GA2450023	Gracewood State School & Hosp.	Richmond
GA2450028	USA-Fort Gordon	Richmond
GA2450029	Heritage Mobile Home Park	Richmond
GA2450038	Simon Trailer Park	Richmond
GA2450061	Oakdale Trailer Park	Richmond
GA2450156	Woodland Trailer Park	Richmond
HUC 03060108		
GA0330000	Girard	Burke
GA0330002	Sardis	Burke
GA0330004	Waynesboro	Burke
GA0330013	Mamie Joe Rhodes Harrison Subdivision	Burke
GA0330044	Keysville	Burke
GA0730020	Mobile City Mobile Home Park	Columbia
GA0730022	Pine Needle Trailer Park	Columbia

Drinking Water Permit Number	Water System Name	County
GA1630005	Wrens	Jefferson
GA1630011	Brown Terrace Subdivision	Jefferson
GA2450001	Blythe	Richmond
GA2510000	Hiltonia	Screven
GA2510046	Rem-Kim Trailer Park	Screven
GA2510047	Friendship Trailer Park	Screven
GA2510050	Lawton Place Mobile Home Park	Screven
HUC 03060109		
GA0510000	Garden City	Chatham
GA0510002	Port Wentworth	Chatham
GA0510003	Savannah-Main	Chatham
GA0510004	Savannah-Industrial & Domestic	Chatham
GA0510005	Tybee Island	Chatham
GA0510019	Cherokee Mobile Home Park	Chatham
GA0510041	Pine Forest Subdivision	Chatham
GA0510092	Derenne Plaza Condo	Chatham
GA0510136	C & S Mobile Estates	Chatham
GA0510137	Barnwell Gardens Subdivision	Chatham
GA0510239	Chatham Co-Savannah Port Authority	Chatham
GA1030001	Rincon	Effingham
GA1030002	Springfield	Effingham
GA1030010	Lakeside Farms/Bloomingdale Subdivision	Effingham
GA1030012	Westwood Heights Subdivision	Effingham
GA1030019	Tara Mobile Home Park	Effingham
GA1030030	Cub Enterprises, L.L.C.	Effingham
GA1030031	Lake Cherie Mobile Home Park	Effingham
GA1030033	Twin Oaks Mobile Home Park	Effingham
GA1030036	Red Gate Mobile Home Park	Effingham
GA1030077	Goshen Villa Subdivision	Effingham
GA1030079	Coastal Chlor-Paddleford Plan.	Effingham
GA1030080	Quail Run Mobile Home Estates	Effingham
GA1030081	Brothers` Keepers	Effingham
GA1030082	Auriga Farms	Effingham
GA1030084	Hunts Mobile Home Park	Effingham
GA1030087	South Effingham Woods Water Co	Effingham
GA1030088	Hawk Hammock	Effingham
GA1030092	Coachwood Estates	Effingham
GA1030093	Saddlebrook Subdivision	Effingham
GA1030095	Wrph Ltd-Pine Hill Subdivision	Effingham
GA1030100	Hickory Knob Subdivision	Effingham
GA1030101	Deerwood Subdivision-Green Peace Park	Effingham
GA1030103	Waterford Plantation Subdivision	Effingham
GA1030108	Lakewood Subdivision	Effingham
GA1030109	Hunters Mill Subdivision	Effingham
GA1030110	Mill Creek Subdivision	Effingham
GA1030115	Twenty-one Center	Effingham
GA1030120	Barrington Subdivision	Effingham
GA1030122	Sandy Woods Subdivision	Effingham
GA1030124	Oetgen`s Mobile Home Park	Effingham
GA2510003	Sylvania	Screven
GA2510021	Brinsons Trailer Park	Screven
GA2510049	Screven Co. Prison	Screven

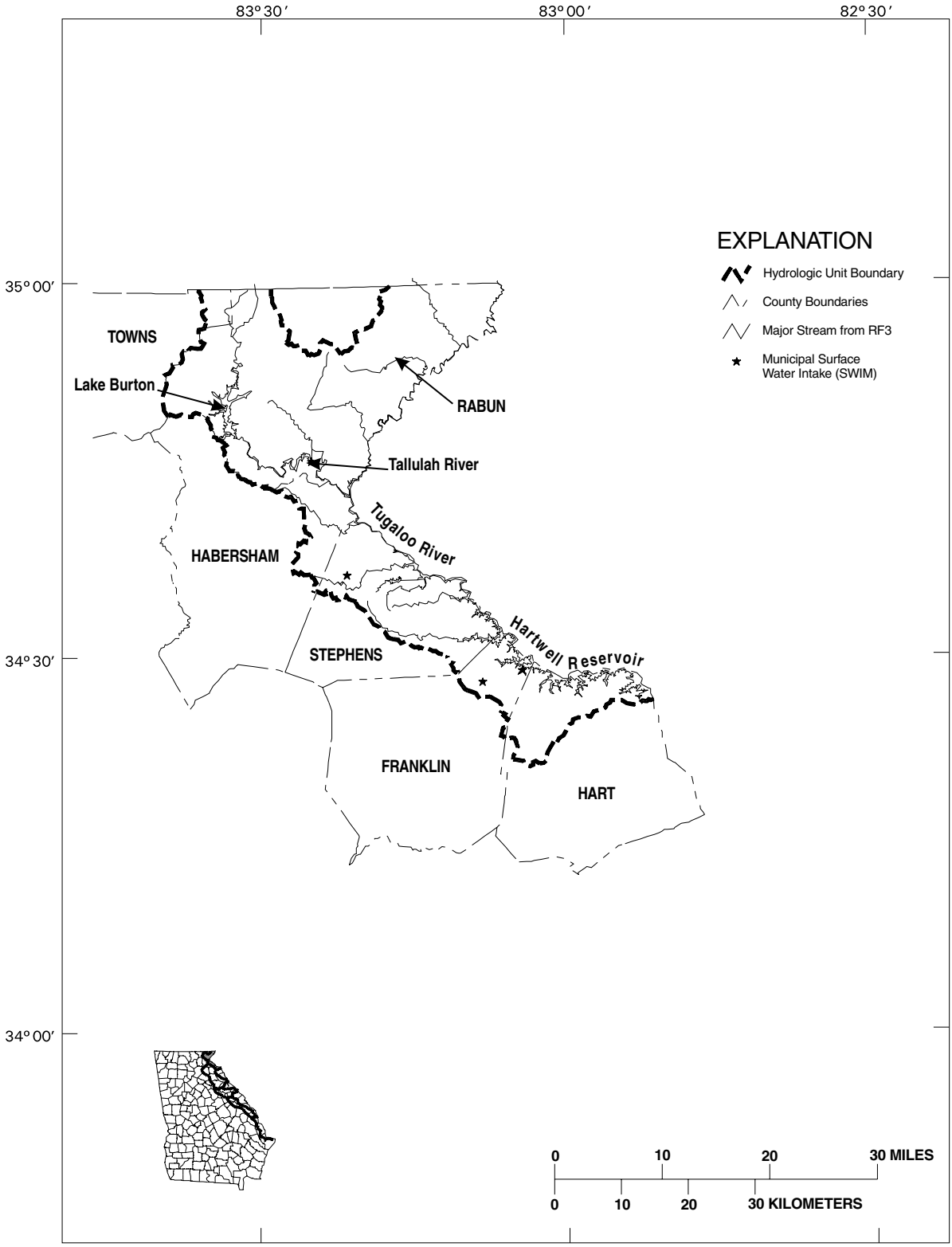

Figure 3-I. Surface Water Intakes, Savannah River Basin, HUC 03060102

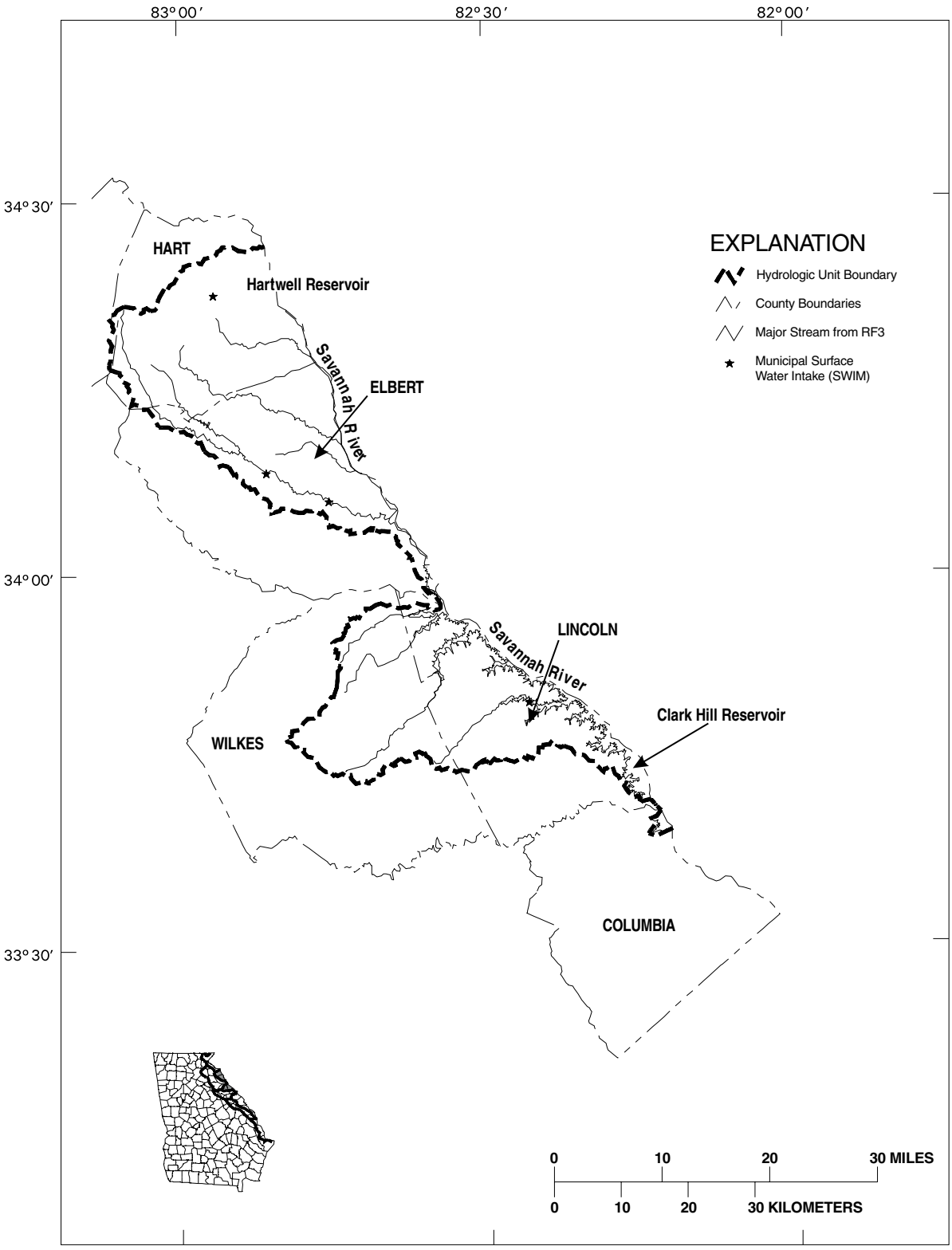

Figure 3-2. Surface Water Intakes, Savannah River Basin, HUC 03060103

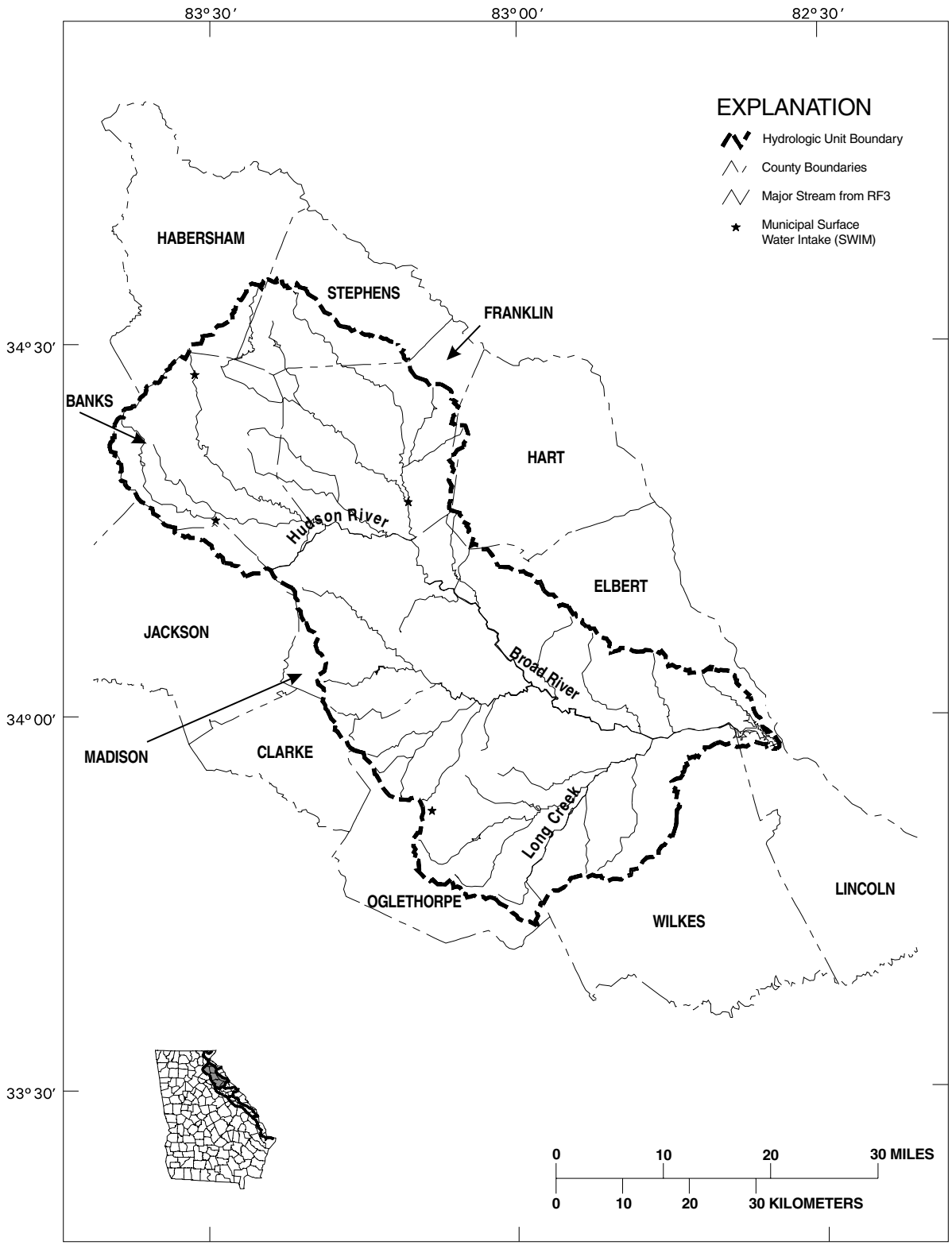

Figure 3-3. Surface Water Intakes, Savannah River Basin, HUC 03060104

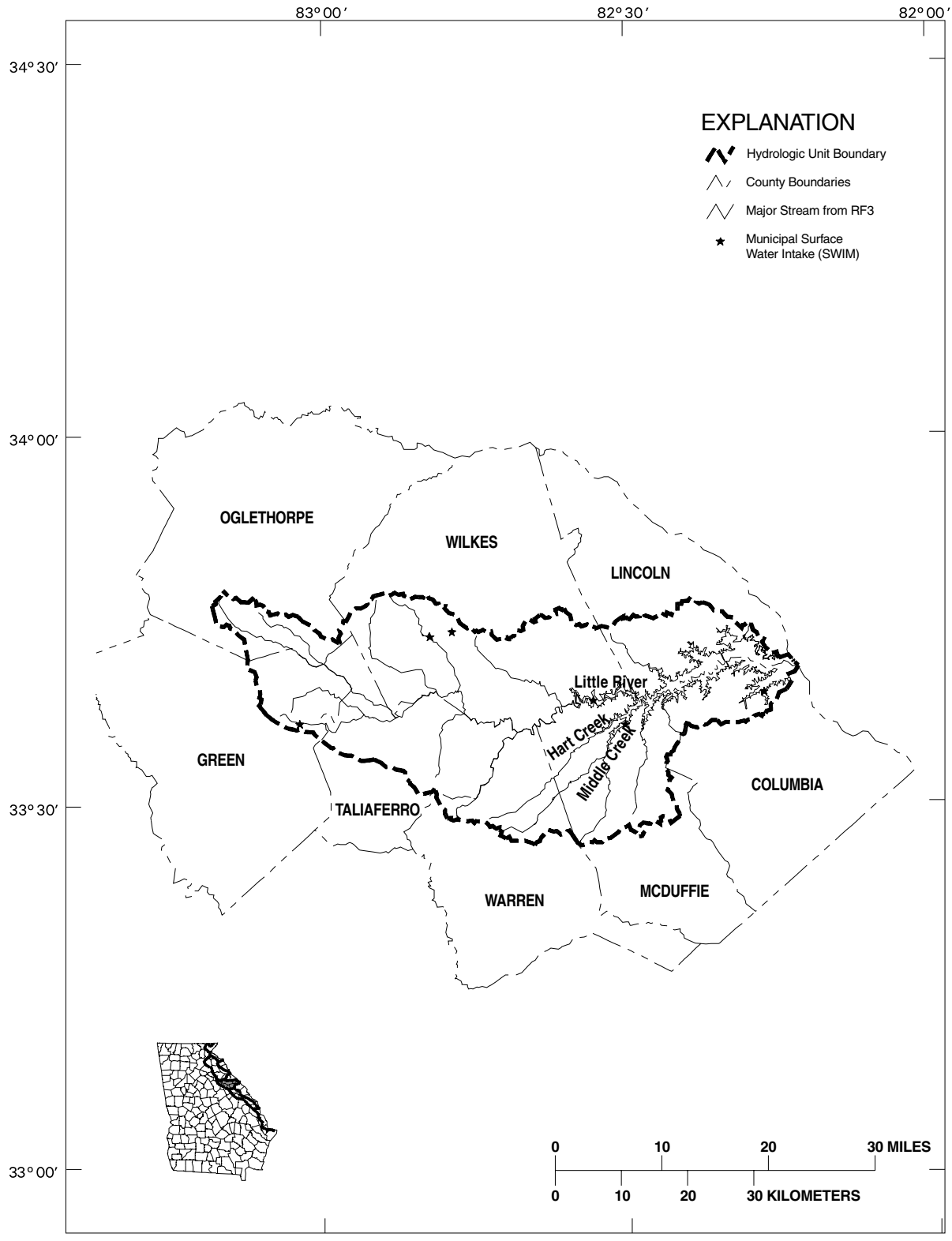

Figure 3-4. Surface Water Intakes, Savannah River Basin, HUC 03060105

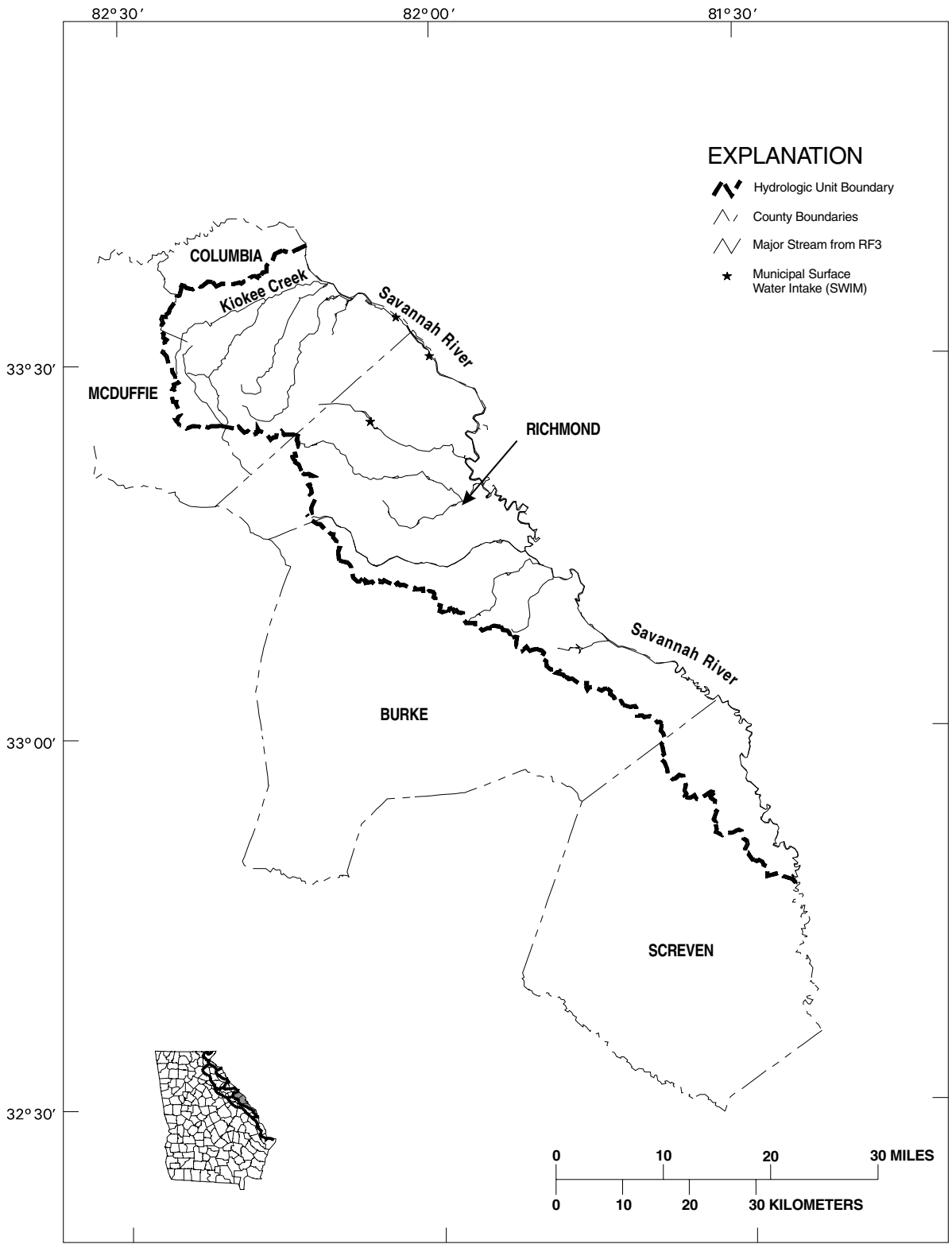

Figure 3-5. Surface Water Intakes, Savannah River Basin, HUC 03060106

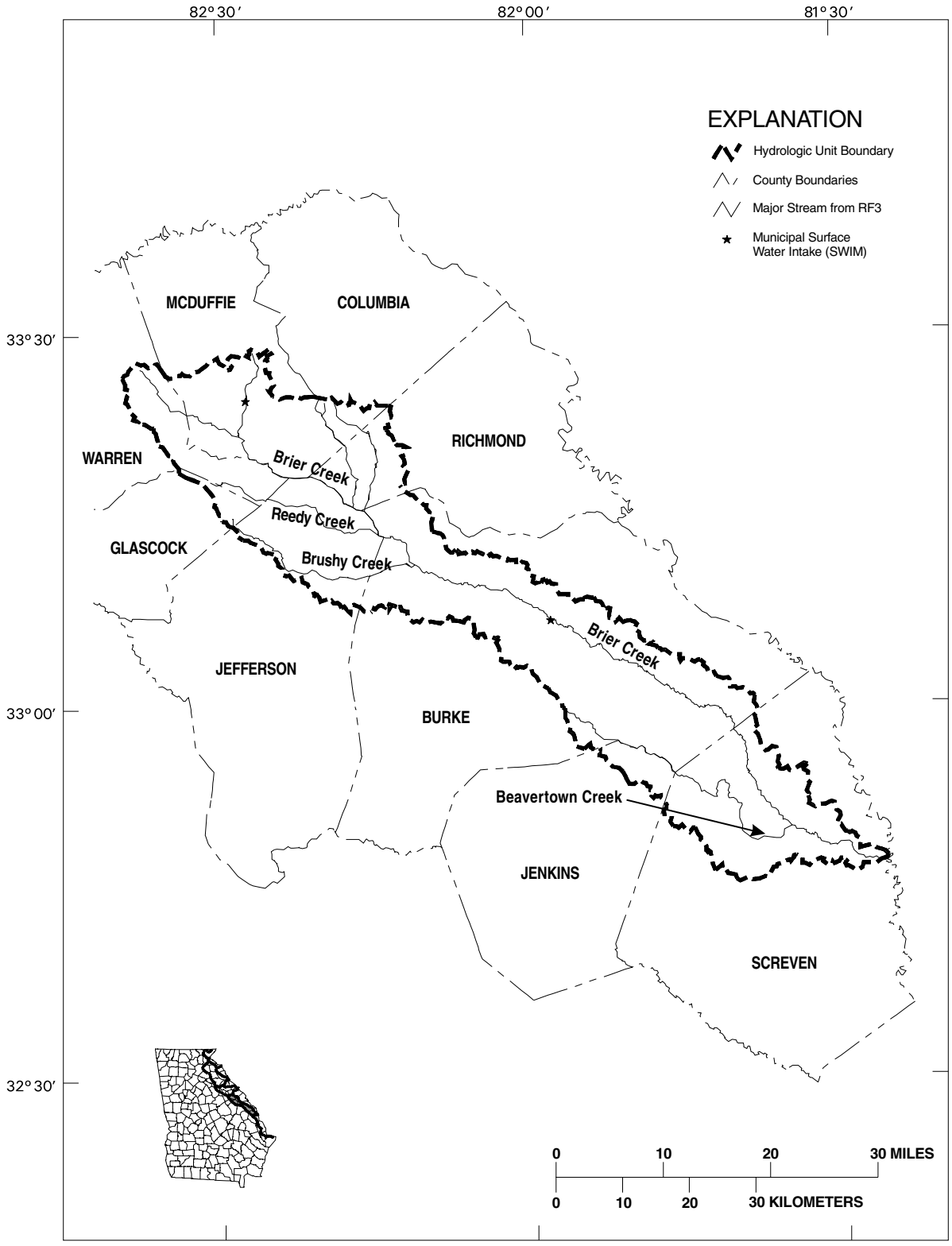

Figure 3-6. Surface Water Intakes, Savannah River Basin, HUC 03060108

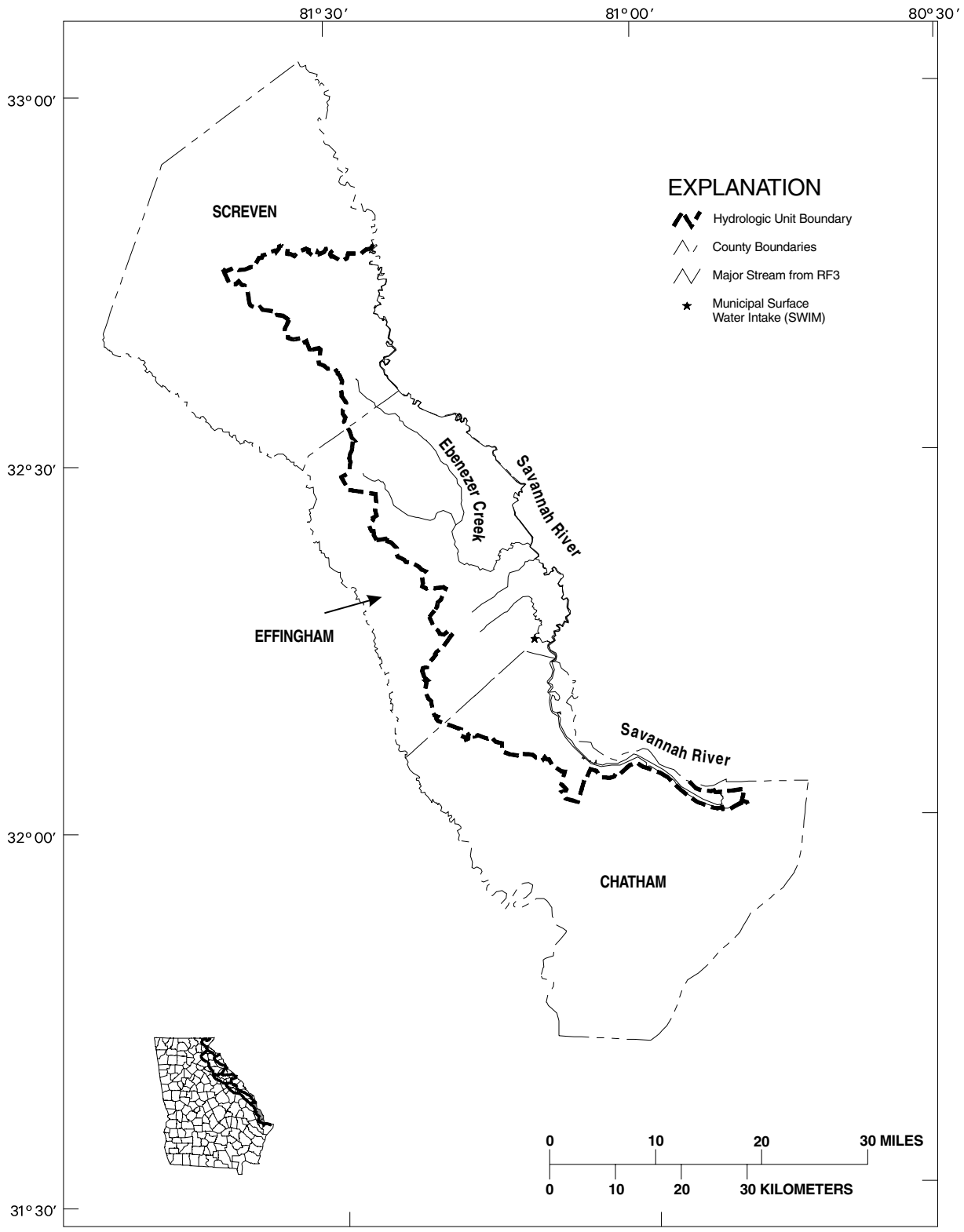

Figure 3-7. Surface Water Intakes, Savannah River Basin, HUC 03060109

the intake. Augusta-Richmond County currently has an intake on the Augusta Canal (part of the Savannah River) and numerous wells scattered in the county area. Augusta-Richmond County have future plans to expand the current intake or build a new one. Also Habersham County, located in the headwaters of the Savannah River, has plans to withdraw water from the Savannah River basin for drinking water uses.

Water Conservation techniques including low flow household plumbing in new construction, can help to mitigate increasing water demand. In 1990, Georgia became one of the first states to adopt ultra-low flow standards for plumbing fixtures. Under this law, local governments were required to adopt ultra-low flow standards (1.6 gpf toilets, 2.5 gpm showerheads, 1.0 gpf urinals, etc.) In order to remain eligible to receive any state water or wastewater grant or loan. These requirements were implemented in 1991 and 1992 and apply to new residential and commercial construction and renovations that include replacement of plumbing fixtures.

3.1.3 Drinking Water Permitting

The Georgia Safe Drinking water Act of 1997, the Rules for Safe Drinking Water (391-3-5) adopted under the act require any person who owns and/or operates a public water system to obtain a permit to operate a public water system from he Environmental Protection Division. The permitting process has three phases: Inquiry and Discovery, Technical Review, and Permitting. During these phases the owners must provide a detailed description of the project; demonstrate the reliability of the water source; render engineering plans and specifications prepared by a professional engineer demonstrating the construction integrity of wells, treatment and distribution; conduct preliminary water sample testing; and legal documentation including an application to operate a public water system. Permits contain specific conditions the owner must meet for different types of public water systems, including a list of approved water sources, filter rates, disinfection and treatment requirements, compliance with sample testing schedule, and number of allowed service connections. Permits are issued for 10 years and are renewable.

3.2 Surface Water Quantity

3.2.1 Surface Water Supply Sources

Surface water supplies in the Savannah basin include water in rivers, ponds, small reservoirs and major federal impoundments. The Savannah River flows in a southeasterly direction for 300 miles from its headwaters in the Blue Ridge Mountains, through Hartwell Lake, Richard B. Russell Lake, and Clarks Hill Lake, and past the cities of Augusta and Savannah, before emptying into the Atlantic Ocean. Total mean annual flow in the Savannah Basin has been estimated to be 13,100 cubic feet per second (cfs) on 8500 million gallons per day (mgd).

3.2.2 Surface Water Supply Demands and Uses

Municipal and Industrial Demand

Municipal and industrial (M&I) water demands include publicly supplied and privately supplied residential, commercial, governmental, institutional, industrial, manufacturing, and other demands such as distribution system water losses. The Army Corps of Engineers, Savannah District, along with the states of Georgia and South Carolina are developing a new updated comprehensive water resources management

study to determine water supply allocations including future demands of the Savannah basin. The study will also examine flood control, hydropower, water quality, habitat, aquatic plant control and recreation issues and is scheduled to be completed in September 2003.

Existing M&I permits for municipal and industrial (nonagricultural) surface water withdrawals in the Savannah River Basin are shown in Table 3-2.

Table 3-2. Permits for Surface Water Withdrawals in the Savannah River Basin

Facility Name	Source Water	Max Day Withdrawal (Mgd)	Monthly Average (Mgd)	County
Augusta-Richmond County	Augusta Canal	50.00	45.00	Richmond
Augusta-Richmond County	Savannah River	37.00	30.00	Richmond
Banks County Board of Commissioners	Mtn. Cr. Res. Strctr 11	1.00	0.70	Banks
Clayton-Rabun Co. Water & Sewer Authority	Lake Rabun	2.00	2.00	Rabun
Columbia County Board of Commissioners	Clarks Hill Reservoir	2.00	2.00	Columbia
Columbia County Water System	Stevens Creek Reservoir	25.00	20.00	Columbia
Commerce, City of	Grove Creek	2.00	1.70	Jackson
Crawford, City of	Trib to Long Creek	0.43	0.25	Oglethorpe
DSM Chemicals Augusta, Inc.	Savannah River	8.20	6.80	Richmond
Elberton, City of	Lake Russell	4.10	3.70	Elbert
Elberton, City of	Beaverdam Creek	2.20	1.70	Elbert
Fort Gordon - Butler Creek	Butler Creek	5.40	5.00	Richmond
Fort Gordon - Cow Branch	Cow Branch	0.60	0.50	Richmond
Fort James Operating Company	Savannah River	35.00	35.00	Effingham
Hartwell, City of	Lake Hartwell	4.50	3.50	Hart
International Paper Board Company, Inc.	Savannah River	85.00	80.00	Richmond
J M Huber Corp - Brier Creek	Brier Creek	4.50	2.50	Warren
J M Huber Corp - Reedy Creek	Reedy Creek	5.80	4.00	Jefferson
Kerr-Mc Gee Chemical	Savannah River	30.00	20.00	Chatham
Kingwood County Club	Trib to Chechero Creek	0.20	0.20	Rabun
Lavonia, City of	Crawford Creek	1.50	1.50	Franklin
Lavonia, City of	Lake Hartwell	0.80	0.20	Franklin
Lee Arrendale Correctional Institute	Little Hudson Creek	0.25	0.22	Banks
Lincolnton, City of	Clarks Hill Reservoir	0.63	0.63	Lincoln
Martin Marietta Aggregates-Augusta Quarry	Sump Pit	3.30	1.20	Richmond
Martin Marietta Aggregates-Camak Quarry	Sump Pit	2.30	0.60	Warren
Martin Marietta Aggregates-Homer Quarry	Sump Pit	1.50	0.60	Banks
Olin Corporation	Savannah River	4.00	2.21	Richmond
PCS Nitrogen Fertilizer, L.P.	Savannah River	21.60	10.80	Richmond
Peridot	Savannah River	5.65	5.30	Richmond
Royston, City of	N Fork of Broad River	0.70	0.40	Franklin
Savannah Electric & Power Co-Effingham	Savannah River	130.00	130.00	Effingham
Savannah Electric & Power Co-Riverside	Savannah River	174.00	174.00	Chatham
Savannah Electric & Pwr Co-Pt Wentworth	Savannah River	267.00	267.00	Chatham
Savannah Ind. & Domestic Water	Abercorn Creek	55.00	50.00	Effingham
Southern Nuclear Operating Co., Inc.	Savannah River	127.00	85.00	Burke
Thiele Kaolin Company	Newsome's Pond	0.75	0.50	Warren
Thomson-McDuffie County W/s Commission	Usry's Lake	2.00	1.50	McDuffie
Thomson-McDuffie County W/s Commission	Clarks Hill Reservoir	3.00	2.00	McDuffie
Toccoa, City of - Lake Toccoa	Lake Toccoa	7.50	6.50	Stephens

Facility Name	Source Water	Max Day Withdrawal (Mgd)	Monthly Average (Mgd)	County
Turner Concrete Company, Incorporated	Broad River	0.60	0.35	Madison
Union Camp Corporation	Savannah River	58.00	50.00	Chatham
Union Point, City of	Sherrill Cr Reservoir	0.45	0.33	Greene
Washington, City of - Clarks Hill	Clarks Hill Reservoir	2.20	2.00	Wilkes
Washington, City of - Old Plant	Little Beaverdam Cr	2.20	1.80	Wilkes
Waynesboro, City of	Brier Creek	1.50	1.00	Burke
Willamette Industries, Inc.	Savannah River	30.50	27.50	Chatham
Willamette Industries, Inc.	Savannah River	60.00	30.00	Chatham

Agricultural Water Demand

The total water demand from agriculture, including both surface water and ground water demand, may be estimated using a variety of agricultural data collected by multiple sources. NRCS has attempted to combine this information for the purpose of estimating current, and future, agricultural water use in the basin. Table 3-3 shows historical irrigated acreage in the basin from 1974 to 1995.

Irrigated acres in the Savannah River basin grew from 546 in 1974 to an all time maximum for the basin of 44,612 in 1982. However, approximately 16, 450 of these irrigated acres were lost between 1982 and 1984. Since 1984, irrigated acreage has moderated with a steady annual increase to a 1995 total of 33,781 acres. Assuming the 1.8 percent annual growth rate observed between 1984 and 1995 continues, there will be approximately 52,000 acres under irrigation by 2020.

Water Demand

Agricultural water demand is dependent upon a number of variable that include, but are not limited to, irrigated acreage, cropping mix and patterns, soil characteristics, climatic conditions, type of animal operation, best management practices, and market conditions. Water use in the Savannah River basin reflects the influence of these variables (Table 3-4). No distinct trend can be observed; however, from 1980 to 1995 there was an increase of 7 MGD from 24 MGD in 1980 to 31 MGD in 1995. Much of this increase can be attributed to increased acreage under irrigation in the basin.

Table 3-3. Irrigated Acres in the Savannah River Basin, 1974-1995 (shown by HUC and Basin Total)

Savannah River Basin - Irrigated Acres								
	3060102	3060103	3060104	3060105	3060106	3060108	3060109	Basin Total
1974	3.53	8.56	83.83	15.24	145.69	216.14	73.88	546.87
1978	162	160	510	158	3997	7421	647	13054
1979	239	240	470	780	6728	12339	1665	22461
1980	211	325	805	609	9884	17412	3588	32834
1981	347	899	1369	979	11215	21107	4140	40055
1982	374	1457	2585	667	12221	22708	4601	44612
1984	107	530	1792	1050	7239	14047	3399	28164
1986	269	593	1351	969	7404	14317	3864	28768
1989	740	1327	1388	194	8013	15179	4445	31285
1992	778	2095	1849	996	7858	15210	3860	32647
1995	1273	3219	1279	726	8433	16000	2851	33781

USDA-NRCS estimates are based on county level data extrapolated to the basin.

Table 3-4 Historical Agricultural Water Use in the Savannah River Basin, 1980-1995 (shown by HUC and Basin Total)

Year	3060102	3060103	3060104	3060105	3060106	3060108	3060109	Basin Total
1980	0.62	0.49	1.96	0.93	6.57	10.48	2.89	23.94
1985	0.41	1.13	2.33	0.9	4.84	7.79	3	20.4
1987	0.58	0.68	2.42	0.86	5.24	9.1	4.59	23.47
1990	0.86	1.47	5.88	0.78	2.96	4.79	2.77	19.51
1995	1.11	1.92	4.78	2.91	8.69	8.49	2.78	30.68

Source: Georgia Geological Survey

Approximately 86 percent of the agricultural water used in 1995 was for irrigation purposes (26.66 MGD). The central portion of the basin just below the Fall Line is where the majority of agricultural irrigation occurs in the basin, the remaining 14 percent (4.34 MGD) was used for animal operations. Ground water sources provided 56 percent of the water used by this industry in 1995.

Future agricultural water demand is expected to increase slightly within the basin to 40.61 MGD by the year 2020. However, undesirable climate and market conditions could force producers to demand as much as 60 MGD on the projected 52,000 acres under irrigation by that time. Table 3-5 shows the likely range of agricultural water demand in the basin through the year 2020. The reader should note that significant increases in irrigated acreage will have the potential to result in a much higher demand.

Power Generation Water Demand

There are three Corps of Engineers power generating plants located within the Savannah basin that use the water resources of the basin. These include Hartwell Lake and Dam, Richard B. Russell Lake and Dam, J. Strom Thurmond Lake and Dam.

Table 3-5 Projected Water Use in the Savannah River Basin, 1995-2020

Irrigated Acres	1995	2000	2005	2010	2015	2020
1.8% growth	33781	36821	40135	43747	47685	51976
Irrigated Water Use (MGD)						
High		32.87	35.82	39.05	42.56	46.39
Medium	26.66	19.17	20.90	22.78	24.83	27.06
Low		13.69	14.93	16.27	17.73	19.33
Animal Water Use		13.55	13.55	13.55	13.55	13.55
Total Water Use (MGD)						
High		46.42	49.37	52.60	56.11	59.94
Medium		32.72	34.45	36.33	38.38	40.61
Low		27.24	28.48	29.82	31.28	32.88

Navigational Water Demand

The Hartwell, Russell and Thurmond projects allow adequate flows to be maintained for navigation other than during low flow periods. The New Savannah Bluff Lock and Dam (Savannah River Mile 202.6), part of the inactive Savannah River Below Augusta Navigation Project, has little commercial navigation above the Savannah Harbor.

Recreation

Recreation in the Savannah River Basin includes fishing activities, boating, swimming, picnicking and other activities.

Fish and Wildlife Water Demand

Three state fish hatcheries are located in the Georgia portion of the Savannah River basin, which include Lake Burton Trout Hatchery (Rabun County), McDuffie Fish Hatchery (McDuffie County), and Richmond Hill Fish Hatchery (Bryan County). Lake Burton Hatchery obtains water from Mocassin Creek about 50 yards upstream from the backwaters of Lake Burton. Mean monthly flow through the raceway system at Burton Hatchery ranges from 6,232 gpm in January to 4,876 gpm in September, with an annual average of 5,461 gpm. For peak efficiency and maximum production, Lake Burton Hatchery requires 6,600 gpm through the raceway system.

Waste Assimilation Water Demand

Water quality, wastewater treatment, and wastewater discharge permitting are addressed in Section 4. However, it should be noted that the guidelines for discharge of treated effluent into the rivers and streams of the Savannah River basin assume that sufficient surface water flow will be available to assimilate waste and ensure that water quality criteria will be met.

Environmental Water Demands

Through the FERC relicensing process, tributary reservoirs were required to maintain agreed upon minimum flows. The three mainstream reservoirs, Hartwell, Russell, and Thurmond, are operated by the United States Army Corps of Engineers and are, therefore, exempt from compliance with state water quality and quantity standards. Aquatic habitat below these federal impoundments is negatively affected by existing operational guidelines for these reservoirs, which result in poor water quality and dewatering of aquatic habitat during non-generation periods.

3.2.3 Surface Water Withdrawal Permitting

The 1977 Surface Water Amendments to the Georgia Water Quality Control Act of 1964 require all nonagricultural users of more than 100,000 GPD on a monthly average (from any Georgia surface water body) to obtain a permit from EPD for this withdrawal. These users include municipalities, industries, military installations, and all other nonagricultural users. The statute stipulates that all pre-1977 users who could establish the quantity of their use prior to 1977 would be “grandfathered” for that amount of withdrawal. Table 3-2 lists the permits in effect in the Savannah River basin.

Applicants are required to submit details relating to the source of withdrawals, demand projections, water conservation measures, low flow protection measures (for nongrandfathered withdrawals), and raw water storage capacities. An EPD-issued permit identifies the source of withdrawal, the monthly average and maximum 24-hour withdrawal, the standard and special conditions under which the permit is valid, and the expiration date of the permit. The standard conditions section of the permit generally defines the reporting requirements (usually annual submission of monthly average withdrawals); the special conditions section of the permit usually specifies measures the permittee is required to undertake so as to protect downstream users and instream uses (e.g. waste assimilation, aquatic habitat). The objective of these permits is to manage and allocate water resources in a manner that both efficiently and equitably meets the needs of all the users.

Farm Irrigation Permits

The 1988 Amendments to the Water Quality Control Act establish the permitting authority within EPD to issue farm irrigation water use permits. As with the previously mentioned surface water permitting statute, the lower threshold is 100,000 GPD; however, users of less water may apply for and be granted a permit. With two exceptions, farm use is defined as irrigation of any land used for general farming, aquaculture, pasture, turf production, orchards, nurseries, watering for farm animals and poultry, and related farm activities. One relevant exception is that the processing of perishable agricultural products is not considered a farm use.

Applicants for these permits who could establish that their use existed prior to July 1, 1988, *and* when these applications were received prior to July 1, 1991, were "grandfathered" for the operating capacity in place prior to July 1, 1988. Other applications are reviewed and granted with an eye towards protection of grandfathered users and the integrity of the resource. Generally, agricultural users are not required to submit any water use reports.

3.2.4 Flooding and Floodplain Management

The Savannah River Basin was unaffected by the massive flooding that occurred in parts of Georgia in 1994, however, seventeen counties within the basin were included in Federal Disaster Declaration #1209 as a result of the 1998 floods that affected a total of 115 counties across the State. The Floods of 1998 further substantiated the fact that flooding is the number one natural hazard in Georgia.

With the exception of Candler, Emanuel and Evans Counties, all disaster declared counties in the Savannah River Basin participate in the National Flood Insurance Program (NFIP). Of the 35 counties associated with the basins, 62 percent are NFIP communities.

Floodplain development is a constant concern, because development within floodplain areas can increase flood levels, thereby increasing the number of people and the amount of property at risk. The term "floodplain management" is often used as a synonym for program or agency-specific projects and regulations. It is in fact quite a broad concept. Floodplain management is a continuous process of making decisions about whether flood plains are to be used for development and how they are to be developed.

The majority of communities in the Savannah River basin are impacted by riverine flooding. As for communities along the coast, they are susceptible to both riverine flooding and flooding from storm-induced waves. Coastal floodplain areas are divided into two adjacent zones that define the different degrees of hazard present. The V zone

(velocity zone), as referenced on the community's flood map, is that portion of the coastal 100-year floodplain that would be inundated by tidal surges with velocity wave action. The A zone is that portion of the 100-year floodplain not subject to wave actions (riverine flooding). The minimum standards for construction in coastal A zones (riverine areas). These minimum standards are incorporated into local flood ordinances adopted by communities as required for participation in the NFIP.

Floodplain Management Activities

To increase understanding and maintain a working knowledge of floodplain management, Georgia's Floodplain Management Office periodically conducts training workshops throughout the State for local officials. On March 24, 1998 at the Regional Development Center (RDC) in Augusta, a floodplain management workshop was held for elected officials and floodplain administrators from communities within the Savannah River Basin. On February 25, 1998, the City of Savannah was host to a floodplain management technical workshop for local building officials from coastal communities participating in the National Flood Insurance Program (NFIP). Savannah was also the site for a Community Rating System (CRS) workshop on November 18, 1997. The CRS is a Federal Emergency Management Agency (FEMA) program that rewards communities that implement floodplain management measures that exceed the minimum standards of the NFIP. Citizens within CRS communities receive discounts on their flood insurance premiums ranging from 5 percent to 45 percent. Chatham County and the cities of Pooler, Savannah and Tybee Island currently participate in the CRS.

The City of Savannah as well as Chatham County and neighboring Bryan, Liberty and McIntosh Counties in the Ogeechee River Basin have joined a new effort of the Federal Emergency Management Agency (FEMA) to create more disaster resistant communities. This new initiative is called "Project Impact." Project Impact works with state and local governments across the country to build communities that are more likely to withstand the ravages of natural disasters. The Savannah area's low elevation makes it vulnerable to tidal flooding and hurricanes. Project Impact's goal is to erase the ceaseless damage-repair-damage cycle by implementing preventive measures before disaster occurs.

3.3 Ground Water Quantity

3.3.1 Ground Water Sources

Generally the Savannah River basin in Georgia is divided into three groundwater regimes. North of the fall line (north of Augusta) is the Piedmont area, a region underlain by igneous and metamorphic crystalline basement rocks. Water is to be found in the overlying weathered zone, in cracks and crevices in the solid rock and in the zones of lithologic contacts. This lack of extensive aquifer greatly limits the amounts of groundwater that can be produced in the Piedmont, so most of the water used is from surface water.

In Richmond, Burke and northern Screven counties, the aquifer of choice is the Cretaceous Sand aquifer. This is a sheet of sand and clay sediments deposited on top of the crystalline basement rock. While the aquifers can deliver a lot of water, high demands in concentrated areas may lead to extensive drawdown, since the aquifer cannot deliver large amounts of water quickly. This is of concern in Augusta, where subdivision growth is putting quite a strain on the resource.

From Screven County south to the coast, the main groundwater source is the Floridan aquifer. This delivers tremendous amounts of water quickly, leading to heavy municipal, industrial and agricultural usage from this source.

3.3.2 Ground Water Supply Demands

Municipal and Industrial Uses

Municipal and Industrial (M&I) water demands include public supplied and private supplied residential, commercial, governmental, institutional, manufacturing and other demands such as distribution system losses.

Existing permitted municipal and industrial groundwater users are shown in the Table 3-6, by county. These permits are for users equal to or greater than 100,000 gallons per day. Users below this amount of groundwater are not required to have a permit for their withdrawals.

Agricultural Water Demand

EPD has issued 201 agricultural permits for surface water withdrawal permits located within the Savannah River basin. The combined permitted capacity pumping capacity of these permits is 220,155 GPM (317 MGD). According to the support information provided with each application, these permits are used to supply water to irrigate some 24, 408 acres of crops, orchards, turf, etc.

Total agricultural water demand for the Savannah River basin is discussed above in Section 3.2.2, and is derived from surface and ground water sources. Agricultural groundwater demand in the Savannah basin is relatively limited. The counties to the north of Richmond are not generally used for farmland. Richmond and Burke counties are now highly developed or becoming more developed and suburban. Screven County and northernmost Effingham County are the only areas where irrigated crops are generally grown. These areas use the Floridan aquifer for their source of groundwater.

3.3.3 Ground Water Supply Permitting

Nonagricultural Permits

The Georgia Ground Water Use Act of 1972 requires permits from EPD for all non-agricultural users of ground water of more than 100,000 GPD. General information required of the applicant includes location (latitude and longitude); past, present, and expected water demand; expected unreasonable adverse effects on other users; the aquifer system from which the water is to be withdrawn; and well construction data. The permits issued by EPD stipulate both the allowable monthly average and annual average withdrawal rates, standard and special conditions under which the permit is valid, and the expiration date of the permit. Ground water use reports are generally required of the applicant on a semi-annual basis. The objective here is the same as with surface water permits. There are no active Georgia municipal and industrial ground water withdrawal permits in the Savannah basin.

Table 3-6 Permits for Groundwater Withdrawals from the Savannah River Basin

County	Permit Number	Permit User Name	Permitted Monthly Avg W/D (MGD)	Permitted Yearly Avg W/D (MGD)	Permitted Aquifer
Burke	017-0001	Sardis, City of	0.200	0.200	Floridan
Burke	017-0002	Waynesboro, City of	4.000	3.500	Cretaceous Sand
Burke	017-0003	Southern Nuclear Operating Co-Plant Vogtle	6.000	5.500	Cretaceous Sand
Chatham	025-0004	National Gypsum - Gold Bond Building Products	0.190	0.185	Floridan
Chatham	025-0005	Pooler, City of	1.136	0.900	Floridan
Chatham	025-0006	Savannah Sugar Refinery	1.080	1.080	Floridan
Chatham	025-0007	Garden City, City of	2.000	1.500	Floridan
Chatham	025-0008	Kemira, Incorporated	4.700	4.400	Floridan
Chatham	025-0009	Union Camp - Savannah Plant	30.100	25.300	Floridan
Chatham	025-0010	Landings Club, Inc - Golf Well #1	0.500	0.225	Floridan
Chatham	025-0011	Southern States Phosphate & Fertilizer	1.512	1.512	Floridan
Chatham	025-0012	Citgo Asphalt Refining Co	0.100	0.100	Floridan
Chatham	025-0013	GAF Corporation	0.450	0.370	Floridan
Chatham	025-0015	Savannah Electric & Power – Riverside	2.600	2.000	Floridan (Non-consumptive)
Chatham	025-0018	Savannah, City of – Main	31.680	25.740	Floridan
Chatham	025-0019	Georgia-Pacific Corp	0.100	0.100	Floridan
Chatham	025-0021	Port Wentworth, City of	1.040	0.690	Floridan
Chatham	025-0022	Thunderbolt, Town of	0.400	0.350	Floridan
Chatham	025-0023	Memorial Medical Center	0.258	0.258	Floridan
Chatham	025-0024	Savannah Electric & Power - Plant Kraft	1.728	1.728	Floridan (some Non-consumptive)
Chatham	025-0025	Hercules, Incorporated	2.500	1.500	Floridan
Chatham	025-0027	Tybee Island, City of	1.600	0.960	Floridan
Chatham	025-0028	Skidaway Island Utilities	4.700	2.610	Floridan
Chatham	025-0030	E.M. Laboratories, Inc	0.400	0.400	Floridan
Chatham	025-0031	Savannah, City of - Travis Field	1.500	1.250	Floridan
Chatham	025-0032	Savannah, City of - Wilmington Island	1.800	1.400	Floridan
Chatham	025-0034	Hunter Army Airfield	1.380	1.030	Floridan
Chatham	025-0035	Bloomingdale,City of	0.156	0.156	Floridan
Chatham	025-0038	Savannah, City of - Gateway Utility	0.613	0.590	Floridan
Chatham	025-0040	Chatham County - Glen of Robin Hood	0.700	0.460	Floridan
Chatham	025-0041	Consolidated Utilities	0.500	0.500	Floridan
Chatham	025-0042	Savannah, City of - Georgetown	1.000	0.870	Floridan
Chatham	025-0044	Landings Club, Inc - Golf Well #2	0.500	0.200	Floridan
Chatham	025-0045	West Chatham County - Hunters Ridge	0.100	0.100	Floridan
Chatham	025-0046	Candler General Hospital	0.100	0.100	Floridan
Chatham	025-0047	Savannah, City of - Whitemarsh Island	0.759	0.656	Floridan
Chatham	025-0048	Chatham County - Sav Port Auth Ind Park	0.173	0.116	Floridan
Chatham	025-0050	Savannah, City of - Dutch Island	0.384	0.282	Floridan
Chatham	025-0051	Savannah, City of - Savannah Quarters	0.646	0.431	Floridan
Chatham	025-0052	Chatham County - Henderson Golf Course	0.116	0.100	Surficial
Chatham	025-0054	Skidaway Institute of Oceanography	0.120	0.120	Floridan

County	Permit Number	Permit User Name	Permitted Monthly Avg W/D (MGD)	Permitted Yearly Avg W/D (MGD)	Permitted Aquifer
Chatham	025-0055	Savannah, City of - Daffin Park	0.864	0.864	Miocene
Columbia	036-0001	Harlem, City of	0.280	0.250	Crystalline Rock
Columbia	036-0002	Grovetown, City of	0.900	0.900	Crystalline Rock
Columbia	036-0003	Columbia County Water Department	0.576	0.576	Crystalline Rock
Columbia	036-0004	Southern Beverage Packers, Inc	0.138	0.138	Crystalline Rock
Effingham	051-0001	Rincon, City of	1.150	0.770	Floridan
Effingham	051-0002	Springfield, City of	0.400	0.375	Floridan
Effingham	051-0004	Savannah Electric & Power - Plant McIntosh	0.550	0.450	Floridan
Effingham	051-0006	Fort James Operating Company	4.000	3.000	Floridan
Effingham	051-0008	Willowpeg Golf Course	0.720	0.720	Floridan
Effingham	051-0009	Springfield, City of - Industrial Park Effingham County	0.400	0.400	Floridan
Effingham	051-0010	Coastal Water & Sewerage Company	0.200	0.200	Floridan
Franklin	059-0001	Franklin Springs, City of	0.125	0.125	Crystalline Rock
Franklin	059-0002	Canon, City of	0.100	0.100	Crystalline Rock
Glascock	062-0001	Thiele Kaolin Co - Reedy Creek Plant	0.100	0.100	Barnwell
Habersham	068-0003	Baldwin, Town of	0.220	0.220	Crystalline Rock
Hart	073-0001	Hartwell Energy Limited Partnership	0.259	0.259	Crystalline Rock
Hart	073-0002	Engelhard Corp – Hartwell	0.400	0.350	Crystalline Rock
Jefferson	081-0001	J.M. Huber Corp - Wrens Plant	1.870	1.690	Dublin - Midville
Jefferson	081-0004	Wrens, City of	0.800	0.650	Cretaceous Sand
Jefferson	081-0006	ECC International - Wrens Plant	0.500	0.300	Cretaceous Sand
Lincoln	090-0002	Lincoln County Water System	0.350	0.300	Crystalline Rock
Lincoln	090-0003	Crider, Inc.	0.280	0.280	Crystalline Rock
Madison	095-0001	Danielsville, City of	0.100	0.100	Crystalline Rock
Madison	095-0002	Comer, City of	0.100	0.100	Crystalline Rock
Madison	095-0003	Trus Joist MacMillan	0.144	0.144	Crystalline Rock
Rabun	119-0002	Sky Valley, City of	0.300	0.300	Crystalline Rock
Richmond	121-0001	Solutia, Inc (ex-Monsanto)	0.422	0.384	Cretaceous Sand
Richmond	121-0002	Amity Dyeing & Finishing Partnershhip	1.350	1.200	Cretaceous Sand
Richmond	121-0003	Hephzibah, City of	0.450	0.400	Cretaceous Sand
Richmond	121-0006	Arcadian Fertilizer, LP	0.580	0.580	Cretaceous Sand
Richmond	121-0007	Augusta-Richmond Utilities Department	18.400	17.400	Cretaceous Sand
Richmond	121-0008	Gracewood State School & Hospital	0.500	0.400	Cretaceous Sand
Richmond	121-0009	Olin Corp	1.224	1.224	Cretaceous Sand
Richmond	121-0010	Thermal Ceramics	0.900	0.900	Cretaceous Sand
Richmond	121-0013	Procter & Gamble Manufacturing Company	0.700	0.700	Cretaceous Sand
Richmond	121-0014	Olin Corp - Corrective Action Wells	0.907	0.907	Cretaceous Sand, KT-3, KT-1
Richmond	121-0015	Alternate Energy Resources, Inc	0.432	0.432	Cretaceous Sand (Upper)
Richmond	121-0016	Southern Wood Piedmont Company	0.790	0.790	Gaillard
Richmond	121-0017	Augusta Recycling Associates, LP	3.312	3.312	Cretaceous Sand, (KT-5)
Screven	124-0002	Sylvania, City of	1.500	1.300	Floridan
Warren	149-0001	J.M. Huber Clay - Warren County Mine	0.864	0.864	Cretaceous Sand

Farm Irrigation Permits

The 1988 Amendments to the Ground Water Use Act establishes the permitting authority within EPD to issue farm irrigation water use permits. As with the previously mentioned ground water permitting statute, the lower threshold is 100,000 GPD; however users of less water may apply and be granted a permit. Agricultural withdrawal permits are too numerous to list in this document.

Applicants for these permits who could establish that their use existed prior to July 1, 1988, *and* when their applications were received prior to July 1, 1991, were "grandfathered" for the operating capacity in place prior to July 1, 1988. Other applications are reviewed and granted with an eye towards protection of grandfathered users and the integrity of the resource. Generally, agricultural users are not required to submit any water use reports.

Excessive Ground Water Withdrawals

Excessive ground water withdrawal can lead to lowering or drawdown of the water table. Localized groundwater drawdowns are generally discovered only after the fact of permitting has occurred and withdrawal operations begun. To avoid such a possibility, if an application for a very large use of groundwater is received, the Water Resources Management Program of the Georgia EPD can take certain steps to possibly contain drawdowns effects. Modeling the hydrogeologic impact of such a large user may be required of the potential permittee. If this computer analysis indicates no unreasonable impact on existing users, such a water use permit may be approved. Another recommended possibility is a negotiated reduction in permit amounts to a more moderate amount of withdrawal, with lessened impacts. Prior to full scale production of a well field, well pumping tests run at or near actual production rates can be required. These may give the permittee and the EPD some real idea of the amount of water that may pumped safely, without endangering other users nor drawing down the aquifer too greatly. Permit withdrawal limits may then be set at some safer yield which is determined by these pumping tests. These tests may also indicate that proposed pumping amounts may require more wells drilled to spread out the ultimate production impact on the aquifer.

In This Section

- Sources and Types of Environmental Stressors
- Summary of Stressors Affecting Water Quality

Section 4

Water Quality: Environmental Stressors

Sections 4, 5, 6, and 7 are closely linked, providing the foundation for the water quality concerns in the basin, identifying the priority issues based on these concerns, and finally, recommending management strategies to address these concerns. Therefore, the reader will probably want to flip back and forth between sections to track specific issues.

This section describes the important environmental stressors that impair or threaten water quality in the Savannah River basin. Section 4.1 first discusses the major sources of environmental stressors. Section 4.2 then provides a summary of individual stressor types as they relate to all sources. These include both traditional chemical stressors, such as metals or oxygen demanding waste, and less traditional stressors, such as modification of the flow regime (hydromodification) and alteration of physical habitat.

4.1 Sources and Types of Environmental Stressors

This section describes the major potential sources of environmental stressors within the Savannah River basin. These sources include point source discharges, nonpoint source contributions from land-use activities, and temperature and flow modifications. The sources are discussed by type, which provides a match to regulatory lines of authority for permitting and management.

4.1.1 Point Sources and Non-discharging Waste Disposal Facilities

Point sources are defined as discharges of treated wastewater to the river and its tributaries, regulated under the National Pollutant Discharge Elimination System (NPDES). These are divided into two main types–permitted wastewater discharges, which tend to be discharged at relatively stable rates, and permitted storm water discharges, which tend to be discharged at highly irregular, intermittent rates, depending on precipitation. Nondischarging waste disposal facilities, including land application systems and landfills, which are not intended to discharge treated effluent to surface waters, are also discussed in this section.

NPDES Permitted Wastewater Discharges

The EPD NPDES permit program regulates municipal and industrial waste discharges, monitors compliance with limitations, and takes appropriate enforcement action for violations. For point source discharges, the permit establishes specific effluent limitations and specifies compliance schedules that must be met by the discharger. Effluent limitations are designed to achieve water quality standards in the receiving water and are reevaluated periodically (at least every 5 years).

Municipal Wastewater Treatment Plant Discharges

Municipal wastewater treatment plants are among the most significant point sources regulated under the NPDES program in the Savannah River basin, accounting for the majority of the total point source effluent flow (exclusive of cooling water). These plants collect, treat, and release large volumes of treated wastewater. Pollutants associated with treated wastewater include pathogens, nutrients, oxygen-demanding waste, metals, and chlorine residuals. Over the past several decades, Georgia has invested more than $136 million in construction and upgrade of municipal water pollution control plants in the Savannah River basin; a summary of these investments is provided in Appendix C. These upgrades have resulted in significant reductions in pollutant loading and consequent improvements in water quality below wastewater treatment plant outfalls. As of the 1998-1999 water quality assessment, 69 miles of river/streams were identified in which municipal discharges contributed to not fully supporting designated uses, all of which are being addressed through the NPDES permitting process.

Table 4-1 lists the major municipal wastewater treatment plants with permitted discharges of 1 million gallons per day (MGD) or greater in the Savannah River basin. The geographic distribution of dischargers is shown in Figure 4-1. In addition, there are discharges from a variety of smaller wastewater treatment plants, including both public facilities (small public water pollution control plants, schools, marinas, etc.) and private facilities (package plants associated with non-sewered developments and mobile home parks) with less than a 1 MGD flow. These minor discharges might have the potential to cause localized stream impacts, but they are relatively insignificant from a basin perspective. A complete list of permitted discharges in the Savannah River Basin is presented in Appendix D.

Most urban wastewater treatment plants also receive industrial process and nonprocess wastewater, which can contain a variety of conventional and toxic pollutants. The control of industrial pollutants in municipal wastewater is addressed through pretreatment programs. The major publicly owned wastewater treatment plants in this basin have developed and implemented approved local industrial pretreatment programs. Through these programs, the wastewater treatment plants are required to establish effluent limitations for their significant industrial dischargers (those which discharge in excess of 25,000 gallons per day of process wastewater or are regulated by a Federal Categorical Standard) and to monitor the industrial user's compliance with those limits. The treatment plants are able to control the discharge of organics and metals into their sewerage system through the controls placed on their industrial users.

Industrial Wastewater Discharges

Industrial and federal wastewater discharges are also significant point sources regulated under the NPDES program. There are a total of 142 permitted municipal, state, federal, private, and industrial wastewater and process water discharges in the Savannah River basin, as summarized in Table 4-2. The complete permit list is summarized in Appendix D.

Table 4-I. Major Municipal Wastewater Treatment Plant Discharges with Permitted Monthly Flow Greater than I MGD in the Savannah River Basin

NPDES Permit No.	Facility Name	County	Receiving Stream	Permitted Monthly Avg. Flow (MGD)
HUC 03060102				
GA0021814	Toccoa Eastanollee Cr WPCP	Stephens	Eastanollee Creek	1.450
HUC 03060103				
GA0020885	Hartwell WPCP	Hart	Cedar Creek	1.250
HUC 03060104				
GA0026247	Commerce Northside WPCP	Jackson	Beaver Dam Creek	1.050
GA0047589	Lavonia WPCP	Franklin	Bear Creek	1.320
HUC 03060105				
GA0020974	Thomson WPCP	Mcduffie	Whites Creek	2.500
GA0031101	Washington WPCP	Wilkes	Rocky Creek	4.000
HUC 03060106				
GA0037621	Augusta Butler Creek WPCP	Richmond	Butler Creek	46.100
GA0031984	Columbia Co Crawford WPCP	Columbia	Crawford Creek	1.500
GA0047775	Columbia Co Little River WPCP	Columbia	Savannah River	1.500
GA0031992	Columbia Co Reed WPCP	Columbia	Reed Creek	4.600
GA0047147	Richmond Co Spirit Cr WPCP	Richmond	Spirit Creek	2.240
HUC 03060108				
GA0020231	Waynesboro WPCP	Burke	Mcintosh Creek	2.000
HUC 03060109				
GA0031038	Garden City WPCP	Chatham	Savannah River	2.000
GA0025348	Savannah President St. WPCP	Chatham	Savannah River	27.000
GA0020427	Savannah Travis Field WPCP	Chatham	Savannah River	1.000
GA0020443	Savannah Wilshire/Windsor WPCP	Chatham	Vernon River	4.500
GA0021385	Sylvania WPCP	Screven	Buck Creek	1.510
GA0020061	Tybee Island WPCP	Chatham	Savannah River	1.000

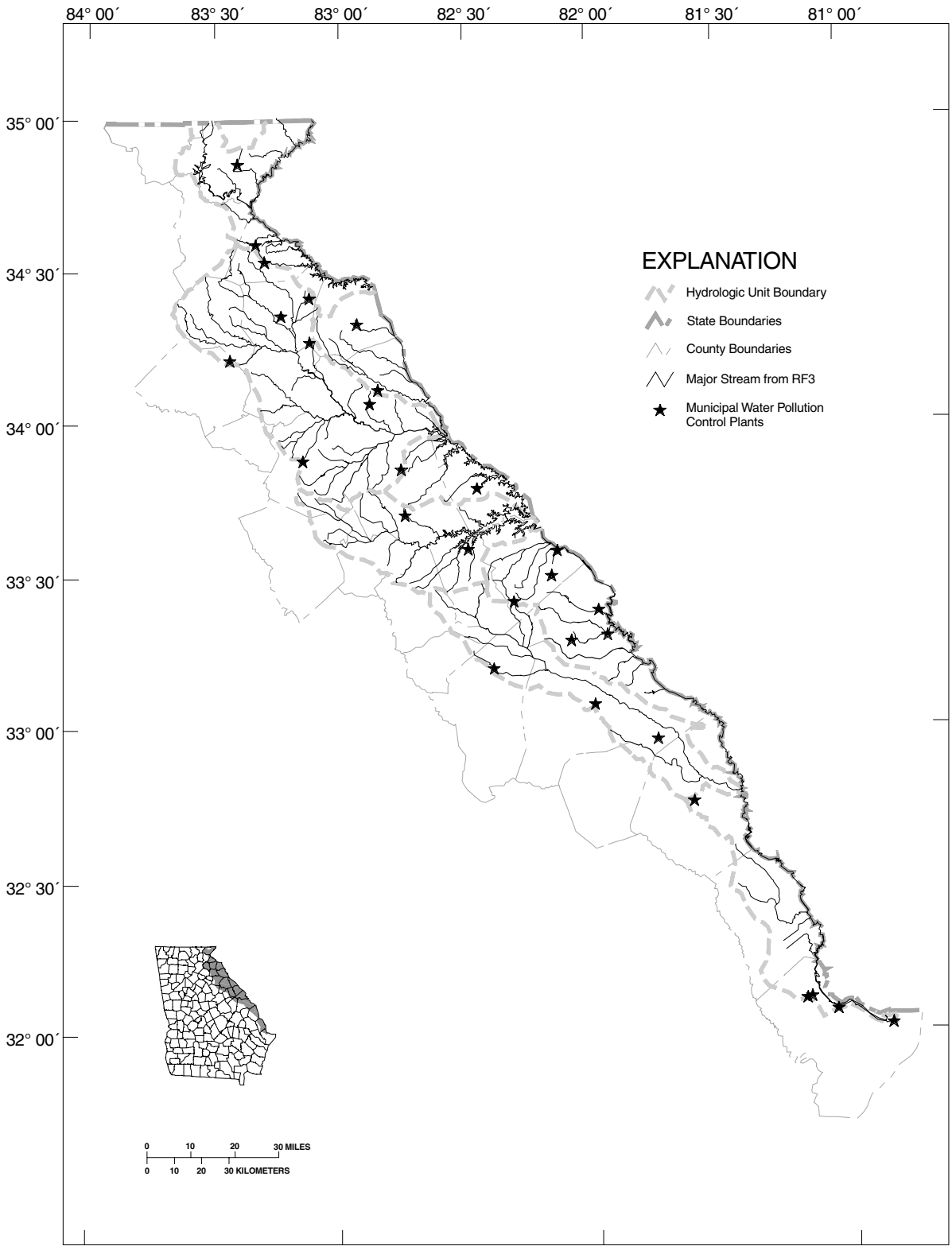

Figure 4-I. Location of Municipal Wastewater Treatment Plants in the Savannah River Basin

Table 4-2. Summary of NPDES Permits in the Savannah River Basin

HUC	Major Municipal Facilities	Major Industrial and Federal Facilities	Minor Public Facilities	Minor Private and Industrial Facilities	Total
03060102	1	1	4	15	21
03060103	1	0	4	7	12
03060104	2	0	13	14	29
03060105	2	0	1	1	4
03060106	5	5	6	12	28
03060108	1	0	2	4	7
03060109	6	7	5	23	41
Total	18	13	35	76	142

The nature of industrial discharges varies widely compared to discharges from municipal plants. Effluent flow is not usually a good measure of the significance of an industrial discharge. Industrial discharges can consist of organic, heavy oxygen-demanding waste loads from facilities such as pulp and paper mills; large quantities of noncontact cooling water from facilities such as power plants; pit pumpout and surface runoff from mining and quarrying operations, where the principal source of pollutants is the land-disturbing activity rather than the addition of any chemicals or organic material; or complex mixtures of organic and inorganic pollutants from chemical manufacturing, textile processing, metal finishing, etc. Pathogens and chlorine residuals are rarely of concern with industrial discharges, but other conventional and toxic pollutants must be addressed on a case-by-case basis through the NPDES permitting process. Georgia's 1998-1999 water quality assessment identified 16 miles of rivers/streams in the basin where permitted industrial discharges contributed to a failure to support designated uses; this is being addressed through the NPDES permitting process. Table 4-3 lists the major industrial and federal wastewater treatment plants with discharges into the Savannah River basin in Georgia.

There are also 58 minor industrial discharges which may have the potential to cause localized stream impacts, but are relatively insignificant from a basin perspective. The locations of permitted point source discharges of treated wastewater in the Savannah River basin are shown in Figures 4-2 through 4-8.

Combined Sewer Overflows

Combined sewers are sewers that carry both storm water runoff and sanitary sewage in the same pipe. Most of these combined sewers were built at the turn of the century and were present in most large cities. At that time both sewage and storm water runoff were piped from the buildings and streets to the small streams that originated in the heart of the city. When these streams were enclosed in pipes, they became today's combined sewer systems. As the cities grew, their combined sewer systems expanded. Often new combined sewers were laid to move the untreated wastewater discharge to the outskirts of the town or to the nearest waterbody.

In later years wastewater treatment facilities were built and smaller sanitary sewers were constructed to carry the sewage (dry weather flows) from the termination of the combined sewers to these facilities for treatment. However, during wet weather, when significant storm water is carried in the combined system, the sanitary sewer capacity is exceeded and a combined sewer overflow (CSO) occurs. The surface discharge is a

Table 4-3. Major Industrial and Federal Wastewater Treatment Facilities in the Savannah River Basin

NPDES Permit No.	Facility Name	County	Description	Flow (MGD)	Receiving Stream
HUC 03060102					
GA0002038	Coats American Inc	Stephens	Textile	2.0	Eastanollee Creek
HUC 03060106					
GA0002071	Arcadian Fertilizer L.p.	Richmond	Fertilizer	1.8	Savannah River
GA0002160	Dsm Chemicals Augusta Inc	Richmond	Chemical-nylon	2.2	Savannah River
GA0026786	Georgia Power Vogtle	Burke	Nuclear Power	7.2	Savannah River
GA0002801	International Paper Company	Richmond	Pulp and Paper	49.0	Savannah River
GA0003484	USA Ft Gordon	Richmond	Sewage	2.1	Butler Cr-Spirit Cr
HUC 03060109					
GA0046973	Fort James Operating Company	Effingham	Pulp and Paper	13.9	Savannah River
GA0003646	Kemira	Chatham	Inorganic Chemicals	24.5	Savannah River
GA0002356	Pcs Nitrogen Fertilizer LP	Chatham	Nitrogen Fertilizers	0.2	Savannah River
GA0003883	Savannah Elec Effingham	Effingham	Steam Electric	108.0	Savannah River
GA0002798	Stone Container Corp	Chatham	Pulp and Paper	38.0	Savannah River
GA0001988	Union Camp Corporation	Chatham	Pulp and Paper	42.3	Savannah River
GA0027588	USA Hunter Afb Stp	Chatham	Sewage	1.25	Forrest River

mixture of storm water and sanitary waste. Uncontrolled CSOs thus discharge raw diluted sewage and can introduce elevated concentrations of bacteria, BOD, and solids into a receiving water body. In some cases, CSOs discharge into relatively small creeks.

CSOs are considered a point source of pollution and are subject to the requirements of the Clean Water Act. Although CSOs are not required to meet secondary treatment effluent limits, sufficient controls are required to protect water quality standards for the designated use of the receiving stream. In its 1990 session, the Georgia Legislature passed a CSO law requiring all Georgia cities to eliminate or treat CSOs.

There are no known combined sewer overflows in the Savannah River Basin. Combined sewer overflows in Augusta were eliminated prior to December 1996 by Augusta-Richmond Utilities Department sewer separation projects.

NPDES Permitted Storm Water Discharges

Urban storm water runoff in the Savannah basin has been identified as a major source of stressors from pollutants such as oxygen-demanding waste (BOD) and fecal coliform bacteria. Storm water may flow directly to streams as a diffuse, nonpoint process, or may be collected and discharged through a storm sewer system. Storm sewers are now subject to NPDES permitting and are discussed in this section. Contributions from nonpoint storm water is discussed in later sections.

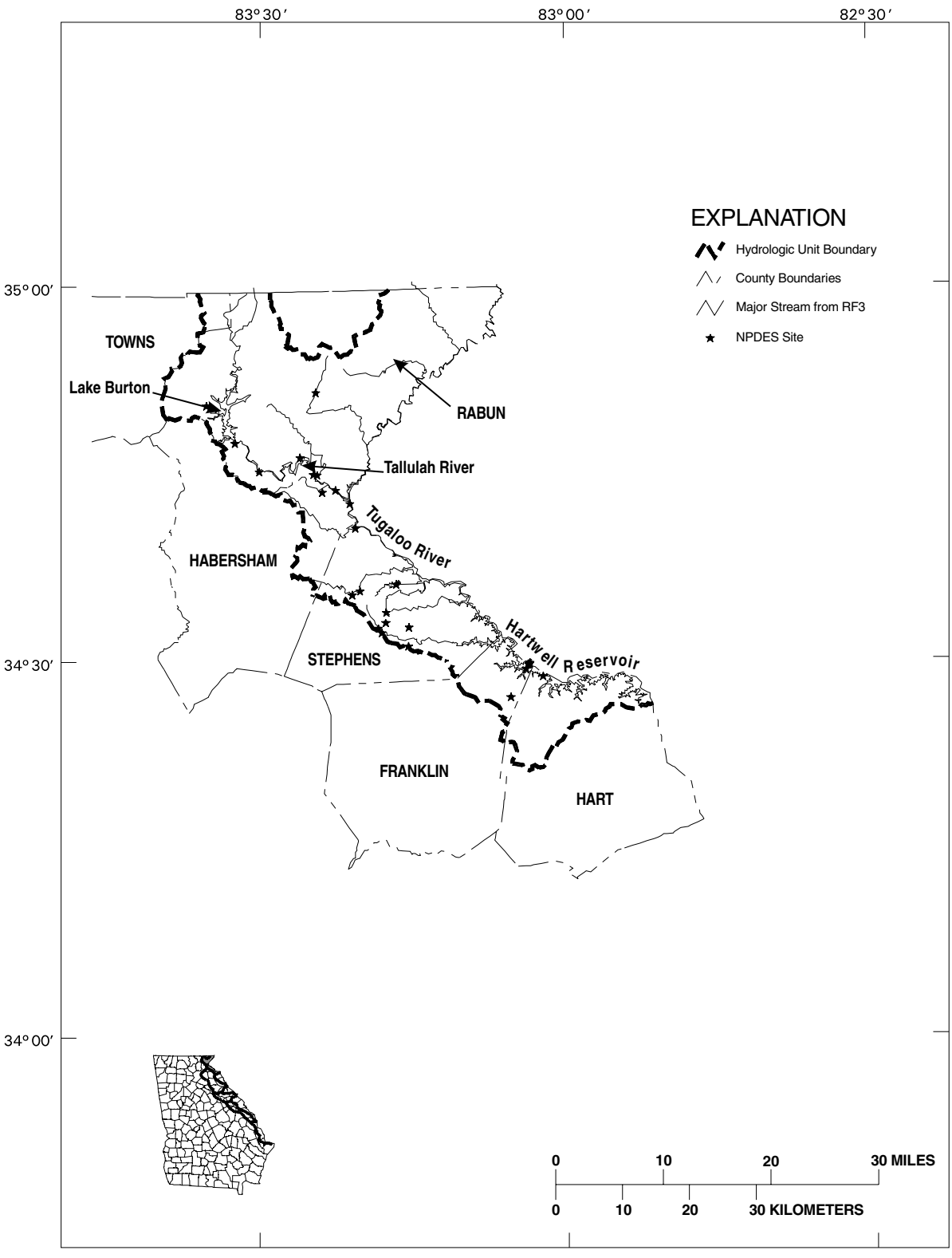

Figure 4-2. NPDES Sites Permitted by GAEPD, Savannah River Basin, HUC 03060102

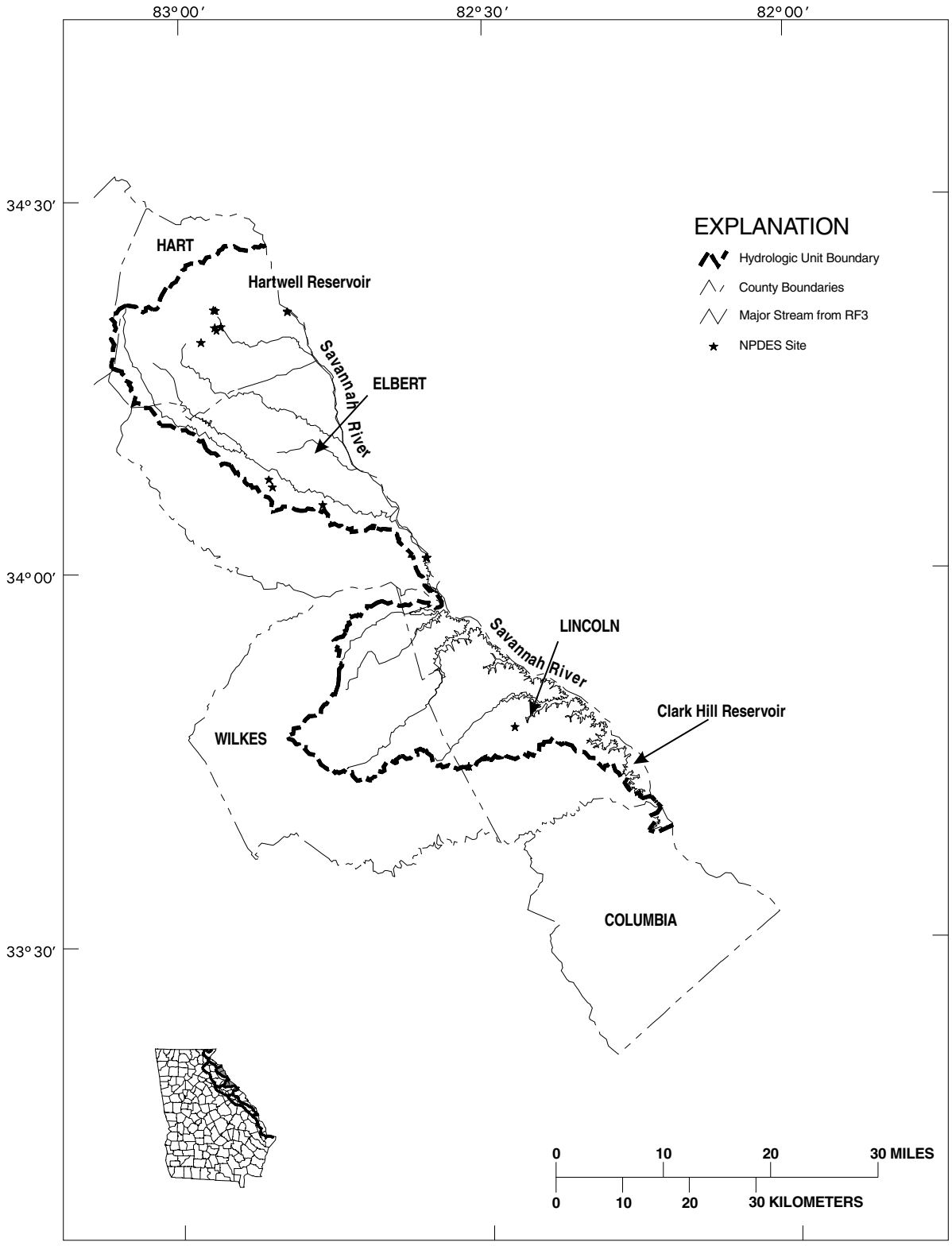

Figure 4-3. NPDES Sites Permitted by GAEPD, Savannah River Basin, HUC 03060103

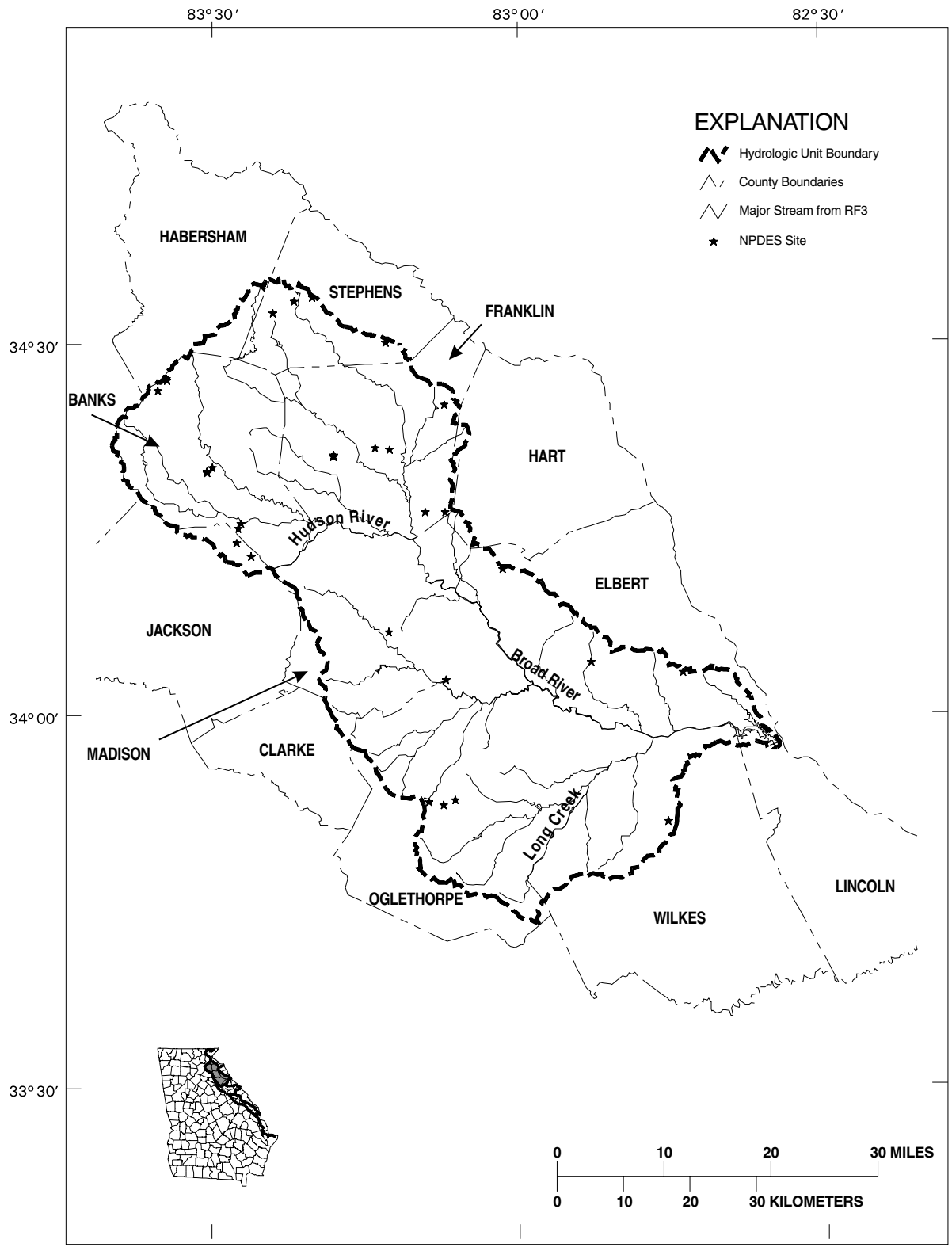

Figure 4-4. NPDES Sites Permitted by GAEPD, Savannah River Basin, HUC 03060104

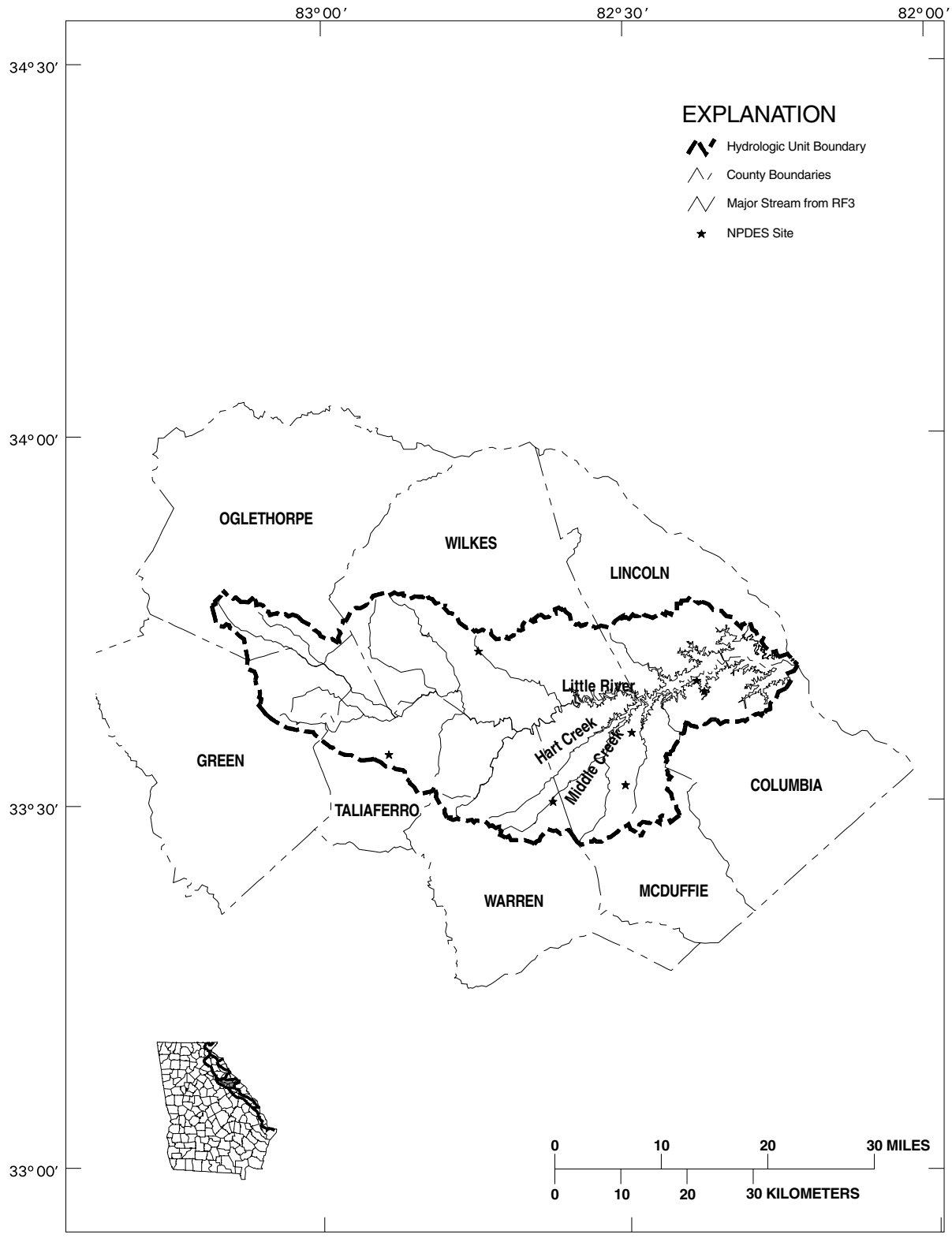

Figure 4-5. NPDES Sites Permitted by GAEPD, Savannah River Basin, HUC 03060105

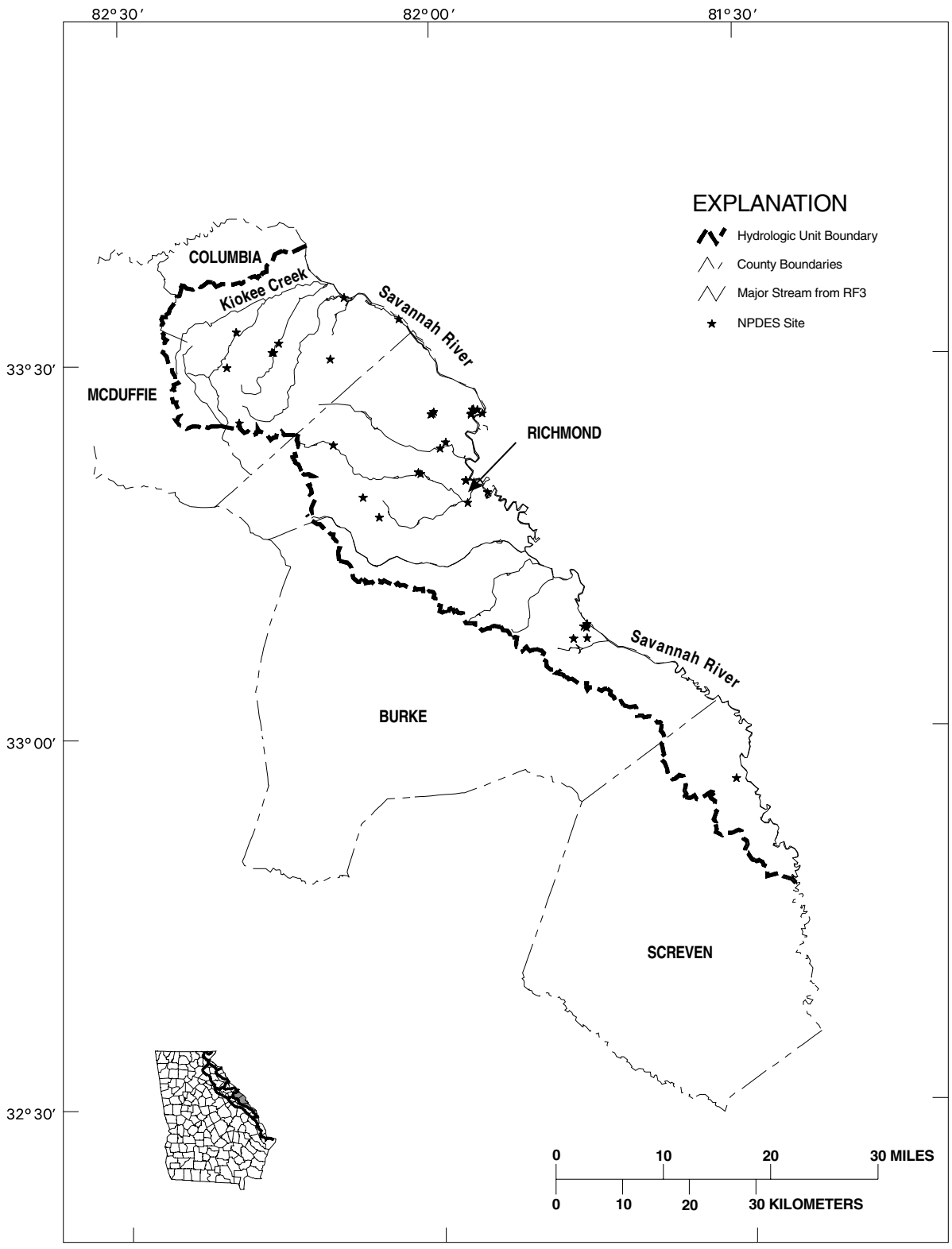

Figure 4-6. NPDES Sites Permitted by GAEPD, Savannah River Basin, HUC 03060106

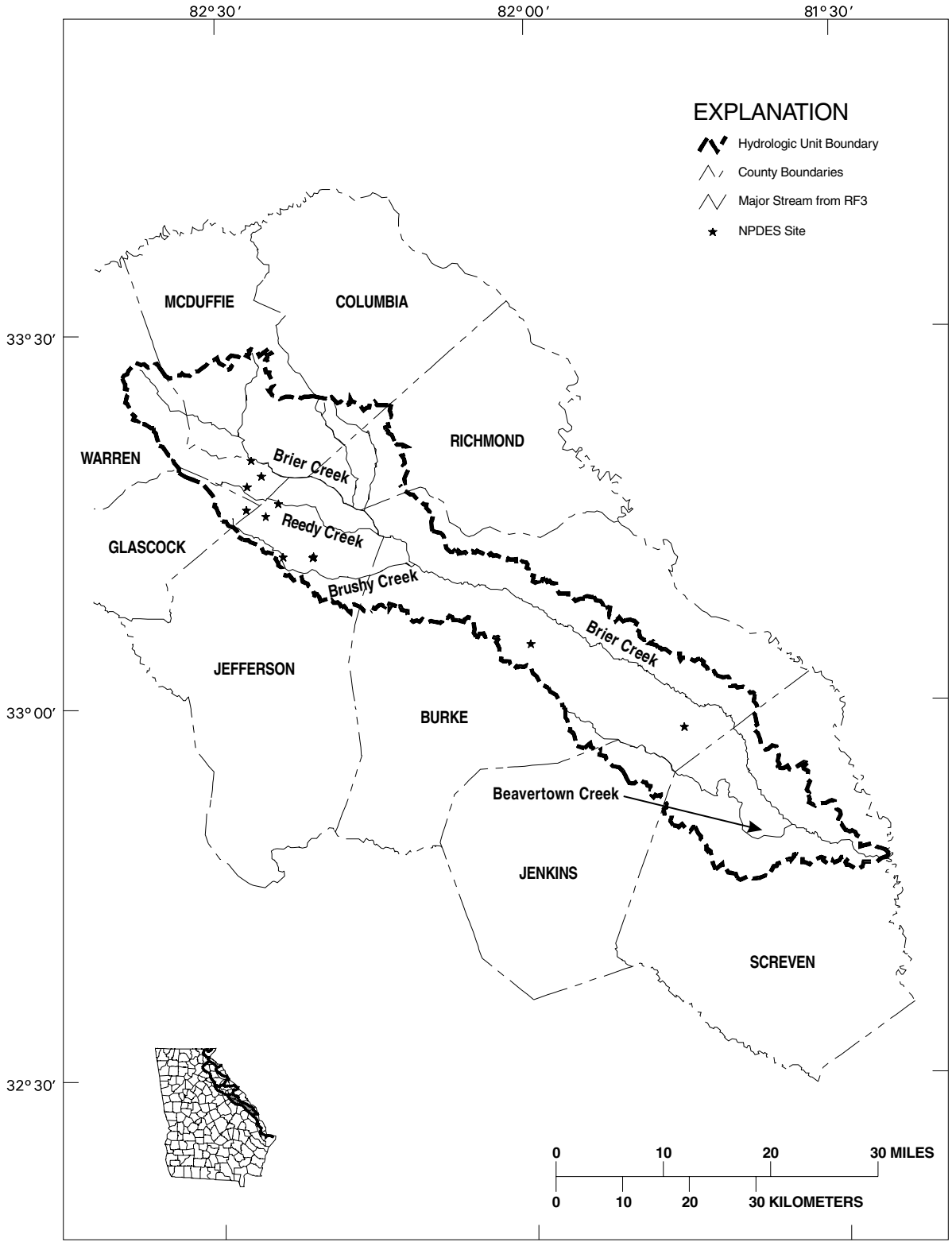

Figure 4-7. NPDES Sites Permitted by GAEPD, Savannah River Basin, HUC 03060108

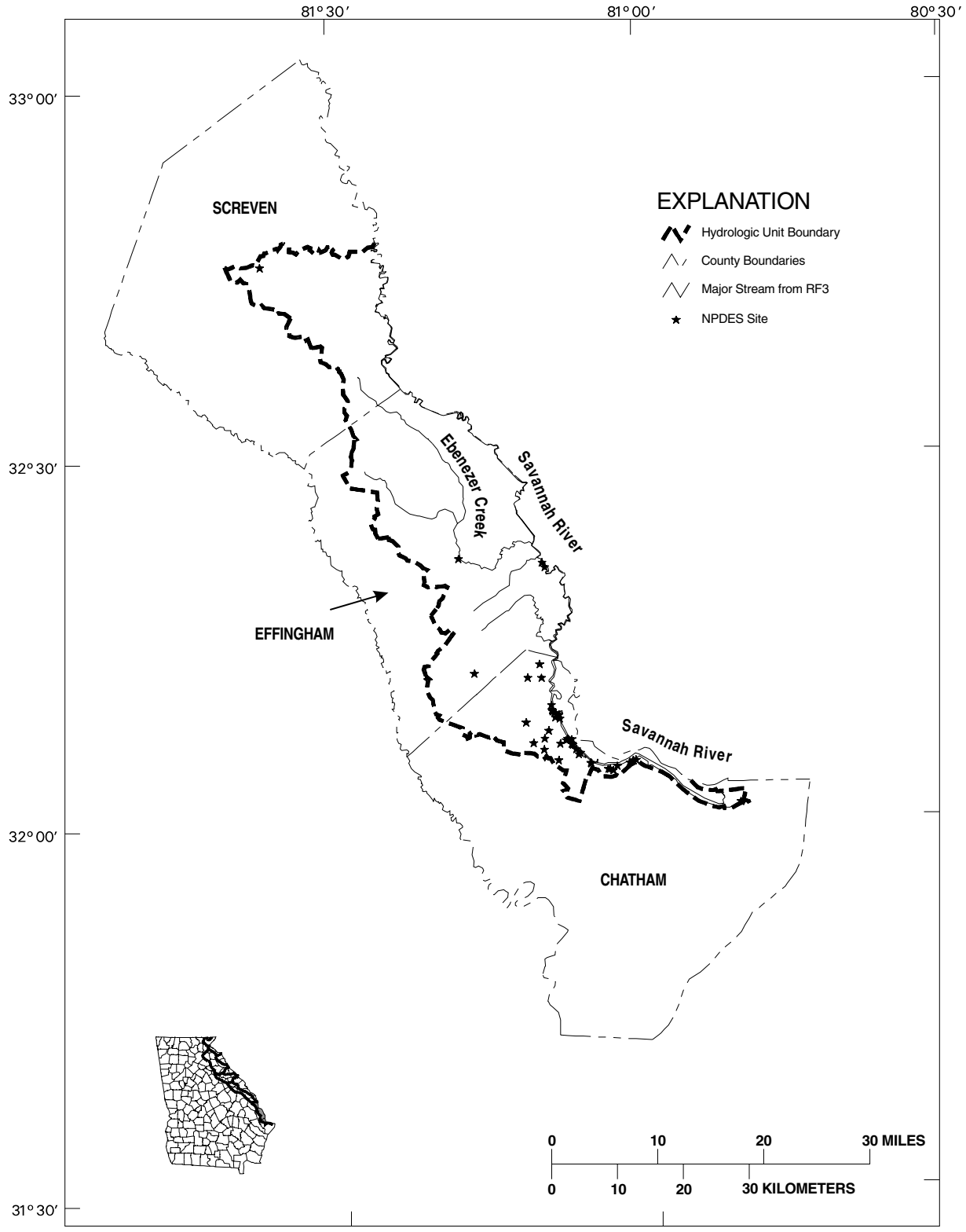

Figure 4-8. NPDES Sites Permitted by GAEPD, Savannah River Basin, HUC 03060109

Pollutants typically found in urban storm water runoff include pathogens (such as bacteria and viruses from human and animal waste), heavy metals, debris, oil and grease, petroleum hydrocarbons and a variety of compounds toxic to aquatic life. In addition, the runoff often contains sediment, excess organic material, fertilizers (particularly nitrogen and phosphorus compounds), herbicides, and pesticides which can upset the natural balance of aquatic life in lakes and streams. Storm water runoff may also increase the temperature of a receiving stream during warm weather, which potentially threatens valuable trout fisheries in the Savannah River basin. All of these pollutants, and many others, influence the quality of storm water runoff. There are also many potential problems related to the quantity of urban runoff, which can contribute to flooding and erosion in the immediate drainage area and downstream.

Municipal Storm Water Discharges

In accordance with Federal "Phase I" storm water regulations, the state of Georgia has issued individual areawide NPDES municipal separate storm sewer system (MS4) permits to 58 cities and counties in municipal areas with populations greater than 100,000 persons. In the Savannah River Basin storm water permits were issued to Augusta and Savannah and the counties surrounding these cities.

Industrial Storm Water Discharges

Industrial sites often have their own storm water conveyance systems. The volume and quality of storm water discharges associated with industrial activity is dependent on a number of factors, such as the industrial activities occurring at the facility, the nature of the precipitation, and the degree of surface imperviousness (hard surfaces). These discharges are of intermittent duration with short-term pollutant loadings that can be high enough to have shock loading effects on the receiving waters. The types of pollutants from industrial facilities are generally similar to those found in storm water discharges from commercial and residential sites; however, industrial facilities have a significant potential for discharging at higher pollutant concentrations, and may include specific types of pollutants associated with a given industrial activity.

EPD has issued has issued NPDES General Permit No. GAR000000 regulating storm water discharges for 10 of 11 federally regulated industrial subcategories. The general permit for industrial activities requires the submission of a Notice of Intent (NOI) for coverage under the general permit; the preparation and implementation of storm water pollution prevention plan; and, in some cases, analytical testing of storm water discharges from the facility. As with the municipal storm water permits, implementation of site-specific best management practices is the preferred method for controlling storm water runoff. As of August 2000, approximately 391 NOIs had been filed for the Savannah River basin. The approximate distribution of NOIs by HUC is as follows:

HUC 03060108 (Brier River Basin)	31
HUC 03060104 (Broad River Basin)	41
HUC 03060105 (Little River Basin)	15
HUC 03060109 (Lower Savannah River Basin)	108
HUC 03060106 (Middle Savannah River Basin)	150
HUC 03060102 (Tugaloo River Basin)	21
HUC 03060103 (Upper Savannah River Basin)	25

The 11th federally regulated industrial subcategory (construction activities) is covered under NPDES General Permit No. GAR100000. This general permit regulates storm water discharges associated with construction activity at sites and common developments

disturbing more than five acres. The general permit requires the submission of a Notice of Intent (NOI) to obtain coverage under the permit, the preparation and implementation of an Erosion, Sedimentation, and Pollution Control Plan, and the preparation and implementation of a Comprehensive Monitoring Program which provides for monitoring of turbidity levels in the receiving stream(s) and/or storm water outfalls(s) during certain rain events. The general permit became effective on August 1, 2000 and will expire on July 31, 2003.

Nondischarging Waste Disposal Facilities

Land Application Systems (LASs)

In addition to permits for point source discharges, EPD has developed and implemented a permit system for land application systems (LASs). LASs for final disposal of treated wastewaters have been encouraged in Georgia and are designed to eliminate surface discharges of effluent to waterbodies. LASs are used as an alternative to advanced levels of treatment or as the only alternative in some environmentally sensitive areas.

When properly operated, a LAS should not be a source of stressors to surface waters. The locations of LASs are, however, worth noting because of the (small) possibility that a LAS could malfunction and become a source of stressor loading.

A total of 128 municipal and 35 industrial permits for land application systems were in effect in Georgia in 1998. Municipal and other wastewater land application systems within the Savannah Basin are listed in Table 4-4. The locations of all LASs within the basin are shown in Figures 4-9 through 4-15.

Table 4-4. Wastewater Land Application Systems in the Savannah River Basin

Facility Name	County	Permit No.	Permitted Flow (MGD)
Atlanta International Drag	Banks	GA02-023	0.070
Banks Co Industrial	Banks	GA02-181	0.045
Banks Co Synthetic Ind	Banks	GA02-210	0.011
Coastal Water & Sewer Co	Effingham	GA02-234	
Columbia Co Detention Center	Columbia	GA02-002	0.010
Crider Poultry Lincoln	Lincoln	GA01-570	0.110
Dearing Las	McDuffie	GA02-007	0.090
Fieldale Corp	Stephens	GA01-369	
Franklin Co Board of Com	Franklin	GA02-065	0.075
Grovetown Las	Columbia	GA02-222	0.580
Hartwell Las	Hart	GA02-114	
Hiltonia Las	Screven	GA02-033	0.044
Kings Point Condominiums	Rabun	GA03-687	0.015
Milliken & Company Las	Franklin	GA01-308	0.005
Mount Vernon Mills Las	Banks	GA01-528	
Norwood Las	Warren	GA02-258	0.050
Savannah Reuse Las	Chatham	GA02-198	2.000
Thomson Las	McDuffie	GA02-252	0.050
Twin Line Dairies Inc	Elbert	GA01-436	0.010

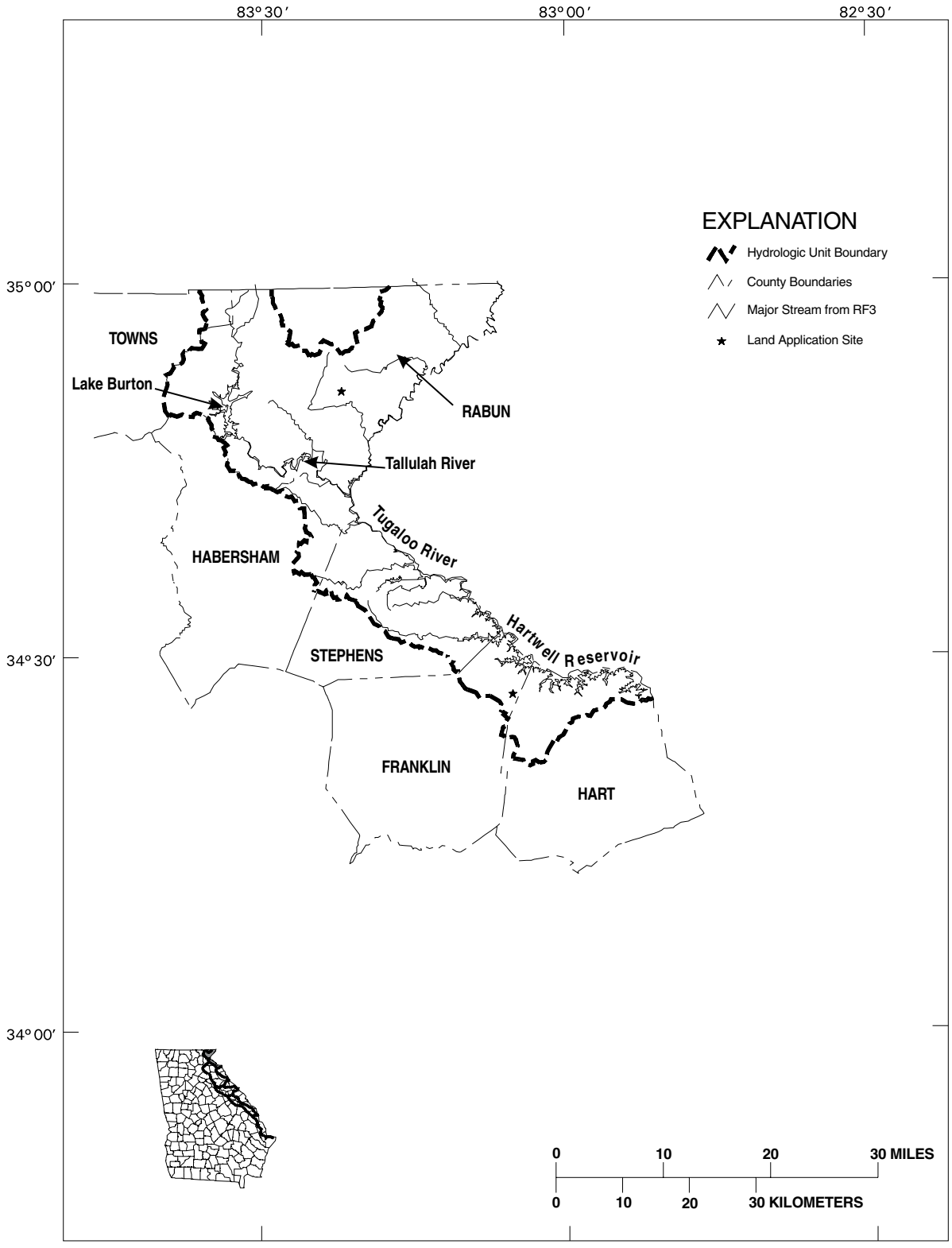

Figure 4-9. Land Application Systems, Savannah River Basin, HUC 03060102

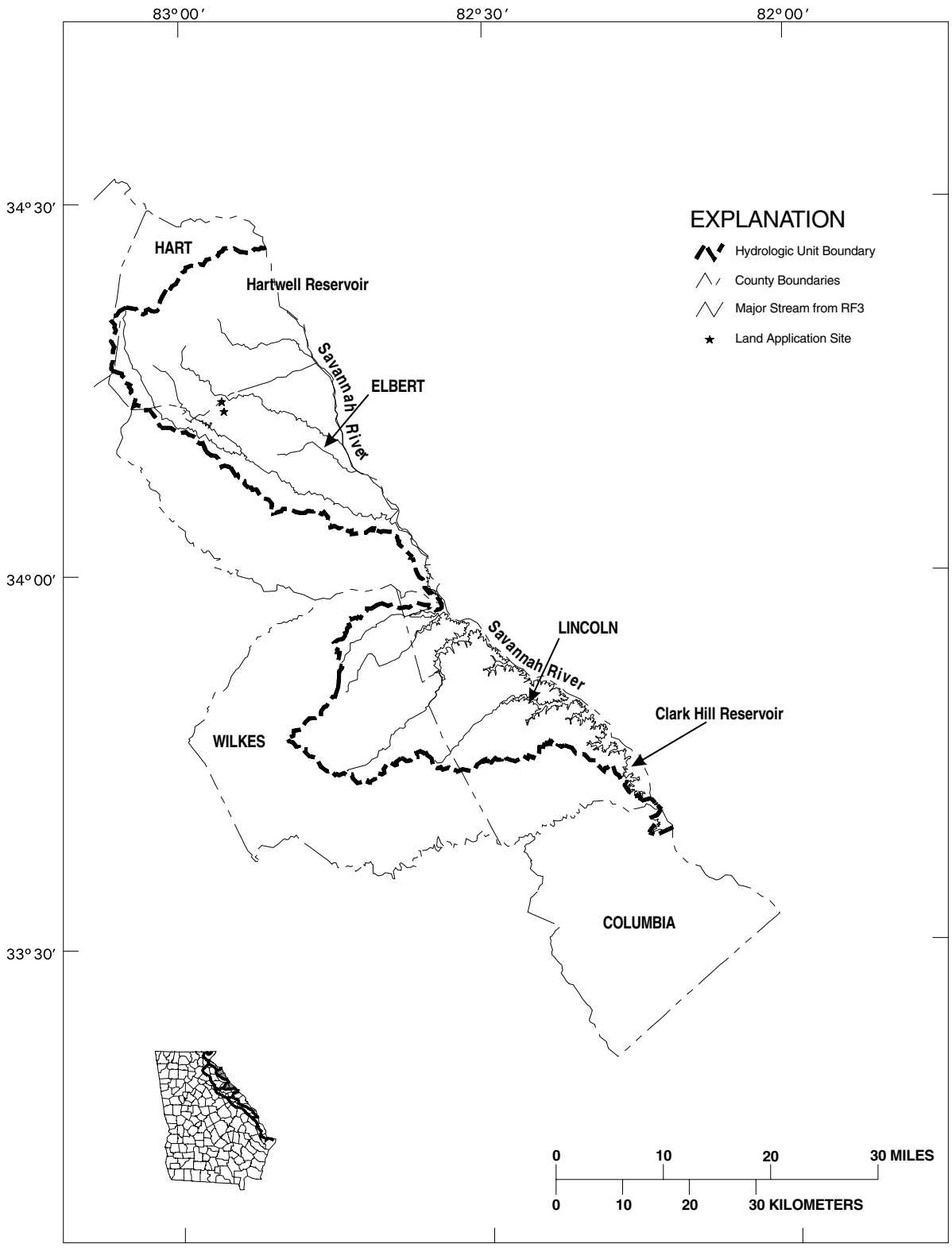

Figure 4-10. Land Application Systems, Savannah River Basin, HUC 03060103

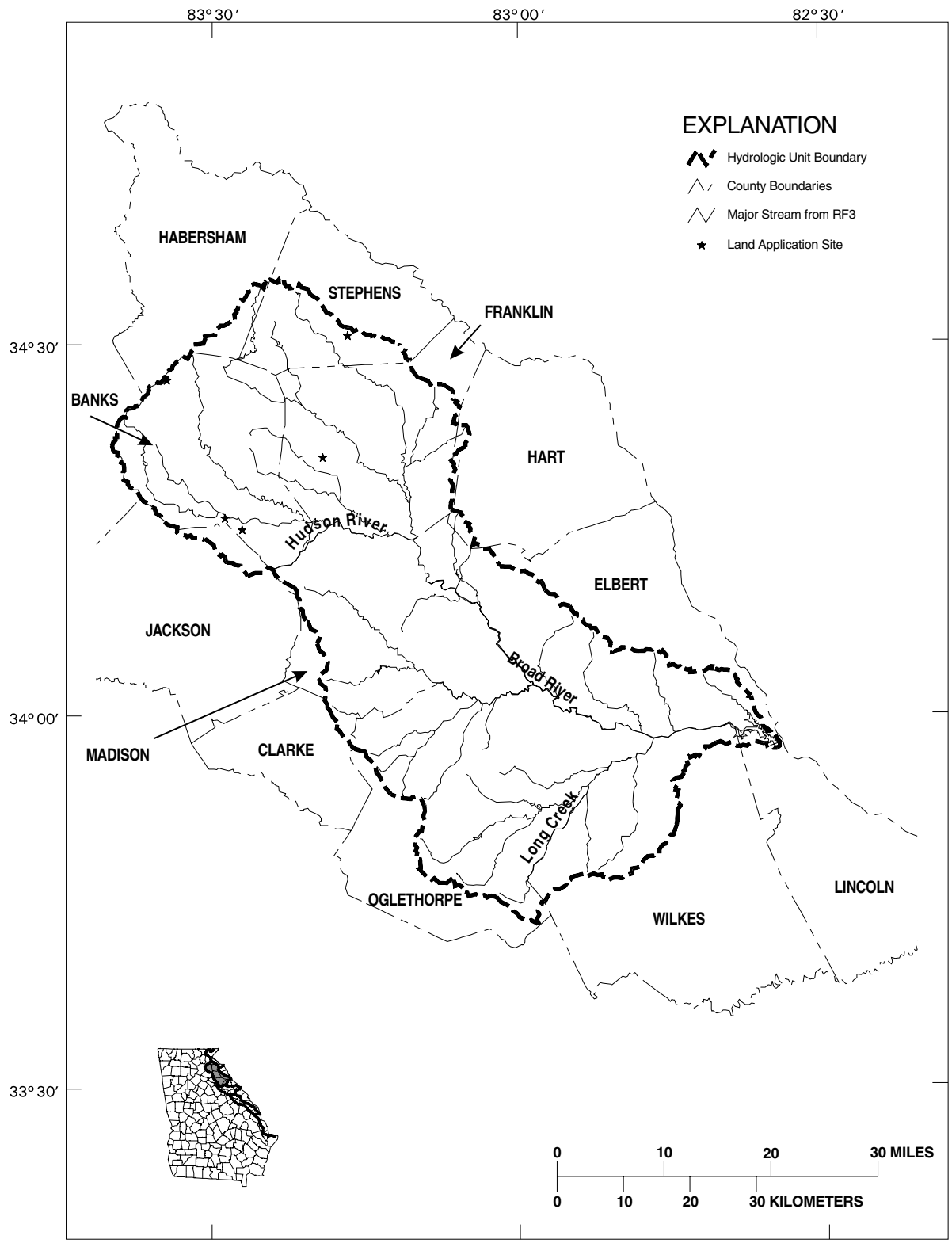

Figure 4-II. Land Application Systems, Savannah River Basin, HUC 03060104

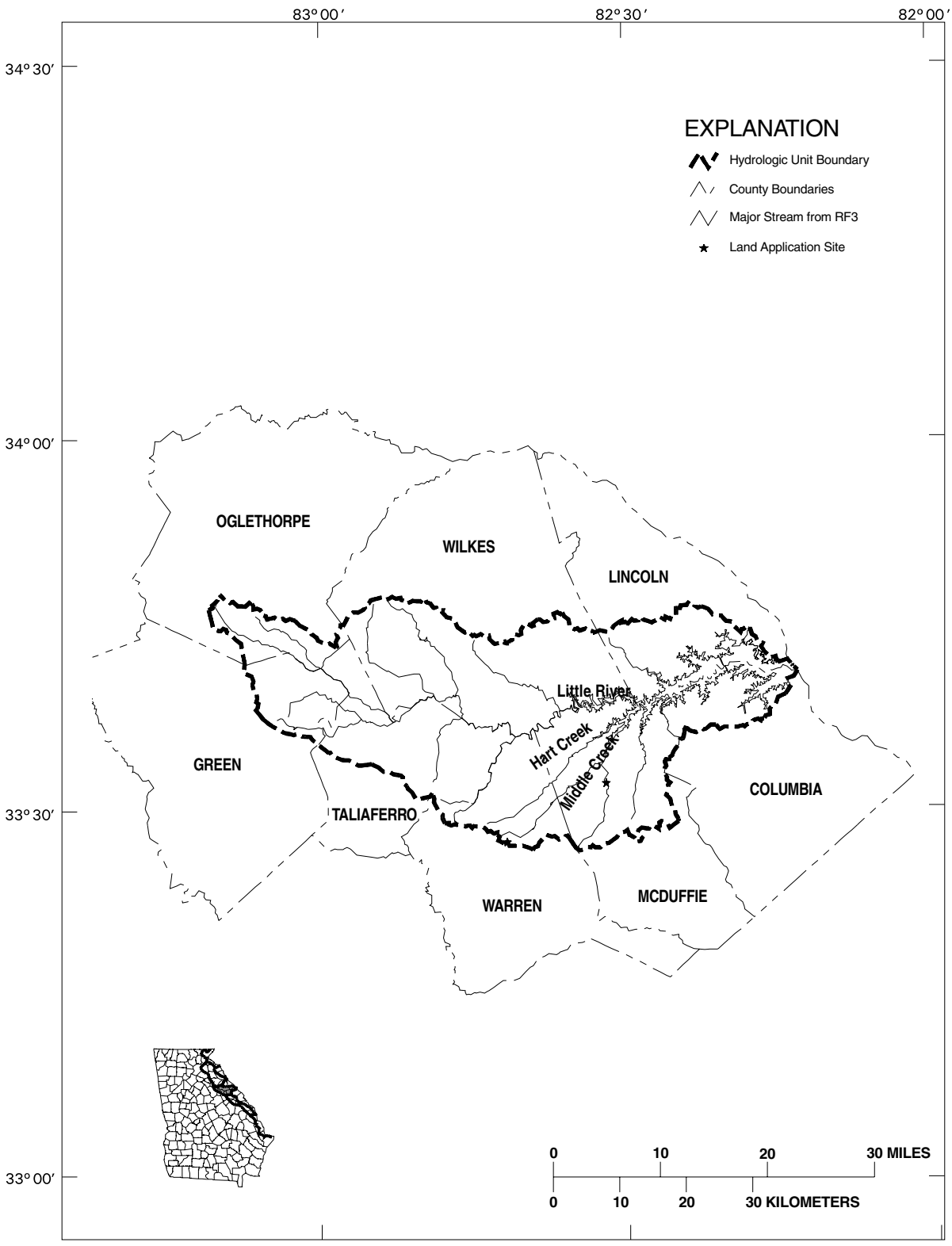

Figure 4-12. Land Application Systems, Savannah River Basin, HUC 03060105

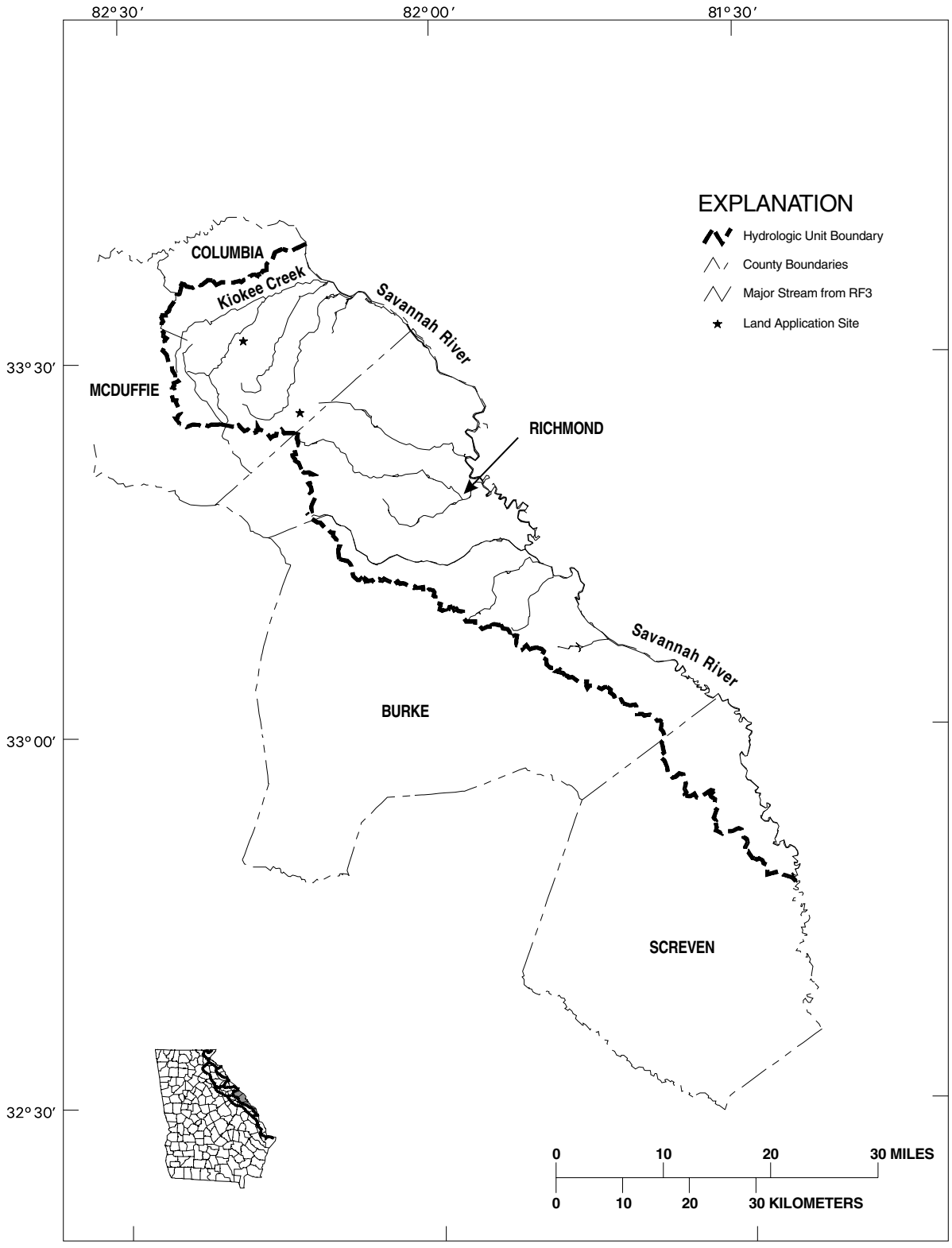

Figure 4-I3. Land Application Systems, Savannah River Basin, HUC 03060106

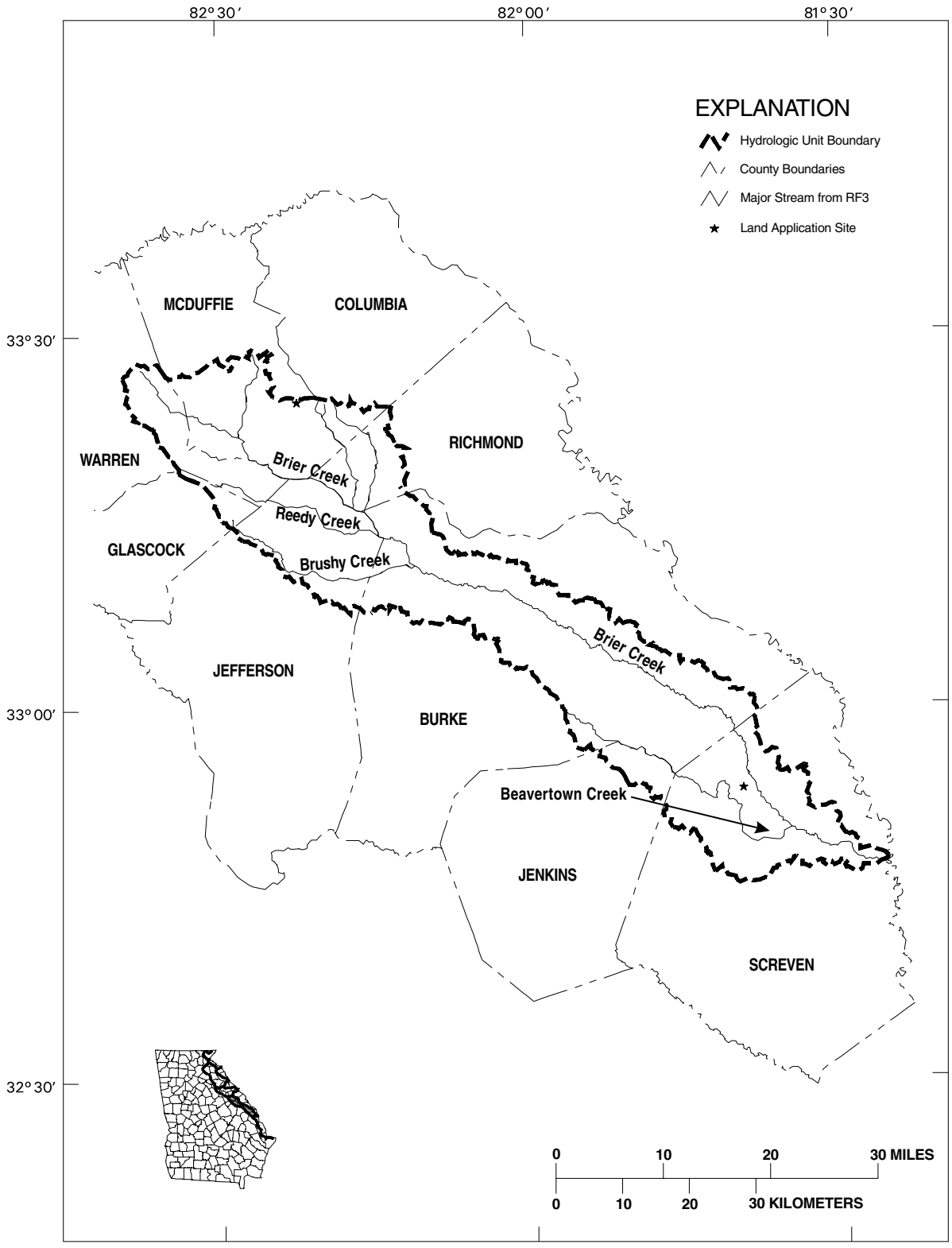

Figure 4-14. Land Application Systems, Savannah River Basin, HUC 03060108

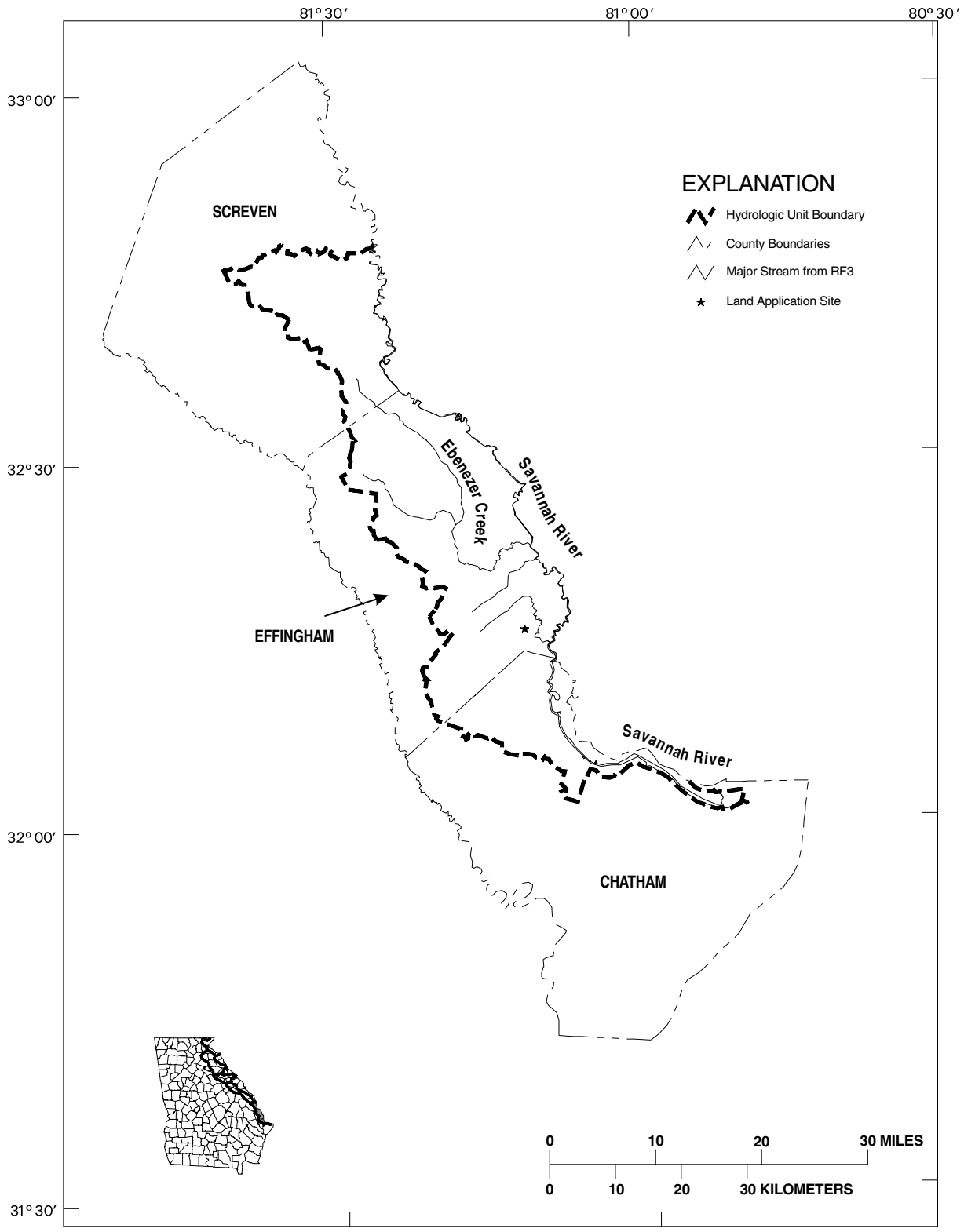

Figure 4-I5. Land Application Systems, Savannah River Basin, HUC 03060109

Landfills

Permitted landfills are required to contain and treat any leachate or contaminated runoff prior to discharge to any surface water. The permitting process encourages either direct connection to a publicly owned treatment works (although vehicular transportation is allowed in certain cases) or treatment and recirculation on site to achieve a no-discharge system. Direct discharge in compliance with NPDES requirements is allowed but is not currently practiced any landfills in Georgia. Groundwater contaminated by landfill leachate from older, unlined landfills represents a potential threat to waters of the state. Ground water and surface water monitoring and corrective action requirements are in place for all landfills operated after 1988 to identify and rededicate potential threats. The provisions of the Hazardous Sites Response Act address threats posed by older landfills as releases of hazardous constituents are identified. All new municipal solid waste landfills are required to be lined and to have a leachate collection system installed.

EPD's Land Protection Branch is responsible for permitting and compliance of municipal and industrial Subtitle D landfills. The location of permitted landfills within the basin is shown in Figure 4-16 through 4-22 and Table 4-5.

4.1.2 Nonpoint Sources

The pollution impact on Georgia's streams has radically shifted over the last two decades. Steams are no longer dominated by untreated or partially treated sewage discharges, which had resulted in little or no oxygen and little or no aquatic life. The sewage is now treated, oxygen levels have recovered, and healthy fisheries have followed. Industrial discharges have also been placed under strict regulation. However, other sources of pollution are still affecting Georgia's streams. These sources are referred to as *nonpoint sources*. Nonpoint sources are diffuse in nature. Nonpoint source pollution can generally be defined as the pollution caused by rainfall or snowmelt moving over and through the ground. As water moves over and through the soil, it picks up and carries away natural pollutants and pollutants resulting from human activities, finally depositing them in lakes, rivers, wetlands, coastal waters, or ground water. Habitat alteration (e.g., removal of riparian vegetation) and hydrological modification (e.g., channelization, bridge construction) can also cause adverse effects on the biological integrity of surface waters and are also treated as nonpoint sources of pollution.

Nonpoint pollutant loading comprises a wide variety of sources not subject to point source control through NPDES permits. The most significant nonpoint sources are those associated with precipitation, washoff, and erosion, which can move pollutants from the land surface to water bodies. A review of the 1998-1999 water quality assessment results for the Savannah basin indicates that urban runoff and rural nonpoint sources contribute significantly to lack of full support for designated uses. The major categories of stressors for nonpoint sources are discussed below.

Nonpoint Sources from Agriculture

Agricultural operations can contribute stressors to water bodies in a variety of ways. Tillage and other soil-disturbing activities can promote erosion and loading of sediment to water bodies unless controlled by management practices. Nutrients contained in fertilizers, animal wastes, or natural soils may be transported from agricultural land to streams in either sediment-attached or dissolved forms. Loading of pesticides and pathogens is also of concern for various agricultural operations.

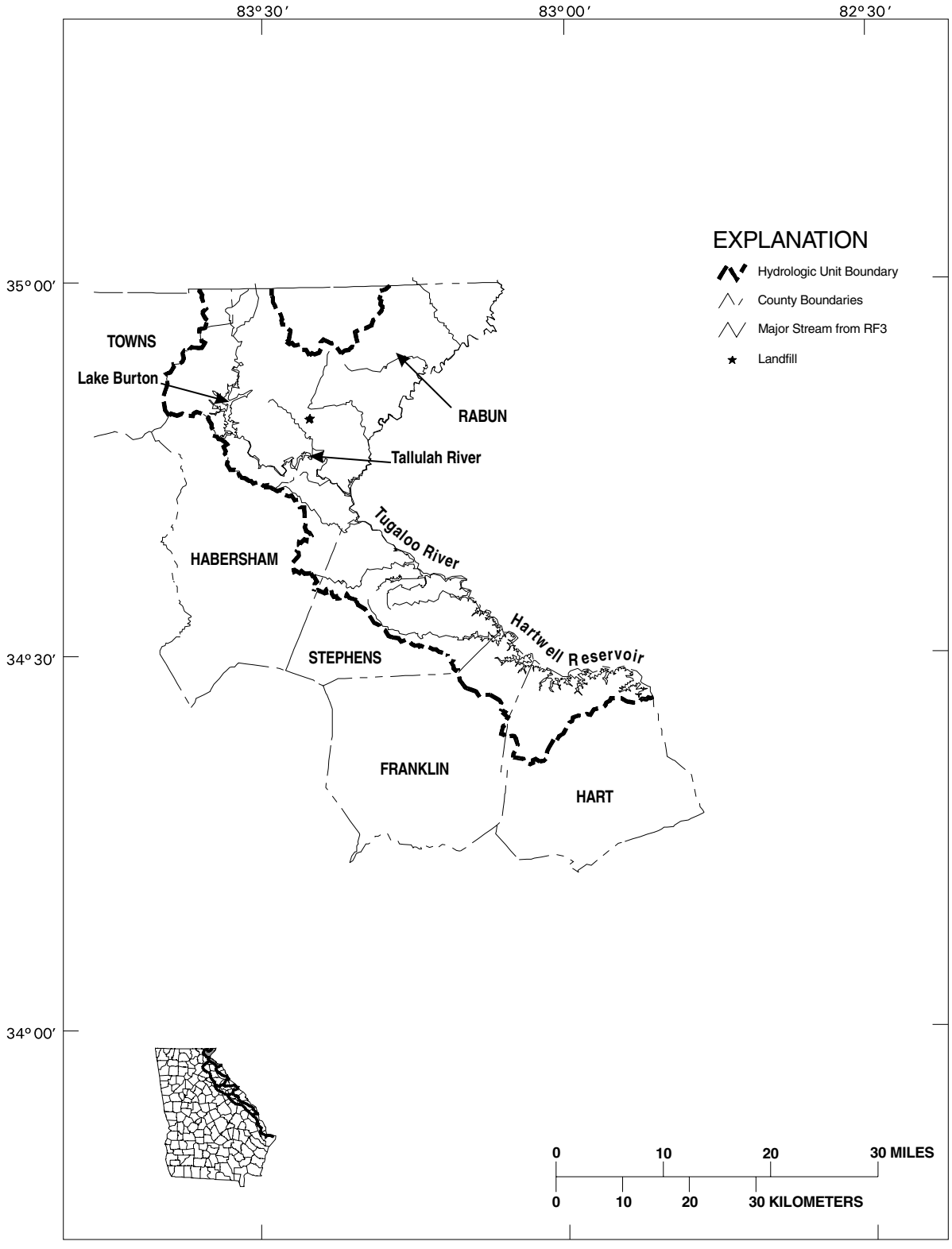

Figure 4-16. Landfills, Savannah River Basin, HUC 03060102

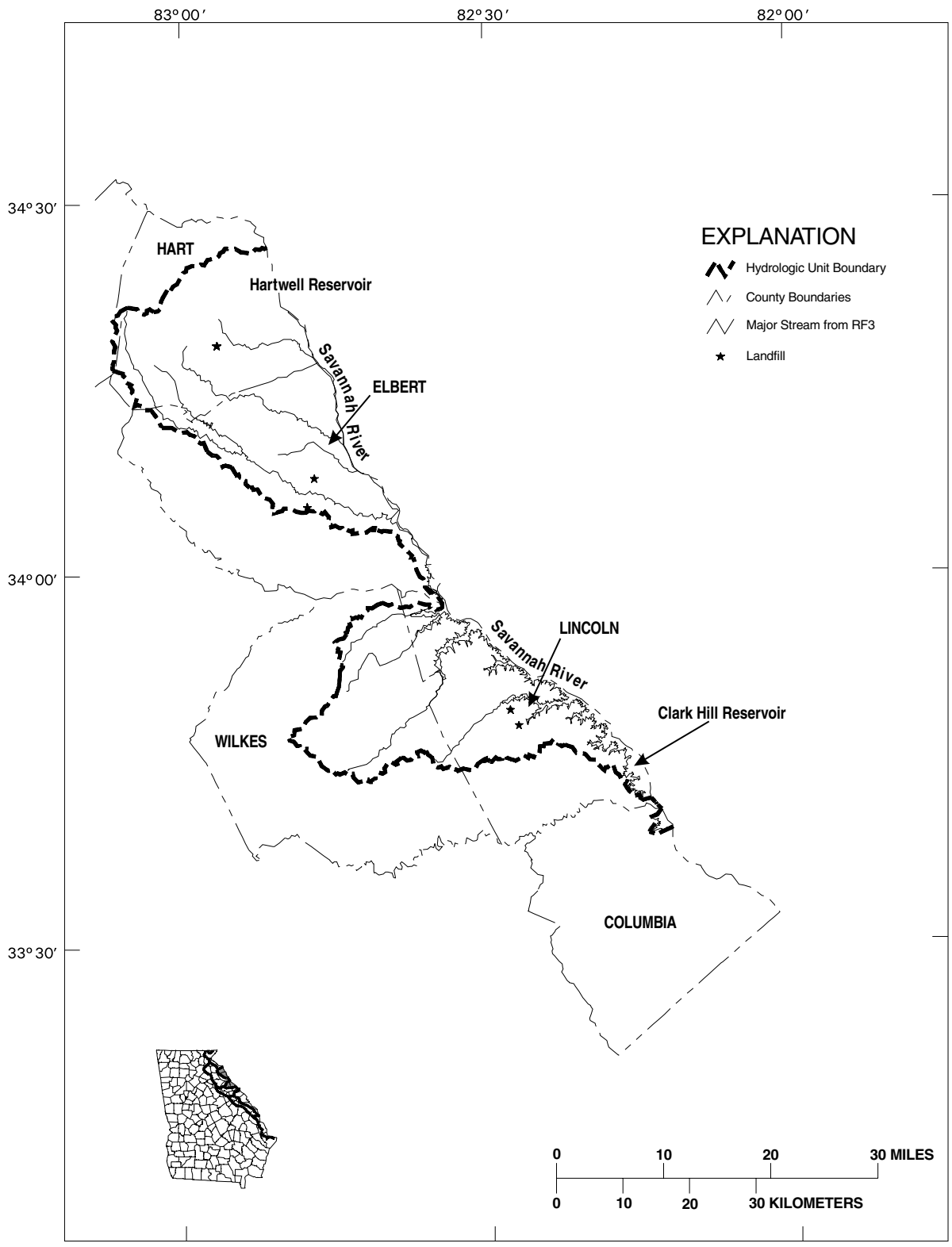

Figure 4-I7. Landfills, Savannah River Basin, HUC 03060103

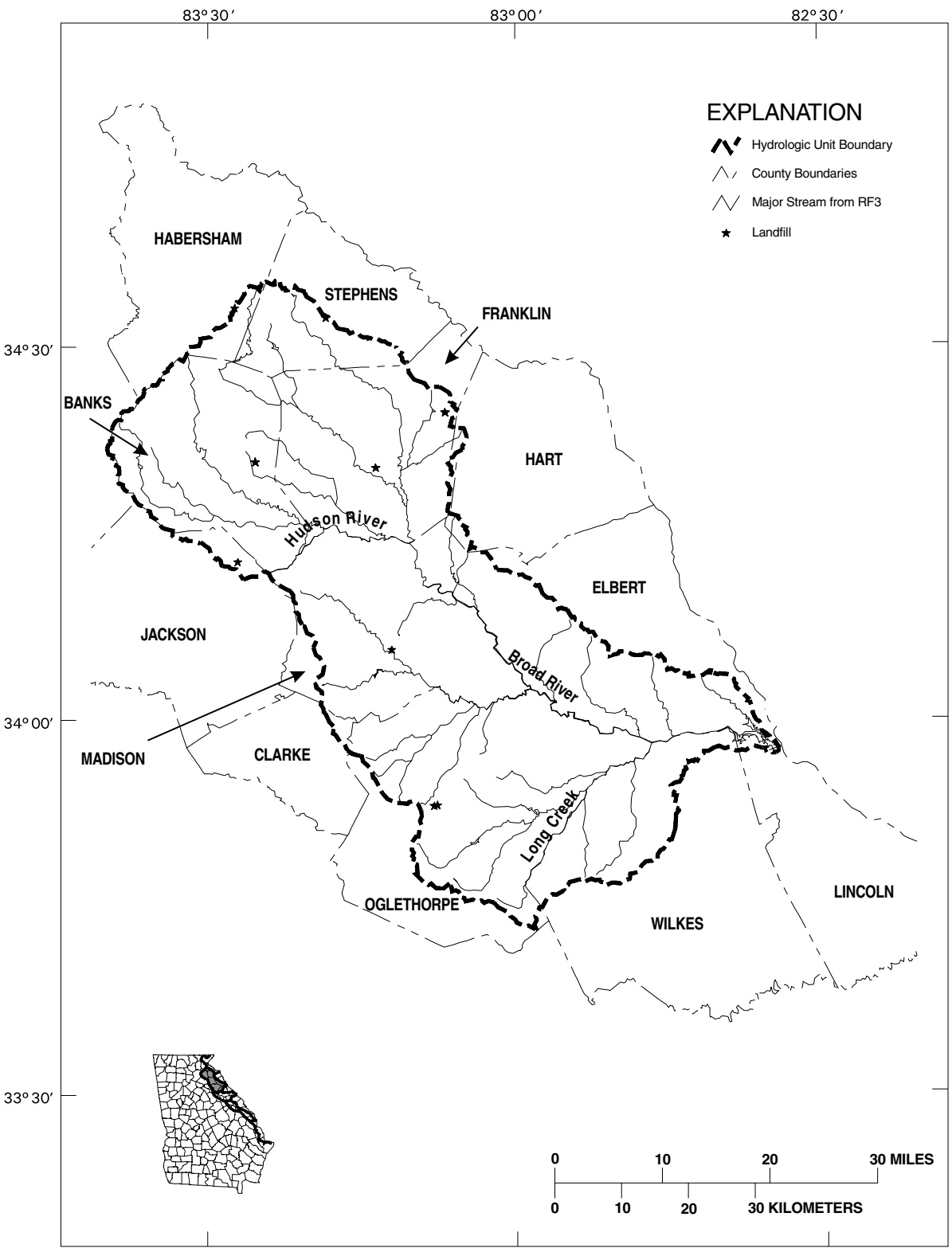

Figure 4-18. Landfills, Savannah River Basin, HUC 03060104

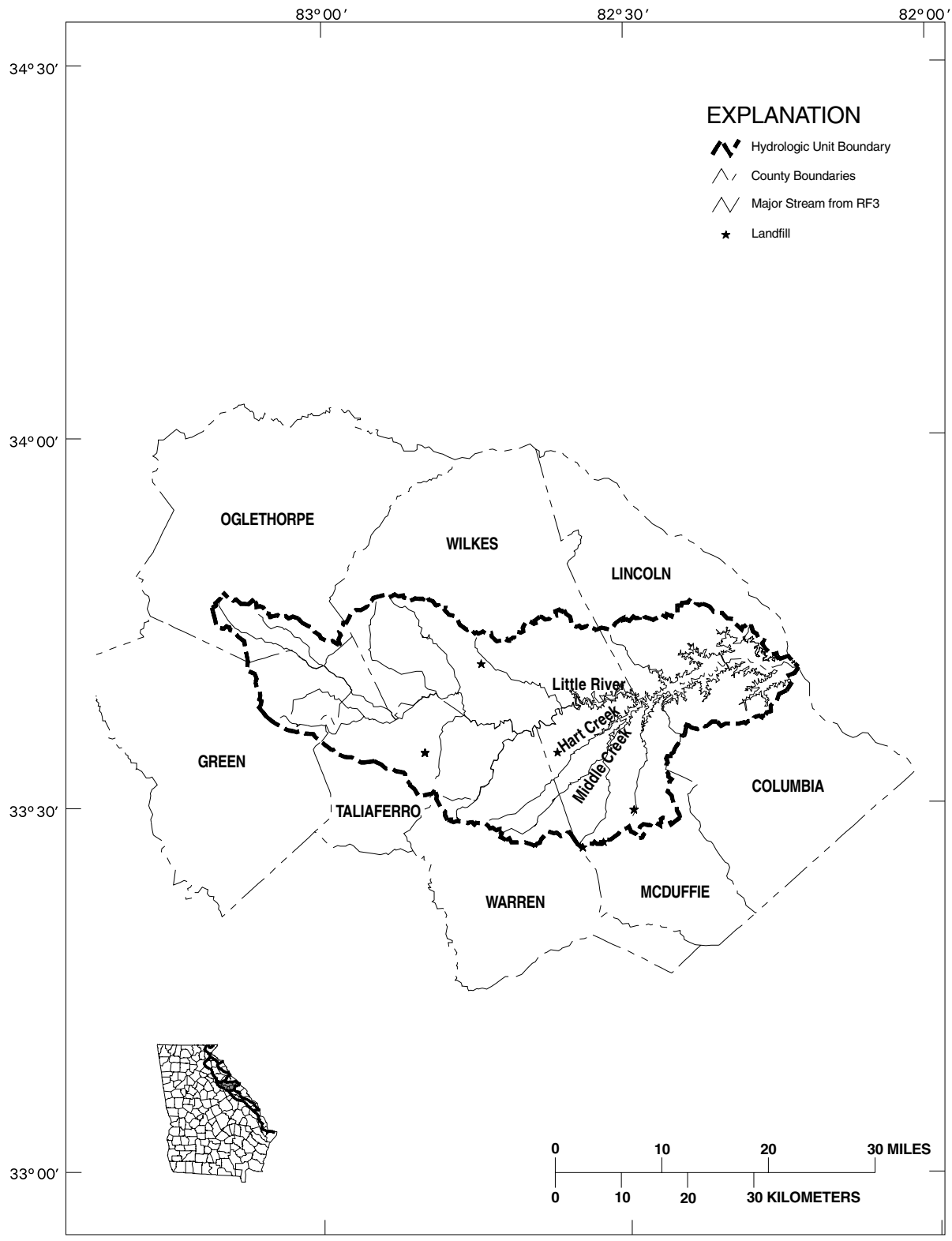

Figure 4-19. Landfills, Savannah River Basin, HUC 03060105

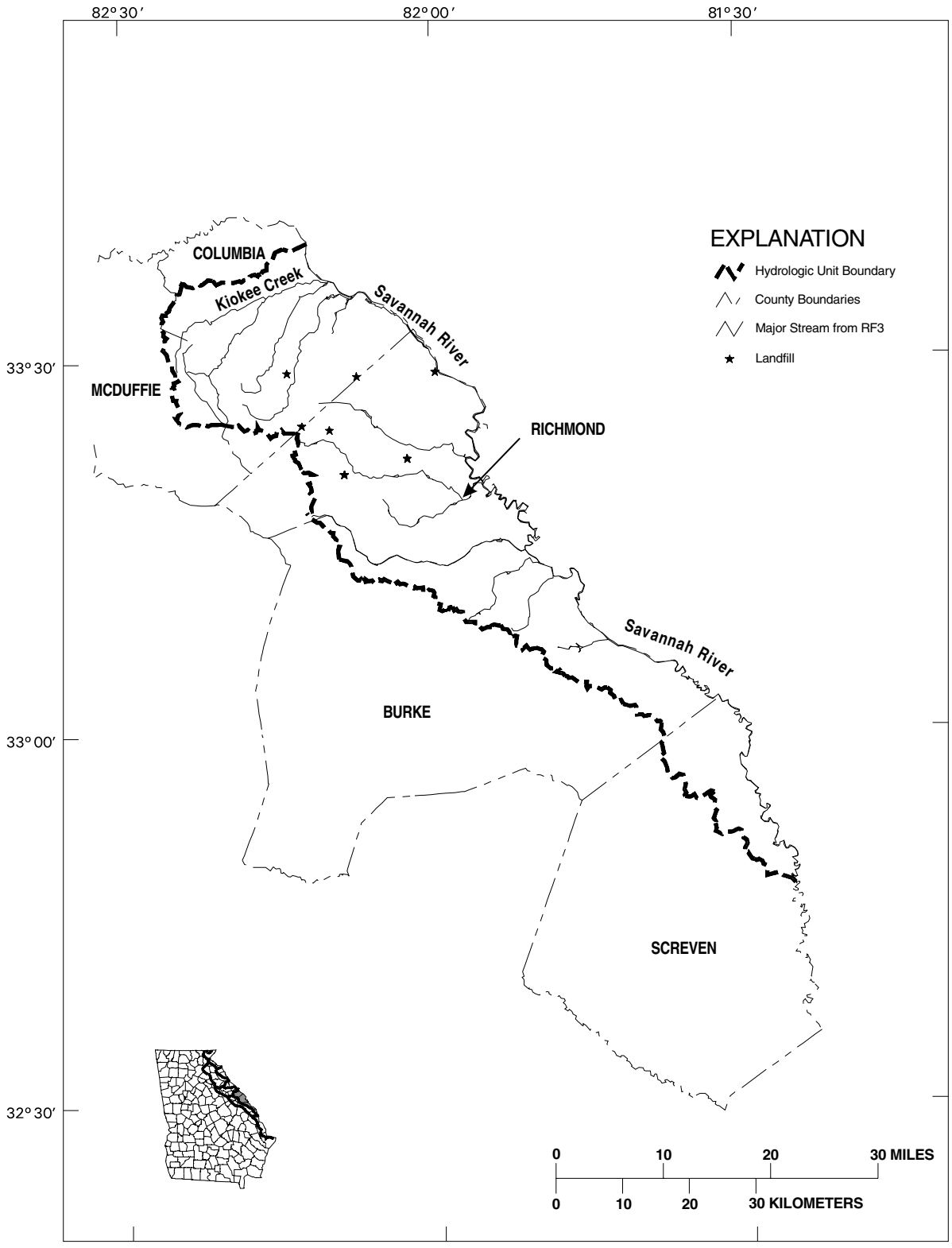

Figure 4-20. Landfills, Savannah River Basin, HUC 03060106

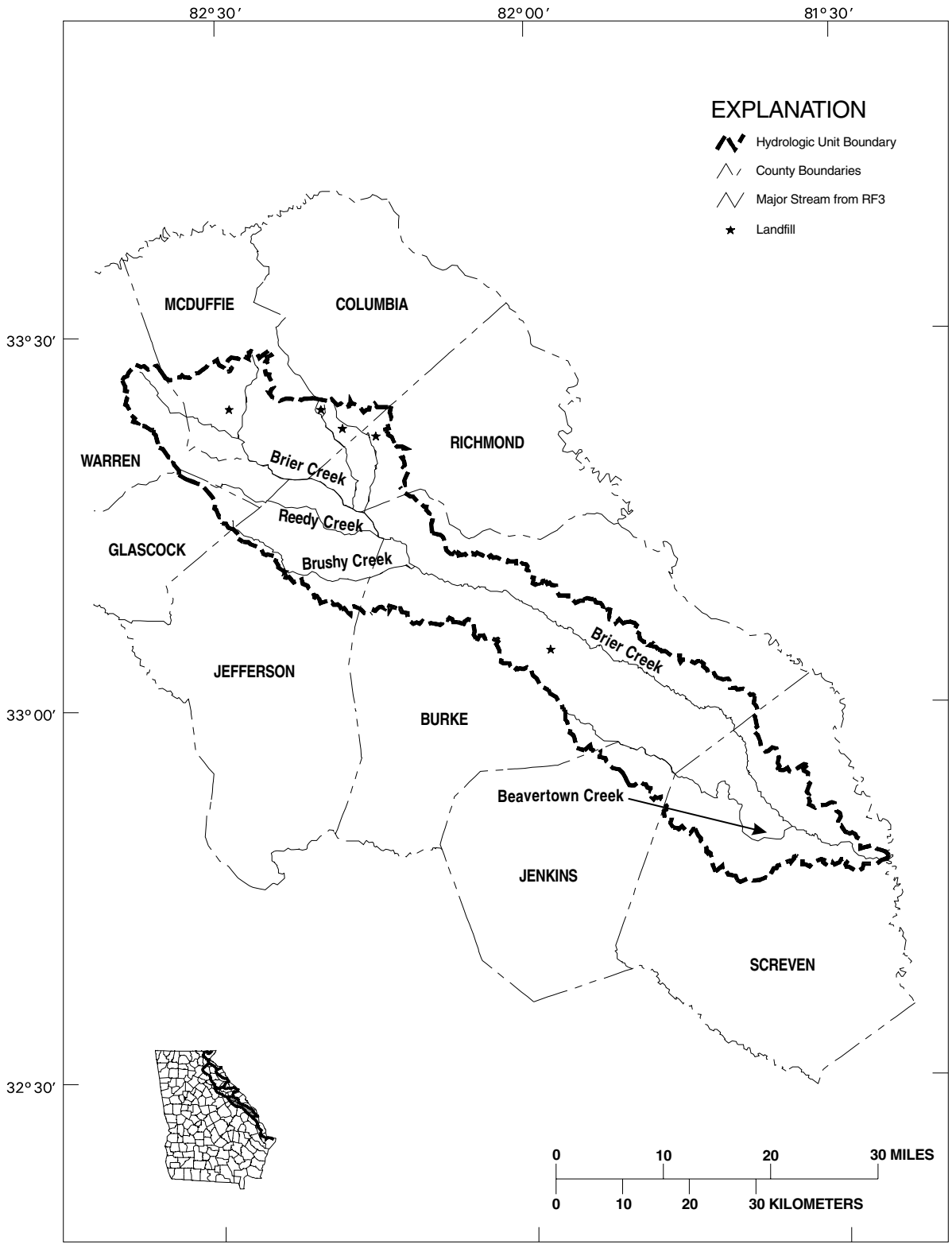

Figure 4-2I. Landfills, Savannah River Basin, HUC 03060108

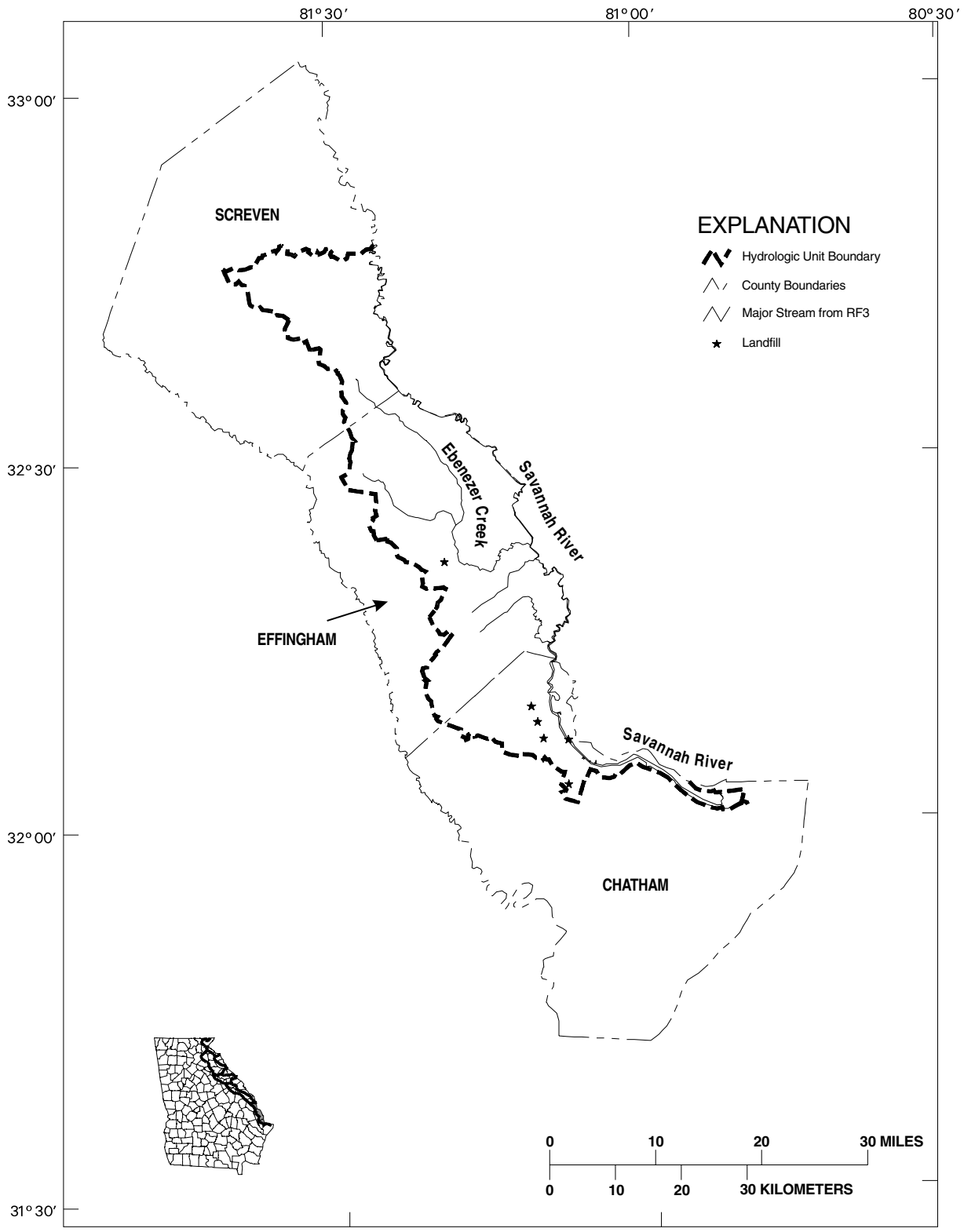

Figure 4-22. Landfills, Savannah River Basin, HUC 03060109

Sediment and Nutrients

Sediment is the most common pollutant resulting from agricultural operations. It consists mainly of mineral fragments resulting from the erosion of soils, but is can also include crop debris and animal wastes. Excess sediment loads can damage aquatic habitat by smothering and shading food organisms, alter natural substrate, and destroying spawning areas. Runoff with elevated sediment concentrations can also scour aquatic habitat, causing significant impacts on the biological community. Excess sediment can also increase water treatment costs, interfere with recreational uses of water bodies, create navigation problems, and increase flooding damage. In addition, a high percentage of nutrients lost from agricultural lands, particularly phosphorus, are transported attached to sediment. Many organic chemicals used as pesticides or herbicides are also transported predominantly attached to sediment.

Agriculture can be a significant source of nutrients, which can lead to excess or nuisance growth of aquatic plants and depletion of dissolved oxygen. The nutrients of most concern from agricultural land uses are nitrogen (N) and phosphorus (P), which may come from commercial fertilizer or land application of animal wastes. Both nutrients assume a variety of chemical forms, including soluble ionic forms (nitrate and phosphate) and less-soluble organic forms. Less soluble forms tend to travel with sediment, whereas more soluble forms move with water. Nitrate-nitrogen is very weakly adsorbed by soil and sediment and is therefore transported entirely in water. Because of the mobility of nitrate-nitrogen, the major route of nitrate loss is to streams by interflow or ground water in deep seepage.

Phosphorus transport is a complex process that involves different components of phosphorus. Soil and sediment contain a pool of adsorbed phosphorus, which tends to be in equilibrium with the phosphorus in solution (phosphate) as water flows over the soil surface. The concentrations established in solution are determined by soil properties and fertility status. Adsorbed phosphorus attached to soil particles suspended in runoff also equilibrates with phosphorus in solution.

In 1993, the Soil Conservation Service (SCS, now NRCS) completed a study to identify hydrologic units in Georgia with a high potential for nonpoint source pollution problems resulting from agricultural land uses (SCS 1993). This study concluded that there is not a major statewide agricultural pollution problem in Georgia. However, the assessment shows that some watersheds have sufficient agricultural loading to potentially impair their designated uses, based on estimates of transported sediments, nutrients, and animal wastes from agricultural lands (Table 4-6).

In July and August 1996, EPA conducted biological assessments on Georgia watersheds that had sufficient agricultural loading to potentially impair designated stream use to determine which of those waters should be added to Georgia's Section 303(d) list of streams with water quality limited segments. Those waters identified by EPA as potentially impaired by agricultural nonpoint source loading and added to the 303(d) list in December 1996 are shown in Table 4-7. The EPA will develop total maximum daily loads (TMDLs) for these waters in 2004.

Animal Waste

In addition to contributing to nutrient loads, animal waste may contribute high loads of oxygen-demanding chemicals and bacterial and microbial pathogens. The waste may reach surface waters through direct runoff as solids or in their soluble form. Soluble forms may reach ground water through runoff, seepage, or percolation and reach surface waters as return flow. As the organic materials decompose, they place an oxygen demand

Table 4-5. Estimated Loads from Agricultural Lands by County (SCS, 1993)

County	Percent of Area in Basin	Acres with Nutrient Application	Sediment (tons)	Sediment (ppm)	Nitrogen (tons)	Nitrogen (ppm)	Phosphorus (tons)	Phosphorus (ppm)
Banks	100	33,302	26,541	27.3	323	0.34	71	0.074
Burke	62	140,992	144,222	28.9	411	0.12	153	0.045
Chatham	33	5,874	495	2.2	3	0.02	1	0.007
Columbia	100	10,066	5,781	18.4	21	0.07	8	0.03
Effingham	72	36,182	14,798	10.4	48	0.04	18	0.014
Elbert	100	42,288	60,755	36.7	207	0.17	76	0.063
Franklin	100	64,549	67,697	35.7	559	0.31	135	0.074
Glascock	12	15,382	4,744	19.1	15	0.09	6	0.033
Greene	21	34,138	5,840	6	62	0.06	20	0.021
Habersham	12	36,763	57,644	54.8	489	0.48	99	0.095
Hall	5	44,459	33,924	26.8	453	0.36	87	0.07
Hart	100	56,284	104,053	55.9	365	0.23	130	0.082
Jackson	8	57,347	37,374	21.3	423	0.26	101	0.062
Jefferson	20	94,553	112,866	39.3	342	0.15	121	0.053
Jenkins	5	56,007	68,295	34.6	233	0.17	80	0.06
Lincoln	100	23,180	6,623	9.3	35	0.05	12	0.018
Madison	96	54,858	74,106	43.5	481	0.31	72	0.046
McDuffie	100	25,874	32,994	44.4	199	0.27	78	0.107
Oglethorpe	84	41,384	31,518	24.6	315	0.27	84	0.072
Richmond	100	17,275	9,943	19.6	32	0.08	11	0.028
Screven	58	106,179	96,731	29.1	272	0.1	103	0.04
Stephens	100	13,088	22,934	61.5	120	0.33	35	0.095
Taliaferro	66	12,746	5,588	15	23	0.06	8	0.022
Towns	10	9,610	17,201	33.7	52	0.1	22	0.043
Warren	49	35,845	29,881	20.7	93	0.09	35	0.035
Wilkes	100	67,383	40,966	20.6	225	0.12	78	0.041

Note: Mass estimates are based on whole county. Concentration estimates are average event runoff concentration from agricultural lands.

Table 4-6. Waters Identified as Potentially Impacted by Agricultural Nonpoint Source Loading and Added to the Georgia 303[d] List

Waterbody	County	Pollutant[s] of Concern
South Fork Broad River	Madison and Oglethorpe	Biota
South River	Madison	Biota, Sediment
Broad River	Madison	Biota, Habitat
Middle Fork Broad River	Franklin, Habersham, Stephens	Habitat
Lower North Fork Broad River	Franklin, Habersham, Stephens	Biota, Habitat
North Fork Broad River	Franklin and Stephens	Habitat
Lake Hartwell Tributaries		
Crawford Creek	Franklin and Hart	Biota
Little Crawford Creek	Franklin and Hart	Biota, Habitat
Little Shoal Creek	Franklin and Hart	Biota, Habitat
Flat Shoals	Franklin and Hart	Habitat
Toccoa Creek	Stephens	Biota

on the receiving waters, which may adversely affect fisheries, and cause other problems with taste, odor, and color. When waters are contaminated by waste from mammals the possible presence of pathogens that affect human health, include fecal bacteria, is of particular concern. In addition to being a source of bacteria, cattle waste might be an important source of the infectious oocysts of the protozoan parasite *Cryptosporidium parvum*.

Pesticides

Pesticides applied in agricultural production can be insoluble or soluble and include herbicides, insecticides, miticides, and fungicides. They are primarily transported directly through surface runoff, either in dissolved forms or attached to sediment particles. Some pesticides can cause acute and chronic toxicity problems in the water or throughout the entire food chain. Others are suspected human carcinogens, although the use of such pesticides has generally been discouraged in recent years.

The major agricultural pesticide/herbicides use within the basin include 2,4-d, Prowl, Blazer/Basagran/Trifluralin/Treflan/Trilin, Aatrex/Atizine, Gramoxone, Classic, Lexone/Sencor, and Lasso (alachlor) (compiled from the Georgia Herbicide Use Survey summary [Monks and Brown, 1991]). Since 1990, the use of alachlor in Georgia has decreased dramatically since peanut wholesalers no longer buy peanuts with alachlor.

Nonherbicide pesticide use is difficult to estimate. According to Stell et al. (1995), pesticides other than herbicides are currently used only when necessary to control some type of infestation (nematodes, fungi, and insects). Other common nonherbicie pesticides include chlorothalonil, aldicarb, chlorpyifos, methomyl, thiodicarb, carbaryl, acephate, fonofos, methyl parathion, terbufos, disulfoton, phorate, triphenyltin hydroxide (TPTH), and synthetic pyrethroids/pyrethrins. Application periods of principal agricultural pesticides span the calendar year in the basin. However, agricultural pesticides are applied most intensively and on a broader rang of crops from March 1 to September 30 in any given year.

It should be noted that past uses of persistent agricultural pesticides that are now banned might continue to affect water quality within the basin, particularly through residual concentrations present in bottom sediments. A survey of pesticide concentration data by Stell et al. (1995) found that two groups of compounds had concentrations at or above minimum reporting levels in56 percent of the water and sediment analyses. The first group included DDT and metabolites, and the second group included chlordane and related compounds (heptachlor, heptachlor epoxide)—while dieldrin was also frequently detected. The USEPA now bans all of these pesticides for use in the United States, but they might persist in the environment for long periods of time.

Nonpoint Sources from Urban, Industrial, and Residential Lands

Water quality in urban waterbodies is affected by both point source discharges and diverse land use activities in the drainage basin (i.e., nonpoint sources). One of the most important sources of environmental stressors in the Savannah River basin, particularly in the developed and rapidly growing areas is diffuse runoff from urban, industrial, and residential land uses (jointly referred to as “urban runoff”). Nonpoint source contamination an impair streams that drain extensive commercial and industrial areas due to inputs of storm water runoff, unauthorized discharges, and accidental spills. Wet weather urban runoff can carry high concentrations of many of the same pollutants found in point source discharges, such as oxygen-demanding waste, suspended solids, synthetic organic chemicals, oil and grease, nutrients, lead and other metals, and bacteria The

major difference is that urban runoff occurs only intermittently, in response to precipitation events.

The characteristics of nonpoint urban sources of pollution are generally similar to those of NPDES permitted storm water discharges (these are discussed in the previous section). Nonpoint urban sources of pollution include drainage from areas with impervious surfaces, but also includes less highly developed areas with greater amounts of pervious surfaces such as lawns, gardens, and septic tanks, all of which may be sources of nutrient loading.

There is little site-specific data available to quantify loading in nonpoint urban runoff in the Savannah River basin, although estimates of loading rates by land use types have been widely applied in other areas.

Pesticides and Herbicides from Urban and Residential Lands

Urban and suburban land uses are also a potential source of pesticides and herbicides through application to lawns and turf, roadsides, and gardens and beds. Stell et al. (1995) provide a summary of usage in the Atlanta Metropolitan Statistic Area (MSA). The herbicides most commonly used by the lawn-care industry are combinations of dicamba, 2,4-D, mecoprop (MCPP), 2,4-DP, and MCPA, or other phenoxy-acid herbicides, while most commercially available weed control products contain one or more of the following compounds: glyphosphate, methyl sulfometuron, benefin (benfluralin), bensulide, acifluorfen, 2,4-D, 2,4-DP, or dicamba. Atrazine was also available for purchase until it was restricted by the State of Georgia on January 1, 1993. The main herbicides used by local and state governments are glyphosphate, methyl sulfometuron, MSMA, 2,4-D, 2,4-DP, dicamba, and chlorsulforon. Herbicides are used for preemergent control of crabgrass in February and October, and in the summer for postemergent control. Data from the 1991 Georgia Pest Control Handbook (Delaplane, 1991) and a survey of CES and SCS personnel conducted by Stell et al. Indicate that several insecticides could be considered ubiquitous in urban/suburban use, including chlorpyrifos, diazinon, malathion, acephate, carbaryl, lindane, and dimethoate. Chlorothalonil, a fungicide, is also widely used in urban and suburban areas.

Other Urban/Residential Sources

Urban and residential storm water also potentially includes pollutant loads from a number of other terrestrial sources:

Septic Systems. Poorly sited and improperly operating septic systems can contribute to the discharge of pathogens and oxygen-demanding pollutants to receiving streams. This problem is addressed through septic system inspections by the appropriate County Health Department, extension of sanitary sewer service and local regulations governing minimum lot sizes and required pump-out schedules for septic systems.

Leaking Underground Storage Tanks. The identification and remediation of leaking underground storage tanks (LUSTs) is the responsibility of the EPD Land Protection Branch. Petroleum hydrocarbons and lead are typically the pollutants associated with LUSTs.

Nonpoint Sources from Forestry

Silvicultural operations may serve as sources of stressors, particularly excess sediment loads to streams, when Best Management Practices (BMPs) are not followed. From a water quality standpoint, woods roads pose the greatest potential threat of any of the typical forest practices. It has been documented that 90 percent of the sediment that entered streams from a forestry operation was directly related to either poorly located or

poorly constructed roads. The potential impact to water quality from erosion and sedimentation is increased if BMPs are not adhered to.

Silviculture is also a potential source of pesticides/herbicides. According to Stell et al. (1995), pesticides are mainly applied during site preparation after clear-cutting and during the first few years of new forest growth. Site preparation occurs on a 25-year cycle on most pine plantation land, so the area of commercial forest with pesticide application in a given year is relatively small. The herbicides glyphosate (Accord), sulfometuron methyl (Oust), hexazinone (Velpar), imazapyr (Arsenal), and metsulfuron methyl (Escort) account for 95 percent of the herbicides used for site preparation to control grasses, weeds, and broadleaves in pine stands. Dicamba, 2,4-D, 2,4,-DP (Banvel), triclopyr (Garlon), and picloram (Tordon) are minor use chemicals used to control hard to kill hardwoods and kudzu. The use of triclopyr and picloram has decreased since the early 1970's.

Most herbicides are not mobile in the soil and are targeted to plants, not animals. Applications made following the label and in conjunction with BMPs should pose little threat to water quality.

Chemical control of insects and diseases is not widely practices except in forest tree nurseries which is a very minor land use. Insects in pine stands are controlled by chlorpyrifos, diazinon, malathion, acephate, carbaryl, lindane, and dimethoate. Diseases are controlled using chlorothalonil, dichloropropene, and mancozeb. There are no commercial forest tree nurseries within the basin.

According to the Water Quality in Georgia 1998 Report, no streams were identified in the basin as impacted due to commercial forestry activities.

Statewide BMP Implementation Survey

In 1992 the Georgia Forestry Commission conducted a statewide BMP implementation survey to determine to what extent forestry BMPs were being implemented. Within the Savannah Basin, the GFC evaluated 35 sites involving 4,464 acres of land. Of the sites evaluated, 19 sites involving 1,826 acres were on private lands, 13 sites involving 1,935 acres were on forest industry land, and 3 sites involving 700 acres were on public lands. Overall compliance with BMPs was 85 percent. By ownership, compliance was approximately 81 percent on private lands, 85 percent on forest industry lands, and 96 percent on public lands.

Approximately 75 percent of the 25.2 miles of main haul roads evaluated on 30 sites were in compliance with BMPs. Most noted problems were that roads did not follow the contour on 44 percent of the sites and water diversions were used to slow surface water flow and divert the flow out of the road only on 50 percent of the sites. Main haul roads crossed streams on 38 percent of the sites and culverts were sized correctly for the watershed on 83 percent of the sites. Forty four percent of the crossings were located at too steep of grades and 56 percent were not stabilized correctly. Water bars were installed in temporary roads only on 25 percent of the sites. By ownership, road compliance for private lands was 63 percent, forest industry was 81 percent, and public lands was 100 percent.

Approximately 85 percent of the 4,461 harvested acres evaluated on the 35 sites were in compliance with BMPs. Problem areas were that water bars were not installed in skid trails on sites with sloping terrain. Only 54 percent of the log decks were stabilized. Equipment was improperly serviced on 11 percent of the sites. Harvesting within the Streamside Management Zones (SMZs) occurred on 64 percent of the sites and resulted in 44 percent of the SMZs rutted or damaged and excess logging debris was left in the streams on 44 percent of the sites. Log decks were properly located outside of the

recommended SMZ on 96 percent of the sites. Temporary stream crossings occurred on 21 percent of the sites and none were properly removed after the harvest. By ownership, harvesting compliance for private lands was 81 percent, forest industry was 85 percent, and public lands was 95 percent.

Approximately 100 percent of the 70 site prepared acres evaluated on one site were in compliance with BMPs. By ownership, site preparation compliance for private lands was 100 percent.

Atmospheric Deposition

Atmospheric deposition can be a significant source of nitrogen and acidity in watersheds. Nutrients from atmospheric deposition, primarily nitrogen, are distributed throughout the entire basin in precipitation. The primary source of nitrogen in atmospheric deposition is nitrogen oxide emissions from combustion of fossil fuels. The rate of atmospheric deposition is a function of topography, nutrient sources, and spatial and temporal variations in climatic conditions.

Atmospheric deposition can also be a source of certain mobile toxic pollutants, including mercury, PCBs, and other organic chemicals.

4.I.3 Flow and Temperature Modification

Many species of aquatic life are adapted to specific flow and temperature regimes. In addition, both flow and temperature affect the dissolved oxygen balance in water, and changes in flow regime can have important impacts on physical habitat. Temperature is particularly critical for the coldwater trout fishery. Georgia is located at the extreme southern edge of trout habitat, and therefore many trout waters approach or exceed maximum tolerable temperatures during the hottest summer months, even under natural conditions. Trout need cold water to survive and reproduce well, so any practices that cause stream warming can have adverse effects.

Thus, flow and temperature modifications can be important environmental stressors. They also interact with one another to affect the oxygen balance: flow energy helps control reaeration rate, while water temperature controls the solubility of dissolved oxygen, and higher water temperatures reduce oxygen solubility and thus tend to reduce dissolved oxygen concentrations. Further, increased water temperature increases the rate of metabolic activity in natural waters, which in turn may increase oxygen consumption by aquatic species.

Flow Modification

Flows from Clarks Hill Dam are primarily driven by hydropower generation schedules for supply of electricity during peak demand times. Weekday generation flows typically range from 8,000 to 20,000 cfs. Releases of 30,000 cfs are not uncommon. Weekend generation flows target a flow of 5800 cfs. When not generating, no minimum flow is provided. Stevens Creek Dam, a run-of-the-river hydropower dam about 15 miles downstream, provides limited re-regulation of flows from Clarks Hill Dam and lessens the impact of high water associated with peak generation. One mile downstream of Stevens Creek Dam, the Augusta Diversion Dam directs a portion of river flow into the Augusta Canal for power and water supply, bypassing six miles of shoals. The combination of peaking flows and flow diversion results in flows that are quite low in the shoals, particularly on weekends (EDAW, 1997). Impacts on juvenile nursery habitat and robust redhorse spawning and rearing habitat are of concern. Also, pool fluctuations in

Stevens Creek Reservoir can be up to 4.5 feet (South Carolina Electric and Gas, 1996), resulting in impacts on spawning fish and access for recreational users.

Temperature

The Savannah basin has many miles of trout waters that are threatened by the impact of small impoundments which can result in increased summer temperatures. Most of the trout streams in the basin are secondary trout streams (they are cold enough to support trout populations, but no natural reproduction occurs) and actual trout fisheries are limited by the supply of trout for stocking. Even small impoundments, if not specifically designed to prevent stream warming, may impact temperatures for several miles downstream.

Another threat to suitable temperature regime in the trout streams of the Savannah River basin is the removal of riparian tree cover, which allows increased warming of water by sunlight. Under natural conditions, smaller streams in Georgia are shaded by a tree canopy. If this canopy is removed the resulting direct sunlight can result in increased water temperatures with adverse effects on native aquatic life. Timber harvest within riparian buffers can thus lead to temperature stress if proper management practices are not followed. Increases in impervious surface area coverage (particularly paved areas) in the watershed also contribute to stream warming. Trout streams in the Savannah basin are also potentially threatened by erosion, sedimentation and temperature impacts.

Hydropower generation at Richard B. Russell Dam consists of four conventional generation units. Four additional generation units with pumpback (reverse flow) capabilities have been installed, mechanically and environmentally tested, and currently in the environmental review process. Test conducted from April to October 1996 increased water temperature in Clarks Hill Lake (U.S. Army Corps of Engineers, Savannah District 1998), negatively impacting critical habitat for striped bass and hybrid (white x striped) bass. Fishing success for these cool water species was reduced during that time period. Long term impacts of elevated water temperatures in Clarks Hill Lake could significantly reduce the already limited summer and early fall habitat currently available for striped and hybrid (white x striped) bass. Trophy striped bass (20-50 lbs) in Clarks Hill Lake would likely cease to exist if the pumpback units are operated without significant mitigation measures.

4.1.4 Physical Habitat Alteration

Many forms of aquatic life are sensitive to physical habitat disturbances. Probably the major disturbing factor is erosion and loading of excess sediment, which changes the nature of the stream substrate. Thus, any land use practices that cause excess sediment input can have significant impacts.

Physical habitat disturbance is also evident in many urban streams. Increased impervious cover in urban areas can result in high flow peaks, which increase bank erosion. In addition, construction and other land-disturbing activities in these areas often provide an excess sediment load, resulting in a smothering of the natural substrate and physical form of streams with banks of sand and silt.

4.2 Summary of Stressors Affecting Water Quality

Section 4.1 described the major sources of loads of pollutants (and other types of stressors) to the Savannah basin. What happens in a river is often the result of the combined impact of many different types of loading, including point and nonpoint

sources. For instance, excess concentrations of nutrients may result from the combined loads of wastewater treatment plant discharges, runoff from agriculture, runoff from residential lots, and other sources. Accordingly, Section 4.2 brings together the information contained in Section 4.1 to focus on individual stressor types, as derived from all sources.

4.2.1 Nutrients

All plants require certain nutrients for growth, including the algae and rooted plants found in lakes, rivers, and streams. Nutrients required in the greatest amounts include nitrogen and phosphorus. Some loading of these nutrients is needed to support normal growth of aquatic plants, an important part of the food chain. Too much loading of nutrients can, however, result in an overabundance of algal growth with a variety of undesirable impacts. The condition of excessive nutrient-induced plant production is known as eutrophication, and waters affected by this condition are said to be eutrophic. Eutrophic waters often experience dense blooms of algae, which can lead to unaesthetic scums and odors and interfere with recreation. In addition, overnight respiration of living algae, and decay of dead algae and other plant material, can deplete oxygen from the water, stressing or killing fish. Eutrophication of lakes typically results in a shift in fish populations to less desirable, pollution-tolerant species. Finally, eutrophication may result in blooms of certain species of blue-green algae which have the capability of producing toxins.

For freshwater aquatic systems, the nutrient in the shortest supply relative to plant demands is usually phosphorus. Phosphorus is then said to be the "limiting nutrient" because the concentration of phosphorus limits potential plant growth. Control of nutrient loading to reduce eutrophication thus focuses on phosphorus control.

Point and nonpoint sources to the Savannah also discharge large quantities of nitrogen, but nitrogen is usually present in excess of amounts required to match the available phosphorus. Nitrogen (unlike phosphorus) is also readily available in the atmosphere and ground water, so it is not usually the target of management to control eutrophication in freshwater. The bulk of the nitrogen in fresh-water systems is found in three ionic forms--ammonium (NH_4^+), nitrite (NO_2^-), or nitrate (NO_3^-). Nitrite and nitrate are more readily taken up by most algae, but ammonia is of particular concern because it can be toxic to fish and other aquatic life. Accordingly, wastewater treatment plant upgrades have focused on reducing the toxic ammonia component of nitrogen discharges, with corresponding increase in the nitrate fraction.

Sources of Nutrient Loading

The major sources of nutrient loading in the Savannah basin are wastewater treatment facilities, urban runoff and storm water, and agricultural runoff. Concentrations found within rivers and lakes of the Savannah basin represent a combination of a variety of point and nonpoint source contributions.

Point source loads can be quantified from permit and effluent monitoring data, but nonpoint loads are difficult to quantify. Rough estimates of average nutrient loading rates from agriculture are available; however, nonpoint loads from urban/residential sources in the basin have not yet been quantified. The net load arising from all sources may, however, be examined from instream monitoring. Long-term trends in nutrients within the Savannah River basin can be obtained by examining results from EPD long-term trend monitoring stations.

Trends in instream total phosphorus concentrations at two sites in the Savannah River are shown in Figures 4-23 and 4-24. At the monitoring location at Clyo, approximately 120 miles downstream, phosphorus concentrations have remained relatively similar over time with some slight increase in the late 1980s. At the monitoring station below Spirit Creek downstream of Augusta, phosphorus concentrations can be seen to increase through the mid to late 1980s with a decrease into the 1990s as a result of upgrades at the Augusta Water Pollution Control Plant.

4.2.2 Dissolved Oxygen

Oxygen is required to support aquatic life, and Georgia water quality standards specify minimum and daily average dissolved oxygen concentration standards for all waters. Problems with oxygen depletion in rivers and streams of the Savannah basin are associated with oxygen-demanding wastes from point and nonpoint sources. Historically, the greatest threat to maintaining adequate oxygen levels to support aquatic life has come from the discharge of oxygen-demanding wastes from wastewater treatment plants. Treatment upgrades and more stringent permit limits have reduced this threat substantially.

Deep, hypolimnetic releases from Hartwell and Clarks Hill Dams result in dissolved oxygen concentrations that do not meet state standards downstream in the Savannah River during summer and early fall months. Oxygen deficiencies are most profound in the Hartwell tailwaters, which are designated as trout waters. The turbines at Hartwell Dam are currently being retrofitted with baffles to improve downstream dissolved oxygen levels. The Corps of Engineers will monitor downstream to document resulting changes in dissolved oxygen.

Trends in instream dissolved oxygen concentrations at two sites in the Savannah River basin are shown in Figures 4-25 and 4-26. At both locations, dissolved oxygen concentrations have remained above the minimum concentration of 4.0 mg/l specified in water quality standards.

4.2.3 Metals

The 1998-1999 water quality assessment noted four stream segments where violations of metals standards caused nonsupport of designated uses In most cases, these metals were attributed to point sources. In each situation, the municipality or industry is under an EPD enforcement action to correct the problem.

4.2.4 Fecal Coliform Bacteria

Violations of the standard for fecal coliform bacteria were the most commonly listed cause of nonsupport of designated uses in the 1998-1999 water quality assessment. Fecal coliform bacteria are monitored as an indicator of fecal contamination and the possible presence of human bacterial and protozoan pathogens in water. Fecal coliform bacteria may arise from many of the different point and nonpoint sources discussed in Section 4.1. Human waste is of greatest concern as a potential source of bacteria and other pathogens. One primary function of wastewater treatment plants is to reduce this risk through disinfection.

Trends in instream fecal coliform concentrations at two sites in the Savannah River Basin are shown in Figures 2-27 and 4-28. At both locations fecal coliform densities have decreased over time due primarily to improved treatment at water pollution control plants.

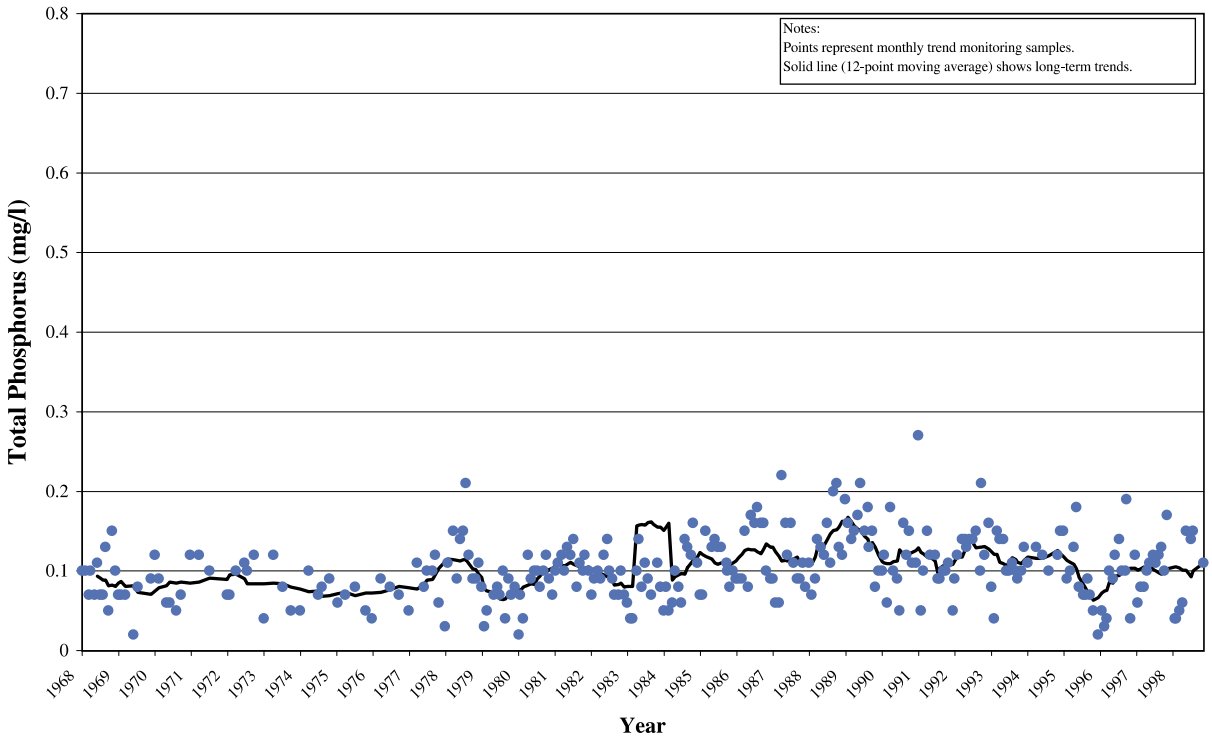

Figure 4-23. Phosphorus Concentrations, Savannah River near Clyo

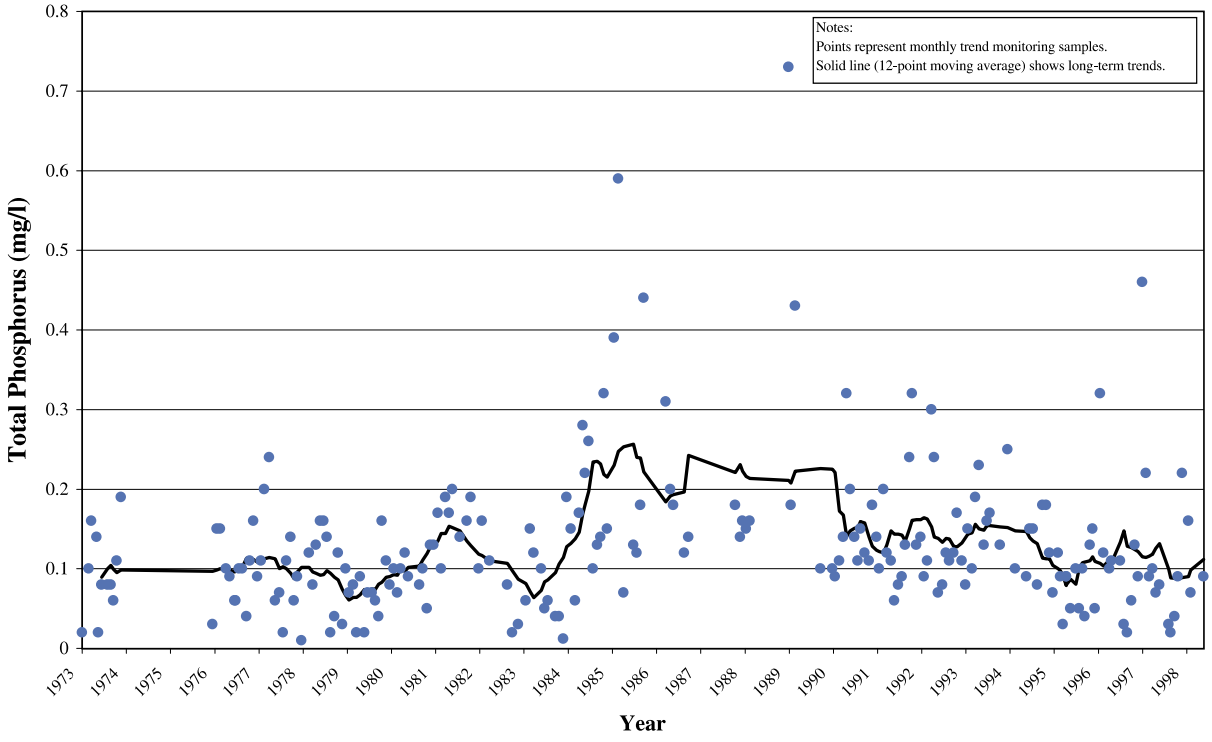

Figure 4-24. Phosphorus Concentrations, Savannah River below Spirit Creek

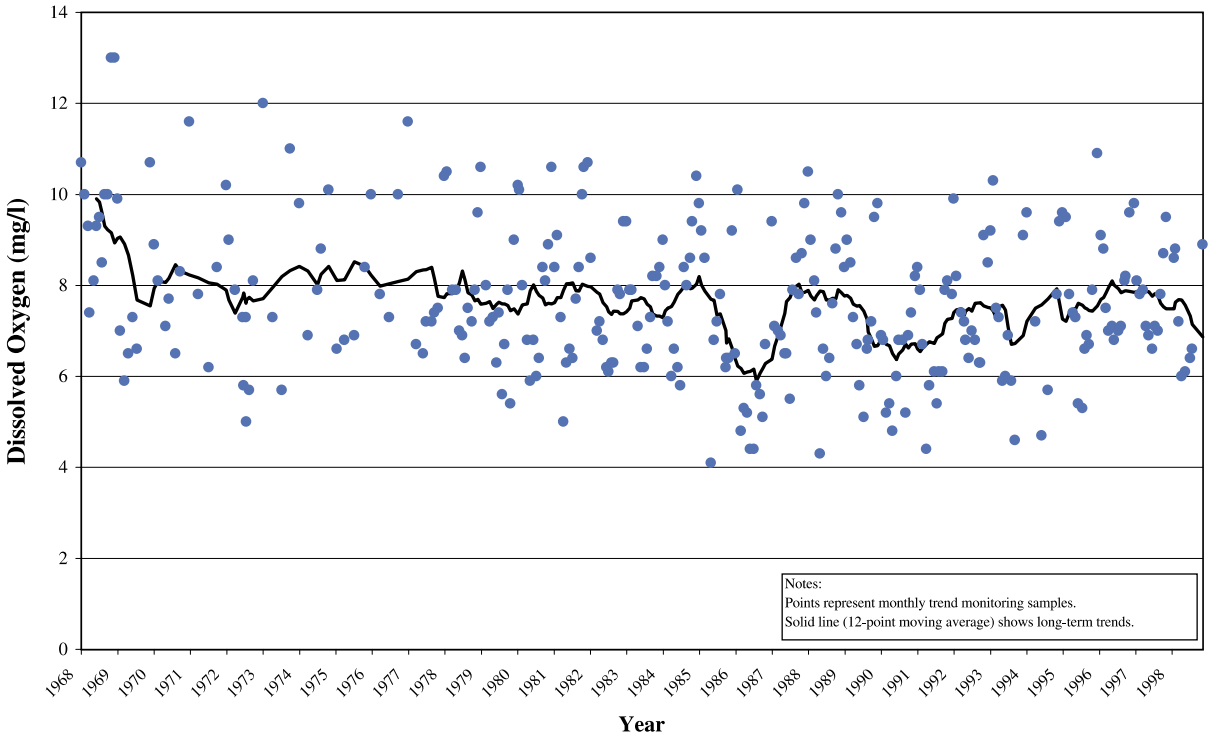

Figure 4-25. Oxygen Concentrations, Savannah River near Clyo

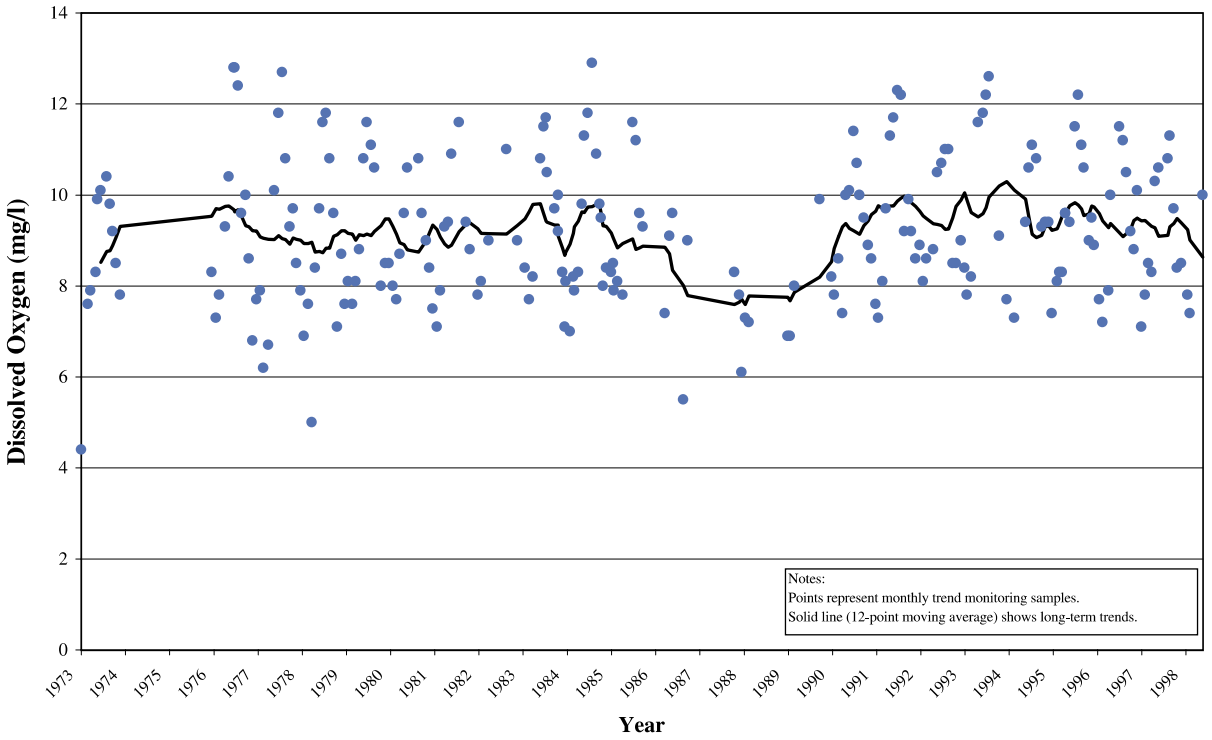

Figure 4-26. Oxygen Concentrations, Savannah River below Spirit Creek

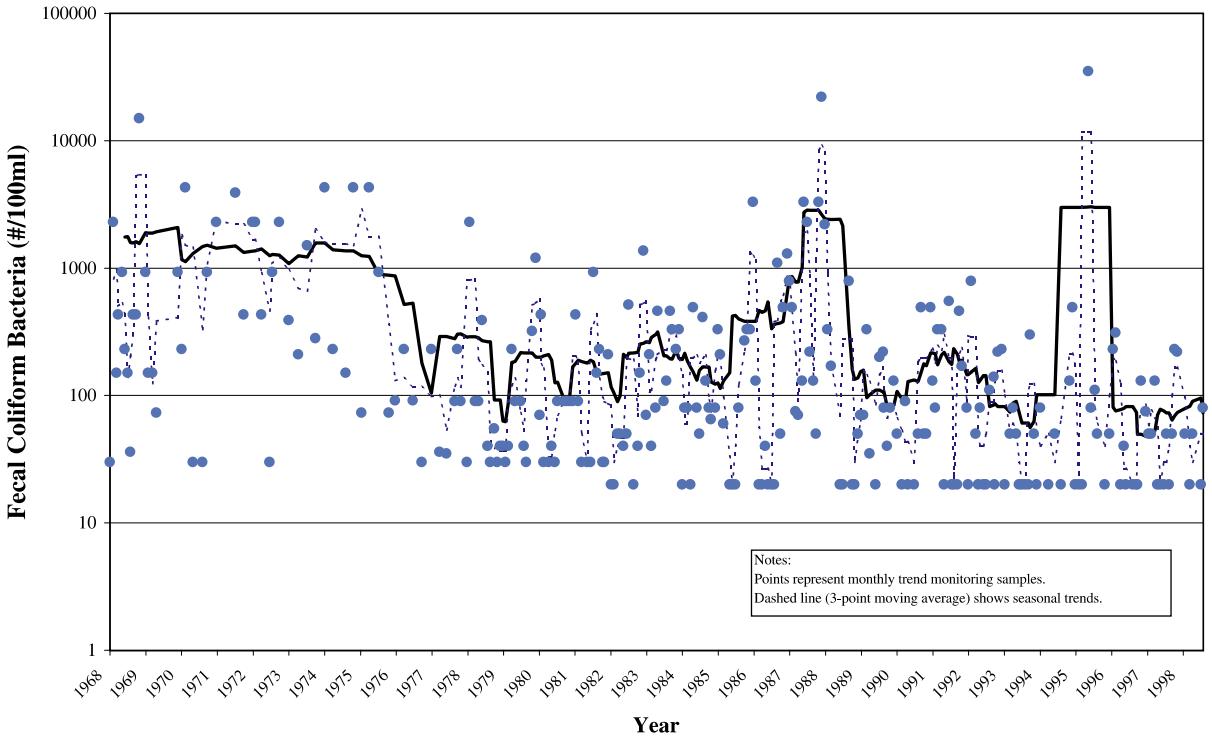

Figure 4-27. Fecal Concentrations, Savannah River near Clyo

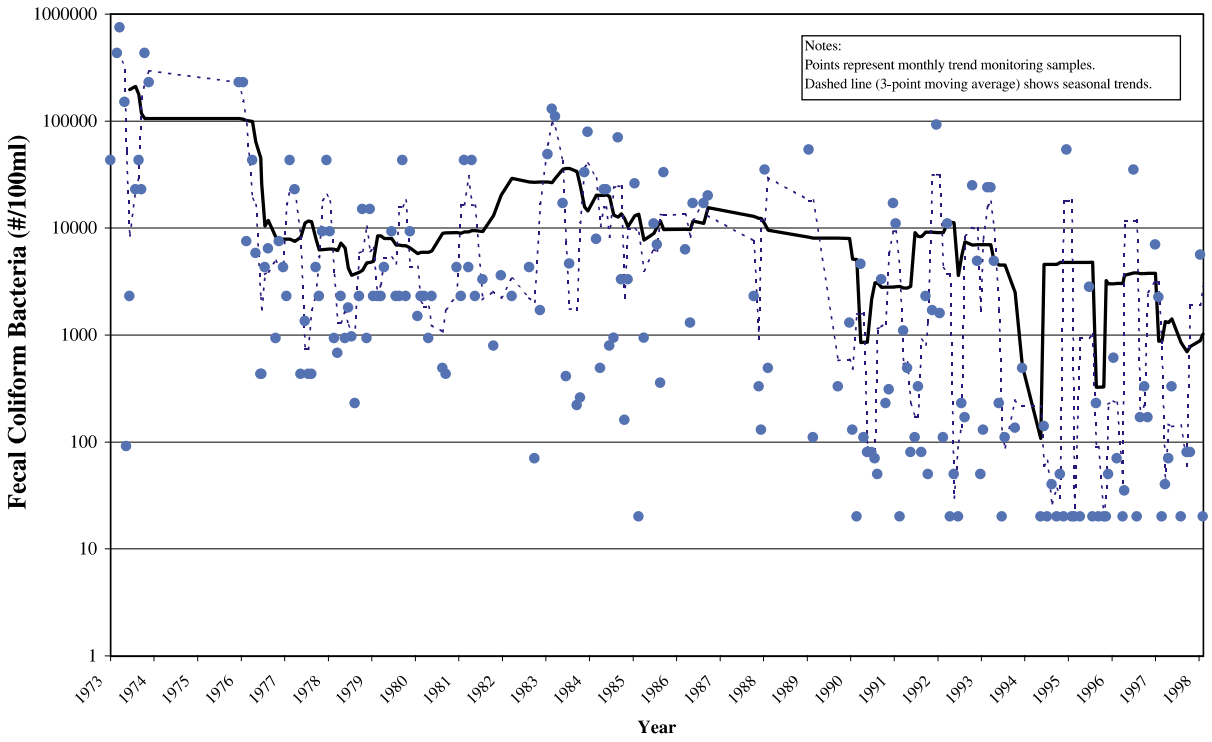

Figure 4-28. Fecal Concentrations, Savannah River below Spirit Creek

As point sources have been brought under control, nonpoint sources have become increasingly important as potential sources of fecal coliform bacteria. Nonpoint sources may include

- Agricultural nonpoint sources, including concentrated animal operations and spreading and/or disposal of animal wastes.
- Runoff from urban areas transporting surface dirt and litter, which may include both human and animal fecal matter, as well as a fecal component derived from sanitary sewer overflows.
- Urban and rural input from failed or ponding septic systems.

4.2.5 Synthetic Organic Chemicals

Synthetic organic chemicals (SOCs) include pesticides, herbicides, and other man-made toxic chemicals. SOCs may be discharged to waterbodies in a variety of ways, including

- Industrial point source discharges.
- Wastewater treatment plant point source discharges, which often include industrial effluent as well as SOCs from household disposal of products such as cleaning agents and insecticides.
- Nonpoint runoff from agricultural and silvicultural land with pesticide and herbicide applications.
- Nonpoint runoff from urban areas, which may load a variety of SOCs such as horticultural chemicals and termiticides.
- Illegal disposal and dumping of wastes.

To date, SOCs have not been detected in the surface waters of the Savannah River basin in problem concentrations. It should be noted, however, that most monitoring has been targeted to waters located below point sources where potential problems were suspected. Agricultural sources were potentially important in the past, particularly from cotton production in the Coastal Plain, but the risk has apparently greatly declined with a switch to less persistent pesticides. Recent research by USGS (Hippe et al., 1994; Stell et al., 1995) suggests pesticide/herbicide loading in urban runoff and storm water may be of greater concern than agricultural loading, particularly in streams of the metropolitan Atlanta area.

4.2.6 Stressors from Flow and Temperature Modification

Stress from flow modification is primarily associated with peaking hydropower operation of dams on the Savannah River, as well as stormflow in smaller streams associated with development and increased impervious area.

4.2.7 Sediment

Erosion, discharge of sediment, and bedload resuspension can have a number of adverse impacts on water quality. First, sediment and bedload resuspension can carry attached nutrients, pesticides, and metals into streams. Second, sediment is itself a stressor. Excess sediment loads and bedload resuspension can alter habitat, destroy spawning substrate, and choke aquatic life, while high turbidity also impairs recreational and drinking water uses. Sediment loading is of concern throughout the basin, but is of

greatest concern in the developing metropolitan areas and major transportation corridors. The rural areas are of lesser concern with the exception of rural unpaved road systems and areas where cultivated cropland exceeds 20 percent of the total land cover.

4.2.8 Habitat Degradation and Loss

In many parts of the Savannah basin, support for native aquatic life is potentially threatened by degradation of aquatic habitat. Habitat degradation is closely tied to sediment loading, and excess sediment is the main threat to habitat in rural areas with extensive land-disturbing activities, as well as in urban areas where increased flow peaks and construction can choke and alter stream bottom substrates. A second important type of habitat degradation in the Savannah basin is loss of riparian tree cover, which can lead to increased water temperatures.

References

Delaplane, K.S., ed. 1991. 1991 Georgia Pest Control Handbook. Special Bulletin 28 Cooperative Extension Service, The University of Georgia College of Agriculture, Athens, Georgia.

EPD. 2000. Water Quality in Georgia, 1998-1999. Georgia Department of Natural Resources, Environmental Protection Division, Atlanta, GA.

SCS. 1993. Georgia Watershed Agricultural Nonpoint Source Pollution Assessment, Cooperative River Basin Study. Prepared by U.S. Department of Agriculture, Forest Service, Conservation Service. Soil Conservation Service, Atlanta, Georgia.

Stell, S.M., E.H. Hopkins, G.R. Buell, and D.J. Hippe. 1995. Use and Occurrence of Pesticides in the Apalachicola-Chattahoochee-Flint River Basin, Georgia, Alabama, and Florida, 1960-91. Open-File Report 95-739. U.S. Geological Survey, Atlanta, Georgia.

In This Section

- Assessment of Water Quantity
- Assessment of Water Quality

Section 5

Assessments of Water Quantity and Quality

This section provides an evaluation of the current conditions in the Savannah River basin, in terms of both water quantity (Section 5.1) and water quality (Section 5.2) issues. The assessment results are then combined with the evaluation of environmental stressors from Section 4 to produce a listing of Concerns and Priority Issues in Section 6.

5.1 Assessment of Water Quantity

Water quantity information provided in this section is taken from several sources including the Water Control Manual, Savannah River Basin Multiple Purpose Projects: Hartwell Dam and Lake, Richard B. Russell Dam and Lake, J. Strom Thurmond Dam and Lake Georgia and South Carolina, US Army Corps of Engineers District, Savannah; Comprehensive Water Supply Management Plan For Chatham County Georgia; and the Georgia Department of Natural Resources, Parks, Recreation and Historic Division.

Additional water resources management issues will be addressed comprehensively as part of the Corps of Engineers Comprehensive Water Resources Management Study of the Savannah River Basin. This study is scheduled to be completed in September 2003. The following sections provide a summary of preliminary findings from these sources.

5.1.1 Municipal and Industrial Water Uses

Municipal and industrial water use projections are not available for the entire Savannah Basin, but they have been calculated for the growing area around Savannah. According to the Savannah-Chatham County estimates, total projected demands is projected to increase from 124.81 MGD in 2000 to 144.81 MGD by 2025. The projected demands includes ground and surface water demand for the Chatham County area.

Drinking Water Quality: Surface Water

Overall the surface water quality in the Savannah River basin is good for use as drinking water. All public water systems in the state of Georgia that use surface water meet federal surface water treatment rules for filtration and treatment. However, surface

water quality problems due to nonpoint source pollution such as agricultural and storm water runoff are concerns to municipalities which withdraw surface water from the Savannah River and tributaries. The contaminant of most concern is high turbidity, especially rapid increases in turbidity, due to erosion and sediment runoff. Water high in turbidity can clog filters, interrupt the proper treatment of raw water, and increase the cost of the water to the consumers because more chemicals are needed to settle out the sediment. Many water plants have reservoirs to store large amounts of water and to settle out excess sediment (turbidity). In some cases, taste and odor problems are associated with algae blooms in reservoirs, or with elevated concentrations of iron and manganese, which can arise when an anoxic, reducing environment exists in the bottom water of reservoirs. Table 5-1 summarizes the known and potential raw water quality problems affecting drinking water supplies associated with surface water intakes within the Savannah basin.

Drinking Water Quality: Groundwater

Overall ground water quality is very good for use as drinking water from wells. Since most wells used in public water systems are constructed by licensed well drillers and draw from deeper aquifers, the number of contaminated wells is small. However, in the Savannah River basin some public water system wells have been contaminated by local pollution sources such as leaky underground storage tanks, malfunctioning septic tank systems, and spills. Those wells that exceed the Maximum Contaminant Level (MCL) for a contaminant are either removed from service or added treatment to the system. Also, a few wells in the basin have been found to be under the direct influence of surface water due to the geology of the area in which the well is located. These wells are monitored and have additional treatment requirements.

Groundwater users in Richmond County have the potential to produce certain industrial contaminants from the sub-surface.

An additional area of concern is the Floridan aquifer in the coastal area of Georgia, specifically Chatham County. Sea-water is entering the aquifer in South Carolina at Port Royal Sound and beginning to move towards the production wells on Hilton Head Island and eventually towards the City of Savannah. The Georgia Environmental Protection Division has developed a policy document relating to this contamination issue called the "*Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer of Southeast Georgia*" dated April 23, 1997. Certain policy measures like reducing Floridan aquifer usage in Chatham County and limiting increased usage from the Floridan aquifer elsewhere in the coastal area are in force. Within the Savannah River basin no wells have yet been closed because of increased salt content in the aquifer and none are anticipated to be closed in the near future.

5.1.2 Agriculture

As stated in Section 3.2.2 the water demand for agricultural use in the Savannah River basin is, and will remain for the foreseeable future, a small portion of the total demand. Whether taken from surface or ground water sources, there is no reason to believe that the supply will not be adequate, even during a drought year.

5.1.3 Recreation

In the Savannah Basin the availability of water is most likely to have a significant effect on recreation through the way in which water levels are managed at Hartwell, Russell and Thurmond Lakes, the three Corps of Engineers projects. In 1994, Hartwell, Russell, and Thurmond Lakes had approximately 21 million visitors, which participated

Table 5-I. Known and Potential Raw Water Quality Problems Affecting Drinking Water Supplies in the Savannah Basin

Water System Name	Water Source Name	Number of Intakes	Reservoir that allow for WQ	No. Of Water Plants	Known Raw Water Quality Problems in the Past and Potential Future Problems	Other Comments
HUC 03060102						
Clayton-Rabun County Authority -2410118	Lake Rabun	1	Y	1	Water quality good. No known potential problems	Water in compliance. New plant.
City of Toccoa - 257001	Lake Toccoa (Cedar Creek)	1	Y	1	Water Quality good.	Water system in compliance. Plant recently upgraded.
City of Lavonia - 1190003	Lake Hartwell	1	Y	1	Water quality good.	Water Systems in compliance. Plant recently upgraded.
	Crawford Creek	1	N	1	Lake and some property around lake owned by city. Raw water turbidity spikes occasionally with heavy storm event. Shallow source with some iron and manganese-problems and taste and odor due to algae blooms.	
City of Washington - 3170002	Lake Wall (Little Beaverdam Creek)	1	Y	2	Water quality fair.	Water system in compliance. Aonia Plant is served by Clarks Hill Lake. Skull Shoals Plant by Lake Wall and Boline. Older Skull Shoals plants needs major upgrades. Aonia plant needs moderate upgrades.
	Lake Boline (Beaverdam Creek)	1	Y		Supplemental intake to Lake Wall. Potential iron and manganese problems. Larger than Lake Wall.	
	Clarks Hill Lake	1	Y		Water quality good.	
Columbia County - 0730000	Clarks Hill Lake	1	Y	2	Water quality good.	Water systems in compliance. Has intakes in HUC 03060105 and HUC 03060106 (Stevens Creek). Both plants may need to expand due to growth in the north part of the County.

Water System Name	Water Source Name	Number of Intakes	Reservoir that allow for WQ	No. Of Water Plants	Known Raw Water Quality Problems in the Past and Potential Future Problems	Other Comments
Thomson-McDuffee Co. 1890001	Clarks Hill Lake	1	Y	2	Water quality good.	Package plant water system in compliance. Has intakes in both HUC 03060105 and HUC 03060108 (Usry Lake).
City of Union Point-1330002	Sherrill's Creek Reservoir	1	Y	1	Water quality fair. Shallow source.	Water system overall in compliance. Under consent order due to lack of certified operators.
Columbia County - 073000	Stevens Creek Reservoir (Savannah River)	1	N	2	Water quality good.	Water system in compliance. Has intakes in HUC 03060105 (Clarks Hill Lake) and HUC 03060106. Both plants may need to expand due to growth in the north part of the County.
City of Augusta-Richmond County 2450000	Augusta Canal (Savannah River)	1	Y (off-site reservoir at plant 4 miles away)	1	Water quality good.	Water System in compliance.
USA Fort Gordon-2450028	Butler Creek	1	Y	1	Water quality good.	Water system in compliance. Up flow clarifiers used.
HUC 03060108						
Thomson-McDuffee County-1890000	Usry Lake	1	Y	2	Water quality fair.	Water system in compliance. Has intakes in both HUC 03060105 (Clarks Hill Lake) and HUC 03060108.
City of Waynesboro-0330004	Brier Creek	1	N	1	Water quality fair.	Water system in compliance. Recent upgrades to plant.
HUC 03060109						
Savannah I&D - 0510004	Abercorn Creek (Savannah River)	1	N	1	Water quality highly variable due to tides and brackish waters and intercoastal waterway. High organics.	Water system in compliance. Recent plant upgrades.

Water System Name	Water Source Name	Number of Intakes	Reservoir that allow for WQ	No. Of Water Plants	Known Raw Water Quality Problems in the Past and Potential Future Problems	Other Comments
City of Hartwell -1470000	Lake Hartwell (Flat Shoals Creek)	1	Y	1	Intake located in deeper area of lake. Intake located to left of bridge at Hwy. 51. Remote chance of impact from the bridge. Area of lake not well developed. Recreational boating and fishing. Turbidity spike with heavy storm event. Overall water quality good.	Water System in compliance Plant upgraded four years ago. City and County need to work together in the protection and proper development of the area upstream intake.
City of Elberton - 1050001	Beaverdam Creek	1	N	1	Emergency intake	Water system in compliance. Need upgrades. City and County need to work together in order to protect and properly develop the area upstream of the intake.
	Lake Russell	1	Y		Water quality good. Pump water into off stream reservoir or to plant. Very little development around the intake. Pasture land adjacent to intake.	
City of Lincolnton-1810000	Clarks Hill Lake (Soap Creek)	1	Y	1	Water quality good but subject to more turbidity spikes due to bank exposure and runoff during heavy storm events. Very little development near the intake.	Water system in compliance. Need upgrades and expansion. Needs more staff. City and County need to work together in order to protect and properly develop the area upstream of the intake.
HUC 03060104						
Banks County-0110026	Mountain Creek Reservoir	1	Y	1	Water quality overall good. Iron and Manganese problems that potential increase with age of reservoir. Residential development increasing causing increasing amount of problems with turbidity. Higher turbidities due to potential development.	Water system in compliance. Brand new plant has Superpulsator plant.
City of Royston-1190004	North Forks Broad River	1	N	1	Water quality OK. Prone flashing due to no reservoir. 185 corridor, local airport. Lavonia wastewater treatment plant. Intake off HWY. 51? Watershed flows through Victoria Bryant State Park.	Water system in compliance. Water plant needs upgrades. Also use spring and wells to supplement water.

Water System Name	Water Source Name	Number of Intakes	Reservoir that allow for WQ	No. Of Water Plants	Known Raw Water Quality Problems in the Past and Potential Future Problems	Other Comments
City of Commerce - 1570001	Grove River Reservoir	1	Y	1	Water quality fair. Iron and Manganese problems. Ongoing problems with taste and odor caused by algae blooms. Shallow lake with pasture lands near lake. Prone to turbidity problems from surrounding area.	Water system in compliance but needs major upgrades. Need to install solids handling capabilities. Future plans to high rate the plant for more capacity. City needs upgrade plant prior to high rate.
City of Crawford - 2210000	Long Creek	1	Y	1	Water quality fair. Shallow source in swampy area prone to taste and odor problems due to algae blooms. High turbidity event after heavy rains causing major silting problems in in-stream impoundment. High levels of iron and Manganese. Low alkalinity concerns. Concerns regarding further degradation of the water source may hamper appropriate treatment in the plant.	Water system in compliance. Needs major upgrades to small plant, possible a new plant. Need more staff. City needs to investigate in either improving in-stream impoundment or finding alternative water source.

in activities such as picnicking, camping, boating, golfing, hiking, sightseeing and fishing. Because of the significant recreational use of the three Corps projects, it is very important that water levels be kept as high as possible, especially in the spring, summer, and early fall. Water level management is as much a function of the way in which the reservoirs are operated as of water availability, however. Should the Corps of Engineers operate the dam in a manner which levels will not be kept as high as would be the case if storage were to be maximized as a precaution against a drought. Under the Corps' conservative operational philosophy, when a drought occurs there will likely be a greater chance that water levels will drop below that which supports optimum recreation potential. However, there are significant issues related to flood protection, which must be considered carefully before normal pool levels are raised.

5.1.4 Hydropower

Hartwell, Russell, and Thurmond Lakes, are authorized and operated for hydropower. Under normal conditions, the water management goals of the projects are to maximize the public benefits of hydropower, flood damage, reduction, recreation, fish and wildlife, water supply, and water quality. Hydropower production to meet peaking needs is dependent on timely release of water through the turbines in the projects. In drought conditions, the water management objectives are (a) the lake levels should not be drawn below the bottom of the conservation pool. (b) Make use of most of the available storage in the lake during the drought of record. The lake should not be drawn down entirely, as contingency against a drought that exceeds the drought of record (the drought of 1986-1989). (c) Maintain hydroelectric plant capacity throughout the drought (d) Minimize adverse impacts to recreation during the recreation season (generally considered from May 1 through Labor Day)

5.1.5 Navigation

Under the Corps of Engineers Water Control Plan, Hartwell, Russell and Thurmond Lakes projects requires adequate flows to be maintained for navigation other than during the low flow periods. Currently, relatively little commercial navigation remains on the Savannah River.

5.1.6 Waste Assimilation Capacity

Georgia has obligations under the Clean Water Act to meet instream water quality standards, and the state places a high priority on this obligation. Only under extreme drought conditions, when sufficient water flow is not available after domestic water supply needs are met, would there be insufficient water to meet instream water quality standards.

5.1.7 Assessment of Ground Water

Groundwater use is somewhat more prevalent in the lower Piedmont and upper Coastal Plain, although surface water continues to be the source of choice. From just south of Augusta to the basin's terminus at the Atlantic Ocean, groundwater is used extensively particularly in the savannah metropolitan area. The intensity of groundwater with withdrawals from the Floridan Aquifer in Savannah, and the resultant decrease in pressure head and water quality in the aquifer, have resulted in concern about increasing future withdrawals. Subsequently, increase in industrial demand are expected are expected to be directed towards the more than ample surface water resources of the Savannah River. Future domestic demand increases are, however, expected to come from groundwater wells in western Chatham county.

Specific Ground Water Concerns

Specific groundwater concerns from certain portions of the basin and select recommendations are noted below.

Serious Floridan aquifer difficulties are being experienced in the coastal counties of Georgia impacted by the Interim Strategy. At present there are serious restrictions on use throughout the basin, including outright bans on new users in portions of southern Effingham and all of Chatham county. The agricultural area from Burke county south shall soon be included in this ban. When that occurs, new irrigation in this farming area (especially Screven county) may come to a halt. Withdrawals contribute to a regional decline in aquifer levels and cannot be continued. In the past there have also been concerns that the amount of water withdrawn from the various aquifers is leading to diminishment of river flow. There is extensive development occurring along the coastal tier of counties. Suburban growth of Effingham and Bryan counties continues unchecked. More water is being requested and cannot be approved or permitted.

Other areas of concern is the demand for groundwater in the Augusta and Richmond county areas, with the potential to mobilize the variety of contamination present in the Cretaceous aquifer in Augusta. Presently EPD is considering the denial of any additional groundwater withdrawals in Augusta, and forcing new users to go to surface water. Whether justified or not, there are also serious concerns about radioactive pollution from the Savannah River Test Site. The SRS occasionally releases Tritium in to the Savannah River directly, and concerns exist about the potential for groundwater pollution moving under the Savannah River and polluting the aquifers in Georgia. Plant Vogtle may also contribute radioactive materials to the environment.

Lastly, development of the mountain areas accelerates, with the associated demand for water resources. South Carolina demands in the north, Georgia demands in the mountain counties and demands near Athens are all accelerating withdrawals of limited Piedmont groundwater.

5.2 Assessment of Water Quality

This assessment of water quality is generally consistent with Georgia's water quality assessments for CWA Section 305(b) reporting to EPA. It begins with a discussion of (1) water quality standards, (2) monitoring programs, and (3) data analyses to assess compliance with water quality standards and determine use support. Following this introductory material, detailed assessment results by subbasin are presented in Section 5.2.4.

5.2.1 Water Quality Standards

Assessment of water quality requires a baseline for comparison. A statewide baseline is provided by Georgia's water quality standards, which contain water use classifications, numeric standards for chemical concentrations, and narrative requirements for water quality.

Georgia's water use classifications and standards were first established by the Georgia Water Quality Control Board in 1966. The water use classification system was applied to interstate waters in 1972 by EPD. Table 5-2 provides a summary of water use classifications and basic water quality criteria for each water use. Georgia also has general narrative water quality standards, which apply to all waters. These narrative standards are summarized in Table 5-3.

Table 5-2. Georgia Water Use Classifications and Instream Water Quality Standards for Each Use

	Bacteria (fecal coliform)		Dissolved Oxygen (other than trout streams)[1]		pH	Temperature (other than trout streams)[1]	
Use Classification	30-Day Geometric Mean[2] (MPN/100 ml)	Maximum (MPN./100 ml)	Daily Average (mg/l)	Minimum (mg/l)	Std. Units	Maximum Rise (°F)	Maximum (°F)
Drinking Water requiring treatment	1,000 (Nov-April) 200 (May-October)	4,000 (Nov-April)	5.0	4.0	6.0-8.5	5	90
Recreation	200 (Freshwater) 100 Coastal)	--	5.0	4.0	6.0-8.5	5	90
Fishing Coastal Fishing[3]	1,000 (Nov-April) 200 (May-October)	4,000 (Nov-April)	5.0	4.0	6.0-8.5	5	90
Wild River	No alteration of natural water quality						
Scenic River	No alteration of natural water quality						

[1] *Standards for Trout Streams for dissolved oxygen are an average of 6.0 mg/l and a minimum of 5.0 mg/l. No temperature alteration is allowed in Primary Trout Streams and a temperature change of 2 °F is allowed in Secondary Trout Streams.*

[2] *Geometric means should be "based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours." The geometric mean of a series of N terms is the Nth root of their product. Example: the geometric mean of 2 and 18 is the square root of 36.*

[3] *Standards are same as fishing with the exception of dissolved oxygen which is site specific.*

Table 5-3. Georgia Narrative Water Quality Standards for All Waters (Excerpt from Georgia Rules and Regulations for Water Quality Control Chapter 391-3-6-.03 - Water Use Classifications and Water Quality Standards)

(5) General Criteria for All Waters. The following criteria are deemed to be necessary and applicable to all waters of the State:

(a) All waters shall be free from materials associated with municipal or domestic sewage, industrial waste or any other waste which will settle to form sludge deposits that become putrescent, unsightly or otherwise objectionable.

(b) All waters shall be free from oil, scum and floating debris associated with municipal or domestic sewage, industrial waste or other discharges in amounts sufficient to be unsightly or to interfere with legitimate water uses.

(c) All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.

(d) All waters shall be free from toxic, corrosive, acidic and caustic substances discharged from municipalities, industries or other sources, such as nonpoint sources, in amounts, concentrations or combinations which are harmful to humans, animals or aquatic life.

(e) All waters shall be free from turbidity which results in a substantial visual contrast in a waterbody due to man-made activity. The upstream appearance of a body of water shall be observed at a point immediately upstream of a turbidity-causing man-made activity. The upstream appearance shall be compared to a point which is located sufficiently downstream from the activity so as to provide an appropriate mixing zone. For land disturbing activities, proper design, installation and maintenance of best management practices and compliance with issued permits shall constitute compliance with [this] Paragraph...

In addition to the basic water quality standards shown above, Congress made changes in the Clean Water Act in 1987 which required each state to adopt numeric limits for

toxic substances for the protection of aquatic life and human health. In order to comply with these requirements, in 1989 the Board of Natural Resources adopted 31 numeric standards for protection of aquatic life and 90 numeric standards for the protection of human health. Appendix B provides a complete list of the toxic substance standards that apply to all waters in Georgia. Georgia has adopted all numeric standards for toxic substances promulgated by the USEPA. As resources are made available, Georgia is also developing site-specific standards for major lakes where control of nutrient loading is required to prevent problems associated with eutrophication.

5.2.2 Surface Water Quality Monitoring

EPD's monitoring program integrates physical, chemical, and biological monitoring to provide information for water quality and use attainment assessments and for basin planning. EPD monitors the surface waters of the state to:

- collect baseline and trend data,
- document existing conditions,
- study impacts of specific discharges,
- determine improvements resulting from upgraded water pollution control plants,
- support enforcement actions,
- establish wasteload allocations for new and existing facilities,
- verify water pollution control plant compliance,
- document water use impairment and reasons for problems causing less than full support of designated water uses, and
- develop Total Maximum Daily Loads.

EPD used a variety of monitoring tools to collect information to determine if the waterbodies are supporting its designated uses. These tools include trend monitoring, intensive surveys, lake, coastal, biological, fish tissue, and toxic substance monitoring, and facility compliance sampling. Each of these is briefly described in the following sections.

Trend Monitoring

Long term monitoring of streams at strategic locations throughout Georgia, trend or ambient monitoring, was initiated by EPD during the late 1960s. This work was and continues to be accomplished to a large extent through cooperative agreements with federal, state, and local agencies who collect samples from groups of stations at specific, fixed locations throughout the year. The cooperating agencies conduct certain tests in the field and send stream samples to EPD for additional laboratory analyses. Although there have been a number of changes over the years, routine chemical trend monitoring is still accomplished through similar cooperative agreements.

Today EPD contracts with the United States Geological Survey (USGS) for the majority of the trend sampling work, and with the U.S. Army Corps of Engineers for samples in the Savannah Harbor. In addition to monthly stream sampling, a portion of the work with the USGS involves continuous monitoring at several locations across the state. EPD associates also collect water and sediment samples for toxic substance analyses, as well as macroinvertebrate samples to characterize the biological community at selected locations as a part of the trend monitoring effort. WRD associates also assess fish communities as a part of the monitoring effort. Additional samples used in the 1997

assessment were collected by other federal, state and local governments, universities, contracted Clean Lakes projects and utility companies. Trend monitoring stations located in the Savannah basin are shown in Figure 5-1.

Focused Trend Monitoring in the Savannah River Basin

In 1995, EPD adopted and implemented significant changes to the strategy for trend monitoring in Georgia. The changes were implemented to support the River Basin Management Planning program. The number of fixed stations statewide was reduced in order to focus resources for sampling and analysis in a particular group of basins in any one year in accordance with the basin planning schedule. Sampling focus was placed on the Savannah River basin and Ogeechee River basin during the 1997 sampling. In mid-1997 an additional effort was made to provide for quarterly sampling of fecal coliform (with four samples collected in a thirty day period), and for metals sampling twice per day. To accomplish this effort sampling in the Savannah and Ogeechee basins was continued through 1998.

Figure 5-2 shows the focused trend monitoring network for the Savannah River basin used in 1997-1998. During this period statewide trend monitoring was continued at the 37 core station locations statewide, in the Savannah Harbor, and at all continuous monitoring locations. The remainder of the trend monitoring resources were devoted to the Savannah and Ogeechee River basins. In addition to chemical sampling, new work on macroinvertebrate sampling was done as a part of the Savannah River basin monitoring work. As a result, more sampling was conducted in the focus river basins. Increasing the resolution of the water quality monitoring improves the opportunity to identify impaired waters, as well as the causes of impairment.

Intensive Surveys

Intensive surveys complement long-term fixed station fixed station monitoring to focus on a particular issue or problem over a shorter period of time. Several basic types of intensive surveys are conducted, including model calibration surveys and impact studies. The purpose of a model calibration survey is to collect data to calibrate a mathematical water quality mode. Models are used for wasteload allocations and/or TMDLs and as tools for use in making regulatory decisions. Impact studies are conducted when information on the cause-and-effect relationships between pollutant sources and receiving waters is needed. In many cases biological information is collected along with chemical data for use in assessing environmental impacts.

Lake Monitoring

EPD has maintained monitoring programs for Georgia's public access lakes for many years. In the late 1960s, a comprehensive statewide study was conducted to assess fecal coliform levels at public beaches on major lakes in Georgia as the basis for water use classifications and establishment of water quality standards for recreational waters. In 1972, EPD staff participated in the USEPA National Eutrophication Survey, which included 14 lakes in Georgia. A postimpoundment study was conducted for West Point Lake in 1974. Additional lake monitoring continued through the 1970s. The focus of these studies was primarily problem/solution-oriented and served as the basis for regulatory decisions.

Trophic Condition Monitoring

In 1980-1981, EPD conducted a statewide survey of public access freshwater lakes. The study was funded in part by USEPA Clean Lakes Program funds. The survey objectives were to identify freshwater lakes with public access, assess each lake's trophic

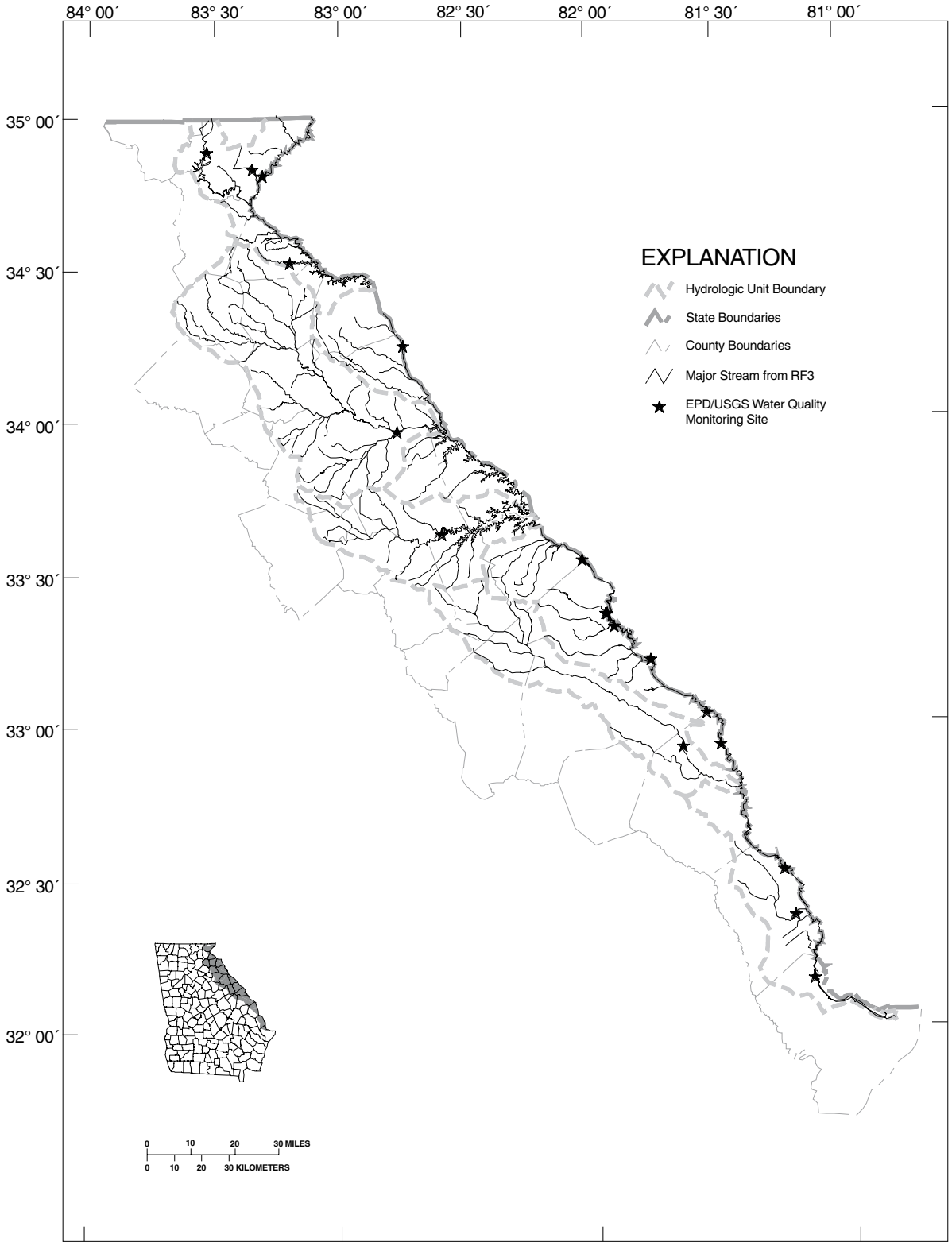

Figure 5-I. Savannah River Basin Fixed Sampling Station Locations

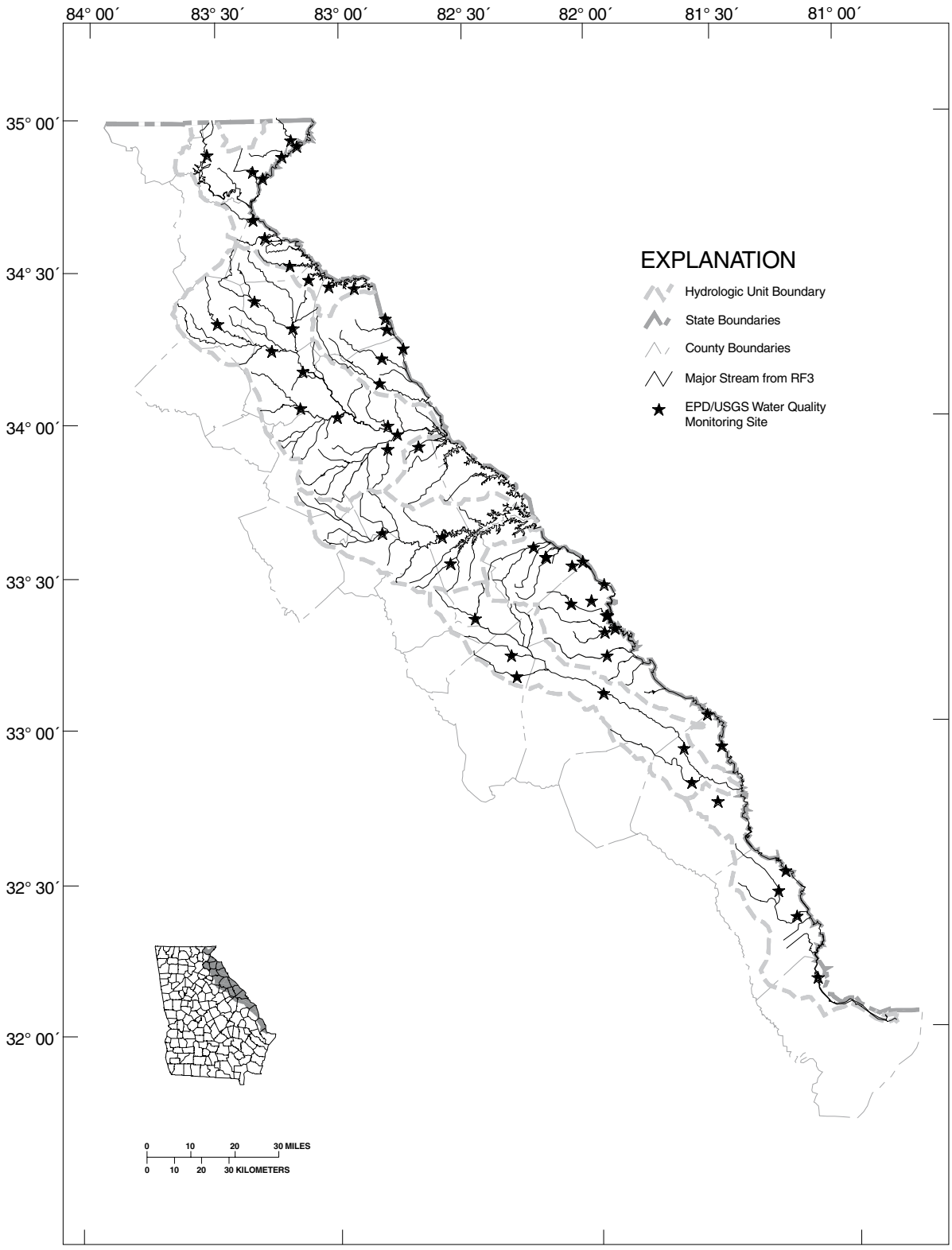

Figure 5-2. Savannah River Basin Trend Monitoring Network Station Locations

condition, and develop a priority listing of lakes as to need for restoration and/or protection. In the course of the survey, data and information were collected on 175 identified lakes in 340 sampling trips. The data collected included depth profiles for dissolved oxygen, temperature, pH, specific conductance, and Secchi disk transparency and chemical analyses for chlorophyll *a*, total phosphorus, nitrogen compounds, and turbidity. The three measures of Carlson's Trophic State Index were combined into a single total trophic state index (TTSI) and used with other field data and observations to assess the trophic condition of each lake. Higher values of the TTSI represent more eutrophic, less desirable conditions. Monitoring efforts have continued since the 1980-1981 Lake Classification Survey with a focus on major lakes (those with a surface area greater than 500 acres), and the TTSI has continued to be employed as a tool to mark trophic state trends. The major lakes in the Savannah basin are listed in Table 5-4 and are ranked according to the TTSI for the period 1984-1993. The monitoring project for major lakes became a part of the River Basin Management Planning process in 1995.

Fish Tissue Monitoring

The DNR conducts fish tissue monitoring for toxic chemicals and issues fish consumption guidelines as needed to protect human health. It is not possible for the DNR to sample fish from every stream and lake in the state. However, high priority has been placed on the 26 major reservoirs which make up more than 90 percent of the total lake acreage. These lakes will continue to be sampled as part of the River Basin Management Planning 5-year rotating schedule to track trends in fish contaminant levels. The DNR has also made sampling fish in rivers and streams down-stream of urban and/or industrial areas a high priority. In addition, DNR will focus attention on areas which are frequented by a large number of anglers.

The program includes testing of fish tissue samples for the substances listed in Table 5-5. Of the 43 constituents tested, only PCBs, chlordane, and mercury have been found in fish at concentrations which could create risk to human health from fish consumption.

Table 5-4. Major Lakes in the Savannah River Basin Ranked by Sum of Trophic State Index Values, 1980-1993

1984		1985		1986		1987		1988	
Burton	125	Burton	121	Burton	114	Burton	<119	Burton	<120
Clarks Hill	144	Clarks Hill	123	Clarks Hill	123	Clarks Hill	151	Clarks Hill	<118
Hartwell	122	Hartwell	116	Hartwell	121	Hartwell	<126	Hartwell	<114
Tugaloo	141	Tugaloo	144	Tugaloo	148	Tugaloo	166	Tugaloo	<133
Rabun	136	Rabun	122	Rabun	117	Rabun	<130	Rabun	111
Russell	136	Russell	122	Russell	131	Russell	<133	Russell	<145
range for state:	120-205	*range for state:*	116-188	*range for state:*	114-177	*range for state:*	<108-184	*range for state:*	111-178

1989		1990		1991		1992		1993	
Burton	123	Burton	138	Burton	130	Burton	149	Burton	145
Clarks Hill	153	Clarks Hill	145	Clarks Hill	146	Clarks Hill	131	Clarks Hill	153
Hartwell	138	Hartwell	136	Hartwell	132	Hartwell	138	Hartwell	146
Tugaloo	156	Tugaloo	161	Tugaloo	133	Tugaloo	157	Tugaloo	143
Rabun	128	Rabun	142	Rabun	122	Rabun	143	Rabun	140
Russell	156	Russell	142	Russell	141	Russell	147	Russell	156
range for state:	123-209	*range for state:*	118-182	*range for state:*	121-193	*range for state:*	131-194	*range for state:*	122-195

Note: Higher values represent more eutrophic conditions.

Table 5-5. Parameters for Fish Tissue Testing

Antimony	a-BHC	Heptachlor
Arsenic	b-BHC	Heptachlor Epoxide
Beryllium	d-BHC	Toxaphene
Cadmium	g-BHC (Lindane)	PCB-1016
Chromium, Total	Chlordane	PCB-1221
Copper	4,4-DDD	PCB-1232
Lead	4,4-DDE	PCB-1242
Mercury	4,4-DDT	PCB-1248
Nickel	Dieldrin	PCB-1254
Selenium	Endosulfan I	PCB-1260
Silver	Endosulfan II	Methoxychlor
Thallium	Endosulfan Sulfate	HCB
Zinc	Endrin	Mirex
Aldrin	Endrin Aldehyde	Pentachloroanisole
		Chlorpyrifos

The test results have been used to develop consumption guidelines which are updated annually and provided to fishermen when they purchase fishing licenses. This program will continue and will be coordinated as a part of the Rive Basin Management Planning process in the future.

In 1994, EPD began utilizing a "risk-based" approach to develop fish consumption guidelines for the state's waters. The EPD's guidelines are based on the use of USEPA potency factors for carcinogenicity and reference doses for noncancer toxicity, whichever is most protective. Inputs used in the derivation of guidelines include a 1 X 10^{-4} risk level for cancer, a 30 year exposure duration, 70 kg as body weight for an adult, and 70 years as the lifetime duration. A range of possible intakes from a low of 3g/day to a high of 30 g/day is evaluated and one of four different recommendations made: no restriction, limit consumption to 1 meal per week, limit consumption to 1 meal per month, or do not eat.

To address concerns about PCBs, recommendations for Lake Hartwell include a fish monitoring program to advise the public of potential health risks and a proactive education campaign which targets anglers and youth. The education campaign is part of a remediation effort that is supervised by EPA (Craig Zeller, EPA, personal communication).

Toxic Substance Stream Monitoring

EPD has focused resources on the management and control of toxic substances in the state's waters for many years. Toxic substance analyses were conducted on samples from selected trend monitoring stations from 1973-1991. Wherever discharges were found to have toxic impacts or to include toxic pollutants, EPD has incorporated specific limitations on toxic pollutants in NPDES discharge permits.

In 1983 EPD intensified toxic substance stream monitoring efforts. This expanded toxic substance stream monitoring project includes facility effluent, stream, sediment, and fish sampling at specific sites downstream of selected industrial and municipal discharges. From 1983 through 1991, 10 to 20 sites per year were sampled as part of this project. Future work will be conducted as a part of the River Basin Management Planning process.

Facility Compliance Sampling

In addition to surface water quality monitoring, EPD conducts evaluations and compliance sampling inspections of municipal and industrial water pollution control plants. Compliance sampling inspections include the collection of 24-hour composite samples, as well as evaluation of the permittee's sampling and flow monitoring requirements.

More than 290 sampling inspections were conducted by EPD staff statewide in 1997. The results were used, in part, to verify the validity of permittee self-monitoring data and as supporting evidence, as applicable, in enforcement actions. Also, sampling inspections can lead to identification of illegal discharges. In 1997, this work was focused on facilities in the Savannah and Ogeechee River basins in support of the basin planning process.

Aquatic Toxicity Testing

In 1982 EPD incorporated aquatic toxicity testing into selected industrial NPDES permits. In January 1995, EPD issued approved NPDES Reasonable Potential Procedures, which further delineated required conditions for conducting whole effluent toxicity (WET) testing for municipal and industrial discharges. All major permitted discharges (flow greater than 1 MGD) are required to have WET tests run with each permit reissuance. Certain minor dischargers are also subject to this requirement if EPD determines that aquatic toxicity is a potential issue.

5.2.3 Data Analysis

Assessment of Use Support - General Procedures

EPD assesses water quality data to determine if water quality standards are met and if the waterbody supports its classified use. If monitoring data shows that standards are not achieved, depending on the frequency with which standards are not met, the waterbody is said to be not supporting or partially supporting the designated use (see box).

Appendix E includes lists of all streams and rivers in the basin for which data have been assessed. The lists include information on the location, data source, designated water use classification, criterion violated, potential cause, actions planned to alleviate the problem, and estimates of stream miles affected. The list is further coded to indicate status of each waterbody under several sections of the Federal Clean Water Act (CWA). Different sections of the CWA require states to assess water quality (Section 305(b)), to list waters still requiring TMDLs (Section 303(d)), and to document waters with nonpoint source problems (Section 319).

The assessed waters are described in three categories: waters supporting designated uses, waters partially supporting designated uses, and waters not supporting designated uses. Waters were placed on the partially supporting list if:

- The chemical data (dissolved oxygen, pH, temperature) indicated an excursion of a water quality standard in 11 percent - 25 percent of the samples collected.
- A fish consumption guideline was in place for the waterbody.

The partially supporting list may also include stream reaches based on predicted concentrations of metals at low stream flow (7Q10 flows) in excess of state standards as opposed to actual measurements on a stream sample. Generally, a stream reach was placed on the not supporting list if:

- The chemical data (dissolved oxygen, pH, temperature) indicated an excursion of a water quality standard in greater than 25 percent of the samples collected.
- A fish consumption ban was in place for the waterbody.
- Acute or chronic toxicity tests documented or predicted toxicity at low stream flow (7Q10) due to a municipal or industrial discharge to the waterbody.

Additional specific detail is provided in the following paragraphs on analysis of data for fecal coliform bacteria, metals, toxicity, dissolved oxygen, fish/shellfish consumption advisories, and biotic data.

5.2.4 Assessment of Water Quality and Use Support

This section provides a summary of the assessment of water quality and support of designated uses for streams and major lakes in the Savannah River basin. These results were previously provided in the Georgia 2000 305(b)/303(d) listing (Georgia DNR, 2000). A geographic summary of assessment results is provided by HUC in Figures 5-3 through 5-9.

Tugaloo River (HUC 03060102)

Appendix E summarizes the determination of support for designated uses of all assessed rivers and streams within this hydrologic unit (GA DNR, 2000).

Monitoring data was collected from 12 trend monitoring stations located within this subbasin during the 1997-1998 period, two of which were on the mainstem. Historically, one trend monitoring station has been sampled within this subbasin. The following assessment is based on data from these trend monitoring stations, as well as from samples collected by other agencies.

Data from the mainstem stations indicate that water quality conditions are being affected by nonpoint source pollution.

Metals

The water use classification of fishing was not fully supported in one tributary stream segment (Eastanolle Creek) due to exceedences of water quality standards for metals. Zinc and copper standards were exceeded in the tributary stream due primarily to urban runoff and water pollution control plant discharges.

Fecal Coliform Bacteria

The water use classifications for fishing or wild/scenic river was not fully supported in six tributary stream segments due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

Analysis of data for fecal coliform bacteria, metals, toxicity, dissolved oxygen, fish/shellfish consumption advisories, and biotic data.

Fecal Coliform Bacteria

Georgia water quality standards establish a fecal coliform criterion of a geometric mean (four samples collected over a 30-day period) of 200 MPN/100 mL for all waters in Georgia during the recreational season of May through October. This is the year-round standard for waters with the water use classification of recreation. For waters classified as drinking water, fishing, or coastal fishing, for the period of November through April, the fecal coliform criterion is a geometric mean (four samples collected over a 30-day period) of 1000 per 100 ml and not to exceed 4000 per 100 ml for any one sample. The goal of fecal coliform sampling in the Savannah River basin focused mointoring in 1997-1998 was to collect four samples in a thirty day period in each of four quarters. If one geometric was in excess of the standard then the stream segment was placed on the partial support list. If more than one geometric mean was in excess of the standard the stream segment was placed on the not support list. In come cases the number of samples was not adequate to calculate geometric means. In these cases, the USEPA recommends the use of a review criterion of 400 per 100 ml to evaluate sample results. This bacterial density was used to evaluate data for the months of May through October and the maximum criterion of 4000 per 100 ml was used in assessing the data from the months of November through April. Thus, where geometric mean data was not available, waters were deemed not supporting uses when 26 percent of the samples had fecal coliform bacteria densities greater than the applicable review criteria (400 or 4000 MPN/100 mL) and partially supporting when 11 to 25 percent of the samples were in excess of the review criterion.

Metals

Since data on metals from any one given site are typically infrequent, using the general evaluation technique of 26 percent excursion to indicate nonsupport and 11 to 25 percent excursion to indicate partial support was not meaningful. Streams were placed in the nonsupporting category if multiple excursions of state criteria occurred and the data were based on more than four samples per year. With less frequent sampling, streams with excursions were placed on the partially supporting list. In addition, an asterisk appears beside metals data in those cases where there is a minimal database. Data were collected in the winter and the summer seasons for the Savannah and Ogeechee for comparison to water quality standards. Clean techniques were used. If one of the samples was in excess of the standard the stream segment was placed on the partial support list. This approach is in accordance with US EPA guidance, which suggests any single excursion of a metals criteria be listed.

Toxicity Testing/Toxic Substances

Data from EPD toxicity testing of water pollution control plant effluents were used to predict toxicity in the receiving waterbody at critical, low flows. Effluent data for metals were used to designate either partial support or nonsupport based on whether instream corroborating metals data were available. When instreammetals data were available the stream was determined to be not supporting if a metal concentration exceeded stream standards; when instream data were not available, the stream was listed as partially supporting.

Dissolved Oxygen, pH, Temperature

When available data indicated that these parameters were out of compliance with state standards more than 25 percent of the time, the waters were evaluated as not supporting the designated use. Between 11 percent and 25 percent noncompliance resulted in a partially supporting evaluation.

Fish/Shellfish Consumption Guidelines

A waterbody was included in the not supporting category when an advisory for “no consumption” of fish, a commercial fishing ban, or a shellfishing ban was in effect. A waterbody was placed in the partially supporting category if a guideline for restricted consumption of fish had been issued for the waters.

Biotic Data

A “Biota Impacted” designation for “Criterion Violated” indicates that studies showed a modification of the biotic community. Communities used were fish. Studies of fish populations by the DNR Wildlife Resources Division used the Index of Biotic Integrity (IBI) to identify affected fish populations. The IBI values were used to classify the population as Excellent, Good, Fair, Poor, or Very Poor. Stream segments with fish populations rated as “Poor” or “Very Poor” were included in the partially supporting list.

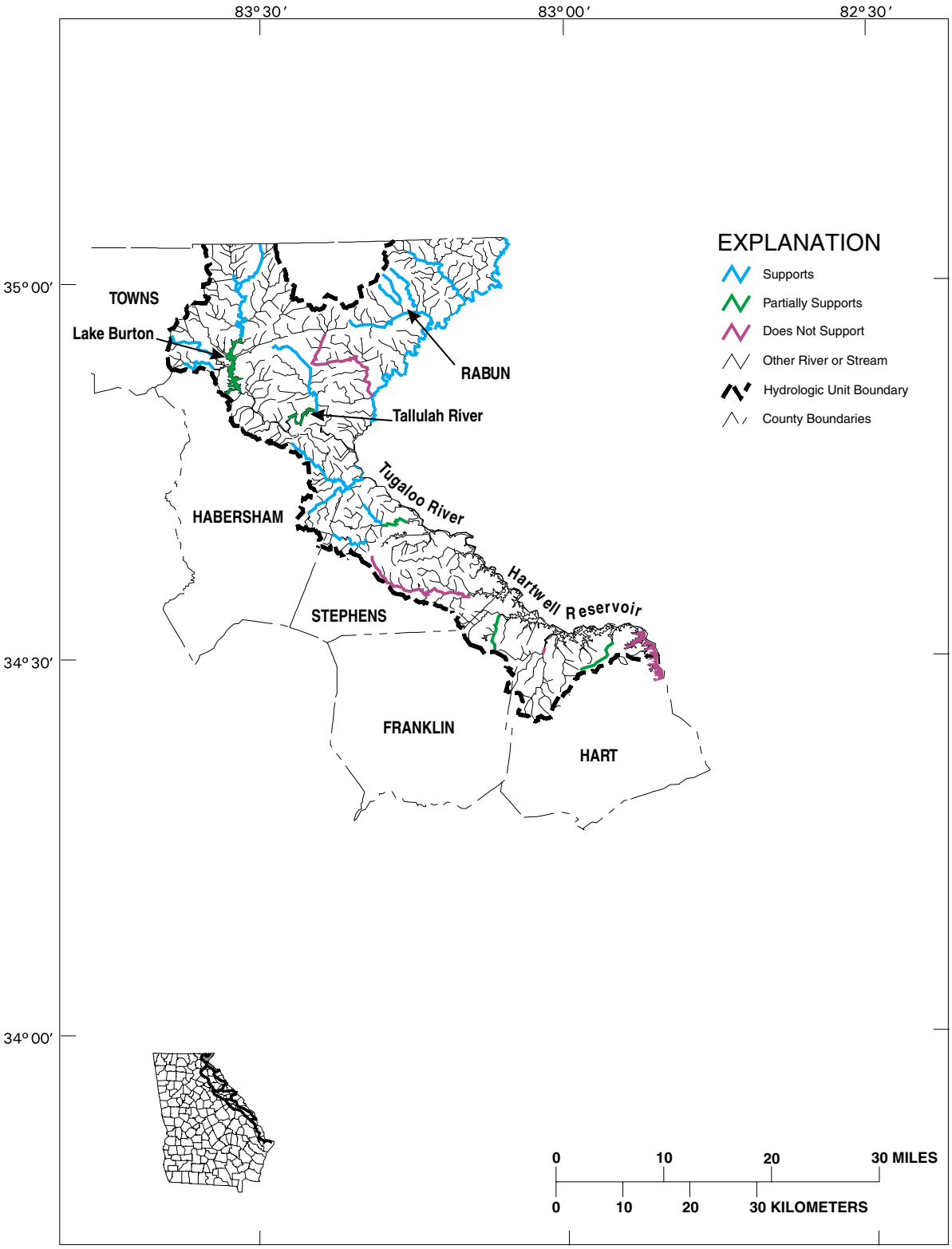

Figure 5-3. Assessment of Water Quality Use Support in the Savannah River Basin, HUC 03060102

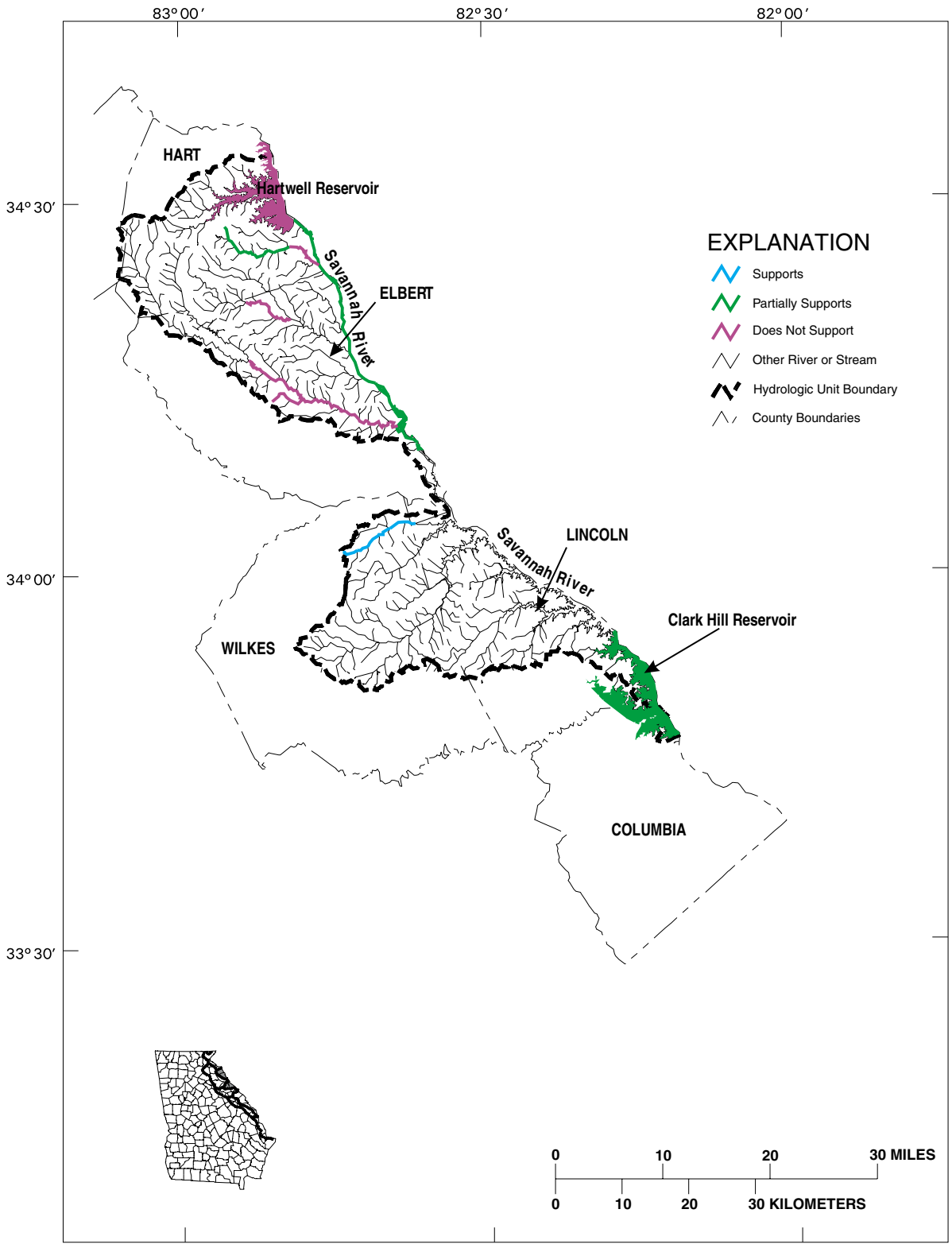

Figure 5-4. Assessment of Water Quality Use Support in the Savannah River Basin, HUC 03060103

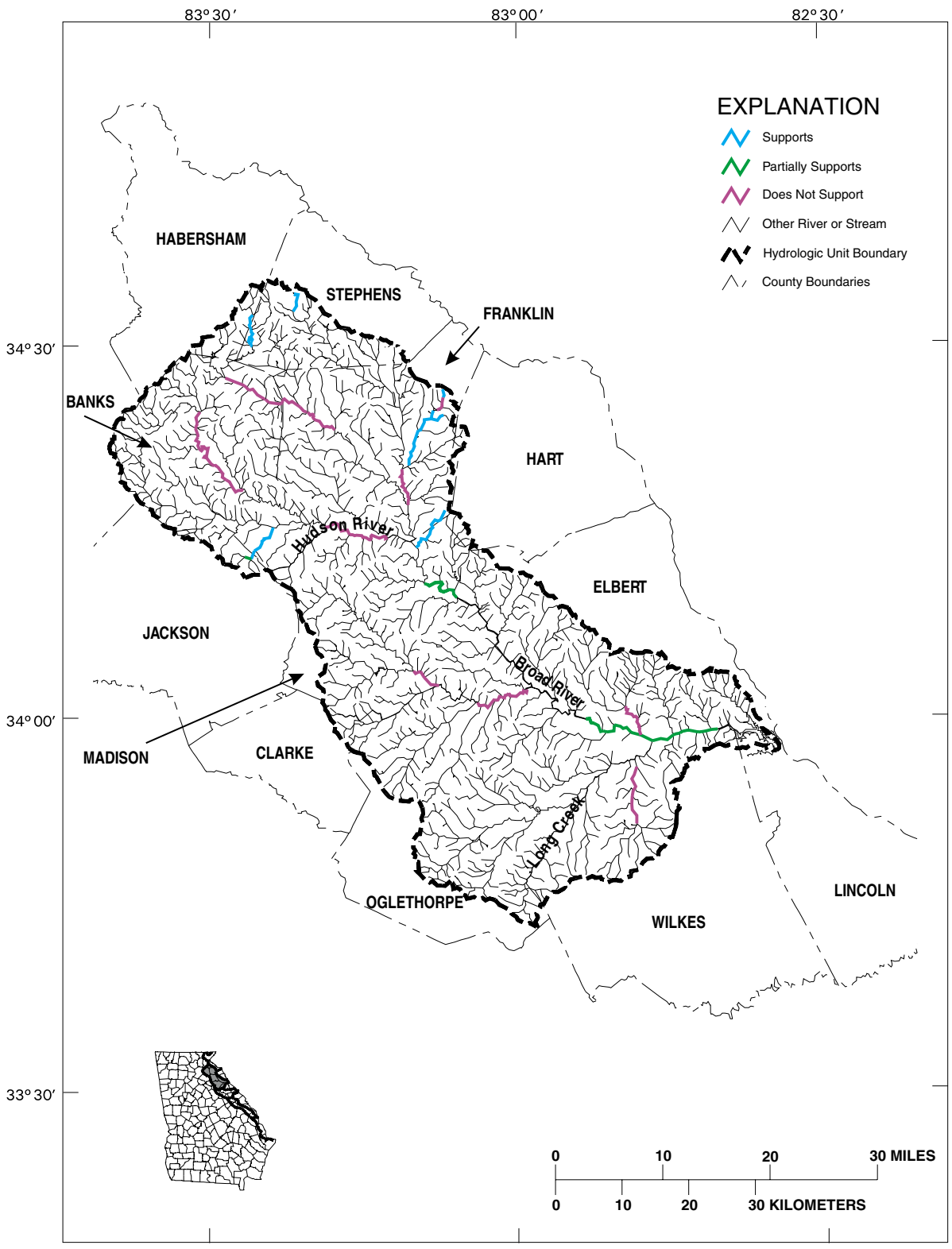

Figure 5-5. Assessment of Water Quality Use Support in the Savannah River Basin, HUC 03060104

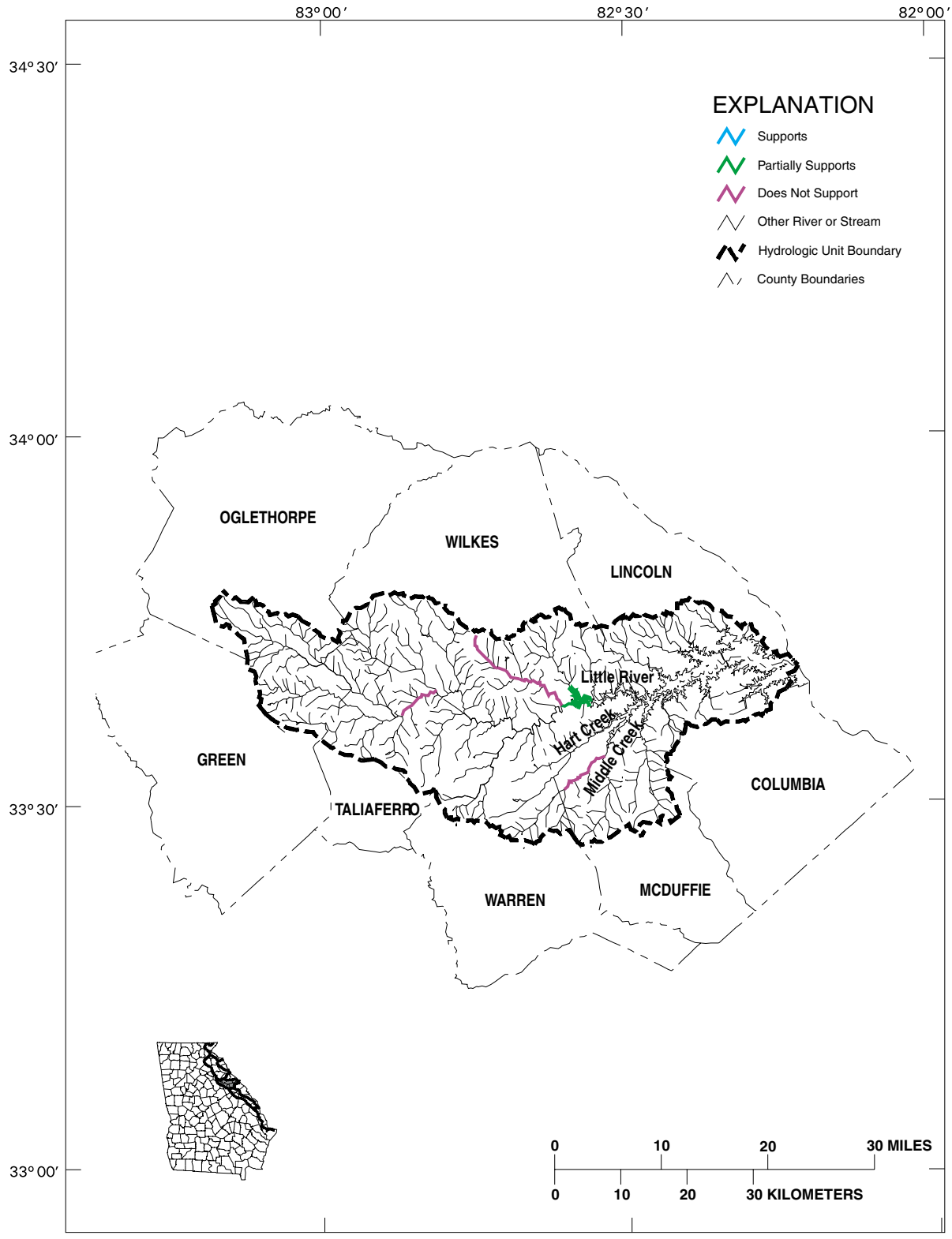

Figure 5-6. Assessment of Water Quality Use Support in the Savannah River Basin, HUC 03060105

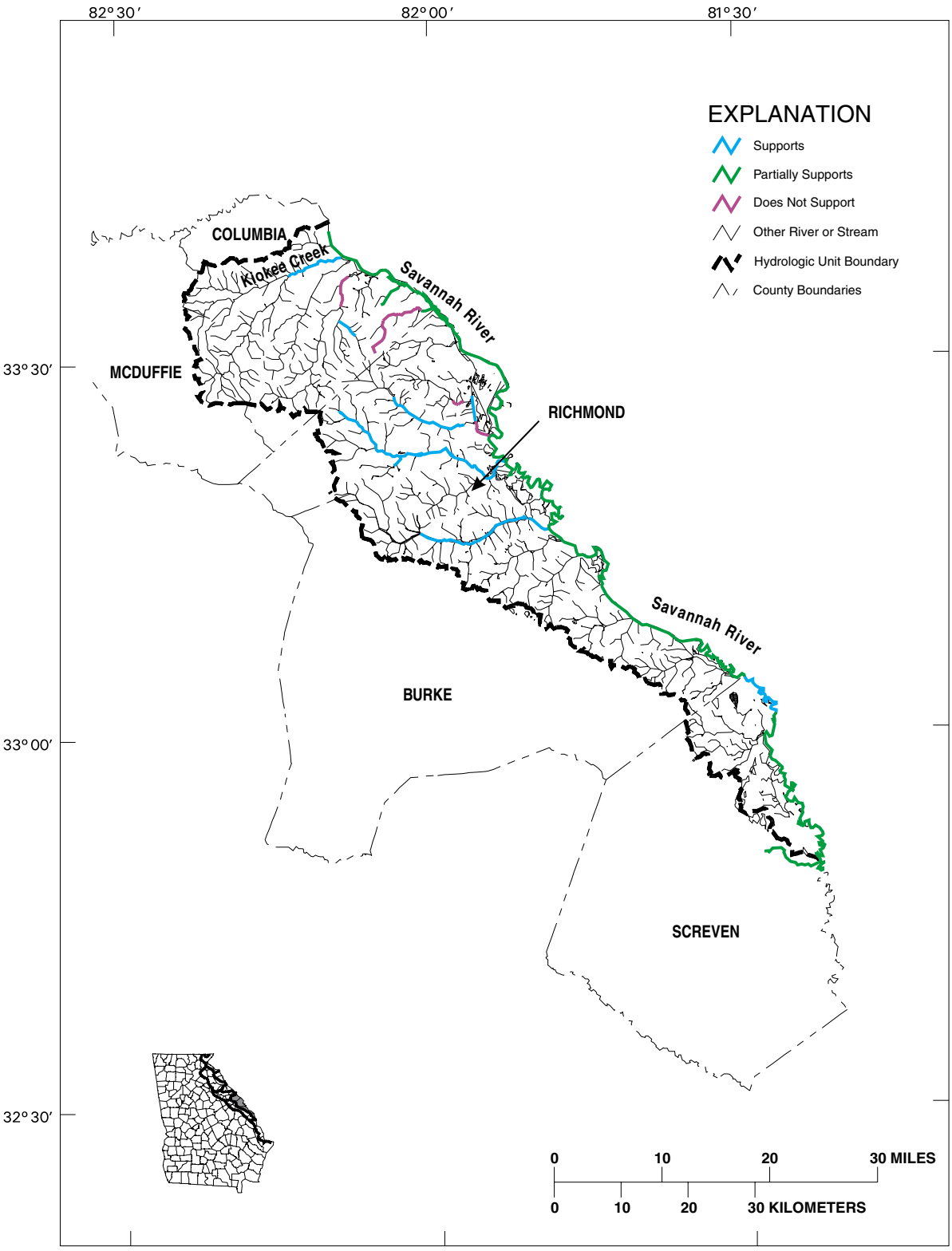

Figure 5-7. Assessment of Water Quality Use Support in the Savannah River Basin, HUC 03060106

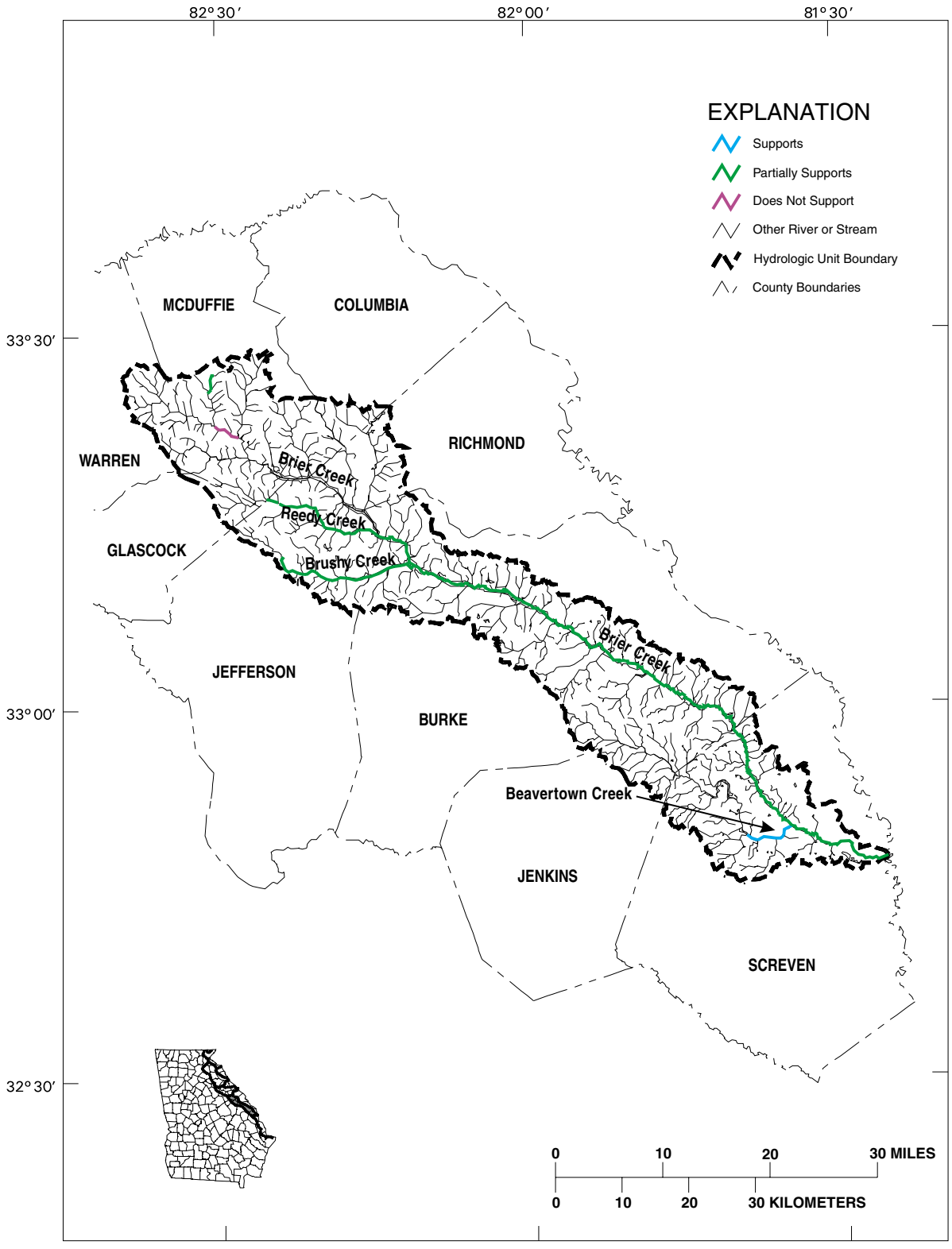

Figure 5-8. Assessment of Water Quality Use Support in the Savannah River Basin, HUC 03060108

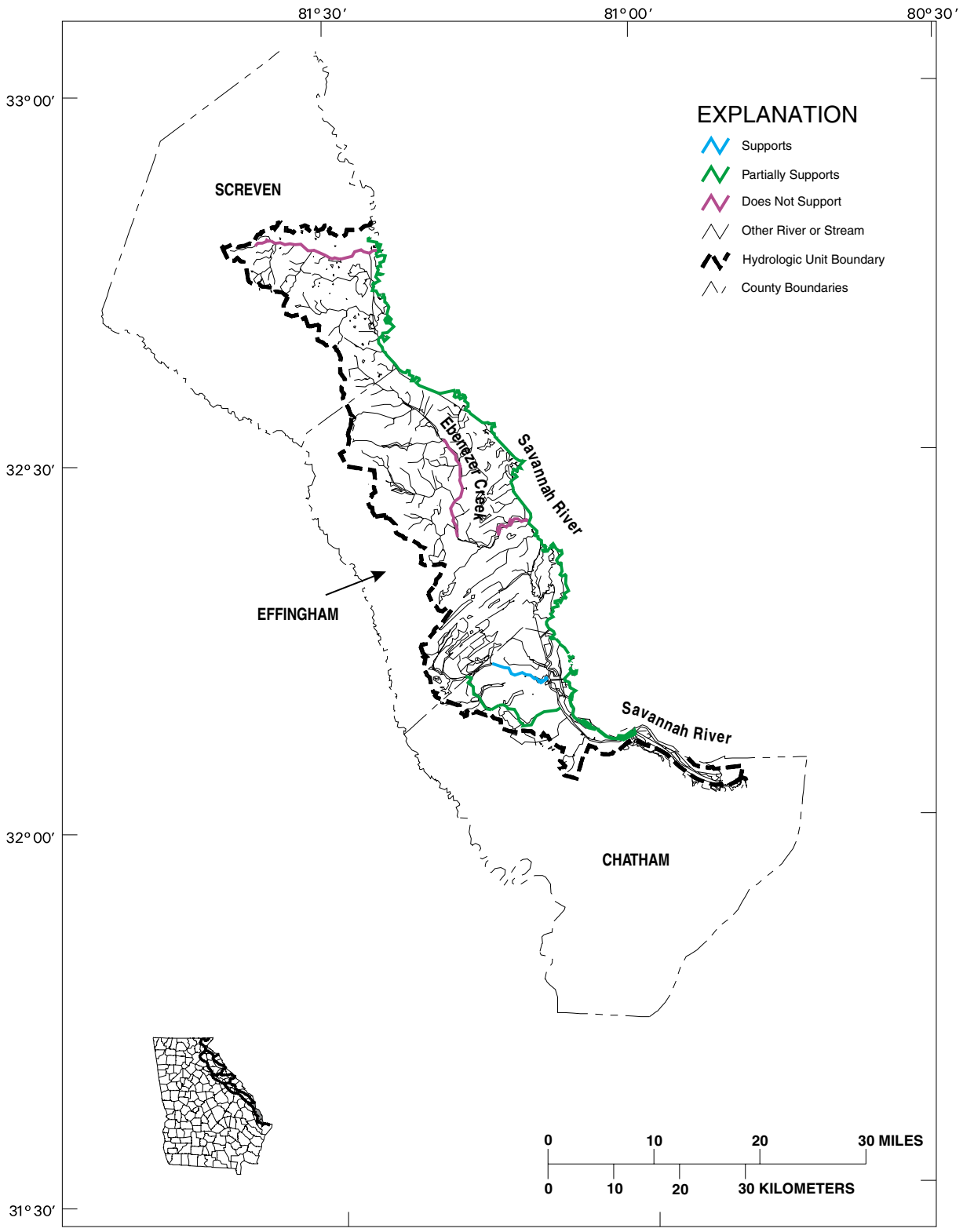

Figure 5-9. Assessment of Water Quality Use Support in the Savannah River Basin, HUC 03060109

Toxicity

The water use classification of fishing is potentially threatened in one tributary stream segment (Eastanollee Creek) due to toxicity. Aquatic toxicity tests on the Coats American, Inc. WTF effluent predicted toxicity in the receiving stream at critical, 7Q10 flows.

Fish Consumption Guidelines

The water use classification of fishing and/or recreation was not fully supported in Lakes Hartwell, Burton, Rabun, and Tugaloo based on fish consumption guidelines due to PCBs in Lake Hartwell and mercury in Lakes Burton, Rabun, and Tugaloo. The guidelines are for largemouth bass, striped/hybrid bass and channel catfish in Lake Hartwell; certain sizes of largemouth bass in Lakes Burton and Tugaloo; and, largemouth bass and white catfish in Lake Rabun.

Nutrients

The water use classification of fishing, drinking water and recreation are potentially threatened in Lake Burton, Lake Rabun and Lake Hartwell due to inputs of nutrients which may cause excess algal growths in the lakes. Nutrient sources include water pollution control plant discharges and nonpoint sources from urban and agricultural areas.

Upper Savannah River (HUC 03060103)

Appendix E summarizes the determination of support for designated uses of all assessed rivers and streams within this hydrologic unit (GA DNR, 2000).

Monitoring data was collected from 7 trend monitoring stations located within this subbasin during the 1997-1998 period, two of which were on the mainstem. Historically, no trend monitoring stations were sampled within this subbasin. The following assessment is based on data from these trend monitoring stations, as well as from samples collected by other agencies.

Data from the mainstem stations indicate that water quality conditions are being affected by dam releases.

Metals

The water use classification of fishing was not fully supported in one tributary stream segment (Cedar Creek) due to exceedences of the water quality standard for zinc due to a water pollution plant discharge.

Fecal Coliform Bacteria

The water use classification of fishing was not supported in five tributary stream segments due to the exceedence of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

Low Dissolved Oxygen

The water use classification of recreation was not fully supported in one Savannah River mainstem segment due to dissolved oxygen concentrations less than standards. Low dissolved oxygen in the river segment was due to bottom water discharges from Lake Hartwell Dam.

Fish Consumption Guidelines

The water use classification was not supported in Lake Hartwell due to fish consumption guidelines primarily due to PCB's. In 1999, Georgia and South Carolina issued fish consumption guidance reflecting a joint reevaluation of data for Lake Hartwell. In Georgia these are for the Tugaloo Arm and for the main body in the dam forebay. In the Tugaloo Arm, hybrid and striped bass over 16 inches should not be eaten and restricted consumption of certain sizes of largemouth bass (PCB's and mercury) and channel catfish (PCB's) is recommended. In the lake main body, any size of hybrid or striped bass should not be eaten, and restricted consumption of largemouth bass and channel catfish is recommended.

The water use classification of fishing and/or recreation was not fully supported in Lakes Richard B. Russell and Clarks Hill (Strom Thurmond) based on fish consumption guidelines due to mercury. The guidelines are for largemouth bass and catfish in both lakes.

Nutrients

The water use classifications of fishing, drinking water and recreation are potentially threatened in Lake Hartwell due to inputs of nutrients which may cause excess algal growth in the lake. Nutrient sources include water pollution control plant discharges and nonpoint sources from urban and agricultural areas.

Broad River (HUC 03060104)

Appendix E summarizes the determination of support for designated uses of all assessed rivers and streams within this hydrologic unit (GA DNR, 2000).

Monitoring data was collected from 11 trend monitoring stations located within this subbasin during the 1997-1998 period, two of which were on the mainstem. Historically, no trend monitoring stations were sampled within this subbasin. The following assessment is based on data from these trend monitoring stations.

Data from the mainstem stations indicate that water quality conditions are being affected by nonpoint source pollution.

Fecal Coliform Bacteria

The water use classification of fishing was not fully supported in ten tributary stream segments due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

Fish Consumption Guidelines

The water use classification of fishing was not fully supported in Nancy Town Lake based on fish consumption guidelines due to chlordane residuals in bream.

Low Dissolved Oxygen

The water use classification of fishing was not fully supported in two tributary stream segments (Bear Creek and Beaverdam Creek) due to dissolved oxygen concentrations less than standards due to water pollution control plant discharges.

Little River (HUC 03060105)

Appendix E summarizes the determination of support for designated uses of all assessed rivers and streams within this hydrologic unit (GA DNR, 2000).

Monitoring data was collected from 3 trend monitoring stations located within this subbasin during the 1997-1998 period, two of which were on the mainstem. Historically, no trend monitoring stations were sampled within this subbasin. The following assessment is based on data from these trend monitoring stations.

Data from the mainstem stations indicate that water quality conditions are being affected by urban runoff and nonpoint source pollution.

Fecal Coliform Bacteria

The water use classification of fishing was not fully supported in three tributary stream segments due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There is one stream segment listed in this subbasin as not fully supporting designated water uses based on biological community which may be due sedimentation.

Fish Consumption Guidelines

The water use classification of fishing was not fully supported in the Little River mainstem above and below Rocky Creek based on fish consumption guidelines due to mercury. The guidelines are for largemouth bass.

Nutrients

The water use classification of fishing, drinking water and recreation are potentially threatened in the Little River Arm of Clarks Hill Lake due to inputs of nutrients which may cause excess algal growth in the lake. Nutrient sources include water pollution control plant discharges and nonpoint sources from urban and agricultural areas.

Middle Savannah River (HUC 03060106)

Appendix E summarizes the determination of support for designated uses of all assessed rivers and streams within this hydrologic unit (GA DNR, 2000).

Monitoring data was collected from 15 trend monitoring stations located within this subbasin during the 1997-1998 period, seven of which were on the mainstem.

Historically, one trend monitoring station has been sampled within this subbasin. The following assessment is based on data from these trend monitoring stations, as well as from samples collected by other agencies.

Data from the mainstem stations indicate that water quality conditions are being affected by urban runoff, water pollution control plant discharges, dam releases, and nonpoint source pollution.

Metals

The water use classification of fishing was not fully supported in one Savannah River mainstem segment and in two tributary stream segments (Butler Creek). The water quality standard for selenium was exceeded in this segment.

Fecal Coliform Bacteria

The water use classification of fishing was not fully supported in one Savannah River mainstem segment, and in seven tributary stream segments due to exceedences of the water qualiyt standard for fecal coliform bacteria. These exceedences may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

Fish Consumption Guidelines

The water use classification of fishing and/or drinking water was not fully supported in the middle Savannah River based on fish consumption guidelines due to mercury. The guidelines are for largemouth bass and spotted sucker.

Low Dissolved Oxygen

The water use classification of fishing water and/or drinking was not fully supported in two Savannah River mainstem segments and one tributary stream segment (Butler Creek) due to dissolved oxygen concentrations less than standards. Low dissolved oxygen in the river segments was due to bottom water discharges from dams, and low dissolved oxygen in the tributary was due to urban runoff and a water pollution control plant discharge.

Toxicity

The water use classification of fishing is potentially threatened in one tributary stream segment (Rocky Creek) due to toxicity.

Brier Creek (HUC 03060108)

Appendix E summarizes the determination of support for designated uses of all assessed rivers and streams within this hydrologic unit (GA DNR, 2000).

Monitoring data was collected from 6 trend monitoring stations located within this subbasin during the 1997-1998 period, two of which were on the mainstem. Historically, no trend monitoring stations were sampled within this subbasin. The following assessment is based on data from these trend monitoring stations.

Data from the mainstem stations indicate that water quality conditions are being affected by nonpoint source pollution.

Fecal Coliform Bacteria

The water use classification of fishing was not fully supported in three tributary streams (Brushy, Reedy, and Brier Creeks) due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources, and/or animal wastes.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

Fish Consumption Guidelines

The water use classification of fishing was not fully supported in one tributary (Brier Creek) segment based on fish consumption guidelines due to mercury. The guidelines are for largemouth bass and spotted sucker.

Toxicity

The water use classification of fishing was not fully supported in one tributary stream segment (Whites Creek) due to toxicity. Aquatic toxicity tests on the Thomson Water Pollution Control Plant effluent predicted toxicity in the receiving stream at critical, 7Q10 low flow conditions.

Lower Savannah River (HUC 03060109)

Appendix E summarizes the determination of support for designated uses of all assessed rivers and streams within this hydrologic unit (GA DNR, 2000).

Monitoring data was collected from 6 trend monitoring stations located within this subbasin during the 1997-1998 period, two of which were on the mainstem. Historically, two trend monitoring stations were sampled within this subbasin. The following assessment is based on data from these trend monitoring stations, as well as from samples collected by other agencies.

Data from the mainstem stations indicate that water quality conditions are being affected by nonpoint source pollution.

Metals

The water use classification of fishing was not fully supported in one tributary stream segment (Buck Creek) due to exceedences of water quality standards for copper due to nonpoint sources and a water pollution control plant discharge.

Fecal Coliform Bacteria

The water use classification of fishing was not fully supported in one tributary stream segment (Runs Branch) and one estuarine water (Savannah Harbor) due to exceedences of the water quality standard for fecal coliform bacteria. These exceedences may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

Fish Consumption Guidelines

The water use classification of fishing, drinking water and/or coastal fishing was not fully supported in one tributary segment (Pipemaker Canal) and the Savannah River mainstem based on fish consumption guidelines due to mercury. The guidelines are for largemouth bass and channel catfish in the river, and largemouth bass in the tributary.

Low Dissolved Oxygen

The water use classification of fishing was not fully supported in three tributary stream segments (Buck Creek, Ebenezer Creek and Runs Branch) due to dissolved oxygen concentrations less than standards. Low dissolved oxygen in two of the tributaries was due to nonpoint sources (Ebenezer Creek and Runs Branch), and a water pollution control plant contributed to the problem in Buck Creek.

5.2.5 Assessment of Fish and Wildlife Resources

Detailed, HUC-level assessments of fish and wildlife resources in the Savannah River basin were not available at the time of compilation of the basin plan. However, rough, basin-scale assessments of fish and wildlife resources have been developed as part of the RiverCare 2000 Georgia Rivers Assessment (EPD, 1998). These results are summarized below.

Ecologically Important Fish Resources

Georgia's fishery resources depend on healthy streams and are part of a diverse community of game and nongame species. These communities by definition include vertebrates like fishes and invertebrates like mussels and aquatic insects. A complete community with all species that naturally occur in a particular river system is irreplaceable. Only a few species can be propagated and restocked into nature. The life found in a Georgia river depends absolutely on the integrity of aquatic habitat, which in turn directly reflects the conditions within the rivers' entire upstream watersheds. Healthy aquatic ecosystems can provide sustainable commercial and recreational fisheries, which are valuable in their own right. The secondary effects often associated with the pursuit of these fisheries adds even more value to Georgia's local economies.

The major threats to ecologically important fish resources come from nonpoint source pollution and the effects of other human activities in the environment. Clearing vegetation, disturbing earth without adequately controlling the movement of sediment, increasing impervious surface, and related activities in a watershed can alter water quality and patterns of stream discharge. Altering river channels, by dredging or by removing snag that furnish many prey organisms for fish, also reduce the quality and quantity of fish habitat. These activities lower the value of streams for fish populations.

Another significant threat to Georgia's fish species is the introduction of exotic, or foreign, species. Many introduced species, such as flathead catfish and blueback herring, compete with native fish for food and cover, take them as food, or parasitize them.

Illegally introduced blueback herring may negatively impact reservoir sport fisheries in the low-productivity, tributary reservoirs by outcompeting young-of-year sunfishes for food and by direct predation on larval and fingerling sunfishes. If the new species are so successful that they reduce or eliminate the native population, they can significantly reduce the river's fishery biodiversity as well.

In 1998, robust redhorse were discovered in the Savannah River downstream of Augusta. Robust redhorse were once thought to be extant; therefore, GADNR is expending considerable effort to propagate this imperiled species and reintroduce hatchery-reared fingerlings into its native range. Current stocking efforts have focused on the Broad River, a major tributary of the Savannah River.

References

Comprehensive Water Supply Management Plan for Chatham County Georgia, Chatham County -Savannah Metropolitan Planning Commission, June 1995.

Water Control Manual, Savannah River Basin Multiple Purpose Projects: Hartwell Dam and Lake, Richard B. Russell Dam and Lake, J. Strom Thurmond Dam and Lake, Georgia and South Carolina, US Army Engineer District, Savannah, 1996.

In This Section

- Identified Basin Planning and Management Concerns
- Priorities for Water Quality Concerns
- Priorities for Water Quantity Concerns

Section 6

Concerns and Priority Issues

The assessments in Section 5 present a number of water quality and quantity concerns within the Savannah River basin. This section aggregates the assessment data to identify priority issues for development of management strategies.

6.1 Identified Basin Planning and Management Concerns

Sections 4 and 5 identified both site-specific and generalized sources of water quality stressors. Some issues are limited to specific segments, but a number of water quality concerns apply throughout the basin. The criterion listed most frequently in the Georgia 2000 305(b)/303(d) List as contributing to nonsupporting or partially supporting status was fish consumption guidelines (258 of 541 miles, or 48% of the stream miles within the basin assessed as not fully supporting), followed by fecal coliform bacteria (216 of 541 stream miles, or 40% of the stream miles within the basin assessed as not fully supporting). Fish consumption and fecal coliform issues are attributed to urban runoff (air deposition with respect to mercury in fish tissue) or nonpoint sources.

Within some individual stream reaches, other sources may be of greater importance (e.g., WPCP effluent); however, urban runoff and general nonpoint sources represent a basin-wide concern. Further, strong population growth and development pressure in parts of the basin will tend to increase the importance of urban runoff as a stressor of concern. For such widespread concerns, basin-wide management strategies will be needed.

Major water quality and quantity concerns for the Savannah River basin are summarized by geographic area in terms of the concerns and sources of these concerns in Table 6-1. Table 6-2 summarizes the pollutants identified as causing impairment of designated uses in the basin; however, not all identified concerns are related to pollutant loads. Ongoing control strategies are expected to result in support of designated uses in a number of waters. In other waters, however, the development of additional management strategies may be required or implemented in order to achieve water quality standards.

In the following pages, priority water quality and quantity concerns are presented by Hydrologic Unit. For some water quality and quantity concerns, problem statements are identical for each HUC, others differ between HUCs. Detailed strategies for addressing these concerns are then supplied in Section 7.

Each concern is listed in the form of a "Problem Statement" which summarizes the linkage between stressor sources and water quality impacts. The order in which concerns are listed for each HUC should not be considered to be significant. Prioritization of basin concerns requires consensus among all stakeholders, and has not been finalized; however, short-term water quality action priorities for EPD are summarized in Section 6.2.

6.1.1 Problem Statements

Basinwide/Regional Issues

Throughout the Savannah River basin, there is a concern about leaking septic tanks and malfunctioning drainfields. Septic systems, especially older models that have been operating for many years, may fail and impact groundwater and surface water resources.

Due to the pressures of growth and development, urban river corridors and forests are being reduced or eliminated. These areas provide important riparian habitat and preserve clean air, water, and a high quality of life.

Tugaloo River Subbasin (HUC 03060102)

The Tugaloo River was targeted in the 1998 Unified Watershed Assessment as one of the top three subbasins in the Savannah and Ogeechee basins where preventative action is needed to sustain water quality and aquatic resources. This rating was primarily due to the length of river miles classified as impaired.

Metals

The water use classification of fishing was not fully supported in one tributary stream segment (Eastanolle Creek) due to exceedences of water quality standards for metals. Zinc and copper standards were exceeded in the tributary stream due primarily to urban runoff and water pollution control plant discharges.

Fecal Coliform Bacteria

The water use classifications of fishing or wild/scenic were not fully supported in six tributary stream segments due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Table 6-I. Summary of Concerns in the Savannah River Basin

	Source of the Stressor by HUC						
Stressors of Concern	**Tugaloo River HUC 03060102**	**Upper Savannah River HUC 03060103**	**Broad River HUC 03060104**	**Little River HUC 03060105**	**Middle Savannah River HUC 03060106**	**Brier Creek HUC 03060108**	**Lower Savannah River HUC 03060109**
Metals	WPCP effluent	WPCP effluent			WPCP effluent		WPCP effluent
Fecal Coliform Bacteria	Multi-source potential	Multi-source potential	Multi-source potential	Multi-source potential	Multi-source potential	Multi-source potential	Multi-source potential
Erosion and Sedimentation	Urban and rural NPS	Agricultural NPS	Agricultural NPS	Urban and rural NPS	Urban and rural NPS	Urban and rural NPS	Urban and rural NPS
Dissolved Oxygen		Dam discharge	WPCP effluent		Dam discharge, NPS, WPCP effluent		Urban and rural NPS, WPCP
Nutrients	Agricultural and urban NPS	Agricultural and urban NPS	Agricultural and urban NPS	Agricultural and urban NPS			
Fish Consumption Guidelines	Nonpoint mercury, PCBs	Nonpoint mercury, PCBs		Nonpoint mercury	Nonpoint mercury	Nonpoint mercury	Nonpoint mercury
Water Temperature		Dam Operations					
Water Quantity							Groundwater overuse and saltwater intrusion
Threatened and Endangered Species					Robust redhorse		
Source Water Protection							Groundwater threatened

Table 6-2. Summary of Pollutants Causing Water Quality Impairment in the Savannah River Basin

	Geographic Area						
Use Classification of Waterbody Segments	**Tugaloo River HUC 03060102**	**Upper Savannah River HUC 03060103**	**Broad River HUC 03060104**	**Little River HUC 03060105**	**Middle Savannah River HUC 03060106**	**Brier Creek HUC 03060108**	**Lower Savannah River HUC 03060109**
Fishing (Support for Aquatic Life)	Metals, nutrients, introduced predation	Toxicity, nutrients, temp, low DO and flows	Low DO	Nutrients	Metals, low DO and flow	Toxicity	Metals and low DO
Fishing (Fish Consumption)	Mercury and PCBs	Mercury and PCBs		Mercury	Mercury	Mercury	Mercury
Fishing (Secondary Contact Recreation)	Fecal coliform	Fecal coliform	Fecal coliform	Fecal coliform	Fecal coliform	Fecal coliform	Fecal coliform
Drinking Water	Algae, turbidity	Algae, turbidity	Algae, turbidity	Algae, turbidity, quantity, metals	Metals, low DO, turbidity	Algae, turbidity, metals	
Wild and Scenic	Fecal coliform						

Animal waste may contribute high loads of bacterial and microbial pathogens. The 1993 Watershed Nonpoint Source Assessment (NRCS) targeted the Tugaloo subbasin for generating the second highest load of animal waste (1,626,669 tons of waste per year) in the Savannah River basin. Because this subbasin contains the least agricultural land area (48,000 total acres in 1997), the animal waste may be concentrated in large-scale confined animal feeding operations (CAFOs) or applied to a higher percentage of the total agriculture land. Fecal coliform bacteria levels may also be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, and/or rural nonpoint sources.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

The EPA recently conducted a study of the Chattooga subbasin to determine whether waters are not meeting water quality standards because of forestry and forestry-related activities. EPA reported that the following streams were not fully supporting designated uses: Stekoa Creek and its tributary streams of Scott Creek, Saddle Gap Creek, and Pool Creek; Upper Warwoman Creek; Law Ground Creek; Roach Mill Creek; and Chechero Creek. The concern is with excessive sediment and the adverse impacts to the biological community. These streams were added to the Georgia 303(d) list in 1999.

Toxicity

The water use classification of fishing is potentially threatened in one tributary stream segment (Eastanollee Creek) due to toxicity. Aquatic toxicity tests on the Coats American, Inc. WTF effluent predicted toxicity in the receiving stream at critical, 7Q10 low flows.

Fish Consumption Guidelines

The water use classifications of fishing and/or recreation were not fully supported in Lakes Hartwell, Burton, Rabun and Tugaloo based on fish consumption guidelines due to PCB's and mercury in Lake Hartwell and mercury in Lakes Burton, Rabun and Tugalo. The guidelines are for largemouth bass, hybrid/striped bass and channel catfish in Lake Hartwell; certain sizes of largemouth bass in Lakes Burton and Tugalo, and for largemouth bass and white catfish in Lake Rabun.

Nutrients

The water use classification of fishing, drinking water and recreation are potentially threatened in Lake Burton, Lake Rabun and Lake Hartwell due to inputs of nutrients which may cause excess algal growths in the lakes. Nutrient sources include water pollution control plant discharges and nonpoint sources from urban and agricultural areas.

Aquatic Habitat

Trout streams in the Upper Tugaloo River subbasin are potentially threatened by erosion, sedimentation, and temperature impacts. The Chattooga River, the Talloola River, and Panther Creek are examples where the erosion and sedimentation due to gravel roads, forestry practices, and development may potentially cause problems.

Protection of Fisheries

Illegally introduced blueback herring may negatively impact reservoir sport fisheries in the low-productivity, tributary reservoirs by outcompeteing young-of-year sunfishes for food and by direct predation on larval and fingerling sunfishes. This threat extends from Lake Burton to the federal mainstem reservoirs.

Upper Savannah River Subbasin (HUC 03060103)

Metals

The water use classification of fishing was not fully supported in one tributary stream segment (Cedar Creek) due to exceedences of the water quality standard for zinc due to a water pollution plant discharge.

Fecal Coliform Bacteria

The water use classification of fishing was not fully supported in five tributary stream segments due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

The 1993 Watershed Non-Point Source Assessment (NRCS) targeted the Upper Savannah subbasin and reported average concentrations of sediment (14.1 mg/L) in runoff to be the second highest in the entire Savannah River basin. Agricultural runoff can be a significant source of sediment and this subbasin contains the third largest agricultural land area (119,475 acres). Other potential sediment sources include urban runoff and development (particularly construction), unpaved rural roads, and forestry practices.

Low Dissolved Oxygen

The water use classification of recreation was not fully supported in one Savannah River mainstem segment due to dissolved oxygen concentrations less than standards. Low dissolved oxygen in the river segment was due to bottom water discharges from Lake Hartwell Dam.

Oxygen deficiencies are most evident in the Hartwell tailwaters, which are designated as trout waters. In the summer and early fall, dissolved oxygen levels below the dam may fall below 2.0 mg/L.

Fish Consumption Guidelines

The water use classification was not supported in Lake Hartwell due to fish consumption guidelines primarily due to PCB's. In 1999, Georgia and South Carolina issued fish consumption guidance reflecting a joint reevaluation of data for Lake Hartwell. In Georgia these are for the Tugaloo Arm and for the main body in the dam forebay. In the Tugaloo Arm, hybrid and striped bass over 16 inches should not be eaten and restricted consumption of certain sizes of largemouth bass (PCB's and mercury) and channel catfish (PCB's) is recommended. In the lake main body, any size of hybrid or

striped bass should not be eaten, and restricted consumption of largemouth bass and channel catfish is recommended.

The water use classification of fishing and/or recreation was not fully supported in Lakes Richard B. Russell and Clarkes Hill (J. Strom Thurmond) based on fish consumption guidelines due to mercury. The guidelines are for largemouth bass and catfish in both lakes.

Nutrients

The water use classifications of fishing, drinking water and recreation are potentially threatened in Lake Hartwell due to inputs of nutrients which may cause excess algal growth in the lake. Nutrient sources include water pollution control plant discharges and nonpoint sources from urban and agricultural areas.

The 1993 Watershed Non-Point Source Assessment (NRCS) targeted the Upper Savannah subbasin and reported average concentrations of nitrogen (0.07 mg/L) and phosphorus (0.04 mg/L) in runoff to be the second highest in the Savannah River basin. Agriculture can be a significant source of nutrients and this subbasin contains the third largest agricultural land area (119,475 acres). Other potential nutrient sources include water pollution control plant discharges and nonpoint sources from urban areas.

Aquatic Habitat

Tailrace flows from Lakes Hartwell and Russell are primarily driven by hydropower generation schedules for supply of electricity during peak demand times. Flow rates of releases vary widely depending on demand. When not generating electricity, no minimum flow is provided. The combination of fluctuating flows and potential low flows may affect fish and other aquatic life habitat and access for recreational users.

Thermal Modification

Hydropower generation at Richard B. Russell Dam includes pumpback (reverse flow) capabilities. Water released from the Russell Dam into the Savannah River immediately upstream from Clarks Hill is pumped back into Russell Lake. Pumping water back into the reservoir increases water temperatures in Clarks Hill Lake and may negatively impact critical habitat for striped bass and hybrid (white x striped) bass. According to the Wildlife Resources Division trophy striped bass (20-50 lbs) in Clarks Hill Lake may cease to exist if the pumpback units are operated without significant mitigation measures.

Broad River Subbasin (HUC 03060104)

The Broad River was targeted in the 1998 Unified Watershed Assessment as one of the top three subbasins in the Savannah and Ogeechee basins where preventative action is needed to sustain water quality and aquatic resources. This rating was primarily due to the length of river miles classified as impaired.

Fecal Coliform Bacteria

The water use classification of fishing was not fully supported in ten tributary stream segments due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Animal waste may contribute high loads of bacterial and microbial pathogens. The 1993 Watershed Non-Point Source Assessment (NRCS) reported that the Broad River subbasin generates, the highest animal waste load (8,888,655 tons of waste per year) in the Savannah River basin. This subbasin also contains the most agricultural land area (238,000 acres), which is partially used for grazing animals, concentrated animal feeding

operations, and animal waste application. Fecal coliform bacteria levels may also be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, and/or rural nonpoint sources.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

The 1993 Watershed Non-Point Source Assessment (NRCS) targeted the Broad River subbasin and reported average concentrations of sediment (16.1 mg/L) in runoff to be the highest in the Savannah River basin. Agricultural runoff can be a significant source of sediment and this subbasin contains the largest agricultural land area (238,000 acres). Other potential sediment sources include urban runoff and development (particularly construction), unpaved rural roads, and forestry practices.

Low Dissolved Oxygen

The water use classification of fishing was not fully supported in two tributary stream segments (Bear Creek and Beaverdam Creek) due to dissolved oxygen concentrations less than standards due to water pollution control plant discharges.

Fish Consumption Guidelines

The water use classification was not fully supported in Nancy Town Lake based on fish consumption guidelines due to chlordane residues in bream.

Nutrients

The water use classification of drinking water is potentially threatened in Grove River Reservoir and Long Creek due to inputs of nutrients which may cause excess algal growth. Nutrient sources include water pollution control plant discharges and nonpoint sources from urban and agricultural areas.

The 1993 Watershed Non-Point Source Assessment (NRCS) targeted the Broad River subbasin and reported average concentrations of nitrogen (0.08 mg/L) and phosphorus (0.06 mg/L) in runoff to be the highest in the Savannah River basin. Agriculture can be a significant source of nutrients and this subbasin contains the largest agricultural land area (238,000 acres). Other potential nutrient sources include water pollution control plant discharges and nonpoint sources from urban areas.

Little River Subbasin (HUC 03060105)

Fecal Coliform Bacteria

The water use classification of fishing was not fully supported in three tributary stream segments due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban

runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There is one stream segment listed in this subbasin as not fully supporting designated water uses based on biological community which may be due sedimentation.

Fish Consumption Guidelines

The water use classification was not fully supported in the Little River mainstream above and below Rocky Creek based on fish consumption guidelines due to mercury. The guidelines are for largemouth bass.

Nutrients

The water use classification of fishing, drinking water and recreation are potentially threatened in the Little River Arm of Clarks Hill Lake and in Lake Wall due to inputs of nutrients which may cause excess algal growth in the lake. Nutrient sources include water pollution control plant discharges and nonpoint sources from urban and agricultural areas.

Middle Savannah River Subbasin (HUC 03060106)

Metals

The water use classification of fishing was not fully supported in one Savannah River mainstem segment and in two tributary stream segments (Butler Creek). The water quality standard for selenium was exceeded in this segment.

Fecal Coliform Bacteria

The water use classification of fishing and/or drinking water was not fully supported in one Savannah River mainstem segment, and in seven tributary stream segments due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

Fish Consumption Guidelines

The water use classification of fishing and/or drinking water was not fully supported in the middle Savannah River based on fish consumption guidelines due to mercury. The guidelines are for largemouth bass and spotted sucker.

Low Dissolved Oxygen

The water use classification of fishing water and/or drinking was not fully supported in two Savannah River mainstem segments and one tributary stream segment (Butler Creek) due to dissolved oxygen concentrations less than standards. Low dissolved oxygen in the river segments was due to bottom water discharges from dams, and low dissolved oxygen in the tributary was due to urban runoff and a water pollution control plant discharge.

Toxicity

The water use classification of fishing is potentially threatened in one tributary stream segment (Rocky Creek) due to toxicity.

Protection of Threatened and Endangered Species

In 1998, robust redhorse fish were discovered in the Savannah River downstream of Augusta. Robust redhorse were once thought to be extinct, so there is concern to preserve the quality of its native range.

Aquatic Habitat

Flows from Clarks Hill Dam are primarily driven by hydropower generation schedules for supply of electricity during peak demand times. Flow rates of releases vary widely depending on demand. When not generating electricity, no minimum flow is provided. The combination of fluctuating flows and potential low flows potentially impact juvenile nursery habitat, robust redhorse spawning and rearing habitat, and access for recreational users.

Groundwater Quality and Quantity

EPD has concerns about groundwater contamination in the Augusta/Richmond County area due to past and present industrial sites. Rapid growth and expanding groundwater usage in the county may mobilize some of the contaminants located at these industrial sites, potentially affecting drinking water sources.

Radioactive contamination is a concern from the Savannah River Site (SRS), a DOE nuclear weapons support facility located in South Carolina. Radioactive contamination from SRS may enter the aquifer, pass under the Savannah River and impact users in Burke County, Georgia. The concerns date back to the 1960's and have always been related to groundwater. Elevated levels of radioactive tritium are routinely detected in fish, precipitation, and surface water. Tritium has also been detected in shallow groundwater in Burke County.

Brier Creek Subbasin (HUC 03060108)

Fecal Coliform Bacteria

The water use classification of fishing was not fully supported in three tributary streams (Brushy, Reedy, and Brier Creeks) due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources, and/or animal wastes.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

Fish Consumption Guidelines

The water use classification of fishing was not fully supported in one tributary (Brier Creek) segment based on fish consumption guidelines due to mercury. The guidelines are for largemouth bass and spotted sucker.

Toxicity

The water use classification of fishing is potentially threatened in one tributary stream segment (Whites Creek) due to toxicity. Aquatic toxicity tests on the Thomson Water Pollution Control Plant effluent predicted toxicity in the receiving stream at critical, 7Q10 low flow conditions.

Lower Savannah River Subbasin (HUC 03060109)

The Lower Savannah River was targeted in the 1998 Unified Watershed Assessment as one of the top three subbasins in the Savannah and Ogeechee basins where preventative action is needed to sustain water quality and aquatic resources. This rating was primarily due to the length of river miles classified as impaired.

Metals

The water use classification of fishing was not fully supported in one tributary stream segment (Buck Creek) due to exceedences of water quality standards for copper due to nonpoint sources and a water pollution control plant discharge.

Fecal Coliform Bacteria

The water use classification of fishing and/or coastal fishing was not fully supported in one tributary stream segment (Runs Branch) and one estuarine water (Savannah Harbor) due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

Fish Consumption Guidelines

The water use classification of fishing, drinking water and/or coastal fishing was not fully supported in one tributary segment (Pipemaker Canal) and the Savannah River mainstem based on fish consumption guidelines due to mercury. The guidelines are for largemouth bass and channel catfish in the river, and largemouth bass in the tributary.

Low Dissolved Oxygen

The water use classification of fishing was not fully supported in three tributary stream segments (Buck Creek, Ebenezer Creek and Runs Branch) due to dissolved oxygen concentrations less than standards. Low dissolved oxygen in two of the tributaries was due to nonpoint sources (Ebenezer Creek and Runs Branch), and a water pollution control plant contributed to the problem in Buck Creek.

Aquatic Habitat

Striped bass populations on the Lower Savannah River are potentially threatened due to the tide gate constructed to control flows into Savannah Harbor. The Corps of Engineers removed the tide gate from service in 1993. Issues which persist with the striped bass fishery may be related to channel constriction caused by the berms and other

structures which have not been removed. The WRD and the Corps together with various other state and federal fish and wildlife agencies are investigating this potential problem.

Groundwater Quality and Quantity

Regional usage of groundwater is leading to declining water levels in the Floridian aquifer. The declining groundwater levels are allowing sea water to enter the aquifer in Port Royal Sound and begin slowly moving towards Savannah, Georgia. All municipal, industrial, and agricultural users of the Floridian Aquifer throughout this basin contribute to the salt water intrusion problem. Another concern is water needs for residential and commercial development growth in southern Effingham County. The limit on availability of groundwater is having an impact on continued development, especially with pressures to reduce usage of the Floridian Aquifer and without any other convenient source of water.

6.2 Priorities for Water Quality Concerns

6.2.1 Short-Term Water Quality Action Priorities for EPD

Section 6.1 identifies known priority concerns for which management and planning are needed in the Savannah River basin. Because of limited resources, and, in some cases, limitations to technical knowledge, not all of these concerns can be addressed at the same level of detail within the current 5-year cycle of basin management. It is therefore necessary to assign action priorities for the short term based on where the greatest return for available effort can be expected.

Current priorities for action by EPD (2000) are summarized in Table 6-3 and discussed below. These reflect EPD's assessment of where the greatest short-term return can be obtained from available resources. These priorities were presented to and discussed with the local advisory committee in March 2000. The priorities were also public noticed and approved by the USEPA as part of the Georgia CWA 303(d) listing process in 2000 and discussed in the report, *Water Quality in Georgia, 1998-1999*.

Assigning Priorities for Stream Segments

For several waters in the Savannah River basin, currently planned control strategies are expected to result in attainment of designated uses. EPD resources will be directed to ensure that the ongoing pollution control strategies are implemented as planned and water quality improvements are achieved. These waters (see Appendix E) are identified as active 305(b) waters, and are the highest priority waters, as these segments will continue to require resources to complete actions and ensure standards are achieved. These stream segments have been assigned priority one.

Table 6-3. EPD's Short-Term Priorities for Addressing Waters Not Fully Supporting Use

Priority	Type
1	Segments where ongoing pollution control strategies are expected to result in achieving support of designated uses; active special projects.
2	Segments with multiple data points which showed metals in excess of water quality standards and segments in which dissolved oxygen is an issue.
3	Waters for which urban runoff and generalized nonpoint sources have resulted in violations of standards for fecal coliform bacteria and waters for which fish consumption guidelines are in place due to air deposition of mercury.

Second priority was allocated to segments with multiple data points which showed metals concentrations from nonpoint sources in excess of water quality standards and to segments in which dissolved oxygen concentration was an issue.

Third priority was assigned to waters where air deposition, urban runoff or general nonpoint sources caused fish consumption guideline listings, and/or metal or fecal coliform bacteria standards violations. Waters added to the Georgia 303(d) list by EPA were also assigned to third priority. Within the current round of basin planning these sources will be addressed primarily through general strategies of encouraging best management practices for control of stressor loadings. In addition, additional work will be initiated to implement approved TMDLs on waters in this group. TMDLs have been completed on those waters in Appendix E that have a "3" in the column labeled 303(d).

Several issues helped forge the rationale for priorities. First, strategies are currently in place to address the significant water quality problems in the Savannah River basin and significant resources will be required to ensure that these actions are completed. Second, a large percentage of waters for which no control strategy is currently in place are listed due to fish consumption guidelines or as a result of exceedance of criteria of fecal coliform bacteria due to urban runoff or nonpoint sources. At the present time, the efficacy of the fecal coliform bacteria standard is in question in the scientific community, as described in Section 4.2. Also, there is no national strategy in place to address air deposition of mercury.

6.2.2 General Long-Term Priorities for Water Quality Concerns

Long-term priorities for water quality management in the Coosa River basin will need to be developed by EPD and all other stakeholders during the next iteration of the basin management cycle. Long-term priorities must seek a balance between a number of different basinwide objectives. These objectives include:

- Protecting water quality in lakes, rivers, streams, estuaries and coastal waters through attainment of water quality standards and support for designated uses;
- Providing adequate, high quality water supply for municipal, agricultural, industrial, and other human activities;
- Preserving habitat suitable for the support of healthy aquatic and riparian ecosystems;
- Protecting human health and welfare through prevention of water-borne disease; minimization of risk from contaminated fish tissue, and reduction of risks from flooding; and
- Ensuring opportunities for economic growth, development, and recreation in the region.

6.3 Priorities for Water Quantity Concerns

Section 5 identified that the major concern in the Savannah basin is the salt water intrusion into the Upper Floridan Aquifer which threatens groundwater supplies in the Hilton Head-Savannah and Brunswick areas. Intrusion rates, however, are quite slow, being more than a hundred years to reach Savannah. The Georgia Environmental Protection Division (GAEPD) has placed limitations on additional withdrawals of groundwater in the affected areas. This has effectively slowed the rate of additional contamination. On April 23, 1997, GAEPD implemented and Interim Strategy to protect the Upper Floridan Aquifer in the 24 coastal counties from salt water intrusion. The strategy developed in consultation with South Carolina and Florida will continue until

December 31, 2005 at which time the GAEPD plans to implement a Final Strategy that will (a) stop salt-water intrusion before municipal water supply wells on Hilton Head Island, South Carolina and Savannah Georgia are contaminated and (b) prevent an existing saltwater problem at Brunswick, Georgia from worsening. To accomplish this objective, the GAEPD will do the following:

(1) Assuming the General Assembly provides funds, conduct expanded scientific and feasibility studies to determine with certainty how to permanently stop the salt water intrusion moving towards Hilton Head Island, South Carolina, and Savannah Georgia and how to prevent the existing salt water intrusion at Brunswick, Georgia from worsening.

(2) Require the development of comprehensive local water supply plans in a 24 county area of southeast Georgia. These are required by December 31, 2000 from all 24 counties as a condition of issuing any future proposed public water, agriculture, or industry water withdrawal permit.

(3) Impose caps on groundwater use in Glynn County, Chatham County, and portions of Bryan and Effingham counties, to avoid worsening the rate for salt water intrusion at Hilton -Head Savannah and at Brunswick.

(4) Reduce groundwater use in Chatham County by at least 10 million gallons per day by December 31, 2005 through conservation and substitution of surface water for groundwater. This will be affirmed through reductions in groundwater use permits.

(5) Allow, on an interim basin, increase in groundwater with drwalas in the area of southeast Georgia that have little impact on salt water intrusion problems.

(6) Encourage and promote water conservation and reduced groundwater usage wherever feasible, throughout Georgia.

6.3.1 Priorities for Competing Demands

With regard to the priority to be placed on meeting competing demands for future water use, the EPD (in conjunction with a broad group of stakeholders from north, central, and southwest Georgia) has established a set of "guiding principles" which will be followed in developing the state's position regarding the allocation of water. These principles are partially based upon the prioritization given to meeting categories of water needs under Georgia law (i.e., municipal needs are the first priority, and agricultural water needs are second; all other water needs follow these two). The principles are summarized below:

1. Municipal (M&I) demands have the highest priority.
2. Agriculture needs must be satisfied.
3. Minimum instream flow rates must be met in order to preserve water quality.
4. If other demands (e.g., industrial, recreation, hydropower, navigation, and environment) can not be met under conditions of water shortage, efforts will be made to optimize the mix of economic and environmental values.

While these "guiding principles" were specifically developed to give expression to Georgia's water needs priorities in those areas of Georgia within the study area of the Alabama-Coosa-Tallapoosa/Appalachicola-Chattahoochee-Flint (ACT/ACF) Comprehensive Study, it is likely that they characterize water needs priorities throughout the state. Thus, Georgia places highest value on the use of water for its citizens to use in drinking and water for agricultural needs.

6.3.2 Priorities for Additional Data Collection

The Savannah District, U. S. Army Corps of Engineers, is also conducting a comprehensive water resources study of the Savannah River Basin. The study will utilize a basin approach in identifying and providing recommendations for meeting the various water supply, flood control, hydropower, water quality (instream flows), aquatic plant control, and recreation needs thought the basin and beyond (i.e. interbasin transfer). A Project Study Plan was initiated in October 1999 and will be completed in September 2003. The project sponsors are the Army Corps of Engineers, the states of Georgia, South Carolina and North Carolina. The Army Corps of Engineers' Savannah River Basin study can be used as a resource for the next Savannah River Basin Plan.

In This Section

- "Big Picture" Overview for the Savannah River Basin
- General Basinwide Management Strategies
- Targeted Management Strategies

Section 7

Implementation Strategies

This section builds on the priority issues identified in Section 6 and proposes strategies to address the major water quality problems in the Savannah River basin.

Georgia's Mission Statement for river basin management planning is "to develop and implement a river basin planning program to protect, enhance, and restore the waters of the state of Georgia that will provide for effective monitoring, allocation, use, regulation, and management of water resources". Associated with this mission are a variety of goals which emphasize coordinated planning necessary to meet all applicable local, state, and federal laws, rules, and regulations, and provide for water quality, habitat, and recreation. For the Savannah basin, these goals will be implemented through a combination of a variety of general strategies, which apply across the basin and across the state, and targeted or site-specific strategies. Section 7.1 describes the big-picture management goals for the Savannah River basin. Section 7.2 describes the general and basinwide implementation strategies most relevant to the Savannah River. Targeted strategies for specific priority concerns within each subbasin, as identified in Section 6, are then presented in 7.3.

7.1 "Big Picture" Overview for the Savannah River Basin

This Savannah River Basin Management Plan includes strategies to address a number of different basinwide objectives. These include:

- Protecting water quality in lakes, rivers, streams, estuaries, and coastal waters through attainment of water quality standards and support for designated uses;
- Providing adequate, high quality water supply for municipal, agricultural, industrial, and other human activities;
- Preserving habitat suitable for the support of healthy aquatic and riparian ecosystems;

- Protecting human health and welfare through prevention of water-borne disease; minimization of risk from contaminated fish tissue, and reduction of risks from flooding; and
- Ensuring opportunities for economic growth, development, and recreation in the region.

Achieving these objectives is the responsibility of a variety of state and federal agencies, local governments, business, industry, and individual citizens. Coordination between partners is difficult, and impacts of actions in one locale by one partner on conditions elsewhere in the basin are not always understood or considered. River Basin Management Planning (RBMP) is an attempt to bring together stakeholders in the basin to increase coordination and to provide a mechanism for communication and consideration of actions on a broad scale to support water resource objectives for the entire basin. RBMP provides the framework to begin to understand the consequences of local decisions on basinwide water resources.

RBMP, begun in 1993, is changing the way EPD and other state agencies do business. At the same time, local government comprehensive planning requirements require a higher degree of effort and awareness by local governments to address resource protection and planning for the future.

This plan presents general broad-scale goals and strategies for addressing the most significant existing and future water quality and quantity issues within the Savannah basin. The basin plan provides a whole-basin framework for appropriate local initiatives and controls, but cannot specify all the individual local efforts which will be required. The basin plan will, however, provide a context and general management goals for the local-scale plans needed to address local-scale nonpoint loads in detail. EPD expects local governments and agencies to take the initiative to develop local strategies consistent with the basin-scale strategies presented in this plan.

A number of concerns identified in this plan will affect planning and decision-making by local governments, state agencies, and business interests. Detailed strategies for addressing identified concerns are presented in Section 7.4. This section provides an overview of the key “big picture” issues and planning opportunities in the Savannah River basin.

7.1.1 Water Quality Overview

As discussed in Section 5, water quality in the Savannah River basin is generally good at this time, although problems remain to be addressed and proactive planning is needed to protect water quality into the future. Many actions have already been taken to protect water quality. Programs implemented by federal, state, and local governments, farmers, foresters, and other individuals have greatly helped to protect and improve water quality in the basin over the past twenty years. Streams are no longer dominated by untreated or partially treated sewage or industrial discharges, which resulted in little oxygen and impaired aquatic life. For the most part, local government and industrial wastewaters are properly treated, oxygen levels have returned, and fish have followed.

The primary source of pollution that continues to affect waters of the Savannah River basin results from nonpoint sources. Key types of nonpoint source pollution impairing or potentially threatening water quality in the Savannah River basin include erosion and sedimentation, bacteria from urban and rural nonpoint sources, metals from air deposition or urban and rural sources, excess nutrient loads to reservoirs, and increases in water temperature resulting from loss of riparian canopy and increased paved surface areas. These problems result from the cumulative effect of activities of many individual landowners or managers. Population is growing every year, increasing the potential risks

from nonpoint source pollution. Growth is essential to the economic health of the Savannah River basin, yet growth without proper land use planning and implementation of best management practices to protect streams and rivers can create harmful impacts on the environment.

Because there are so many small sources of nonpoint loading spread throughout the watershed, nonpoint sources of pollution cannot effectively be controlled by state agency permitting and enforcement, even where regulatory authority exists. Rather, control of nonpoint loading will require the cooperative efforts of many partners, including state and federal agencies, individual landowners, agricultural and forestry interests, local county and municipal governments, and Regional Development Centers. A combination of regulatory and voluntary land management practices will be necessary to maintain and improve the water quality of rivers, streams, and lakes in the Savannah River basin.

Key Actions by EPD

The Georgia EPD Water Protection Branch has responsibility for establishing water quality standards, monitoring water quality, river basin planning, water quality modeling, permitting and enforcement of point source NPDES permits, and developing Total Maximum Daily Loads (TMDLs) where ongoing actions are not sufficient to achieve water quality standards. Much of this work is regulatory. EPD is also one of several agencies responsible for facilitating, planning, and educating the public about management of nonpoint source pollution. Nonpoint source programs implemented by Georgia and by other states across the nation are voluntary in nature. The Georgia EPD Water Resources Branch regulates the use of Georgia's surface and ground water resources for municipal and agricultural uses, which includes source water assessment and protection activities in compliance with the Safe Drinking Water Act.

Actions being taken by EPD at the state level to address water quality problems in the Savannah River basin include the following:

- **Watershed Assessments and Watershed Protection Implementation Plans**. When local governments propose to expand an existing wastewater facility, or propose a new facility with a design flow greater than 0.5 million gallons per day, EPD requires a comprehensive watershed assessment and development of a watershed protection implementation plan. The watershed assessment includes monitoring and assessment of current water quality and land use in the watershed and evaluation of the impacts of future land use changes. A watershed protection implementation plan includes specific strategies such as land use plans and local actions designed to ensure that existing problems are being addressed and that future development will be conducted in a way to prevent water quality standards violations.
- **Total Maximum Daily Loads (TMDLs)**. Where water quality sampling has documented standards violations and ongoing actions are not sufficient to achieve water quality standards in a two year period, a TMDL will be established for a specific pollutant on the specific stream segment in accordance with EPA guidance. The TMDL will specify the allowable loading of a pollutant from both point and nonpoint sources. EPD will implement TMDLs through a watershed approach using a combination of regulatory and non-regulatory tools. TMDLs established under the Clean Water Act for stream segments within this basin are included in this River Basin Plan and are incorporated by reference herein. Those stream segments are identified with a "3" in the 303(d) column of the table in Appendix E of this plan. The TMDLs for this river basin are too voluminous to be attached to this plan, but copies of any or all of the TMDLs adopted by reference may be obtained from EPD by sending a request to the address in the Preface.

- **Source Water Protection**. Most of the public water supply in the Savannah basin is drawn from surface water. To provide for the protection of public water supplies, Georgia EPD is developing a Source Water Assessment Program in alignment with the 1996 amendments to the Safe Drinking Water Act and corresponding recent EPA initiatives. This new initiative is expected to result in assessments of threats to drinking water supplies and, ultimately, local Source Water Protection Plans. Recent "Criteria for Watershed Protection" (a sub-section of the Rules for Environmental Planning Criteria) produced by the Department of Community Affairs set minimum guidelines for protection of watersheds above "governmentally owned" water supply intakes.
- **Fish Consumption Guidelines**. EPD and the Wildlife Resources Division work to protect public human health by testing fish tissue and issuing fish consumption guidelines as needed, indicating the recommended rates of consumption of fish from specific waters. The guidelines are based on conservative assumptions and provide the public with factual information for use in making rational decisions regarding fish consumption.

Key Actions by Resource Management Agencies

Nonpoint source pollution from agriculture and forestry activities in Georgia is managed and controlled with a statewide non-regulatory approach. This approach is based on cooperative partnerships with various agencies and a variety of programs.

Agriculture in the Savannah River basin is primarily restricted to livestock and poultry operations. Key partners for controlling agricultural nonpoint source pollution are the Soil and Water Conservation Districts, the Georgia Soil and Water Conservation Commission, and the USDA Natural Resources Conservation Service. These partners promote the use of environmentally sound best management practices (BMPs) through education, demonstration projects, and financial assistance. In addition to incentive payments and cost-sharing for BMPs, three major conservation programs from USDA will be available to producers and rural landowners. These are the Conservation Reserve Program, which protects highly erodible and environmentally sensitive land; the Wetland Reserve Program, designed to protect, restore, and enhance wetlands with cost-share incentives; and the Wildlife Habitat Incentives Program, which will help landowners develop and improve wildlife habitat.

Forestry is a major part of the economy in the Savannah basin. The Georgia Forestry Commission (GFC) is the lead agency for controlling silvicultural nonpoint source pollution. The GFC develops forestry practice guidelines, encourages BMP implementation, conducts education, investigates and mediates complaints involving forestry operations, and conducts BMP compliance surveys. Recently, the State Board of Registration for Foresters adopted procedures to sanction or revoke the licenses of foresters involved in unresolved complaints where the lack of BMP implementation has resulted in water quality violations.

Key Actions by Local Governments

Addressing water quality problems resulting from nonpoint source pollution will primarily depend on actions taken at the local level. Particularly for nonpoint sources associated with urban and residential development, it is only at the local level that regulatory authority exists for zoning and land use planning, control of erosion and sedimentation from construction activities, and regulation of septic systems.

Local governments are increasingly focusing on water resource issues. In many cases, the existence of high quality water has not been recognized and managed as an economic

resource by local governments. That situation is now changing due to a variety of factors, including increased public awareness, high levels of population growth in many areas resulting in a need for comprehensive planning, recognition that high quality water supplies are limited, and new state-level actions and requirements. The latter include:

- Requirements for Watershed Assessments and Watershed Protection Implementation Plans when permits for expanded or new municipal wastewater discharges are requested;
- Development of Source Water Protection Plans to protect public drinking water supplies;
- Requirements for local comprehensive planning, including protection of natural and water resources, as promulgated by the Georgia Department of Community Affairs.

In sum, it is the responsibility of local governments to implement planning for future development which takes into account management and protection of the water quality of rivers, streams, and lakes within their jurisdiction. One of the most important actions that local governments should take to ensure recognition of local needs while protecting water resources is to participate in the basin planning process, either directly or through Regional Development Centers.

7.1.2 Water Quantity Overview

In addition to protecting water quality, it is essential to plan for water supply in the Savannah River basin. The Georgia EPD Water Resources Branch regulates the use of Georgia's surface and ground water resources for municipal and agricultural uses, and is responsible for ensuring sufficient instream flows are available during a critical drought condition to meet permitted withdrawal requirements without significant impact to the environment. The withdrawal permit process must not overuse the available resources. The Water Resources Branch is also responsible for regulation of public water systems for compliance with the Safe Drinking Water Act, and regulation of dams for compliance with the Safe Dams Act.

In 1997, Georgia EPD developed the "Interim Strategy for Managing Saltwater Intrusion in the Upper Floridan Aquifer of Southeast Georgia" to address concerns regarding the general regional use of groundwater throughout coastal Georgia that is leading to declining water levels in the Floridan aquifer. The Interim Strategy includes policies such as establishing caps on groundwater use in the areas of Glynn County, Chatham County and southern portions of Bryan and Effingham Counties, and a reduction in ground water use in Chatham County by at least 10 million gallons per day by December 2005.

7.2 General Basinwide Management Strategies

There are many statewide programs and strategies that play an important role in the maintenance and protection of water quality in the Savannah basin. These general strategies are applicable throughout the basin to address both point and nonpoint source controls.

7.2.1 General Surface Water Protection Strategies

Antidegradation

The State of Georgia considers all waters of the state as high quality and applies a stringent level of protection for each waterbody. Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6-03(2)(b) contains specific antidegradation provisions as follows:

> (b) Those waters in the State whose existing quality is better than the minimum levels established in standards on the date standards become effective will be maintained at high quality; with the State having the power to authorize new developments, when it has been affirmatively demonstrated to the State that a change is justifiable to provide necessary social or economic development and provided further that the level of treatment required is the highest and best practicable under existing technology to protect existing beneficial water uses. Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected. All requirements in the Federal Regulations, 40 C.F.R. 131.12, will be achieved before lowering of water quality is allowed for high quality water.

The antidegradation review process is triggered at such time as a new or expanded point source discharge is proposed that may have some effect on surface water quality. Such proposals are reviewed to determine if the new discharge is justifiable to provide necessary social or economic development and that the level of treatment required is the highest and best practicable under existing technology to protect existing beneficial water uses.

Applicants for new or expanded point source discharges into any surface water must perform an alternative analysis comparing the proposed discharge alternative to a "no-discharge" land application or urban reuse alternative. The application for discharge to surface waters will only be considered if the less degrading alternatives are determined to be economically or technically infeasible. In all cases, existing instream water uses and the level of water quality necessary to protect the existing use shall be maintained and protected.

Water Supply Watershed Protection Strategy

As population continues to increase within the Savannah River basin, it will become ever more important to protect the water quality of already developed raw water sources. EPD is acting in concert with the Department of Community Affairs to produce a set of "guidelines" which define, among other things, measures that local governments are encouraged to take to protect drinking water sources. The "guidelines" are entitled Rules for Environmental Planning Criteria, and establish environmental protection criteria for five environmental categories: water supply watersheds, groundwater recharge areas, mountains, river corridors and wetlands. The *Criteria for Watershed Protection* (a sub-section of the Rules for Environmental Planning Criteria) set minimum guidelines for protection of watersheds above "governmentally owned" water supply intakes. The degree of protection depends upon the size of the watershed; watersheds with drainage areas of less than 100 square miles are subject to more strict criteria as summarized below:

- Impervious surface densities limited to 25 percent over the entire watershed.
- Buffer/setback requirements equal to 100/150 feet within seven (7) mile radius of the intake and 50/75 feet outside the seven (7) mile radius; and

- A reservoir management plan (including 150 foot buffer around the perimeter of the reservoir).

Watersheds with drainage areas of 100 square miles or more are subject to less strict criteria as summarized below:

- An intake on a flowing stream (as opposed to being located within a reservoir) shall have no specified minimum criteria; and
- An intake with a water supply reservoir shall have a minimum of 100 feet natural buffer within a seven mile radius of the reservoir, and no impervious cover constructed within a 150 foot setback area on both banks of the stream.

EPD is also actively working toward meeting the national goal that, by the year 2005, 60 percent of the population served by community water systems will receive their water from systems with source water protection programs (SWPP) in place under both wellhead protection and watershed protection programs. EPD intends to accomplish this goal by developing and implementing a source water assessment program (SWAP) in alignment with EPA's initiatives.

Although the procedures and strategies of the new program are incomplete to date, the Drinking Water Program (DWP) will compile a statewide source water assessment plan soliciting input from the public and approval from EPA. The plan will specify how the state will delineate areas providing source waters for public water systems, identify origins of contaminants in delineated areas, determine the susceptibility of public water sources to the contaminants and provide the basis for local individual source water protection plans for each different public water system. Once the statewide plan is approved the DWP will be allowed the flexibility to help complete the local source water protection plans for contracted public water systems and provide financial and technical assistance to help develop long range source water protection strategies for the public water system. The Source Water Assessment program will build upon EPD's other assessment and prevention programs, including the Well Head Protection Program, the Vulnerability Assessment and Waiver Program and the River Basin Management Plans, by soliciting active public participation from the local communities and assist in the preparation of the local water system's protection plan.

Total Maximum Daily Loads

Section 303(d) of the Clean Water Act (CWA) establishes the TMDL, or total maximum daily load, process as a tool to implement water quality standards. Georgia is required by the CWA to identify and list waterbodies where water quality standards are not met following the application of technology based controls, and to establish TMDLs for the listed stream segments. The USEPA is required to approve or disapprove Georgia's 303(d) list of waters and TMDLs.

The most recent requirement for 303(d) list submittal occurred in 2000. Georgia public noticed and submitted a draft 303(d) list package to the EPA in February 2000. The public and EPA reviewed the draft 303(d) list package and provided comments in March 2000. Georgia reviewed the input, made appropriate changes and submitted a final 303(d) listing to the EPA in April 2000. EPA approved the Georgia list in August 2000.

Georgia's 2000 303(d) listing is based on the Georgia 305(b) water quality assessments. The 305(b) assessment is presented in the report *Water Quality in Georgia, 1998-1999*. The 305(b) assessment tables are reprinted in Appendix E of this report. The tables provide a code indicating the 303(d) listing status of assessed segments within the Savannah River basin. An explanation of the codes is given below. An "X" in the 303(d) column indicates the segment is on the Georgia 303(d) list.

NA Waters assessed as supporting designated uses. These waters are not part of the Georgia 303(d) list.

1 Segments identified as not supporting or partially supporting designated uses where actions have been taken and compliance with water quality standards achieved. These segments are not part of the Georgia 303(d) list.

2 Segments identified as not supporting or partially supporting designated uses where existing enforceable State, local, or Federal requirements are expected to lead to attainment of water quality standards within two years without additional control strategies. These segments are not part of the Georgia 303(d) list.

3 Segments where TMDLs were completed and approved by EPA in 1998-2000. These waters are not part of the Georgia 303(d) list.

X Waters on the Geogia 303(d) list. These segments are assessed as not supporting or partially supporting designated uses, and may require additional controls to achieve designated uses. These segments make up the Georgia 303(d) list.

Georgia will address a number of the listed waters in the 2000-2001 time period, however, the majority of work on segments in the Savannah River will be addressed in the next iteration or cycle of Savannah river basin planning in 2001-2005.

7.2.2 Management of Permitted Point Sources

The strategies in this section strive to minimize adverse effects from municipal, industrial, and concentrated discharges. Permitted discharges of treated wastewater are managed via the National Pollutant Discharge Elimination system (NPDES) permit program. The NPDES permit program provides a basis for regulating municipal and industrial discharges, monitoring compliance with effluent limitations, and initiating appropriate enforcement action for violations. EPD has formulated general strategies for a number of types of environmental stressors under the NPDES program.

Analysis of Alternatives

Applicants for new or expanded point source discharges into any surface water must perform an alternative analysis comparing the proposed discharge alternative to a "no discharge", land application or urban reuse alternative. The application for discharge to surface waters will only be considered if the less degrading alternatives are determined to be economically or technically infeasible. In all cases, existing instream water uses and the level of water quality necessary to protect the existing use shall be maintained and protected.

Permit Issuance/Reissuance Strategies

During the basin plan implementation phase, issues identified in the written basin plan pertaining to point source discharges will be assessed. The assessment will include such things as 1) identified point source discharge problem areas, 2) data evaluations, 3) wasteload allocations and/or TMDLs with identified problem point sources, and 4) toxic pollutants identified with point source discharges. Permits associated with identified problems will be evaluated to determine if a reopening of the permit is appropriate to adequately address the problem.

Watershed Assessment Requirements

A watershed assessment is generally initiated when, due to growth and development, a local government sees a need to increase the hydraulic capacity of an existing

wastewater treatment facility (or propose a new facility) and contacts the EPD for a NPDES permit modification. If an antidegradation review demonstrates that it is not feasible to handle the additional capacity needs with a land treatment or other no discharge system, the community may pursue an increase in its surface water discharge. The initial step in this process is the completion of a watershed assessment, which is the first step towards assuring that all water quality standards will be maintained throughout a watershed during both critical dry and wet weather conditions in response to both point and nonpoint source loads.

The watershed assessment is actually a study, an assessment, and a plan. It is about collecting data and learning relationships between what is going on in a watershed and how these activities (land uses, etc.) impact water quality, then using this knowledge to develop both short and long term plans designed to ensure the attainment of water quality standards. The assessment should address current conditions and consider projected land use changes. Only when it can be demonstrated that water quality standards are and will continue to be maintained, can the EPD prepare a defensible permit for a proposed new wastewater treatment facility or proposed hydraulic expansion of an existing wastewater treatment facility discharging to the watershed. The assessment should include a detailed plan to address both current water quality problems and any predicted future water quality problems. Key components of such a plan will likely be adopted by EPD as "special conditions" of the pertinent new or modified NPDES permit.

Facility Construction/Improvements

EPD has promoted continuing improvement in the quality of return flows from permitted point sources in the basin. Upgrading wastewater treatment facilities is a significant strategy to meet effluent limits from discharges. In the past ten years, various upgrades and improvements have been made to industrial and municipal treatment systems throughout the Savannah River Basin. The funding for these projects has come from state and federal construction grants and loans and the citizens of local municipalities. Appendix C provides detailed information on expenditures by city and county governments on upgrading wastewater treatment facilities in the basin.

Domestic Wastewater Systems

The collecting, treating and disposing of wastewater in Georgia is regulated by a number of environmental laws that are administered by various agencies in local and state government. When a local government or private concern (owner) identifies a need for a wastewater treatment and disposal system it is imperative that thorough and adequate planning take place.

Wastewater systems that discharge treated wastewater to a surface stream must be permitted through the federal National Pollution Discharge Elimination System (NPDES) and meet all the requirements of that system. In Georgia, with very few exceptions, surface discharge permits will only be issued to publicly owned systems.

Wastewater systems that do not result in a discharge to surface waters, such as slow rate land treatment systems and urban reuse systems (no discharge), are permitted through the State of Georgia's land application system (LAS) permitting process. Both publicly and privately owned systems can apply for and receive LAS permits.

Chlorine

If a chlorine limit is not already required in an NPDES permit, all major municipal wastewater facilities (i.e., those with design flows greater than or equal to 1.0 million gallons per day [MGD]) are required to meet a chronic toxicity-based chlorine limitation

when the permit comes up for routine reissuance. The limitation is calculated based on a maximum instream concentration of 0.011 mg/l, the facility's design flow, and the 7Q10 low flow of the receiving stream. No facilities are given a limitation higher than 0.5 mg/l as this is deemed to be an operationally achievable number even if a facility does not have dechlorination equipment installed. Facilities which are given a limitation more stringent than 0.5 mg/l which do not already have dechlorination equipment installed, are given up to a two year schedule in which to meet the limitation. All discharging facilities which are upgrading are required to meet a chlorine limitation as part of the upgrade, based on the same criteria noted above.

Ammonia

Ammonia in effluents poses a problem both as a source of toxicity to aquatic life and as an oxygen-demanding waste. New facilities and facilities proposed for upgrade are required to meet ammonia limits for toxicity if those limits are more stringent than instream dissolved oxygen based limits. Existing facilities are not be required to meet ammonia limits based on calculated toxicity unless instream toxicity has been identified through toxicity testing.

Metals/Priority Pollutants

Major municipal and industrial facilities are required to submit periodic priority pollutant scans to EPD as part of their permit monitoring requirements or upon submittal of a permit application for permit reissuance. The priority pollutant data is assessed in accordance with the Georgia Rules and Regulations for Water Quality Control. The results of the assessment can be used to trigger either additional priority pollutant monitoring, a toxicity reduction evaluation or permit limits for certain parameters.

Color

The State's narrative water quality standard for color requires that all waters shall be free from material related to discharges which produce color which interferes with legitimate water uses. EPD's color strategy will address this standard for industrial and municipal discharges by implementing permit limits and/or color removal requirements. EPD requires new facilities or discharges to prevent any noticeable color effect on the receiving stream. EPD requires existing facilities with color in their effluent to collect upstream and downstream color samples when their NPDES permit is reissued. The facility must conduct an assessment of the sources of color. Also, a color removal evaluation may be required at permit reissuance. EPD will also target facilities for color removal requirements based on significant citizen complaints of discoloration in streams.

Phosphorus

EPD establishes phosphorus control strategies where needed to address water bodies where water quality is limited by excess phosphorus loading. At the present time, there are no data to suggest phosphorus loading problems in the Savannah River basin.

Temperature

Permits issued for facilities which discharge to primary trout streams are required to have no elevation of natural stream temperatures. Permits issued for facilities which discharge to secondary trout streams are required to not elevate the receiving stream more than 2 degrees Fahrenheit.

Storm Water Permitting

The 1987 Amendments to the federal Clean Water Act require permits to be issued for certain types of discharges, with primary focus on runoff from industrial operations and large urban areas. The EPA promulgated Storm Water Regulations on November 16, 1990. EPD subsequently received delegation from the EPA in January 1991 to issue General Permits and regulate storm water in Georgia. EPD has developed and implemented a strategy which assures compliance with the federal regulations.

The "Phase I" Federal Regulations set specific application submittal requirements for large (population 250,000 or more) and medium (population 100,000 to 250,000) municipal separate storm sewer systems. Accordingly, Georgia has issued individual area-wide NPDES municipal separate storm sewer system (MS4) permits to 58 cities and counties in municipal areas with populations greater than 100,000 persons. These permits authorize the municipalities to discharge storm water from the MS4s which they own or operate, and incorporate detailed storm water management programs. These programs may include such measures as structural and non-structural controls, best management practices, inspections, enforcement and public education efforts. Storm water management ordinances, erosion and sediment control ordinances, development regulations and other local regulations provide the necessary legal authority to implement the storm water management programs. Illicit discharge detection and long-term wet weather sampling plans are also included in the management programs. The permit requires the submission of Annual Reports to EPD, describing the implementation of the storm water management program. Among other things, the Annual Report includes a detailed description of the municipality's implementation of its Storm Water Management Plan.

EPA's Phase I Rule addresses only municipalities with populations greater than 100,000 people and construction sites larger than five acres. EPA is proposing a Phase II Rule for municipalities with populations less than 100,000 people and construction sites smaller than five acres. This rule is not expected to be finalized until at least March, 1999. The Phase II Rule will eventually impact some of the municipalities within the basin.

EPD has issued one general permit regulating storm water discharges for 10 of 11 federally regulated industrial subcategories defined in the Phase I Federal regulations. The eleventh subcategory, construction activities, will be covered under a separate general permit, which is not yet finalized. The general permit for industrial activities requires the submission a Notice of Intent (NOI) for coverage under the general permit, the preparation and implementation of a storm water pollution prevention plan, and in some cases, the monitoring of storm water discharges from the facility. As with the municipal storm water permits, implementation of site-specific best management practices is the preferred method for controlling storm water runoff.

7.2.3 Nonpoint Source Management

The strategies in this section address sources of environmental stressors which are not subject to NPDES permitting and typically originate from diffuse or nonpoint sources associated with land uses. Most strategies that address nonpoint source concerns are not regulatory in nature, but involve a variety of approaches such as technical assistance and education to prevent and reduce nonpoint source pollution in the basin. Strong stakeholder involvement will be essential to effectively implement many of these strategies.

Georgia Nonpoint Source Management Program

The Georgia Environmental Protection Division (EPD) has produced the Georgia Nonpoint Source Management Program (PFY98-02), which provides an overview of the State's nonpoint source water quality management activities as well as a summary of what the State intends to accomplish in the next five federal fiscal years. The Georgia Nonpoint Source Management Plan addresses the following categories of nonpoint source pollution loading: Agriculture (crops, pasture, animal operations, aquaculture), Silviculture, Construction, Urban Runoff, Resource Extraction/Exploration/ Development, Land Disposal (Runoff/Leachate from Permitted Areas), Hydrologic/Habitat Modification, and Other.

Agricultural Nonpoint Source Control Strategies

Agricultural nonpoint source pollution continues to be managed and controlled with a statewide non-regulatory approach. This approach uses cooperative partnerships with various agencies and a variety of programs. A brief description of these agencies and outline of their functions and programs is provided below.

Soil and Water Conservation Districts (SWCDs)

Georgia's SWCDs were formed by Act No. 339 of the Georgia General Assembly on March 26, 1937. Their role is to provide leadership in the protection, conservation, and improvement of Georgia's soil, water, and related resources. This is accomplished through promotion efforts related to the voluntary adoption of agricultural best management practices (BMPs).

Georgia Soil and Water Conservation Commission (GSWCC)

Georgia's SWCDs receive no annual appropriations and are not regulatory or enforcement agencies. Therefore, the GSWCC was also formed in 1937 to support the SWCDs. GSWCC has been designated as the administering or lead agency for agricultural nonpoint source (NPS) pollution prevention in the state. The GSWCC develops NPS water quality programs and conducts educational activities to promote conservation and protection of land and water resources devoted to agricultural uses. Primary functions of the GSWCC are to provide guidance and assistance to the Soil and Water Conservation Districts and provide education and oversight for the Georgia Erosion and Sedimentation Act.

There are a number of other agricultural agencies administering programs to address water quality and natural resource management issues. Resource Conservation and Development (RC&D) Councils are organized groups of local citizens–supported by USDA–involved in a program to encourage economic development, as well as the wise conservation of natural and human resources. The University of Georgia College of Agricultural and Environmental Sciences (CAES) conducts an education and outreach campaign that encourages producers to increase productivity using environmentally sound techniques. This is accomplished through a number of programs like Farm*A*Syst, Well Water Testing, Nutrient Management, Soil and Water Laboratory Analysis, and informational material on a wide range of subjects. Georgia’s Department of Agriculture (GDA) administers a wide variety of insect and plant disease control programs to help regulate the use of pesticides. GDA also inspects irrigation system requirements, such as check valves and back flow prevention devices, for protection of groundwater. The Agricultural Research Service (ARS) conducts research designed to improve the effectiveness of agricultural conservation techniques and promote sustainability. The Natural Resources Conservation Service (NRCS), along with the Farm Services Agency (FSA) and through local Soil and Water Conservation Districts,

administers Farm Bill Programs that provide technical and financial incentives to producers to implement agricultural BMPs. The Agricultural Water Use Coordinating Committee, through it's individual members regularly applies for, and receives, funds under section 319(h) of the Clean Water Act to best management practices and demonstration projects throughout the state. The Georgia Soil and Water Conservation Commission has provided state leadership with many of these efforts.

Collectively, these programs will serve to address resource concerns related to agricultural land uses in a coordinated fashion over the next five years until the second iteration of the River Basin Management Planning Cycle. Much of the information regarding opportunities to participate under this voluntary approach to complying with water quality standards is disseminated through commodity commissions and organizations such as the Farm Bureau Federation, Agribusiness Council, Cattlemen's Association, Milk Producers Association, Pork Producers Association, Poultry Federation, and other agricultural support industries.

Prioritization Activities under the Farm Bill

The 1996 Farm Bill provides a number of programs, and processes, designed to address those environmental stressors related to nonpoint sources from Agriculture which were identified in section 4.1.2. A new flagship conservation program, the Environmental Quality Incentives Program (EQIP), will provide the lion's share of funding for technical, educational, and financial assistance. The USDA Natural Resources Conservation Service (NRCS) has leadership for EQIP and works with the USDA Farm Service Agency (FSA) to set policies, priorities, and guidelines. These two agencies take recommendations from local work groups and a State Technical Committee, comprised of resource professionals from a variety of disciplines, when addressing actual, and potential, resource impairments associated with agricultural land uses.

EQIP provides incentive payments and cost-sharing for conservation practices through 5 to10 year contracts. Producers may receive federal cost-sharing up to 75 percent of the average cost of certain conservation practices such as terraces, grassed waterways, filter strips, buffer strips, manure management facilities, animal waste utilization, and 46 other conservation practices important to improving and maintaining the health of natural resources in an area. An individual producer can receive as much a $50,000 in EQIP funds to implement needed conservation practices.

A majority of funds allocated to Georgia (65 percent) will be spent in priority areas where there are serious and critical environmental needs and concerns. High priority is given to areas where state and local governments offer financial and technical assistance, and where agricultural improvements will help meet water quality and other environmental objectives.

The remaining 35 percent of funds allocated to Georgia can be extended outside priority areas to other parts of the state. Eligibility is limited to persons who are engaged in agricultural productions. Eligible land includes cropland, pastureland, forestland, and other farm lands.

In addition to EQIP there are three major conservation programs from USDA that will be available to producers, and rural landowners. The first is the Conservation Reserve Program (CRP), which protects highly erodible and environmentally sensitive land with grass, trees, and other long-term cover. The Wetland Reserve Program (WRP) is a voluntary program designed to protect, restore, and enhance wetlands with cost-share incentives. Also, the Wildlife Habitat Incentives Program (WHIP) will help landowners develop and improve habitats for upland wildlife, wetland wildlife, endangered species, fisheries, and other wildlife.

Forestry Nonpoint Source Control Strategies

In 1977, the Governor's Silviculture Task Force prepared a report which recommended a voluntary approach to the implementation of best management practices (BMPs) and the designation of the Georgia Forestry Commission (GFC) as the lead agency for implementing the Silviculture portion of the State Section 208 Water Quality Management Plan. The GFC was designated as the lead agency for silvicultural nonpoint source pollution prevention in the state in November, 1979. The Forestry Nonpoint Source Control Program is managed and implemented by the GFC, with the support of the forest industry, for the voluntary implementation of best management practices.

The Forestry Nonpoint Source Control Program is managed by a Statewide Coordinator and appointed foresters serving as District Coordinators from each of the 12 GFC districts. The Statewide and District Coordinators conduct educational workshops, training programs and field demonstrations for the forest community (i.e., landowners, land management and procurement foresters, consulting foresters, timber buyers, loggers, site preparation contractors). The GFC investigates and mediates complaints involving forestry operations. In addition, the GFC conducts BMP compliance surveys to assess the effectiveness of BMP in the forest community. The GFC has established procedures for installing water control structures in firebreaks to reduce soil erosion and sedimentation.

Recently, the State Board of Registration for Foresters adopted procedures to sanction or revoke the licenses of professional foresters involved in unresolved complaints where the lack of BMP implementation has resulted in state water quality or federal wetlands requirement violations.

Additional requirements are imposed within the National Forest areas of Georgia. Each National Forest produces and regularly updates and Land and Resource Management Plan to guide timber harvest and other activities. These plans establish long range goals and objectives; specific management prescriptions and the vicinity in which they will occur; standards and guidelines on how management prescriptions will be applied; and monitoring procedures to assure the Plan is followed.

Urban Nonpoint Source Control Strategies

The 1990 report of the Community Stream Management Task Force, *We All Live Downstream*, established a road map for urban nonpoint source management in Georgia. The Task Force recognized two major impediments to effectively managing the quality of urban water bodies. The first is the division between 1) statutory responsibilities for management of water quality, granted to EPD, and 2) local government's Constitutional responsibility for management of the land activities which affect urban water bodies. The second impediment is the widespread nature of the nonpoint sources and the variety of activities which may contribute to impacts from urban runoff. They concluded that management of urban nonpoint source pollution would require ". . . a cooperative partnership between layers of government, the private sector, and the general public. The development of such a partnership will require a strong impetus to accept new institutional roles and make the structural changes necessary to support and sustain the stream management process."

EPD has a primary role in facilitating the management of urban runoff, and is responsible for administering and enforcing a variety of permit programs, including permitting of discharges. In addition to these regulatory activities, EPD seeks to assist in development of local solutions to water quality problems; provides technical information on the water resources of the state; and administers grant programs, with funds from various sources to support non-point source planning and assessment, implementation of

BMPs, and regional or local watershed management initiatives. EPD also conducts a variety of outreach and educational activities addressing urban runoff in general, regulatory requirements, and cooperative or non-regulatory approaches.

For urban runoff, activities of the Nonpoint Source Management Program interact strongly with point source controls for combined sewers and storm sewers, both of which discharge urban runoff through point conveyances. While the state continues to have an important regulatory role, aspects of the cooperative intergovernmental partnerships envisioned by the Task Force have emerged and are being strengthened. EPD is implementing programs which go beyond traditional regulation, providing the regulated community with greater flexibility and responsibility for determining management practices. Current activities for urban surface runoff control include the following:

- Implement local nonpoint source (NPS) management programs, streambank and stream restoration activities, and community Adopt-A-Stream programs.
- Develop and disseminate local watershed planning and management procedures.
- Implement state and local Erosion and Sedimentation Control Programs.
- Prepare and disseminate technical information on best management practices and nonpoint source monitoring and assessment.
- Implement NPS education programs for grades K through 12 through Project WET (Water Education for Teachers), as described below in Section 7.3.6.
- Implement the Georgia Adopt-A-Stream Program, as described in Section 7.3.6.
- Identify and evaluate resources to support urban watershed planning and management.

7.2.4 Floodplain Management

Floodplain Management Strategies

Floodplain Management in the State of Georgia is administered under federal regulations and local ordinances. The federal statues are found in Title 44 of the Code of Federal Regulations Parts 59-79. As a condition of participation in the National Flood Insurance Program (NFIP), local political jurisdictions voluntarily adopt Flood Damage Prevention Ordinances, which are based on federal regulations, to enforce and administer floodplain development. Georgia's Floodplain Management Office does not issue permits for floodplain development.

Georgia's Floodplain Management Office, located within the Department of Natural Resources, Environmental Protection Division, serves as liaison between the Federal Emergency Management Agency (FEMA) and local communities participating in the NFIP. However, Georgia's Floodplain Management Office has no regulatory authority. Participation by the local communities in the NFIP is a requirement for the Federal Government to make flood insurance available to all property owners. Through workshops, newsletters, technical assistance and community visits, the Floodplain Management Office assists local governments to maintain compliance with NFIP requirements. The Floodplain Management Office also provides technical data, floodplain maps, and training workshops to various public and private entities involved in floodplain management and floodplain determinations. In addition, the Floodplain Management Office reviews all state-funded and federal-funded projects for development in designated Special Flood Hazard Areas. A major thrust of the Floodplain Management Office is to increase the number of political jurisdictions participating in the NFIP, thereby increasing the number of flood insured structures in Georgia.

River Care 2000 Program

Georgia also has strategies to protect and manage riparian floodplain areas. Of particular relevance is River Care 2000, a conservation program which Governor Miller established in September 1995. One key objective of this program is acquisition of river-corridor lands for purposes of protection and to forestall unwise development in flood-prone areas. The Coordinating Committee has approved procedures for three types of projects: Riverway Demonstration Projects, which improve public access to a river with scenic and recreation uses, and protects natural and historic resources by acquiring and managing land in the river corridor; Significant Sites, which are tracts of land which DNR will acquire and operate as a traditional state public-use facility: wildlife management or public fishing area, park or historic site, natural area, or greenway; and Restoration Sites, which are tracts of land which the state will identify, acquire, and manage to reduce nonpoint-source water pollution.

The River Care 2000 program is also charged with assessing important river resources throughout the state and identifying more effective management tools for river corridors. The program recently released a state-wide assessment of resources associated with rivers throughout the state (GA DNR, 1998).

7.2.5 Wetland Management Strategies

The loss of wetlands, because of the associated adverse impacts to flood control, water quality, aquatic wildlife habitat, rare and endangered species habitat, aesthetics, and recreational benefits, has become an issue of increasing concern to the general public as they become better informed of the values and functions of wetlands. We still suffer from the lack of accurate assessments for current and historic wetland acreage, but, regardless of the method used to measure total acreage or wetland losses, Georgia still retains the highest percentage of precolonial wetland acreage of any southeastern state.

Efforts to Track No Net Loss of Wetlands

While the 1993 Federal Administration Wetlands Plan calls for a concerted effort by EPA and other federal agencies to work cooperatively toward achieving a no overall net loss of wetlands in the short term and a net increase in the quantity of the nation's wetlands in the long run, there have been no statutory or executive level directives to carry out this policy. Achievement of the goal of no net loss is dependent upon limited changes to regulations, memoranda of understanding, cooperative agreements, and other partnerships between federal, state, and local governments, conservation organizations, and private citizens.

All dredge and fill activities in freshwater wetlands are regulated in Georgia by the U.S. Army Corps of Engineers (COE) under Section 404 of the Clean Water Act. The majority of wetland alterations occur under nationwide or general permits, which include permits for bridge building, minor road crossing fills, and fills of less than ten acres above the “headwaters” point of non-tidal streams where the annual average flow is less than 5 cubic feet per second. Enforcement is carried out by the COE and EPA in freshwater wetlands. Normal agricultural and silvicultural operations are exempted under Section 404 regulations.

The COE may require wetland mitigation activities in association were permitting, including creation, restoration, and protection of wetlands. COE may also require wetland restoration in case of violations. In the settlement of violations, restorations occurred on 16.8 acres in 1994, and 17.8 acres in 1995.

Land Acquisition

The Department of Natural Resources (DNR), Wildlife Resources Division (WRD), began a land acquisition program in 1987 to acquire 60,000 acres of additional lands for Wildlife Management Areas (WMAs) and Public Fishing Areas (PFAs). This initiative was funded by $30 million of 20-year obligation bonds to be paid off by hunting and fishing license increases and WMA permit fees.

Beginning in 1990 Governor Zell Miller initiated Preservation 2000, a $60 million program to acquire 100,000 acres of lands to be used for wildlife and fisheries management, parks and recreation, natural area preservation, and general conservation. Additional wetlands acquisition occurs as part of the River Care 2000 initiative, discussed above.

7.2.6 Stakeholder Involvement/Stewardship Strategies

Effective nonpoint source management must address the numerous activities of individuals, businesses, industries, and governments which can adversely affect urban and rural waters. In many cases, these groups are unaware of the potential impacts of their activities or corrective actions which may be taken. Stakeholder involvement and stewardship are essential to address these major challenges.

Georgia has chosen a two-pronged approach to encourage stewardship via education and citizen monitoring. EPD is the lead agency in these education and citizen monitoring programs, but, like other aspects of the state's nonpoint source management effort, cooperative efforts with local governments and community-based groups are critical to their implementation. Outreach and education, including citizen monitoring, lays the groundwork for behavior change and is often an important pre-requisite for effective implementation of BMPs and comprehensive watershed management programs.

General goals for stakeholder involvement and stewardship strategies are:

- Generate local support for nonpoint source management through public involvement and monitoring of streams and other water bodies and of results of management actions.
- Increase individual's awareness of how they contribute to nonpoint source pollution problems and implement appropriate strategies to motivate behavior change and actions to address those problems.
- Provide the educational tools, assistance, and support for addressing NPS problems to target audiences across the state.

Georgia Adopt-A-Stream

The Georgia Adopt-A-Stream Program is a citizen monitoring and stream protection program with two staff positions in the EPD and four Regional Training Centers. Established in 1996, the Regional Training Centers are a network of college-based training centers located in Columbus, Milledgeville, Savannah and Valdosta, Georgia. This network of training centers allow the Georgia Adopt-A-Stream Program to be accessible to all areas of the State. The Regional Training Centers ensure that volunteers are trained consistently and that the monitoring data is professionally assessed for quality assurance and quality control. Savannah State University provides training and technical support at the regional level for the lower portions of the Savannah River Basin.

Currently, more than 7,000 volunteers participate in individual and community sponsored Adopt-A-Stream Programs. The existing community Adopt-A-Stream

Programs in the Savannah River Basin are located in Augusta (Richmond County), Hiawassee (Towns County), Savannah (Chatham County) and Springfield (Effingham County).

Volunteers are offered different levels of involvement. Each level involves an education and action component on a local stream. Volunteers commit for a minimum of one year on a half-mile stream segment. The introductory consists of setting up a project (i.e., identifying a stream segment or wetland, identifying partners, registering with the Georgia Adopt-A-Stream Program), evaluating land use and stream conditions during a "watershed walk", conducting quarterly visual evaluations and clean-ups, and one public outreach activity. Volunteers create a "Who to Call for Questions or Problems" list so that if something unusual is noted, immediate professional attention can be obtained. Advanced levels of involvement include either biological monitoring, chemical monitoring or a habitat improvement project.

The Georgia Adopt-A-Stream Program conducts numerous presentations and workshops throughout the State. Approximately 1,000 volunteers participate in a variety of workshops each year. An "Introduction to the Georgia Adopt-A-Stream Program" and "Watershed Walk" videos have been produced, duplicated and distributed on loan. The Georgia Adopt-A-Stream Program manuals have been printed and distributed to approximately 2,500 volunteers. In addition, a bi-monthly newsletter is published and distributed to over 2,500 volunteers with program updates, workshop schedules, information about available resources, reports about local watershed projects, and success stories.

In addition, the Georgia A-Adopt-Stream Program organizes the annual Georgia River Clean-Up Week - Rivers Alive! each fall, with over 7,000 volunteers cleaning up rivers, creeks, canals, lakes, and ponds in over 100 locations statewide.

Nonpoint Source Education: Project WET (Water Education for Teachers)

A report outlining a plan for nonpoint source education in Georgia was completed in 1994. The Georgia Urban Waterbody Education Plan and Program, delineated nonpoint education strategies for seven target audiences: general public, environmental interest organizations, civic associations, educators, business associations, local government officials, and state government officials. Given limited resources and the scope of effort required to target each of these audiences concurrently, EPD decided to initially target nonpoint source education efforts toward educators and students in grades K-12. As described above, EPD is currently targeting initial nonpoint education efforts towards both formal and non-formal educators.

In October 1996, EPD selected Project WET (Water Education for Teachers) Curriculum as the most appropriate water science and education curriculum for the State. The Project WET Curriculum is an interdisciplinary curriculum of school, museum, university pre-service class, or a community organization. The goals of the Georgia Project WET Program are facilitate and to promote awareness, appreciation, knowledge and stewardship of water resources through the development and dissemination of classroom (K-12) ready teaching aids.

Since 1997, several Project WET Facilitator Training Workshops have been successfully completed in Athens, Atlanta, Dahlonega, Macon, Savannah, Valdosta, and Warner Robbins with a total of 141 Project WET Facilitators trained in Georgia. In addition, over 115 Project WET Educator Workshops have been successfully completed in Georgia with more than 2,000 educators implementing the Project WET Curriculum statewide.

Currently in the Savannah River Basin, there are 21 Project WET Facilitators with over 250 educators having received certified Project WET training. In addition, Oatland Island Environmental Education Center educators are certified Project WET Facilitators and conduct Project WET workshops for educators in the lower portions of the Savannah River Basin.

Georgia Project WET provides facilitators and educators the use of additional water resources such as the Enviroscape Module and the Ground Water Module, demonstration tools used to emphasize the impact of nonpoint source pollution to surface and ground waters pollution. In addition, the newsletter, "The Dragonfly Gazette," is published and distributed quarterly to over 2500 teachers and environmental educators.

The Georgia Project WET Program has been nationally recognized for its training strengths and techniques – specifically the use of arts in environmental education. The Georgia Project WET Program in conjunction with International Rivers Network offers educators in Georgia the opportunity to participate in the "River of Words," an international poetry and art contest for student (K-12). This contest provides students with the opportunity to explore their own watersheds and to learn their 'ecological" addresses through poetry and art. National winners are selected by the former U.S. Poet Laureate, Rob Hass, and the International Children's Art Museum. Annually, only eight students are selected as the National Grand Prize winners to be honored at the Library of Congress in Washington, DC and treated to many V.I.P. tours of the nation's capital. Since 1997, five students from Georgia have been recognized as National Grand Prize Winners and an additional 20 students from Georgia have been as National Finalists.

The Georgia Project WET Program provides educators with 'River of Words – Teacher's Guide" along with resource information specific to Georgia. Annually, selected poetry and art are on display throughout Georgia for the year following the contest.

7.2.7 Ground Water Protection Strategies

In 1984, EPD developed its first management plan to guide the management and protection of Georgia's ground water quantity and quality. The current version, Georgia Geologic Survey Circular 11, published in 1996, is the basis of Georgia's application to be certified by U.S. EPA for a Comprehensive State Ground Water Protection Plan (CSGWPP). The goal of Georgia's ground water management plan is:

> . . . to protect human health and environmental health by preventing and mitigating significant ground water pollution. To do this, Georgia will assess, protect, and, where practical, enhance the quality of ground waters to levels necessary for current and projected future uses for public health and significant ecological systems.

The goal recognizes that not all ground water is of the same value. The Division's goal is primarily preventive, rather than curative; but it recognizes that nearly all ground water in the state is usable for drinking water purposes and should remain so. EPD pursues this goal through a policy of anti-degradation by which ground water resources are prevented from deteriorating significantly, preserving them for present and future generations. Selection of this goal means that aquifers are protected to varying degrees according to their value and vulnerability, as well as their existing quality, current use, and potential for future use.

EPD has adequate legal authority to prevent ground water from being significantly polluted and to clean-up ground water in the unlikely event pollution were to occur. Extensive monitoring has shown that incidents of ground water pollution or contamination are uncommon in Georgia; no part of the population is known to be at risk.

In general, the prevention of ground water pollution includes—(1) the proper siting, construction, and operation of environmental facilities and activities through a permitting system; (2) implementation of environmental planning criteria by incorporation in land-use planning by local government; (3) implementation of a Wellhead Protection Program for municipal drinking water wells; (4) detection and mitigation of existing problems; (5) development of other protective standards, as appropriate, where permits are not required; and (6) education of the public to the consequences of ground water contamination and the need for ground water protection.

Ground water pollution is prevented in Georgia through various regulatory programs (administered by the State's Department of Natural Resources) which regulate the proper siting, construction, and operation of the following:

- Public water supply wells, large irrigation wells and industrial wells withdrawing more than 100,000 gallons per day.
- Injection wells of all types.
- Oil and gas wells (including oil and gas production).
- Solid waste handling facilities.
- Hazardous waste treatment/storage/disposal facilities.
- Municipal and industrial land treatment facilities for waste and wastewater sludge.
- Municipal and industrial discharges to rivers and streams.
- Storage/concentration/burial of radioactive wastes.
- Underground storage tanks.

EPD prevents the contamination of ground water used for municipal drinking water through an EPA-approved Wellhead Protection Program. As a result of this program, certain new potentially polluting facilities or operations are restricted from wellhead protection areas, or are subject to higher standards of operation and/or construction. EPD also encourages local governments to adhere to the *Criteria for the Protection of Groundwater Recharge Areas* (a section of the Rules for Environmental Planning Criteria), which define higher standards for facility siting, operation, and clean-up in significant ground water recharge areas. The most stringent guidelines of these criteria pertain to those recharge areas with above average ground water pollution susceptibility indexes.

Additionally, EPD has legal authority under the Georgia Water Quality Control Act to clean up ground water pollution incidents. Additional clean up authority occurs as special trust funds established to clean up leaking underground storage tanks, abandoned hazardous waste sites, and scrap tire dumps.

Most laws providing for protection and management of ground water are administered by EPD. Laws regulating pesticides are administered by the Department of Agriculture, environmental planning by the Department of Community Affairs; and on-site sewage disposal, by the Department of Human Resources. EPD has established formal Memoranda of Understanding (MOU) with these agencies. The Georgia Groundwater Protection Coordinating Committee was established in 1992 to coordinate groundwater management activities between the various departments of state government and the several branches of EPD.

7.3 Targeted Management Strategies

This section describes specific management strategies targeted to address concerns and priority issues for the Savannah River Basin that were described in Section 6. Strategies are presented for each issue of concern, with divisions by geographic area and/or HUC unit as appropriate. For each of the identified concerns, the management strategy consists of five components: a problem statement (identical to that given in Section 6), general goals, ongoing efforts, identified gaps and needs, and strategies for action. The purpose of these statements is to provide a starting point for key participants in the subbasin to work together and implement strategies for addressing each priority concern. In some cases, a strategy may simply consist of increased monitoring; in other situations, the stakeholders in the subbasin will need to develop innovative solutions to these water quality issues. While EPD will continue to provide technical oversight, conduct monitoring surveys as needed, and evaluate data on a basin-wide scale, locally-led efforts in the subbasins will be required to help to monitor, assess, restore, and maintain the water quality throughout the Savannah River Basin.

7.3.1 Metals and Toxicity

Tugaloo River Subbasin (Hydrologic Unit 03060102)

Problem Statement

Metals: The water use classification of fishing was not fully supported in one segment of Eastanollee Creek due to exceedences of water quality standards for copper and zinc due to a combination of nonpoint runoff and the discharges from the Toccoa Eastanollee Creek WPCP and Coats American WTF.

Toxicity: The water use classification of fishing was not fully supported in one segment of Eastanollee Creek due to predicted toxicity. Aquatic toxicity tests on the Coats American WTF effluent predicted toxicity in the receiving stream at critical 7Q10 low flows.

General Goals

Meet applicable water quality standards; ensure that levels of metals and predicted effluent toxicity do not interfere with support of Eastanolle Creek's designated stream classification of fishing.

Ongoing Efforts

The City of Toccoa is under Federal and State Consent Orders requiring facility upgrades and sewerage system improvements to address metals issues. Coats American is constructing a wetland system to replace its current discharge to Eastanollee Creek. These efforts, when completed, should result in the water quality standards being met in Eastanollee Creek.

Identified Gaps and Needs

Metals: EPD will conduct follow-up monitoring of Eastanolle Creek during the next basin monitoring cycle to assess copper and zinc concentrations in the creek.

Toxicity: Once Coats American has completed the construction of its constructed wetland system, the industry will be required to conduct follow-up toxicity testing on the wetlands system discharge.

General Strategies for Action

First address point source problems, then determine additional efforts required for nonpoint sources.

Specific Management Objectives

1. Bring point sources into compliance.
2. Monitor to assess achievement of water quality standards or need for further reductions from nonpoint sources.
3. Encourage local government watershed planning and management to ensure that designated water uses are supported.

Action Plan

1. The City of Toccoa has completed the upgrades to its wastewater treatment plants as required by the Order and is currently in compliance with its NPDES Permit. EPD will continue to monitor the compliance through monthly discharge monitoring reports submitted by the city.
2. Coats American completed the constructed wetland system as of 9/1/99.
3. EPA finalized a TMDL for zinc in Eastanolle Creek in March 2000.
4. EPD will implement the TMDL.
5. EPD will work with local governments to secure voluntary efforts to reduce potential nonpoint source for metals.

Upper Savannah River Subbasin (Hydrologic Unit 03060103)

Problem Statement

The water use classification of fishing was not fully supported in one segment of Cedar Creek due to an exceedence of the water quality standard for zinc due primarily to the City of Hartwell WPCP.

General Goals

Meet applicable water quality standards; ensure that the discharge does not interfere with support of Cedar Creek's designated stream classification of fishing.

Ongoing Efforts

The City of Hartwell WPCP discharge was eliminated June 1999.

Identified Gaps and needs

Metals: EPD will conduct follow-up monitoring of Cedar Creek during the next basin monitoring cycle to assess zinc concentrations in the creek.

General Strategies for Action

Re-evaluate water quality status during the next monitoring cycle to determine if further management is required.

Specific Management Objectives

Monitor zinc concentrations in Cedar Creek during the next monitoring cycle to assess water quality status. If water quality standards are not met, work with the City of Hartwell to identify the causes and sources of impairment and develop and implement additional management measures.

Action Plan

The City of Hartwell is required through a Consent Order to conduct stream studies to document improved water quality in Cedar Creek as the result of the elimination of the WPCP discharge. EPD will monitor the City's compliance with this Consent Order. Once the stream studies have been completed, EPD will review the results and make a determination if further action is needed to bring Cedar Creek into compliance with the water quality standards for fishing.

Middle Savannah River Subbasin (Hydrologic Unit 03060106)

Problem Statement

Metals: The water use classification of fishing was not fully supported in one segment of Butler Creek due to exceedences of water quality standards for selenium due to nonpoint sources and the discharge from the City of Augusta WPCP.

Toxicity: The water use classification of fishing was not fully supported in one segment of Rocky Creek due to toxicity resulting from runoff and groundwater leaching from the Southern Wood Piedmont facility.

General Goals

Meet applicable water quality standards; ensure that levels of metals and toxicity do not interfere with support the designated stream classification of fishing in each creek.

Ongoing Efforts

Metals: The City of Augusta WPCP upgraded to a constructed wetlands system. The City also eliminated all CSOs from its sewer system. The City has also revised its local limits (part of its Industrial Pretreatment Program) resulting more stringent limits for industrial users its sewer system.

Toxicity: The Southern Wood Piedmont site is being remediated in accordance with an EPD Order.

Identified Gaps and Needs

Metals: EPD will conduct follow-up sampling of Butler Creek during the next monitoring cycle to assess selenium concentrations in Butler Creek.

Toxicity: EPD will continue to monitor the Southern Wood Piedmont remediation project to ensure its completion.

General Strategies for Action

EPD assess water quality during the next monitoring cycle to determine if current efforts have resulted in achievement of water quality standards or if further actions are necessary.

Specific Management Objectives

Monitor selenium concentrations in Butler Creek during the next monitoring cycle to assess current water quality status. If water quality standards are not met, work with the City of Augusta and other stakeholders to identify the causes of impairment and develop and implement additional management measures.

Action Plan

1. EPD will monitor selenium concentration in Butler Creek during the next monitoring cycle.

2. EPD will monitor the Southern Wood Piedmont remediation project to ensure that the project is completed on time.

Brier Creek Subbasin (Hydrologic Unit 03060108)

Problem Statement

Toxicity: The water use classification of fishing was not fully supported in one segment of Whites Creek. Aquatic toxicity tests of the City of Thomson WPCP effluent predicted toxicity in the receiving stream at critical 7Q10 low flow conditions.

General Goals

Eliminate predicted toxicity to support designated stream classification of fishing.

Ongoing Efforts

The City of Thomson WPCP is under Order to pay stipulated penalties for whole effluent toxicity limit violations. EPA and UGA scientists are currently evaluating potential sources of toxicity.

Identified Gaps and needs

Addressing the predicted toxicity in the Thomson WPCP effluent will require additional studies of the wastewaters being discharged to the city sewer system.

General Strategies for Action

EPD will continue to enforce the facility NPDES permit and Consent Order.

Specific Management Objectives

Evaluate findings of toxicity sources identification study and require the City of Thomson to implement measures to reduce toxicity in the Thomson WPCP effluent.

Action Plan

1. Once EPA/UGA completes their evaluation, EPD will formulate a strategy to ensure that the recommendations/findings are addressed by the City of Thomson.
2. EPA finalized a TMDL for toxicity for Whites Creek in March 2000.
3. EPD will implement the TMDL.

Lower Savannah River (Hydrologic Unit 03060109)

Problem Statement

The water use classification of fishing was not fully supported in one segment of Buck Creek due to exceedences of water quality standards for copper due to nonpoint sources and the City of Sylvania WPCP discharge.

General Goals

Meet water quality standards to support designated stream classification of fishing.

Ongoing Efforts

The City of Sylvania WPCP is now in compliance with its copper limits. Major industrial user has reduced its copper discharge to the City.

Identified Gaps and needs

EPD will monitor copper in Buck Creek during the next monitoring cycle in order to assess current water quality status.

General Strategies for Action

EPD will assess water quality during the next monitoring cycle to determine if ongoing efforts result in achievement of water quality standards or if further actions are necessary.

Specific Management Objectives

Monitor copper concentrations Buck Creek during the next monitoring cycle to assess current water quality status. If water quality standards are not met, work with the City of Sylvania and other stakeholders to identify the causes and sources of impairment and develop and implement additional management measures.

Action Plan

Monitor copper concentrations during the next monitoring cycle.

7.3.2 Fecal Coliform Bacteria

Problem Statement

The water use classifications of fishing, wild/scenic, or drinking water were not fully supported in several water body segments due to exceedences of the water quality standards for fecal coliform bacteria. These water quality exceedences are found in a number of stream segments in the Savannah River basin and are primarily attributed to urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources, and/or animal wastes. A common strategy is proposed for addressing fecal coliform bacteria throughout the basin. However, achieving standards in individual stream segments will depend on the development of site specific local management plans.

Tugaloo River Subbasin (Hydrologic Unit 03060102)

The water use classifications of fishing or wild/scenic were not fully supported in six tributary stream segments due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources, and/or animal wastes.

Animal waste may contribute high loads of bacterial and microbial pathogens. The 1993 Watershed Nonpoint Source Assessment (NRCS) targeted the Tugaloo subbasin for generating the second highest load of animal waste (1,626,669 tons of waste per year) in the Savannah River basin. Because this subbasin contains the least agricultural land area (48,000 total acres in 1997), the animal waste may be concentrated in large-scale confined animal feeding operations (CAFOs) or may possibly be applied to a higher percentage of the total agricultural land.

Upper Savannah River Subbasin (Hydrologic Unit 03060103)

The water use classification of fishing was not fully supported in five tributary stream segments due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Broad River Subbasin (Hydrologic Unit 03060104)

The water use classification of fishing was not fully supported in five stream segments due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Animal waste may contribute high loads of bacterial and microbial pathogens. The 1993 Watershed Nonpoint Source Assessment (NRCS) reported that the Broad River subbasin generates the highest load of animal waste (8,888,655 tons of waste per year) in the Savannah River basin. This subbasin contains approximately 238,000 total acres of agricultural land, some of which is partially used for grazing animals, concentrated animal feeding operations, and animal waste application.

Little River Subbasin (Hydrologic Unit 03060105)

The water use classification of fishing was not fully supported in three stream segment due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources, and/or animal wastes.

Middle Savannah River Subbasin (Hydrologic Unit 03060106)

The water use classifications of fishing and/or drinking water were not fully supported in one Savannah River mainstem segment and seven tributary stream segments due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources, and/or animal wastes.

Brier Creek Subbasin (Hydrologic Unit 03060108)

The water use classification of fishing was not fully supported in three stream segments (Brier Creek, Brushy Creek and Reedy Creek) due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources, and/or animal wastes.

Lower Savannah River Subbasin (Hydrologic Unit 03060109)

The water use classifications of fishing and/or coastal fishing were not fully supported in one tributary stream segment (Runs Branch) and one estuarine harbor (Savannah Harbor) due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources, and/or animal wastes.

General Goals

Meet water quality standards to support designated water uses and increase public awareness of fecal coliform bacterial pollution prevention through coordinated education and outreach efforts.

Ongoing Efforts

The primary sources of exceedence of water quality standards for fecal coliform bacteria in the Savannah River basin are urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources, and/or animal wastes.

EPD administers and enforces a variety of permit programs designed to facilitate the management of urban runoff, including both point and nonpoint source controls. EPD's Nonpoint Source Program regulates municipal and industrial storm water discharges through the National Pollutant Discharge Elimination System (NPDES) permitting process. Sanitary sewer overflows are managed through EPD's Permitting Compliance and Enforcement Program. Animal wastes in Georgia are addressed through the Memorandum of Agreement (MOA) with NRCS and SWCC, and through recently adopted rules designed to regulate Concentrated Animal Feeding Operations (CAFOs)

for swine. This includes a requirement for certain operations to obtain individual NPDES permits.

In addition to regulatory activities, EPD assists in the development of local solutions to water quality problems by administering grant programs and providing technical assistance to various regional and local watershed management initiatives. EPD also conducts a variety of outreach and public education programs addressing urban runoff in general, point and Nonpoint source pollution, BMP implementation, regulatory requirements, and cooperative or nonregulatory approaches.

The Georgia Department of Human Resources (DHR) Division of Public Health - Environmental Services has promulgated new rules (O.C.G.A Chapter 290.5.26) to regulate the design, operation, and maintenance of on-site sewage management systems. DHR subsequently formed the On-site Sewage Management Systems Technical Review Committee in 1999. The Committee's function will be to make recommendations to DHR regarding the approval of new systems, assist DHR with the development and revision of standards and guidelines for new technology, assist with the adoption of periodic updates to the Manual for On-Site Sewage Management Systems, and serve as the final authority in contested interpretation issues regarding the Rules and the Manual for On-site Sewage Management Systems.

EPA Region IV initiated the Savannah River Basin Watershed Project in 1992. EPA, along with Georgia and South Carolina water quality agencies and other basin stakeholders, developed the project with the following goal: "To manage the Savannah River Basin using comprehensive management to conserve, restore, enhance, and protect it's ecosystems, especially aquatic ecosystems, in a way that allows the balancing of multiple uses". A number of committees consisting of interested stakeholders have completed Baseline Assessments which were used to develop an Initial Assessment Report. The Initial Assessment Report is the basis for the development of a watershed strategy for the Savannah River Basin. The watershed strategy will identify the highest priority issues, describe specific actions to address those issues, and coordinate cooperative efforts by project participants.

Eight Resource Conservation and Development (RC&D) Councils, four of which are in Georgia, are mobilizing to develop needed implementation measures identified in the Savannah River Watershed Project's Nonpoint Source Action Plan in the Tugaloo, Upper Savannah, Middle Savannah, Lower Savannah, Broad, and Little River subbasins.

The U.S. Army Corps of Engineers - Savannah District initiated the first phase of a two-phased comprehensive water resources study of the Savannah River Basin in 1998. The study was designed to "develop an updated plan addressing current and future needs in the basin, examine reallocation of storage at Corps of Engineers multi-purpose projects, and to develop a better management structure to address basin water resources. The study will complement and the Georgia River Basin Management Planning Process and the EPA's Savannah River Basin Watershed Project and will become a major tool to use in helping to accomplish portions of the EPD Basin Plan and the EPA Watershed Study's goals and objectives.

The University of Georgia College of Agriculture and Environmental Sciences' Animal Waste Awareness in Research & Extension (AWARE) program conducts research on animal waste management and provides public education through Southeast Sustainable Animal Waste Workshops and a variety of Internet publications.

Local Soil and Water Conservation Districts and RC&D Councils are working with producers to utilize animal waste according to Nutrient Management Plans through their Lagoon Pumpout Program in the Tugaloo, Upper Savannah, Middle Savannah, Lower Savannah, Broad and Little River subbasins.

Agriculture is making progress in controlling bacterial loads. Considerable effort has been directed toward animal confinement areas. Georgia Universities and agricultural agencies or groups are conducting several agricultural efforts with statewide implementations. Sustainable Agriculture and Farm*A*Syst Training will be scheduled within the basin. The University of Georgia and ARS have proposals for assessing nutrient and fecal coliform bacteria reducing BMPs on 10 farms that will have statewide implications. Soil and Water Conservation Districts annually convene Local Work Groups (LWGs) which are comprised of resource professionals from a variety of disciplines and interested stakeholders at the local level, to identify resource concerns in their areas. The LWGs develop proposals for USDA or other funding to address identified resource concerns.

The NRCS, along with support from the GSWCC and Georgia's Agricultural Community, is conducting watershed assessments to quantify agricultural NPS pollution in the Tugaloo and Little River subbasins.

The Georgia Soil & Water Conservation Commission (GSWCC) is demonstrating agricultural BMPs related to animal operations in the Tugaloo and Broad River subbasins.

The Chestatee-Chattahoochee Rivers RC&D is demonstrating the benefits of conservation buffers in the Tugaloo and Broad River subbasins and has also developed a proposal to demonstrate BMPs in tributaries of Lake Hartwell.

The Stephens County SWCD is implementing a watershed protection plan for Eastanollee Creek in the Tugaloo River subbasin.

The Little River is a Priority Area for USDA Cost-Share funds to implement agricultural BMPs through NRCS' EQIP Program.

The University of Georgia is testing agricultural uses of municipal biosolids in the Middle Savannah River subbasin.

The Coastal RC&D Council is demonstrating a watershed approach for agricultural BMP implementation in the Ebeneezer Creek Watershed and is also demonstrating the benefits of conservation buffers in the Lower Savannah River subbasin.

Identified Gaps and Needs

Sources of fecal coliform bacteria in many stream segments are not clearly defined. In some cases, fecal bacterial loads may be attributable to natural sources (e.g. wildlife); alternative bacteriological sampling methods may be useful to distinguish between human, other mammalian, and avian fecal coliform sources. Sanitary sewer leaks and overflows may be a source of fecal coliform bacteria as well. Some of the sampling was not conducted at a sufficient frequency to determine whether the monthly geometric mean criterion specified in the standard has actually been violated. Thus, an initial effort in the next RBMP cycle may be to continue the work to collect an adequate number of samples (four over a 30-day period) to support geometric mean calculations to determine if water quality standards are actually being exceeded.

Many fecal coliform bacteria reducing practices are expensive and the percentage of reduction is often unknown. Many landowners are reluctant to spend today's dollars for long term amortization in uncertain future markets. Agricultural BMPs cost share dollars (Farm Bill) and grants (Section 319) need to be concentrated in priority watersheds with sufficient technical workforce to implement BMPs through long term agreements or contracts to significantly reduce sediment loading.

Additional efforts should be directed toward increasing public awareness of fecal coliform bacteria pollution, with an emphasis on potential sources and controls. State and basin-wide coordination between agencies and organizations providing public education and technical assistance may help to extend outreach efforts. EPA's Savannah River Basin Watershed Project emphasized the need to create, improve, develop incentives for, and educate citizens and industries about BMPs.

Strategies for Action

Separate strategies are needed to address Nonpoint fecal coliform bacteria loadings for urban and rural sources.

A. General Strategies for Urban Sources

Addressing urban runoff will be a complex task, and will require implementation of watershed pollution control programs by local governments. Management of urban runoff is needed to address a variety of water quality problems, including metals, fecal coliform bacteria, nutrients, and habitat degradation. For this five-year phase of the basin management cycle, management will concentrate on source control and planning. Evaluation of the efficacy of this approach will be made during the basin strategy re-evaluation scheduled for 2005 in accordance with the statewide RBMP management cycle. In addition, the EPA has developed a number of TMDLs for fecal coliform for the Savannah River and EPD will, along with partner agencies such as local governments, NRCS, and GPC, be implementing the TMDLs.

Specific Management Objectives

Stakeholders will work together to facilitate local watershed planning and management to ensure that designated water uses are supported.

Agricultural agencies will provide technical and educational assistance to producers for the purpose of facilitating agricultural BMP implementation.

Management Option Evaluation

Integrated management options will be proposed, implemented, and evaluated by local governments.

Action Plan

EPD will monitor and assess use support in listed stream segments during the next monitoring cycle and encourage local efforts to address nonpoint source pollution. EPD will complete reassessment of fecal coliform bacteria monitoring protocols and will propose a plan for resampling of selected streams identified as not supporting or partially supporting designated uses and complete sampling by December, 2002 in accordance with the statewide RBMP cycle.

EPD will continue to ensure that all permitted sources remain in compliance with permitted effluent limitations for fecal coliform bacteria. EPD will also request a comprehensive watershed assessment, focusing on both point and Nonpoint sources, from localities applying for new or expanded NPDES point source discharge permits. The intent is to direct localities' attention toward current and future Nonpoint source issues in their watersheds and to have them consider ways to prevent or control water quality impacts due to growth. Approved watershed management steps will be included as a condition for expansion of existing water pollution control plants or construction of new plants.

EPD will continue to administer the NPDES and Permitting and Compliance and Enforcement Programs (PCEP) and encourage local planning to address management on a basin-wide scale.

Local governments will continue to operate and maintain their sewer systems and wastewater treatment plants, monitor land application systems, develop and implement regulations, zoning and land use planning, and implement local watershed initiatives and monitoring programs. EPD will encourage local authorities to institute programs to identify and address illicit sewage discharges, leaks and overflows of sanitary sewers, and failing septic tanks within their jurisdiction.

DHR will continue to regulate on-site sewage management systems and will work to educate local governments and citizen groups about the need for proper design, construction, and maintenance of septic systems to protect water quality. DHR will also utilize the criteria presented in the Growth Planning Act for septic system setbacks from high value waters. Local municipalities should work with the local health departments to identify locations of septic systems and educate owners about the proper care and maintenance of septic systems.

The EPA finalized TMDLs for fecal coliform for Eastanolle Creek, Little River, Reed Creek, Stekoa Creek, Savannah Harbor, Rocky Creek (Augusta), and the Savannah River (Butler Creek to McBean Creek). The EPD will be responsible for implementing the TMDLs.

EPD will encourage citizen involvement through Adopt-A-Stream groups to address restoration of urban streams. Citizen groups will implement Adopt-A-Stream programs, and work with local governments in implementing watershed initiatives.

Method for Tracking Performance

EPD tracks point source discharges through inspections and evaluations of self-monitoring data. An evaluation of the status of listed water bodies will be made coincident with the next iteration of the RBMP cycle for the Savannah River basin in 2005.

B. General Strategies for Rural Sources

Agricultural BMPs cost share dollars (Farm Bill) and grants (Section 319) need to be concentrated in priority watersheds with sufficient technical workforce to implement BMPs through long term agreements or contracts.

Specific Management Objectives

Stakeholders will work together to encourage and facilitate local watershed planning and management to ensure that designated water uses are supported.

Agricultural agencies will provide technical and educational assistance to producers for the purpose of facilitating agricultural BMP implementation.

Management Option Evaluation

Evaluation will be on a site-by-site basis. For agricultural BMP support, existing prioriitization methods of the organics will be used.

Action Plan

EPD will monitor and assess use support in listed streams, encourage local planning efforts and regulate point sources under the NPDES program. EPD will continue to ensure that all permitted sources remain in compliance with fecal coliform bacteria limits. EPD will also continue monitoring and assessment of Land Application Systems.

GSWCC and local SWCDs and RC&D councils, with assistance from NRCS, will continue to support adoption of BMPs for animal waste handling and will follow up on complaints related to fecal coliform bacteria associated with agriculture. Methods for prioritization and implementation of cost-share incentives under the 1996 Farm Bill will be targeted to areas of apparent water quality impact, including rural streams which may contain excessive fecal coliform bacteria loads from animal and cropland operations.

Local SWCDs will convene Local Work Groups to identify resource concerns and develop proposals for funding to address these concerns.

DHR will continue to regulate on-site sewage management systems and will work to educate local governments and citizen groups about the need for proper design, construction, and maintenance of septic systems to protect water quality. DHR will also utilize the criteria presented in the Growth Planning Act for septic system setbacks from high value waters. Local municipalities should work with the local health departments to identify locations of septic systems and educate owners about the proper care and maintenance of septic systems.

The EPA finalized TMDLs for fecal coliform for Eastanolle Creek, Little River, Reed Creek, Stekoa Creek, Savannah Harbor, Rocky Creek (Augusta), and the Savannah River (Butler Creek to McBean Creek). The EPD will be responsible for implementing the TMDLs.

The University of Georgia will provide on-farm assessments to local producers through the Farm-A-Syst program.

EPD will encourage citizen involvement through Adopt-A-Stream groups to address restoration of urban streams. Citizen groups will implement Adopt-A-Stream programs, and work with local governments in implementing watershed initiatives.

Method for Tracking Performance

Agricultural agencies will track rates of BMP implementation for cropland and animal operations. An evaluation of the status of listed water bodies will be made coincident with the next iteration of the RBMP cycle for the Savannah River basin in 2001-2005.

7.3.3 Erosion and Sedimentation

Problem Statement

Water use classifications in the Savannah River basin are potentially threatened in many water body segments by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, stream erosion (including head cutting, bank erosion, and shifting of the bedload), forestry practices, and agriculture. EPA added eight stream segments to the Georgia 303(d) list in June, 1999 as not fully supporting designated uses due to sedimentation, and potential threats from sediment loading are possible throughout the entire Savannah River basin. A common strategy is proposed for addressing erosion and sedimentation throughout the basin.

However, achieving standards in individual stream segments will depend on the development of site-specific local management plans.

Tugaloo River Subbasin (Hydrologic Unit 03060102)

EPA recently conducted a study of the Chattooga River subbasin to determine whether waters are not meeting water quality standards because of forestry and forestry-related activities. EPA reported that the following streams are partially supporting designated uses: Stekoa Creek and its tributary streams of Scotts Creek, Saddle Gap Creek, and Pool Creek; Upper Warwoman Creek; Law Ground Creek; and Roach Mill Creek. Chechero Creek was classified as not supporting designated uses. The concern is with excessive sediment and the adverse impacts to the aquatic community.

The United States Forest Service (USFS) is developing a project in the Chattooga River basin which will focus on reducing sediment from roads, trails, and areas of construction and cultivation. The project will improve water quality and aquatic habitats by relocating and improving recreation facilities, roads and trails, and through the conservation education programs.

The 1992 Georgia Forestry Commission (GFC) compliance survey examined one site involving 62 acres in this subbasin. The site occurred on USFS land. Overall, 97 percent of the harvested acres and 100 percent of main haul road miles were in compliance with BMPs. No site prepared acres or regenerated acres were evaluated. Another BMP survey was conducted during 1998 but the results are not complete.

Also the GFC assisted the EPA in the assessment of forestry BMPs in the Chattooga River Watershed subbasin as a result of a federal lawsuit against EPA. The EPA was charged with assessing BMPs for forestry and forestry-related activities in the basin to determine whether additional BMPs are needed to attain water quality standards. The sub-basin contains approximately 122,536 acres of public land and 56,168 acres of private land. All sites that were silviculturally treated within the last two years, prior to October 1997, were audited for BMP implementation.

Three sites were located on private lands that accounted for 121 acres along 1.31 miles of streams. Streamside Management Zone (SMZ) BMPs were fully implemented 78.2 percent. Stream crossing BMPs were implemented only 40.0 percent. Temporary haul roads were 68.2 percent. Timber harvesting was 63.1 percent. Chemical treatments were 100 percent. Control burning was 50 percent. Artificial planting was 100 percent. The overall average of applicable BMP implementation was 71.3 percent.

Sixteen sites were evaluated on the USFS lands that accounted for 382 acres along 29.75 miles of streams. Of the applicable BMPs for each practice evaluated, the scores were as follows: SMZs were 80 percent, Stream Crossings were 50.9 percent, Temporary haul roads were 82.6 percent, Timber harvesting was 95.7 percent, Control burning was 71.4 percent, and artificial regeneration was 100 percent. Total overall score was 80 percent.

Unpaved roads that serve several sites were evaluated independently. Although some of these roads carry a USFS designation, many are old county roads which the county no longer maintains but will not permit to be closed. A total of 11.5 miles were assessed along 2.15 miles of streams. Of the applicable BMPs, the scores were as follows: SMZs was 50 percent, Stream Crossings was 55 percent, Haul roads was 81.4 percent. The total overall average was 67.9 percent.

According to EPA assessments, TMDLs for sediment will likely be established on eight streams within the Chattooga basin.

Upper Savannah River Subbasin (Hydrologic Unit 03060103)

The 1992 Georgia Forestry Commission (GFC) compliance survey examined six sites involving 820 acres in this subbasin. Three sites were evaluated on private land and three were on forest industry lands. Overall, 86 percent of harvested acres and 56 percent of main haul road miles were in compliance with BMPs. No site preparation or regenerated acres were evaluated. By ownership, compliance for roads and harvesting on private lands was 44 percent and 79 percent, respectively. Compliance on forest industry land for roads and harvesting was 89 percent and 92 percent, respectively. Another BMP survey was conducted during 1998, but the results are not complete.

Broad River Subbasin (Hydrologic Unit 03060104)

The 1992 Georgia Forestry Commission (GFC) compliance survey examined nine sites involving 745 acres in this sub-basin. Three sites were evaluated on private lands, five on forest industry lands, and one on public land. Overall, 82 percent of harvested acres and 70 percent of main haul road miles were in compliance with BMPs. No site prepared or regenerated acres were evaluated. By ownership, compliance for roads and harvesting on private lands was 33 percent and 95 percent, respectively. Compliance on forest industry lands for roads and harvesting was 71 percent and 78 percent, respectively. Compliance for roads and harvesting on public land was 100 percent and 95 percent, respectively. Another BMP survey was conducted during 1998, but the results are not complete.

Little River Subbasin (Hydrologic Unit 03060105)

The 1992 Georgia Forestry Commission (GFC) compliance survey examined five sites involving 1,088 acres in this sub-basin. Three sites were evaluated on private lands and one site on forest industry lands and public lands each. Overall, 84 percent of harvested acres and 84 percent of main haul road miles were in compliance with BMPs. By ownership, compliance for roads and harvesting on private lands was 71 percent and 68 percent respectively. Compliance on forest industry lands for roads and harvesting was 50 percent and 88 percent respectively. Compliance on public lands for roads and harvesting was 100 percent and 95 percent respectively. Another BMP survey was conducted during 1998.

Middle Savannah River Subbasin (Hydrologic Unit 03060106)

The 1992 Georgia Forestry Commission (GFC) compliance survey examined three sites involving 479 acres in this subbasin. Two sites were evaluated on private lands and one on forest industry lands. Overall, 89 percent of harvested acres and 95 percent of main haul road miles were in compliance with BMPs. By ownership, compliance for roads and harvesting on private lands was 0 percent and 90 percent, respectively. Compliance on forest industry lands for roads and harvesting was 100 percent and 89 percent respectively. Another BMP survey was conducted during 1998, but the results are not complete.

Brier Creek Subbasin (Hydrologic Unit 03060108)

The 1992 Georgia Forestry Commission (GFC) compliance survey examined five sites involving 965 acres in this subbasin. Three sites were evaluated on private lands and two on forest industry lands. Overall, 79 percent of harvested acres and 77 percent of main haul road miles were in compliance with BMPs. By ownership, compliance for roads and harvesting on private lands was 78 percent and 76 percent, respectively. Compliance on forest industry lands for roads and harvesting was 77 percent and 82 percent respectively. Another BMP survey was conducted during 1998, but the results are not complete.

Lower Savannah River Subbasin (Hydrologic Unit 03060109)

The 1992 Georgia Forestry Commission (GFC) compliance survey examined six sites involving 305 acres in this subbasin. Five sites were evaluated on private lands and one on forest industry lands. Overall, 95 percent of harvested acres, 86 percent of main haul road miles, and 100 percent of site prepared acres were in compliance with BMPs. By ownership, compliance for roads, harvesting, and site preparation on private lands was 85 percent, 95 percent, and 100 percent, respectively. Compliance on forest industry lands for roads and harvesting was 100 percent and 100 percent respectively. Another BMP survey was conducted during 1998, but the results are not complete.

General Goals

Control erosion and sedimentation from land disturbing activities in order to meet narrative turbidity water quality standards and support designated uses. Increase public awareness of erosion and sedimentation through coordinated education and outreach efforts.

The GFC will encourage implementation of the newly revised 1999 forestry BMPs through workshops and demonstrations.

Ongoing Efforts

Forestry and Agriculture both have voluntary E&SC programs built around implementation of BMPs and a water complaint resolution procedure in place. GSWCC recently updated and is distributing the Manual for Erosion and Sediment Control in Georgia and the Field Manual for Erosion and Sediment Control in Georgia. The GSWCC, with its agricultural partners, has produced and distributed three E&SC pamphlets; "Guidelines for Stream Bank Restoration", "A Guide to Controlling Erosion with Vegetation", and "Agricultural Management Practices". These and numerous other E&SC-related pamphlets and other informational materials are available in agricultural offices throughout the State. Soil and Water Conservation Districts annually convene Local Work Groups (LWGs) which are comprised of resource professionals from a variety of disciplines and interested stakeholders at the local level to identify resource concerns in their areas. These LWGs develop proposals for USDA or other funding to address identified resource concerns.

Forestry has made significant E&SC progress. GFC has been specifically targeting those landowner groups and regions with low compliance for increased BMP education through local talks, workshops, etc. The Georgia Forestry Association and the American Forest and Paper Association (AF&PA) sponsor Master Timber Harvesters Workshops with the goal of training every logger in the State on BMPs. In addition, the Georgia State Board of Registration for Foresters requires every licensed forester to implement BMPs as a minimum standard of practice. As they become standard within the industry, the new Forestry BMP Guidelines, printed in January, 1999, will result in additional sedimentation reductions with more riparian tree cover left over perennial and intermittent streams.

EPD serves as the "Issuing Authority", providing permitting, inspection, and compliance enforcement services in those localities across the State where local Erosion and Sedimentation Control Ordinances or Programs are not yet established. EPD is also continuing its efforts to develop a NPDES General Permit (No. GAR100000) for storm water discharges associated with construction activity. The permit will provide guidelines and regulations for effective control of silt, sediment and other pollutants which are carried by storm water runoff from construction sites. The General Permit has been

issued, appealed, and overturned four times between 1992 and 1998, but was approved in 2000.

An Erosion and Sedimentation Control (E&SC) Advisory Committee developed an Erosion and Sediment Control Complaint Resolution Procedure by which concerned citizens or other parties may register E&SC complaints. The procedure is a three-step process with Local Issuing Authorities serving as the primary contact, followed by the local Soil and Water Conservation District, and finally EPD in some cases. The purpose of the procedure is to provide timely and workable solutions to E&SC control complaints through local Soil and Water Conservation Districts.

There are several erosion educational initiatives underway which have an urban focus. Each year GSWCC and EPD conduct five formal E&SC courses to provide training to the regulated community, regulators, consultants, and interested citizens. GSWCC also provides detailed E&SC training for eight to 11 units of government each year. A task force established by the Lieutenant Governor and the Erosion and Sediment Control Technical Study Committee, also known as DIRT II, is assessing the economic and environmental impacts of erosion prevention and sediment control BMPs for urban construction sites. Another urban initiative is the U.S. Forest Service's Planting Along Stream Sides (PASS) which deals with vegetative plantings to reduce erosion from stream banks.

In 1997, EPD, in cooperation with the University of Georgia, prepared and distributed the *Land Development Provisions to Protect Georgia Water Quality* report. The report describes provisions which may be modified or added to local development programs to better protect water quality. Portions of the report address water quality impacts from storm water runoff and its relationship to urban development.

Large portions of the Tugaloo River Basin (HUC 03060102) are managed by the U.S. Forest Service as part of the Chattahoochee National Forest. Management of the National Forest is prescribed in a Land and Resource Management Plan, which specifies the standards and guidelines and appropriate timing and vicinity of allowed practices.

Eight Resource Conservation & Development (RC&D) Councils, four of which are from Georgia, are mobilizing to develop needed implementation measures identified in the Savannah River Watershed Project's NonPoint Source Action Plan in the Tugaloo, Upper Savannah, Middle Savannah, Lower Savannah, Broad, and Little River subbasins.

Local Soil and Water Conservation Districts and RC&D Councils are working with crop producers to reduce erosion and sedimentation through their No-Till Drill Program in the Tugaloo, Upper Savannah, Middle Savannah, Lower Savannah, Broad and Little River subbasins.

The NRCS is working with USFS and EPA to develop a GIS-based model to estimate erosion and sedimentation. The model is being field tested in the Tugaloo subbasin. The NRCS, along with support from the GSWCC and Georgia's Agricultural Community, is conducting watershed assessments to quantify agricultural NPS pollution in the Tugaloo and Little River subbasins.

The Chestatee-Chattahoochee Rivers RC&D is demonstrating the benefits of conservation buffers in the Tugaloo and Broad River sub-basins and has developed a proposal to demonstrate BMPs in tributaries of Lake Hartwell. The Chestatee-Chattahoochee Rivers RC&D is also demonstrating the benefits of streambank stabilization in the Broad River subbasin.

The Georgia Soil & Water Conservation Commission (GSWCC) is demonstrating agricultural BMPs related to animal operations in the Broad River subbasin.

The Stephens County SWCD is implementing a watershed protection plan for Eastanollee Creek in the Tugaloo River subbasin.

The Little River is a Priority Area for USDA Cost-Share funds to implement agricultural BMPs through NRCS' EQIP Program.

The University of Georgia is testing agricultural uses of municipal biosolids in the Middle Savannah River subbasin.

The Coastal RC&D Council is demonstrating a watershed approach for agricultural BMP implementation in the Ebeneezer Creek Watershed and is also demonstrating the benefits of conservation buffers in the Lower Savannah River subbasin.

Forestry BMP Education

From 1996 through 1999, the GFC offered a 3-day Master Timber Harvester Workshop. During the 3-year period, the workshop was attended by the following number of personnel affiliated with timber buyers and loggers in the seven subbasins:

- Tugaloo River Subbasin (Hydrologic Unit 03060102) – 38 personnel
- Upper Savannah River Subbasin (Hydrologic Unit 03060103) – 80 personnel
- Broad River Subbasin (Hydrologic Unit 03060104) – 68 personnel
- Little River Subbasin (Hydrologic Unit 03060105) – 90 personnel
- Upper Savannah River Subbasin (Hydrologic Unit 03060106) – 118 personnel
- Brier Creek Subbasin (Hydrologic Unit 03060108) – 111 personnel
- Lower Savannah River Subbasin (Hydrologic Unit 03060109) – 39 personnel

Identified Gaps and Needs

A key for addressing erosion, sedimentation, and habitat issues on highly impacted streams is the definition of appropriate management goals. Many highly impacted streams cannot be returned to "natural" conditions. An appropriate restoration goal needs to be established in consultation between EPD partners and other stakeholders.

Many privately owned sawmills are not members of the AF&PA. These mills and their producers are not required to attend the Master Timber Harvesters Workshops. The GFC, UGA, GFA, and the Southeastern Wood Producers Association are working on a solution. A need still exists for education of private landowners who are selling timber for the last time prior to land development. Many such landowners attempt to maximize return on timber, sometimes at the expense of BMPs.

Much of the sediment being produced and adversely impacting streams and lakes is associated with development and maintenance of unpaved rural roads. In many instances E&SC plans, implementation, inspection, and enforcement are not adequate on unpaved rural road projects. Without aggressive inspection and enforcement, contractors sometimes tend to allow erosion to occur and attempt mitigation after the fact. Georgia DOT and other agencies charged with E&SC need to work with county road departments in identifying road segments that are high sediment producers and recommend abatement measures. Further monitoring may be needed to quantify the impact of unpaved rural roads as a source of sedimentation into streams.

Additional efforts should be directed toward increasing public awareness of erosion and sedimentation, with an emphasis on potential sources and controls. State and basin-wide coordination between agencies and organizations providing public education and technical assistance may help to extend outreach efforts. EPA's Savannah River

Basin Watershed Project emphasized the need to create, improve, develop incentives for, and educate citizens and industries about BMPs.

Adverse impacts of excess sediment loading include degradation of habitat and reduction of species diversity. These types of impacts are best evaluated through biological monitoring. EPD is developing increased capability for biomonitoring using Rapid Bioassessment Protocols (RBPs) for benthic macroinvertebrates. The EPD protocols also include habitat assessment. The WRD is working with the IBI (Index of Biologic Integrity) to assess fish communities. These tools will provide methods to detect and quantify impairment of aquatic life resulting from habitat-modifying stressors such as sediment, as well as impacts from other stressors.

General Strategies for Action

Many agricultural sediment reduction practices are relatively expensive and landowners are reluctant to spend today's dollars for long term BMP amortization in uncertain future markets. Agricultural cost share dollars (Farm Bill) should be concentrated in priority watersheds with sufficient technical workforce to implement BMPs through long term agreements or contracts to reduce sediment loading. An understanding of the role of erosion and sedimentation in urban streams is incomplete at this time. Most of these streams are impacted by a variety of stressors. An incremental or phased approach is needed to address these issues.

Key Participants and Roles

GFC: encourage implementation of the newly revised 1999 forestry BMPs through landowner assistance, workshops and demonstrations.

American Forest and Paper Association (AF&PA): The forest products industry has a strong record of stewardship on the land it owns and manages. Member companies have agreed to a Sustainable Forestry Initiative (SFI) program. The goal of the program is to improve the performance of member companies and licensees, and set new standards for the entire forest industry as well as for other forest landowners through implementation of the following twelve objectives:

1. Broaden the practice of sustainable forestry by employing an array of scientifically, environmentally, and economically sound forest practices in the growth, harvest, and use of forests.
2. Promptly reforest harvested acres to ensure long-term forest productivity and conservation of forest resources.
3. Protect the water quality in streams, lakes, and other water bodies by establishing riparian protection measures based on soil type, terrain, vegetation, and other applicable factors, and by using EPA approved Best Management Practices in all forest management operations.
4. Enhance the quality of wildlife habitat by developing and implementing measures that promote habitat diversity and the conservation of plant and animal populations found in forest communities.
5. Minimize the visual impact by designing harvests to blend into the terrain by restricting clear-cut size (120 acres average) and/or by using harvest methods, age classes, and judicious placement of harvest units to promote diversity in forest cover.
6. Manage company lands of ecologic, geologic, or historic significance in a manner that accounts for their special qualities.

7. Contribute to bio-diversity by enhancing landscape diversity and providing an array of habitats.
8. Continue to improve forest utilization to help ensure the most efficient use of forest resources.
9. Continue the prudent use of forest chemicals to improve forest health and growth while protecting employees, neighbors, the public, and sensitive lands.
10. Broaden the practice of sustainable forestry by further involving non-industrial landowners, loggers, consulting foresters, and company employees who are active in wood procurement and landowner assistance programs.
11. Publicly report Program Participants' progress in fulfilling their commitment to sustainable forestry.
12. Provide opportunities for the public and the forestry community to participate in the commitment to sustainable forestry.

From a water quality perspective, Objectives 3 and 10 are extremely important. Performance measures for Objective 3 state:

- Participants will meet or exceed all established BMPs, all applicable state water quality laws and regulations, and the requirements of the Clean Water Act for forestland.
- Participants will establish and implement riparian protection measures for all perennial streams and lakes and involve a panel of experts at the state level to help identify goals and objectives for riparian protection.
- Participants will individually, through cooperative efforts or through AF&PA, provide funding for water quality research.

Performance measures for Objective 10 state:

- Participants will encourage landowners that sell timber to reforest, following harvest, and to use BMPs by providing these landowners with information on the environmental and economic advantages of these practices.
- Participants will work closely with the Southeastern Wood Producers Association, the Georgia Forestry Association, the University of Georgia School of Forest Resources, the Georgia Forestry Commission, the Georgia Wildlife Resources Division, and others in the forestry community to further improve the professionalism of loggers through the Master Timber Harvesters program by establishing and/or cooperating with existing state groups to promote the training and education of loggers in:
    1. BMPs, including road construction and retirement, site preparation, streamside management, etc.
    2. Awareness of responsibilities under the Endangered Species Act and other wildlife consideration.
    3. Regeneration and forest resource conservation.
    4. Logging safety.
    5. OSHA and wage and hour rules.
    6. Transportation.
    7. Business management including employee training, public relations, etc.

Specific Management Objectives

Control erosion and sedimentation from land disturbing activities in order to meet narrative water quality standards.

Management Option Evaluation

During this iteration of the basin cycle, management will focus on source control BMPs.

Action Plan

EPD will work with local governments and with the issuing authority for erosion and sedimentation controls, first through education and second through enforcement, to control erosion at construction sites, and will encourage local governments to implement land use planning.

GSSWC and local SWCDs and RC&D Councils, and assistance from NRCS, will provide technical and educational assistance to producers to encourage the implementation of BMPs to control erosion of agricultural lands. The University of Georgia will provide on-farm assessments to local producers through the Farm-A-Syst program.

Local SWCDs will convene local workgroups to identify local resource concerns and develop proposals for funding to address these concerns.

The Georgia Forestry Commission (GFC) will encourage implementation of the newly revised 1999 forestry BMPs through workshops and demonstrations. GFC will continue to monitor BMP implementation rates through biennial surveys and determine effectiveness of BMPs through habitat assessments and rapid bioassessments of the aquatic organisms above and below forestry operations. GFC will target landowner and user groups with low implementation rates for BMP education to encourage compliance with forestry BMP guidelines. GFC will work with AF&PA and forestry community to provide BMP training.

American Forest and Paper Association (AF&PA): Member companies will document performance measures for each objective through annual reports to AF&PA as required for Objective 11. AF&PA will issue an annual report to the public.

EPD will encourage citizen involvement through Adopt-A-Stream groups to address restoration of streams. Citizen groups will implement Adopt-A-Stream programs and work with local governments in implementing watershed initiatives. EPD and WRD will continue to develop biological monitoring capabilities designed to assess aquatic life.

Method for Tracking Performance

GSWCC, GFC, EPD, and issuing authorities will track BMP implementation: GSWCC by the number of E&SC plans reviewed and DAT evaluations and recommendations; GFC through its biennial surveys; and EPD through routine inspections of permitted projects, surveillance for any incidences of noncompliance, and enforcement activities. NRCS will track BMP implementation through its NIMS reporting system.

7.3.4 Fish Consumption Guidelines

Problem Statement

Water use classifications were not fully supported in several water body segments due to fish consumption guidelines for mercury, PCBs, or chlordane.

Tugaloo River Subbasin (Hydrologic Unit 03060102)

The water use classifications of fishing and/or recreation were not fully supported in Lakes Hartwell, Burton, Rabun and Tugalo based on fish consumption guidelines due to PCBs and mercury in Lake Hartwell and mercury in Lakes Burton, Rabun and Tugalo. The guidelines are for largemouth bass, hybrid/striped bass and channel catfish in Lake Hartwell; certain sizes of largemouth bass in Lakes Burton and Tugalo, and for largemouth bass and white catfish in Lake Rabun.

Upper Savannah River Basin (Hydrologic Unit 03060103)

The water use classification was not supported in Lake Hartwell due to fish consumption guidelines primarily due to PCBs. In 1999, Georgia and South Carolina issued fish consumption guidance reflecting a joint reevaluation of data for Lake Hartwell. In Georgia these are for the Tugaloo Arm and for the main body in the dam forebay. In the Tugaloo Arm, hybrid and striped bass over 16 inches should not be eaten and restricted consumption of certain sizes of largemouth bass (PCBs and mercury) and channel catfish (PCBs) is recommended. In the lake main body, any size of hybrid or striped bass should not be eaten, and restricted consumption of largemouth bass and channel catfish is recommended.

The water use classification was not fully supported in Lakes Richard B. Russell and Clarks Hill (J. Strom Thurmond) based on fish consumption guidelines due to mercury. The guidelines are for largemouth bass and catfish in both lakes.

Broad River Basin (Hydrologic Unit 03060104)

The water use classification was not fully supported in Nancy Town Lake based on fish consumption guidelines due to chlordane residues in bream.

Little River Basin (Hydrologic Unit 03060105)

The water use classification was not fully supported in the Little River mainstream above and below Rocky Creek based on fish consumption guidelines due to mercury. The guidelines are for largemouth bass.

Middle Savannah River Basin (Hydrologic Unit 03060106)

The water use classification was not fully supported in the Middle Savannah River main stem based on fish consumption guidelines due to mercury. The guidelines are for largemouth bass and spotted sucker.

Briar Creek River Basin (Hydrologic Unit 03060108)

The water use classification was not fully supported in Briar Creek due fish consumption guidelines due to mercury. The consumption guidelines are for largemouth bass and spotted sucker.

Lower Savannah River Basin (Hydrologic Unit 03060109)

The water use classification was not fully supported in the Savannah River main stem and Pipemakers Canal due fish consumption guidelines due to mercury. The consumption guidelines are for largemouth bass, bowfin, and white catfish.

General Goals

Work to protect human health by providing guidelines for consumption of fish.

Ongoing Efforts

DNR has monitored fish and issued fish consumption guidelines. Ongoing efforts will focus on continued monitoring of residue levels and issuance of updated consumption guidance. Mercury may be present in fish due to mercury content in the soils, from municipal and industrial sources, or from fossil fuel use. It is also possible that the elevated mercury level is related to global atmospheric transport.

Tugaloo River Subbasin (Hydrologic Unit 03060102)

There are no known point sources or other identifiable anthropogenic sources of mercury in the Tugaloo River Subbasin where fish consumption guidelines have been issued.

Upper Savannah River Basin (Hydrologic Unit 03060103)

In 1999, Georgia and South Carolina issued fish consumption guidance reflecting a joint reevaluation of data for Lake Hartwell. The PCB contamination in Lake Hartwell originated from the historical industrial use at the Cornell-Dubilier Marketing site (formerly owned by Sagamo), on Town Creek in South Carolina. Portions of Lake Hartwell became eligible for Superfund support in 1990 and subsequent cleanup efforts have reduced inputs to the lake. The source of PCBs in Lake Hartwell has been remediated as part of the Superfund program and levels will continue to decrease over time. Although they were banned in 1976, PCBs do not break down easily and remain in sediment for years. It is now illegal to manufacture PCBs; however, in the past, these synthetic oils were regularly used as fluids for electrical transformers, cutting oils, and carbonless paper. Residual contamination in sediment presumably drives fish body burdens, but the cycling of PCBs in the lake is not fully characterized. South Carolina has continued to document a gradient of decreasing fish tissue PCB levels with distance from the Twelve Mile Creek to the Twelve Mile Creek embayment area of Lake Hartwell where the highest contaminant levels are found.

There are no known point sources or other identifiable anthropogenic sources of mercury in the Upper Savannah River Basin that have fish consumption guidelines issued for mercury.

Broad River Basin (Hydrologic Unit 03060104)

The source of chlordane within Nancy Town Lake's watershed is thought to be nonpoint in nature. Chlordane was historically used as an agricultural pesticide, but was restricted to termite control use in 1978. It has since been banned for all uses. Chlordane is persistent in the environment and may remain in aquatic sediments for years. Review of trends in fish tissue chlordane residues in Georgia indicates that concentrations in fish tissue are declining. There is no known point or other identifiable anthropogenic source of the chlordane in this waterbody.

Little River Basin (Hydrologic Unit 03060105)

There are no known point sources or other identifiable anthropogenic sources of mercury in the Little River Basin where fish consumption guidelines have been issued.

Middle Savannah River Basin (Hydrologic Unit 03060106)

Sources of mercury in this section are considered to be from atmospheric background loadings and anthropogenic inputs. One point source in the Augusta area is the Olin

chlor-alkali plant. On-site sources such as groundwater, runoff and process water are collected, treated, monitored and discharged at the facility NPDES outfall. The facility has been in compliance with the NPDES mercury limit. Additional mercury may be entering the Savannah River from streams draining the U.S. Department of Energy Savannah River Site (SRS) in South Carolina. Some of the mercury found in streams within the SRS watersheds is thought to be anthropogenic. Mercury may also be present in fish due to mercury content in the natural soils, from municipal or industrial sources, or from fossil fuel use. It is also possible that the elevated mercury level is related to global atmospheric transport.

Analyses of fish tissue by EPD has shown that fish in the vicinity of the SRS in South Carolina (Upper Three Runs Creek, Four Mile Creek, Steel Creek, and Lower Three Runs Creek), and in the Savannah River at Cox Point, contain elevated concentrations of cesium (Cs-137), and strontium (Sr-90). Elevated concentrations of radionuclides were also observed in Ebeneezer Swamp (connected to the Savannah River and located approximately 90 miles downstream of SRS). Elevated concentrations of radionuclides for fish adjacent to SRS are attributed primarily to operations at SRS. Since the aquatic environment in Ebenezer Swamp is different from that found in the main stem Savannah River and many miles downstream, elevated concentrations of radionuclides observed in fish from the swamp cannot be definitely linked to SRS operations. While specific fish consumption advisories have not been issued for radionuclides in the Savannah River by EPD or South Carolina, the data were evaluated in light of the current fish consumption guidelines based on mercury and deemed to be protective.

Briar Creek River Basin (Hydrologic Unit 03060108)

There are no known point sources or other identifiable anthropogenic sources of mercury in this watershed. Briar Creek is a coastal plain blackwater swamp system. These systems are characterized by a high content of organic carbon (organic ligand humic substances), low alkalinity and pH, and naturally lower dissolved oxygen content. Blackwater systems have been found to have physico-chemical characteristics that provide both a sink for the accumulation of mercury, and to provide an environment conducive to the methylation of mercury. As a result, baseline mercury residues found in fish tissues are higher than that found in other waterbodies having a different chemistry.

Lower Savannah River Basin (Hydrologic Unit 03060109)

There are no known point sources or other identifiable anthropogenic sources of mercury in this watershed.

Identified Gaps and Needs

Sources of mercury are not well quantified. Mercury within the Savannah River Basin are likely derived from natural sources combined with unidentifiable anthropogenic sources, and/or from atmospheric deposition.

The source of PCBs in Lake Hartwell has been remediated as part of the USEPA Superfund program and levels are expected to continue to decrease over time.

The source of chlordane within Nancy Town Lake's watershed is thought to be Nonpoint in nature. Residue values are expected to decrease over time. The use of chlordane has been banned. Catfish collected in the Broad River were found to be free of chlordane.

EPD will continue to work with South Carolina to sample and test fish in the Savannah River for radionuclides. Guidelines will be reassessed as new data becomes available.

General Strategies for Action

The strategy is to keep the fishing public notified of risks associated with fish consumption guidelines that have been issued for mercury, chlordane and/or PCBs.

The Lake Hartwell PCB source has been remediated to the extent feasible and the strategy is to keep the fishing public notified of risks associated with consuming fish contaminated with PCBs in this interstate water body.

The EPA proposed a TMDL for mercury in the Savannah River Basin in 2000 and is scheduled to finalize the TMDL in early 2001.

Specific Management Objectives

EPD and WRD will work to protect public human health by issuing fish consumption guidelines as needed, indicating the recommended rates of consumption of fish from specific waters. The guidelines are based on conservative assumptions and provide the public with factual information for use in making rational decisions regarding fish consumption.

Action Plan

- WRD and EPD will continue to sample and analyze fish tissue and issue fish consumption guidelines as needed. The next round of fish tissue sampling for this watershed will be considered in fiscal year 2002 in accordance with the river basin monitoring cycle.
- EPD will evaluate the need for additional sampling of different media (fish tissue, water and/or sediment), if localized anthropogenic sources are indicated.
- Georgia will continue to interface with South Carolina on fish tissue monitoring and consumption guidance issued on shared interstate waters.
- EPA will finalize a TMDL for mercury in the Savannah River Basin and the Georgia EPD will be responsible for implementing the TMDL.

Method of Tracking Performance

Trends in fish tissue concentration; number of Fish Consumption Guidelines.

7.3.5 Dissolved Oxygen

Problem Statement

Water use classifications for fishing, recreation and drinking water were not fully supported in several water body segments due to excursions of the water quality standards for dissolved oxygen. These excursions are primarily attributed to nonpoint sources, hydropower generation and to natural conditions.

Upper Savannah River Subbasin (HUC 03060103)

The water use classification of recreation was not fully supported in the Savannah River mainstem due to dissolved oxygen concentrations less than standards. Low dissolved oxygen concentration in the mainstem river segment was due to bottom water discharges from Lake Hartwell Dam.

Broad River Subbasin (HUC 03060104)

The water use classification of fishing was not fully supported in two stream segments (Bear Creek and Beaverdam Creek) due to dissolved oxygen concentrations less than standards due to water pollution control plant discharges.

Middle Savannah Subbasin (HUC 03060106)

The water use classifications of fishing and/or drinking were not fully supported in two Savannah River mainstem segments and one tributary stream segment (Butler Creek) due to dissolved oxygen concentrations less than standards. Low dissolved oxygen in the river segments was due to bottom water discharge from dams and low dissolved oxygen in the tributary was due to urban runoff and a water pollution control plant discharge.

Lower Savannah River Subbasin (HUC 03060109)

The water use classifications of fishing were not fully supported in three tributary segments (Buck Creek, Ebenezer Creek and Runs Branch) due to dissolved oxygen concentrations less than standards. Low dissolved oxygen in two tributaries (Ebenezer Creek and Runs Branch) was due to nonpoint sources and a water pollution control plant contributed to the problem in Buck Creek. Dissolved oxygen may be lower in these areas due to natural conditions.

General Goals

Meet water quality standards to support designated water uses.

Ongoing Efforts

In the Broad River Subbasin EPD completed and is implementing TMDLs for Bear Creek and Beaverdam Creek. In the Lower Savannah River Subbasin, the City of Sylvania completed an Individual Control Strategy in 1994 and is in compliance with its NPDES Permit. A multiagency study of Ebenezer Creek is ongoing to address issues and implement solutions. The Coastal RC&D Council is demonstrating a watershed approach for agricultural BMP implementation in the Ebenezer Creek Watershed. The Coastal RC&D Council is demonstrating the benefits of conservation buffers in this subbasin.

Identified Gaps and Needs

Low dissolved oxygen concentrations in this part of the state are often due to natural environmental conditions. Work is needed to identify and characterize natural background dissolved oxygen concentrations in this area.

General Strategies for Action

Upper Savannah River Subbasin (HUC 03060103)

Low dissolved oxygen concentration in the mainstem river segment was due to bottom water discharges from Lake Hartwell Dam. In the summer and early fall, dissolved oxygen levels below the dam typically fall below standards. EPD will work with the Corps of Engineers to assess and implement feasible actions to maintain acceptable dissolved oxygen concentrations in waters released from the dam.

Broad River Subbasin (HUC 03060104)

Low dissolved oxygen concentrations in Beaverdam Creek was due to the City of Commerce water pollution control plant discharge. Low dissolved oxygen concentrations in Bear Creek was due to the City of Lavonia water pollution control plant discharge.

Both of these plant discharges are in compliance with permit limits. TMDLs have been developed and are being implemented by the Georgia EPD for Beaverdam Creek and Bear Creek. The TMDL will require additional treatment at each facility.

Middle Savannah Subbasin (HUC 03060106)

Low dissolved oxygen concentrations in the river segment was due to bottom water discharges from Clarks Hill Dam. During late summer and early fall, the low dissolved oxygen concentrations below Clarks Hill Dam below the dam typically fall below standards. EPD will work with the Corps of Engineers to assess and implement feasible actions to maintain acceptable dissolved oxygen concentrations in waters released from the dam.

Low dissolved oxygen concentration in Butler Creek was due to the City of Augusta water pollution control plant discharge. EPD has issued an Administrative Order to the City of Augusta requiring improvements in the water pollution control plant operation and maintenance.

Lower Savannah River Subbasin (HUC 03060109)

Low dissolved oxygen concentrations in Ebenezer Creek and Runs Branch were due to nonpoint sources. EPD will address nonpoint sources in the Runs Branch drainage through a watershed protection strategy.

Specific Management Objectives

Maintain dissolved oxygen concentrations adequate to support aquatic life and meet water quality standards.

Action Plan

Upper Savannah River Subbasin (HUC 03060103)

- The Corps of Engineers will evaluate alternatives in the dam operations to improve dissolved oxygen concentrations in the releases from Lake Hartwell.
- EPD will monitor and assess dissolved oxygen in the listed waters and work with the Corps to assess cost-effective changes.

Broad River Subbasin (HUC 03060104)

- EPD has developed and is implementing TMDLs for both listed waters and will monitor dissolved oxygen concentrations in these streams during the next monitoring cycle.
- City of Commerce will upgrade facilities to implement the TMDL and maintain water pollution control plant in compliance with permit.
- City of Lavonia will upgrade facilities to implement the TMDL and maintain water pollution control plant in compliance with permit.

Middle Savannah Subbasin (HUC 03060106)

- The Corps of Engineers will evaluate alternatives in the dam operations to improve dissolved oxygen concentrations in the releases from Clarks Hill Lake.
- EPD will monitor and assess dissolved oxygen in the listed waters and work with the Corps to assess cost-effective changes.
- The City of Augusta will continue to make plant improvements in accordance with the EPD order.

- EPD will monitoring dissolved oxygen in the listed waters during the next monitoring cycle.

Lower Savannah River Subbasin (HUC 03060109)

- EPD will monitoring dissolved oxygen in the listed waters during the next monitoring cycle.

Methods for Tracking Performance

A reevaluation of the status of the listed waterbodies will be made coincident with the next iteration of the RBMP management cycle for the Savannah River basin in 2001-2005.

7.3.6 Thermal Regime in Clarkes Hill Lake

Upper Savannah River Subbasin (HUC 03060103)

Problem Statement

Hydropower generation at Richard B. Russell Dam includes pumpback (reverse flow) capabilities. Water released from the Russell Dam into the Savannah River immediately upstream of Clarks Hill Reservoir is pumped back into Russell Lake. Pumping water back above the dam increases water temperatures in Clarks Hill Lake downstream and may affect critical habitat for striped bass and hybrid (white x striped) bass. According to the DNR Wildlife Resources Division the trophy striped bass may be eliminated in Clarks Hill Lake if the pumpback operation continues without significant mitigation measures.

General Goals

Operation of Richard B. Russell Dam and pumpback facilities in a manner consistent with maintaining water temperatures for the striped bass and hybrid bass fisheries of Clarks Hill Lake.

Ongoing Efforts

WRD is working with the Corps of Engineers to assess feasible solutions.

Identified Gaps and Needs

Information is needed as to what specific changes in operation of the facility would result in improvement in the fishery.

General Strategies for Action

WRD will work with the Corps of Engineers to assess and implement feasible actions.

Specific Management Objectives

Maintain water temperatures for stripped bass fishing.

Action Plan

- WRD will continue to document the effects of thermal modification.

- Corps of Engineers will work to evaluate alternatives in operations to reduce temperature effects from the pumpback.

Methods for Tracking Performance

WRD will monitor fish populations in Lakes Russell and Clarks Hill to assess fishery and effects of hydropower generation and pump back operations.

7.3.7 Protection of Threatened and Endangered Species

Problem Statement

Middle Savannah Subbasin (HUC 0050060106)

The Middle Savannah Subbasin is home to the robust redhorse, a fish that is threatened or endangered and needs protection.

General Goals

To provide aquatic habitat and management to support the survival and propagation of threatened and endangered species; to meet or exceed state and federal laws, rules, and regulations for the protection of endangered species; and to incorporate planning for protection of threatened and endangered species into basin planning.

Ongoing Efforts

The WRD is working with other States, federal, and local agencies to help protect the robust redhorse in the Middle Savannah Subbasin.

7.3.8 Source Water Protection for Drinking Water Sources

Problem Statement

Many public water supplies have no control over their source watersheds and have to spend additional treatment dollars to insure a high quality water supply. All streams with municipal water intakes need to have watershed assessments and protection plans developed, and implemented.

General Goals

EPD will establish proactive planning and management to maintain safety and high quality of drinking water sources on all streams with municipal water intakes by having watershed assessments and protection plans developed and im implemented. All streams and existing lakes under serious consideration for use as public water supplies will have a source water assessment made early in the planning process.

Ongoing Efforts

Georgia efforts is developing a Source Water Program (SWAP) in alignment with EPA's initiatives. EPD is working with USGS on some programs elements and beginning to work with some water authorities in starting the process. Some water authorities and local governments have adopted source water protection measures in conjunction with Growth Strategies Initiatives.

Identified Gaps and Needs

This is a new and much more comprehensive initiative and neither EPD nor many local authorities have much experience in performing the assessments and the protection plans. The Implementation Plan is still under development by EPD.

There are complexities in developing an assessment that would be general to all watersheds because of the varying land uses. Therefore, EPD has the task of deriving a number of approaches that can be applied to a watershed deepening upon the assistance of advisory committees and the public prior to submitting the SWAP Implementation Plan to EPD.

EPD must also find effective measures to promote and encourage local communities to adopt source water protection programs using the assessment results.

Strategies for Action

EPD submitted to the Environmental Protection Agency a SWAP Implementation Plan in February 1999. EPD will describe in the SWAP Implementation Plan methods and approaches for (1) delineating the source water protection areas for all public water supply sources within the State (the outer management zone for groundwater sources); (2) inventorying potential contaminants within the delineated protection zone; (3) determining water supply susceptibility to significant potential contaminants with in the protection zone; and (4) involving the public in developing SWAPs and make assessments available to the public.

Key Participants and Roles

EPD, local governments, water authorities, federal, state, local agencies, and special interest groups.

Specific Management Objectives

The EPD is actively working toward the national goal of the year 2005, 60 percent of the population served by community water systems will received their water from systems with source water protection systems (SWPP) in place under both wellhead protection and watershed protection programs". EPD intends to accomplish this goal by developing and implementing a source water assessment program (SWAP) in alignment with EPA's initiatives.

Management Option Evaluation

Formulation will be on a site by site basis and be updated with each planning cycle in the basin.

Action Plan

- SWAP Implementation Plan submitted to EPA in February 1999.
- Identify water intakes and authorities.
- Delineate watersheds contributing to intakes.
- Establish criteria and guidelines for assessments and protection plans.
- Provide support to water authorities and local governments.
- Review and approve source water protection plans.

Methods for Tracking Performance

To be determined.

7.3.9 Groundwater Quality and Quantity

Lower Savannah River Subbasin (Hydrologic Unit 03060109)

Issue A. Upper Floridan Aquifer

Problem Statement

Regional use of ground water throughout coastal Georgia (and in South Carolina) has reduced water levels in the Upper Floridan aquifer. The declining groundwater levels have reduced pressures in the aquifer sufficiently to allow seawater to enter the aquifer in Port Royal Sound north of Hilton Head Island, South Carolina (and potentially elsewhere) then begin to slowly moving towards Savannah, Georgia. All municipal, industrial, and agricultural users withdrawing water from the Upper Floridan aquifer throughout this basin contribute to this salt-water intrusion problem.

Another concern is the water necessary for continued residential growth and commercial development in southern Effingham County and northwestern Chatham county.

General Goals

Stop the intrusion of salt-water before the municipal supply wells on Hilton Head Island, South Carolina and in Savannah, Georgia are contaminated.

Ongoing Efforts

After several years of working with the stakeholders throughout the coastal area, EPD developed the *"Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer of Southeast Georgia"* (dated April 23, 1997). This Interim Strategy defines the EPD roles and requirements for studies and stakeholder efforts through December 31, 2005. The legislature has funded an extensive Sound Science Initiative to provide some of the necessary information to determine what is happening in the aquifer and what can be done to minimize or eliminate the salt-water intrusion problems. The scientific information gathered shall be discussed with stakeholders and used in developing the Final Strategy for water withdrawals before January, 2006. To meet these objectives, EPD will do the following:

(1) Conduct expanded scientific (Sound Science effort) and feasibility studies to determine with certainty how to permanently stop the salt-water intrusion moving towards Hilton Head Island, South Carolina and Savannah, Georgia.

(2) Require the development of comprehensive local water supply plans in a 24 county area of southeast Georgia.

(3) Create one or more technical advisory committees (TAC). With their input, the additional scientific information and the local water supply plans, develop a long-term ground water management plan for southeast Georgia by the end of the year 2005, which will protect the Upper Floridan aquifer from further salt-water intrusion.

(4) Impose caps on ground water use in all areas of Glynn County, all of Chatham County, and southern portions of Bryan and Effingham counties, to avoid worsening the rate of salt water intrusion at Hilton Head - Savannah and at Brunswick.

(5) Reduce ground water use in Chatham County by at least 10 million gallons per day by December 31, 2005 through conservation and substitution of surface water for ground water. Union Camp will provide at least 6.5 Mgd of the total 10 Mgd of ground water reduction in Chatham County. This will be affirmed through reductions in ground water use permits.

(6) Allow, on an interim basis, increases in groundwater withdrawals up to an additional 36 Mgd in the areas of southeast Georgia that have little impact on salt-water intrusion problem.

(7) Encourage and promote water conservation and reduced ground water usage wherever feasible, throughout southeast Georgia.

Identified Gaps and Needs

EPD needs an expanded compliance effort to better account for actual amounts of groundwater withdrawals from the Floridan aquifer.

EPD, USGS and several consulting firms are working on creating improved computer modeling efforts to provide better and more complete information regarding the impacts of withdrawals on salt-water intrusion into the aquifer.

EPD in conjunction with the USGS and contracted consulting firms is trying to identify alternative water sources to allow additional water from sources outside of the Floridan aquifer.

EPD and contracted consulting firms are assessing engineered and non-engineered methods of stopping/containing salt-water intrusion.

Strategies for Action

EPD and the coastal stakeholders currently are implementing policies recommended in the Interim Strategy, are analyzing new information developed under the Sound Science Initiative, and eventually, will be developing recommendations of policy measures for the Final Strategy to protect coastal Georgia from salt -water intrusion.

Key Participants and Roles

Georgia EPD: Monitor strategy efforts and inform stakeholders of progress via public meetings at the Upper Floridan Technical Advisory Committee (TAC); publish results of technical studies; assist the General Assembly in developing new targets that will help protect the aquifer; and initiate a public participation process that will develop a Final Strategy by December 31, 2005.

South Carolina DHEC: Because of the contamination moving under Hilton Head Island, SC DHEC expects to partner with EPD in development of the Final Strategy.

County and Municipal Governments: Each local government in the area has it's own interest in economic development and residential growth and expects to partner with EPD in the development of the Final Strategy.

Industrial Representatives: Industrial users are the largest users of groundwater in the area and expects to partner with EPD in the development of the Final Strategy.

Public Citizen groups: Public participation is essential to insure public acceptance on any proposed interim measures and in the development of the Final Strategy. The Interim Strategy commits EPD to aggressive public participation.

Specific Management Objectives

EPD and others will encourage water conservation by all parties. EPD needs to insure that Chatham County will reduce their groundwater usage by 10 Mgd by December 31,

2005. EPD will prevent any withdrawal increases within the rest of the Capped area, if not associated with any nearby withdrawal reductions to offset the increase. EPD will limit new or increased Upper Floridan Aquifer ground water withdrawals from elsewhere. Finally, EPD with a comprehensive program of scientific studies will develop the information needed to identify the best methods for stopping or reducing salt-water intrusion.

Management Option Evaluation

Apply the Interim Strategy to permitting actions in coastal Georgia.

Develop the Final Strategy by December 31, 2005.

Action Plan

Implement the Coastal Interim Strategy before December 31, 2005

Develop the Final Management Strategy for action in January, 2006.

Direct and manage the Sound Science Initiative.

Update stakeholders regularly using an aggressive public participation process.

Methods for Tracking Performance

Accurately measure water use (both ground and surface water) throughout the coastal region.

Develop ground water models that are capable of determining the velocity of the salt-water intrusion is accelerating or decelerating in its movement towards Hilton Head Island, SC and Savannah, Ga.

Utilize the Upper Floridan Technical Advisory Committee to audit the progress and results of the Sound Science Initiative.

Issue B. Contamination in Richmond County

Problem Statement

EPD has concerns about potential groundwater contamination in the Augusta/Richmond area due to past and present industrial users. Rapid growth and expanding groundwater usage in the county may mobilize some of the contaminants located at these industrial sites, potentially affecting drinking water sources.

General Goals

Protection of the sources of drinking water from mobilization of these contaminants, by limiting any potential increased use of groundwater in the county, for either industrial or public drinking water, without associated reductions of groundwater use elsewhere in the county.

Ongoing Efforts

The Georgia EPD Drinking Water program is trying to limit any additional withdrawals of groundwater in the county, to prevent such withdrawals from pulling contaminants towards drinking water wells and thereby creating a new public health problem. If new withdrawals are permitted, they may potentially force movement in the subsurface of contaminants caused by past industrial incidents. If withdrawals are kept close to current amounts, it is thought that the contaminants will remain in place and not create any new hazard to public supply wells.

Identified Gaps and Needs

Better delineation of the contaminant locations is important. Enhanced computer groundwater modeling would give EPD and the groundwater users in the county a better idea of impacts created by the existing withdrawals and any proposed new withdrawals.

Strategies for Action

Try to limit any new groundwater withdrawals from being permitted, without associated groundwater withdrawals elsewhere in the county. Recommendations have been presented to the Augusta / Richmond County water system that for additional groundwater to be used in the fast growing suburban areas, greater use of the city's surface water treatment plant shall be required. Geographic areas which can use surface water should be placed on surface water, and the previous groundwater amounts supplied to those places may then be transferred or allocated farther out to the growth areas of the county, presently outside the reach of the surface water infrastructure. Industrial users are being requested to follow the same process, where they need to investigate sources of water alternate to new groundwater, such as the purchase of city water, use of self-supplied surface water or the reallocation of reduced groundwater from elsewhere.

Key Participants and Roles

Georgia EPD (Drinking Water): Watch the water quality of the public supply wells, and the resulting impact of all groundwater withdrawals in the county. Encouraging the use of the surface water supplied by a large city water treatment plant.

Local governments: Investigating alternate sources of water rather than just going to groundwater.

Public Citizen groups: Being informed about water issues.

Specific Management Objectives

EPD Drinking Water will work to protect public health by monitoring the water quality in the public supply wells. EPD will limit any new groundwater withdrawal permits to prevent the mobilization of subsurface contaminants. Treated surface water is to be used replace groundwater in the near urban areas, for new developments near distribution lines and generally for any additional growth where feasible. Any new groundwater usage must be offset by groundwater reductions elsewhere.

Action Plan

EPD will encourage non-groundwater sources of water for any new developments or applications within the county.

EPD will develop better groundwater models to track the impact of any new or existing groundwater withdrawal in the county.

Methods for Tracking Performance

EPD - Hazardous Waste monitoring of contamination sites should determine whether mobilization is occurring. EPD - Drinking Water monitoring of public water supply wells will determine any new public health hazards. Limiting any new withdrawals through the EPD - Water Resources Management Program may prevent any new mobilization from beginning.

Issue C. Groundwater Quality and Quantity

Problem Statement

Radioactive contamination is a concern from the Savannah River Site (SRS), a DOE nuclear weapons support facility in South Carolina. Radioactive contamination from SRS may enter the aquifer, pass under the Savannah River and impact users in Burke County, Georgia. The concerns date back to the 1960's and have always been related to groundwater movements. Elevated levels of radioactive tritium are routinely detected in fish, precipitation and surface water. Tritium has also been detected in shallow groundwater in Burke County.

General Goals

Monitor the situation to be aware of any radioactive hazard in the groundwater.

Ongoing Efforts

Working with South Carolina and the Federal government (Savannah River Site) to detect any potential radioactive contamination in Georgia groundwater.

Identified Gaps and Needs

A more extensive network of monitoring wells in Georgia may be necessary to insure adequate warning of any contamination.

Strategies for Action

Georgia EPD is pushing for more federal involvement in funding such monitoring activities.

Key Participants and Roles

Georgia EPD

US Department of Energy

Savannah River Site contractors

7.3.10 Aquatic Habitat

Problem Statement

Aquatic habitats in segments of the Savannah River mainstem and tributary streams may be affected by riparian development, erosion and sedimentation, hydroelectric power generation and channel alteration for navigational purposes near Savannah Harbor.

Tugaloo River Subbasin (HUC 03060102)

Trout streams in the Upper Tugaloo river subbasin are potentially affected by erosion, sedimentation, and temperature impacts. The Chattooga River, Tallulah River, and Panther Creek are examples when there is erosion and sedimentation due to graveled roads, forestry practices, and development.

Tailrace flows from dams on the Savannah River may also affect downstream dissolved oxygen and temperature. Problem statements and management strategies for these issues are addressed in sections 7.3.5 (dissolved oxygen) and 7.3.6 (temperature).

Upper Savannah River Subbasin (HUC 03060103)

Tailrace flows from Lakes Hartwell and Russell are primarily driven by hydropower generation schedules for supply of electricity during peak demand times. Flow rates of releases vary widely depending on demand. When not generating electricity, no minimum

flow is provided. The combination of fluctuating flows and potential low flows may affect fish and other aquatic life habitat and access for recreational users.

Middle Savannah River Subbasin (HUC 03060106)

Flows from Clarks Hill Dam are primarily driven by hydropower generation schedules for supply of electricity during peak demand times. Flow rates of releases vary widely depending on demand. When not generating electricity, no minimum flow is provided. The combination of fluctuating flows and potential low flows affect juvenile nursery habitat, robust redhorse spawning and rearing habitat, and access for recreational users.

Lower Savannah River Subbasin (HUC 03060109)

Striped bass populations in the Lower Savannah river are potentially affected by channel constriction caused by the berns and other structures which were not removed when the tide gate was removed from service in 1993.

General Goals

To support designated water uses by preserving and protecting riparian and aquatic habitat.

Ongoing Efforts

Tugaloo River Subbasin (HUC 03060102)

The Chestatee-Chattahoochee Rivers RC&D is demonstrating the benefits of conservation buffers in this Sub-Basin and has developed a proposal to demonstrate BMPs in Lake Hartwell Tributaries. Local Soil and Water Conservation Districts and RC&D Councils are working with producers to reduce erosion and sedimentation through their No-Till Drill Program.

The NRCS, along with support from the GSWCC and Georgia's Agricultural Community, is conducting watershed assessments to quantify agricultural NPS pollution in the Sub-Basin.

The NRCS is working with USFS and EPA to develop a GIS based model to estimate erosion and sedimentation and field testing this model in the Sub-Basin.

The Stephens County SWCD is implementing a watershed protection plan for Eastanolle Creek.

Lower Savannah River Subbasin (HUC 03060109)

The Corps of Engineers removed the tide gate from service in 1993. Issues which persist with the striped bass fishery may be related to channel constriction caused by the berms and other structures which have not been removed. The WRD and Corps of Engineers together with various other state and federal fish and wildlife agencies are investigating this potential problem.

WRD regularly restocks Striped Bass in this portion of the lower Savannah. The strategy is that continued restocking will eventually result in the restoration of a breeding population. Ongoing investigations of channel construction may indicate other needs.

Identified Gaps and Needs

In the Lower Savannah River Subbasin, many more years of striped bass restocking may be required in order to determine if the discontinuation of tide gate operations will result in a self sustaining population of this species.

General Strategies for Action

Tugaloo River Subbasin (HUC 03060102)

Understanding the role of erosion and sedimentation in urban streams is incomplete at this time. Most of these streams are impacted by a variety of stressors. An incremental or phased approach is needed to address these issues.

Most agricultural sediment reduction practices are expensive and landowners are reluctant to spend today's dollars for long term BMP amortization in uncertain future markets. Agricultural cost share dollars (Farm Bill) need to be concentrated in priority watersheds with sufficient technical workforce to implement enough BMPs through long term agreements or contracts to reduce sediment loading.

Upper Savannah River Subbasin (HUC 03060103)

WRD and EPD will work with the Corps of Engineers to assess the magnitude of impacts from reduced flows and implement feasible actions.

Middle Savannah River Subbasin (HUC 03060106)

WRD and EPD will work with the Corps of Engineers to determine a regime of water releases, including those during and between peak power generation flows which to enhance the fishery, other aquatic life and recreational uses.

Specific Management Objectives

Tugaloo River Subbasin (HUC 03060102)

Control erosion and sedimentation from land disturbing activities in order to meet narrative water quality standards.

Evaluate forestry practices and management plans on National Forest lands.

Evaluate E&SC related to construction activities and stormwater management (vacation homes, urban development, etc.) and continue to manage erosion and sedimentation from land disturbing activities in order to meet narrative water quality standards.

Upper Savannah River Subbasin (HUC 03060103) and Middle Savannah River Subbasin (HUC 03060106)

Maintain streamflows adequate to support aquatic life. Determine if feasible alternatives to present extremes in flows below hydropower generating facilities exist.

Lower Savannah River Subbasin (HUC 03060109)

Obtain adequate information to determine whether channel constriction or other factors are affecting the striped bass fishery. Take cost-effective actions to minimize stress on the striped bass population.

Action Plan

- EPD will participate in meetings with USFS and WRD to assist with updating each National Forest Management Plan as they relate to aquatic habitat protection.
- GSSWC and local SWCDs and RC&D Councils with assistance from NRCS will encourage the implementation of BMPs to control erosion of agricultural lands.
- GFC will target landowner and user groups for BMP education to encourage compliance with forestry BMP guidelines.

- EPD will work with local governments with issuing authority for erosion and sedimentation controls first through education and second through enforcement to control erosion at construction sites, and will encourage local governments to implement land use planning.
- EPD will encourage citizen involvement through Adopt-A-Stream groups to address restoration of urban streams
- EPD and WRD will continue to develop biological monitoring capabilities designed to assess aquatic life.
- WRD and EPD will work with the Corps of Engineers to develop strategies for improving flow regimes below hydroelectric power facilities to improve habitats and environmental conditions for fish and other aquatic life.
- WRD will work with the Corps of Engineers to assess the viability of the striped bass populations in the lower Savannah River and to determine what factors limit that population.

Methods for Tracking Performance

GSWCC, GFC, EPD, and issuing authorities will track BMP implementation: GSWCC by the number of E&SC plans reviewed and DAT evaluations and recommendations; GFC through its biennial surveys; and EPD through routine inspections of permitted projects, surveillance for any noncompliance, and the conduct of necessary compliance and enforcement activities. NRCS will track BMP implementation through its NIMS reporting system.

References

GA DNR. 1999. Guidelines for Eating Fish from Georgia Waters. Georgia Department of Natural Resources, Atlanta, GA.

SCDHEC. June, 1999. South Carolina Fish Consumption Advisories. South Carolina Department of Health and Environmental Control, Columbia, SC.

SCDHEC. December 1997. Watershed Water Quality Assessment Savannah and Salkehatchie River Basins. Technical Report No. 003-97. South Carolina Department of Health and Environmental Control, Columbia, SC.

In This Section

- Where Do We Go From Here?
- Working to Strengthen Planning and Implementation Capabilities
- Addressing the Impacts from Continued Population Growth and Land Development
- The Next Iteration of the Basin Cycle
- Priorities for Additional Data Collection

Section 8

Future Issues and Challenges

8.1 Where Do We Go From Here?

The Dynamic Process of Basin Management

This plan represents another step in managing the water resources in the Savannah River basin, but not the final step. It is important to recognize that effective basin management is ongoing and dynamic because changes in resource use and conditions occur continually, as do changes in management resources and perspectives. Therefore, management planning and implementation must remain flexible and adapt to changing needs and capabilities.

Building on Past Improvements

For the past few decades, management efforts have resulted in substantial improvements in water quality and reduction in pollutant loading for many waters (see examples in Section 4). Much of these improvements stem from increased wastewater treatment at municipalities and industries, and from implementation of best management practices by landowners that help reduce soil and contaminated runoff. Indeed, many of the waterbodies in the basin are fully supporting their designated uses. The assessments summarized in this plan show, however, that not all waters are at the level of quality deemed necessary to support designated uses. There are existing waters still in need of restoration and attention.

Participation by Many Different Stakeholders

The current and proposed strategies summarized in this plan do not "solve" all existing problems. Many of the unsolved problems will require actions by stakeholders other than those that have been involved in planning to date. For example, resolution of fecal coliform bacteria problems will typically require local government (e.g., dealing

with urban storm water issues and leaking and overflowing sanitary sewers) and private landowner actions (e.g., correcting failed septic systems; using best management practices in animal operations and land application of waste residuals). Other issues will require significant additional time and effort before they are addressed sufficiently (e.g., restoration of riparian zones and aquatic habitat). Some of these issues may require trial management efforts and adapting those efforts over time based on observations of what works well, particularly where there is no 100 percent effective solution evident at the time of strategy development. Future management should focus on the priorities among those continuing needs, as determined by communities and partners in management.

Additionally, continued growth in population is expected in the Savannah basin (see Section 2). This growth will place additional demands on water resources, and require corresponding responses in management. More people means more water use (drinking water, industrial consumption, irrigation), more storm water runoff (from impervious surfaces of new houses, roads, industries, businesses, and parking lots), and more contamination (sediment; nutrients; organic material; pesticides, herbicides, and other toxics). Therefore, it is essential that stakeholders continue to work together to plan and implement the most cost-effective ways of restoring and protecting water resources.

Blending Regulatory and Voluntary Approaches

Although the regulatory authorities of agencies such as EPD are important for protection and restoration of Georgia's waters, RBMP partners will continue to emphasize voluntary and cooperative approaches to watershed management. This will take time and be very challenging. Long-term protection means that the people, local governments, and businesses must learn collectively what is needed for protection and adapt their lifestyles and operations accordingly. Experience indicates that we are much more likely to buy into proposed management solutions in which we have a say and control over how we spend our time and money. The challenge in the future, therefore, is to continue to "build bridges" between regulatory and voluntary efforts, using each were they best serve the people and natural resources of Georgia.

8.2 Working to Strengthen Planning and Implementation Capabilities

Understanding One Another's Roles

Increasing awareness and understanding of the roles and capabilities of local, state, and federal partners is one of the keys to future success in basin management for the Savannah River. Lack of understanding can lead to finger pointing and frustration on the part of all involved. Increasing opportunities for stakeholders to develop this awareness and understanding should result in more effective management actions.

This basin plan provides one opportunity for stakeholders to increase their awareness of conditions in the basin and to learn about ongoing and proposed new management strategies. Within this context, stakeholders can develop a better understanding of certain roles and responsibilities. For example, this basin plan points out several areas where EPD has regulatory authority and corresponding duties, including:

- Establishing water quality use classifications and standards.
- Assessing and reporting on water quality conditions.
- Facilitating development of River Basin Management Plans.
- Developing TMDLs

- Implementation Plan Development through Regional Development Centers (RDCs)
- Issuing permits for point source discharges of treated wastewater, municipal storm water discharges as required, and land application systems.
- Issuing water supply permits.
- Enforcing compliance with permit conditions.

In many areas, however, organizations or entities other than EPD are responsible; for example,

- Septic tank permitting and inspection (County Health Departments) and maintenance (individual landowners).
- Land development (land use) and zoning ordinances (local governments).
- Sanitary sewer and storm water ordinances (local governments).
- Water supply source water protection ordinances (local governments).
- Urban storm water and drainage (local governments).
- Erosion and sediment control (local governments).
- Siting of industrial parks, landfills, and wastewater treatment facilities (local governments).
- Floodplain management (FEMA, local governments).
- Implementation of forestry best management practices (Georgia Forestry Commission with support from the American Forest and Paper Association, Georgia Forestry Association, The University of Georgia School of Forest Resources, Southeastern Wood Producers Association, and the American Pulpwood Association).
- Implementation of agricultural best management practices (landowners with support from state and federal agricultural agencies).
- Proper use, handling, storage, and disposal of chemicals (businesses, landowners, municipalities, counties, etc.).

These are but a few of the areas involved, but they illustrate how responsibilities are spread across many stakeholders in each basin. Additionally, other agencies and organizations—regional development centers; federal, state, and local technical assistance programs; citizens groups; and business associations—assist in planning and implementation in many of these areas. As stakeholders become more familiar with one another's responsibilities and capabilities, they will become increasingly aware of appropriate partners to work with in addressing their issues of concern.

Using the RBMP Framework to Improve Communication

Raising awareness frequently involves two-way communication. The RBMP framework's interactive planning and outreach sessions provide additional opportunities for two-way communication. For example, Basin Technical Planning Team meetings provide opportunities for partners to share information on their responsibilities and capabilities with each other. Similarly, River Basin Advisory Committee meetings and Stakeholder meetings provide opportunities for citizens, businesses, government agencies, associations, and others. to share information and learn from each other. Although these interactions often require considerable time, they are critical to the future

of management in the basin because they build the working relationships and trust that are essential to carrying out effective, integrated actions.

Continuing to Streamline Our Efforts

Increased coordination will also result if partners in this approach continue to streamline their efforts. There are many laws and requirements with related and complementary goals, e.g., Georgia's Growth Strategies Act, Planning Act, River Corridor Protection Act, Comprehensive Ground Water Management Plan, and River Basin Management Planning requirements, in addition to federal Clean Water Act water quality regulations and Safe Drinking Water Act source water protection requirements. Partners should continue to find ways to make actions under these laws consistent and complementary by eliminating redundancy and leveraging efforts. Again, partners can use the forums in the RBMP framework (e.g., river basin team and advisory committees) to discuss and implement ideas to streamline roles and make the best use of their funds and staff resources.

8.3 Addressing the Impacts from Continued Population Growth and Land Development

Supporting Consistent Implementation of Protection Measures

In addressing the impacts from anticipated population growth and increased land development in the basin, future managers will need to increase their understanding of roles and use forums to coordinate and develop more specific action plans. Historically, mitigating impacts from newly developed areas has been approached mostly on a case-by-case basis. Unfortunately, this approach has resulted in inconsistent planning and implementation of water resource protection measures. River basin planning offers an opportunity for a more consistent approach by making it easier for landowners, local governments, and businesses to work together at the watershed and basin levels.

One way that Georgia EPD will address this issue is by approving only new and expanding permits for water withdrawals and wastewater discharges that are consistent with the basin plan and that meet the intent of the Georgia Planning Act. Rather than waiting for the permit application process, however, local governments can work together and with EPD to work out some of these issues in advance. There are incentives for organizations such as the Georgia Water Pollution Control Association (WPCA), the Georgia Municipal Association (GMA), the Association of County Commissioners of Georgia (ACCG), and the Regional Development Centers (RDCs) to work out consistent methods to conduct watershed assessments in developing areas and to improve the implementation of protection measures as development occurs. EPD, DCA, and other partners can coordinate by facilitating discussion at RBMP meetings and supporting local initiatives aimed at this issue. An excellent example of this cooperative effort is the Georgia Water Management Campaign being facilitated by the Association of County Commissioners in cooperation with the Georgia EPD, the Georgia Municipal Association, and the Georgia Environmental Facilities Authority.

8.4 The Next Iteration of the Basin Cycle

Building on Previous, Ongoing, and Planned Efforts

As discussed above and in Section 7.3, there is more work to do to adequately restore and protect all of Georgia's water resources. After focusing on the implementation of this

plan, the Savannah River basin will enter into its second iteration of the basin management cycle (scheduled for April 2001). The next cycle will provide and opportunity to review issues that were not fully addressed during the first cycle and to reassess or identify any new priority issues. In other words, future management efforts can and should build on the foundation created by previous, ongoing, and already planned management actions.

Providing a Historical Reference for the Next Basin Planning Effort

Additional water resources management issues will also be addressed in the Comprehensive Water Resources Management Study for the Savannah River basin (SRB Study). The 1996 Water Resources Development Act authorized the U.S. Army Corps of Engineers to develop an updated plan addressing current and future needs in the basin, examine reallocation of storage at Corps of Engineers multipurpose projects, and develop a better management structure to deal with basin water resource issues. Potential water resources management issues to be addressed in the study include upper basin needs vs. downstream needs, water supply allocations, flood control, hydropower, water quality, habitat, aquatic plant control, and recreation.

The Reconnaissance phase of the comprehensive water resources management study for the basin was initiated in February 1998 and completed in July 1999. The final report will be completed in September 2003.

The Corps of Engineers is also coordinating this effort with various state and federal agencies including the states of Georgia and South Carolina, as well as Federal agencies such as the Environmental Protection Agency (EPA), US Geological Survey, and the Natural Resources Conservation Service.

Savannah Harbor Channel Deepening Project

Another concern that will be addressed during the next basin planning cycle is the environmental impacts of the proposed Savannah Harbor Deepening Project Georgia. Georgia Ports Authority is recommending a plan to increase the channel depth of the Port of Savannah from 42 to 48 feet to accommodate larger container vessels calling at the port. The potential environmental impacts could include increased salinity levels and decreased oxygen levels in the river and adjacent to the Savannah National Wildlife Refuge, loss of acres of saltwater wetlands, and increased chloride levels at the city of Savannah water intake on a tributary to the Savannah River. Construction on the project is scheduled to start in the fall of 2001 and be completed in the year 2005.

New Savannah Bluff Lock and Dam

Another future issue in the Savannah River basin is the continued operation and maintenance of the New Savannah Bluff Lock and Dam (NSBLD), which was constructed in 1937. The Army Corps of Engineers, Savannah District, initiated a study to review the current use of the NSBLD and recommend its future disposition to Congress. The project was authorized for the sole purpose of supporting commercial navigation along the Savannah River. Augusta-Richmond County currently operates the lock and the adjacent 50-acre public park and recreational area under an agreement with the Corps. The project currently provides water supply, recreation, tourism, and environmental benefits to the region. The study was completed in 2000 and a report was submitted to Congress for action. The Corps will rehabilitate the lock and dam and work with local governments in Geogia and South Carolina to establish a plan for operation of the project.

8.5 Priorities for Additional Data Collection

In 1997-1998 monitoring efforts were focused on the Savannah and Ogeechee River basins in accordance with the EPD basin planning schedule. Intensive monitoring will return to the Savannah basin in support of the next iteration of the basin planning cycle in 2002. Prior to this time, EPD and partners will develop a monitoring plan for the Savannah. The monitoring plan will have two manage components: general assessment of water quality status within the basin, and targeted assessment to address priority issues and concerns.

River Basin Planning Act

(O.C.G.A. 12-5-520 to 525)

92 SB637/AP

Senate Bill 637

By: Senators Johnson of the 47th, Pollard of the 24th, Edge of the 28th and Egan of the 40th.

An Act

To amend Chapter 5 of Title 12 of the Official Code of Georgia Annotated, relating to water resources, so as to define certain terms; to provide for the development of river basin management plans for certain rivers; to provide for the contents of such plans; to provide for the appointment and duties of local advisory committees; to provide for notice and public hearings; to provide for submission to and approval of plans to the Board of Natural Resources; to make certain provisions relative to issuing certain permits; to provide for the application for and use of certain funds; to provide that this Act shall not enlarge the powers of the Department of Natural Resources; to repeal conflicting laws; and for other purposes.

Be It Enacted by the General Assembly of Georgia:

Section 1. Chapter 5 of Title 12 of the Official Code of Georgia Annotated, relating to water resources, is amended by inserting at the end thereof the following:

Article 8

12-5-520. As used in this article, the term:

(1) "Board" means the Board of Natural Resources.

(2) "Director" means the director of the Environmental Protection Division of the Department of Natural Resources.

12-5-521. The director shall develop river basin management plans for the following rivers: Alapaha, Altamaha, Canoochee, Chattahoochee, Coosa, Flint, Ochlocknee, Ocmulgee, Oconee, Ogeechee, St. Marys, Satilla, Savannah, Suwanee, Tallapoosa, and Tennessee. The director shall consult the chairmen of the local advisory committees on all aspects of developing the management plans. The director shall begin development of the management plan for the Chattahoochee and Flint river basins by December 31, 1992, and for the Coosa and Oconee river basins by December 31, 1993. Beginning in 1994, the director shall begin development of one management plan per calendar year until all required management plans have been begun. All management plans shall be completed not later than five years after they were begun and shall be made available to the public within 180 days after completion.

12-5-522. The management plans provided by Code Section 12-5-521 shall include, but not be limited to, the following:

(1) A description of the watershed, including the geographic boundaries, historical, current, and projected uses, hydrology, and a description of water quality, including the current water quality conditions;

(2) An identification of all governmental units that have jurisdiction over the watershed and its drainage basin;

(3) An inventory of land uses within the drainage basin and important tributaries including point and nonpoint sources of pollution;

(4) A description of the goals of the management plan, which may include educating the general public on matters involving the environmental and ecological concerns specific to the river basin, improving water quality and reducing pollution at the source, improving aquatic habitat and reestablishing native species of fish, restoring and protecting wildlife habitat, and providing recreational benefits; and

(5) A description of the strategies and measures necessary to accomplish the goals of the management plan.

12-5-523. As an initial action in the development of a management plan, the director shall appoint local advisory committees for each river basin to consist of at least seven citizens and a chairman appointed by the director. The local advisory committees shall provide advice and counsel to the director during the development of the management plan. Each committee shall meet at the call of the chairman but not less than once every four months. The chairman and members of the local advisory committees shall serve without compensation or reimbursement of expenses.

12-5-524.

(a) Upon completion of the penultimate draft of a management plan, the director shall conduct public hearings within the river basin. At least one public hearing shall be held in each river basin named in Code Section 12-5-521. The director shall publish notice of each such public hearing in a newspaper of general circulation in the area announcing the date, time, place, and purpose of the public hearing. A draft of the management plan shall be made available to the public at least 30 days prior to the public hearing. The director shall receive public comment at the public hearing and for a period of at least ten days after the public hearing.

(b) The division shall evaluate the comments received as a result of the public hearings and shall develop the final draft of the management plan for submission to the board for consideration within 60 days of the public hearing.

(c) The board shall consider the management plan within 60 days after submission by the director. The department shall publish the management plan adopted by the board and shall make copies available to all interested local governmental officials and citizens within the river basin covered by such management plan.

(d) Upon the board's adoption of a final river basin management plan, all permitting and other activities conducted by or under the control of the Department of Natural Resources shall be consistent with such plan.

(e) No provision of this article shall constitute an enlargement of the existing statutory powers of the department.

12-5-525. The director is directed to apply for the maximum amount of available funds pursuant to Sections 106, 314, 319, and 104(b)(2) of Public Law 95-217, the federal Clean Water Act, and any other available source for the development of river basin management plans."

Section 2. All laws and parts of laws in conflict with this Act are repealed.

Georgia Instream Water Quality Standards For All Waters: Toxic Substances

(Excerpt From Georgia Rules and Regulations for Water Quality Control Chapter 391-3-6-.03 Water Use Classifications and Water Quality Standards)

I Instream concentrations of the following chemical constituents which are considered to be other toxic pollutants of concern in the State of Georgia shall not exceed the criteria indicated below under 7-day, 10-year minimum flow (7Q10) or higher stream flow conditions except within established mixing zones:

1. 2,4-Dichlorophenoxyacetic acid (2,4-D) 70 µg/l
2. Methoxychlor* 0.03 µg/l
3. 2,4,5-Trichlorophenoxy propionic acid (TP Silvex) 50 µg/l

II Instream concentrations of the following chemical constituents listed by the U.S. Environmental Protection Agency as toxic priority pollutants pursuant to Section 307(a)(1) of the Federal Clean Water Act (as amended) shall not exceed criteria indicated below under 7-day, 10-year minimum flow (7Q10) or higher stream flow conditions except within established mixing zones or in accordance with site specific effluent limitations developed in accordance with procedures presented in 391-3-6-.06.

1. Arsenic
   (a) Freshwater 50 µg/l
   (b) Coastal and Marine Estuarine Waters 36 µg/l
2. Cadmium
   (a) Freshwater
   (at hardness levels less than 100 mg/l) 0.7 µg/l*
   (at hardness levels of 100 mg/l to 199 mg/l) 1.1 µg/l*
   (at hardness levels greater than or equal to 200 mg/l) 2.0 µg/l*
   Note: Total hardness expressed as $CaCO_3$.
   (b) Coastal and Marine Waters 9.3 µg/l
3. Chlordane*
   (a) Freshwater 0.0043 µg/l
   (b) Coastal and Marine Estuarine Waters 0.004 µg/l
4. Chromium (VI)
   (a) Freshwater 11 µg/l
   (b) Coastal and Marine Estuarine Waters 50 µg/l
5. Total Chromium
   (at hardness levels less than 100 mg/l) 120 µg/l
   (at hardness levels of 100 mg/l to 199 mg/l) 210 µg/l
   (at hardness levels greater than or equal to 200 mg/l) 370 µg/l
   Note: Total hardness expressed as $CaC0_3$.
6. Copper
   (a) Freshwater
   (at hardness levels less than 100 mg/l) 6.5 µg/l*
   (at hardness levels of 100 mg/l to 199 mg/l) 12 µg/l
   (at hardness levels greater than or equal to 200 mg/l) 21 µg/l
   Note: Total hardness expressed as $CaCO_3$.
   (b) Coastal and Marine Estuarine Waters 2.9 µg/l*
7. Cyanide*
   (a) Freshwater 5.2 µg/l
   (b) Coastal and Marine Estuarine Waters 1.0 µg/l
8. Dieldrin* 0.0019 µg/l
9. 4,4'-DDT* 0.001 µg/l
10. a-Endosulfan*
    (a) Freshwater 0.056 µg/l
    (b) Coastal and Marine Estuarine Waters 0.0087 µg/l
11. b-Endosulfan*
    (a) Freshwater 0.056 µg/l
    (b) Coastal and Marine Estuarine Waters 0.0087 µg/l
12. Endrin* 0.002 µg/l
13. Heptachlor*
    (a) Freshwater 0.0038 µg/l
    (b) Coastal and Marine Estuarine Waters 0.0036 µg/l
14. Heptachlor Epoxide*
    (a) Freshwater 0.0038 µg/l

(b) Coastal and Marine Estuarine Waters 0.0036 µg/l

15. Lead*
    (a) Freshwater
        (at hardness levels less than 100 mg/l) 1.3 µg/l
        (at hardness levels of 100 mg/l to 199 mg/l) 3.2 µg/l
        (at hardness levels greater than or equal to 200 mg/l) 7.7 µg/l
        Note: Total hardness expressed as $CaCO_3$.
    (b) Coastal and Marine Estuarine Waters 5.6 µg/l
16. Lindane [Hexachlorocyclohexane (g-BHC-Gamma)] 0.08 µg/l
17. Mercury*
    (a) Freshwater 0.012 µg/l
    (b) Coastal and Marine Estuarine Waters 0.025 µg/l
18. Nickel
    (a) Freshwater
        (at hardness levels less than 100 mg/l) 88 µg/l
        (at hardness levels of 100 mg/l to 199 mg/l) 160 µg/l
        (at hardness levels greater than or equal to 200 mg/) 280 µg/l
        Note: Total hardness expressed as $CaCO_3$.
    (b) Coastal and Marine Estuarine Waters 8.3 µg/l
19. Pentachlorophenol*
    (a) Freshwater 2.1 µg/l
    (b) Coastal and Marine Estuarine Waters 7.9 µg/l
20. PCB-1016 0.014 µg/l
21. PCB-1221 0.014 µg/l
22. PCB-1232 0.014 µg/l
23. PCB-1242 0.014 µg/l
24. PCB-1248 0.014 µg/l
25. PCB-1254 0.014 µg/l
26. PCB-1260 0.014 µg/l
27. Phenol 300 µg/l
28. Selenium
    (a) Freshwater 5.0 µg/l
    (b) Coastal and Marine Estuarine Waters 71 µg/l
29. Silver **
30. Toxaphene 0.0002 µg/l
31. Zinc
    (a) Freshwater
        (at hardness levels less than 100 mg/l) 60 µg/l
        (at hardness levels of 100 mg/l to 199 mg/l) 110 µg/l
        (at hardness levels greater than or equal to 200 mg/l) 190 µg/l
        Note: Total hardness expressed as $CaCO_3$.
    (b) Coastal and Marine Estuarine Waters 86 µg/l

Notes:

- The in-stream criterion is lower than the EPD laboratory detection limits.

** Numeric limits are not specified. This pollutant is addressed in 391-3-6-.06.

III Instream concentrations of the following chemical constituents listed by the U. S. Environmental Protection Agency as toxic priority pollutants pursuant to Section 307(a)(1) of the Federal Clean Water Act (as amended) shall not exceed criteria indicated below under annual average or higher stream flow conditions:

1. Acenaphthene **
2. Acenaphthylene **
3. Acrolein 780 µg/l
4. Acrylonitrile 0.665 µg/l
5. Aldrin 0.000136 µg/l
6. Anthracene 110000 µg/l
7. Antimony 4308 µg/l
8. Arsenic 0.14 µg/l
9. Benzidine 0.000535 µg/l
10. Benzo(a)Anthracene 0.0311 µg/l
11. Benzo(a)Pyrene 0.0311 µg/l
12. 3,4-Benzofluoranthene 0.0311 µg/l
13. Benzene 71.28 µg/l
14. Benzo(ghi)Perylene **
15. Benzo(k)Fluoranthene 0.0311 µg/l
16. Beryllium **
17. a-BHC-Alpha 0.0131 µg/l
18. b-BHC-Beta 0.046 µg/l
19. Bis(2-Chloroethyl)Ether 1.42 µg/l
20. Bis(2-Chloroisopropyl)Ether 170000 µg/l
21. Bis(2-Ethylhexyl)Phthalate 5.92 µg/l
22. Bromoform (Tribromomethane) 360 µg/l
23. Carbon Tetrachloride 4.42 µg/l
24. Chlorobenzene 21000 µg/l
25. Chlorodibromomethane 34 µg/l
26. 2-Chloroethylvinyl Ether **
27. Chlordane 0.000588 µg/l
28. Chloroform (Trichloromethane) 470.8 µg/l
29. 2-Chlorophenol **
30. Chrysene 0.0311 µg/l
31. Dibenzo(a,h)Anthracene 0.0311 µg/l
32. Dichlorobromomethane 22 µg/l
33. 1,2-Dichloroethane 98.6 µg/l
34. 1,1-Dichloroethylene 3.2 µg/l
35. 1,3-Dichloropropylene (Cis) 1700 µg
36. 1,3-Dichloropropylene (Trans) 1700 µg/l
37. 2,4-Dichlorophenol 790 µg/l
38. 1,2-Dichlorobenzene 17000 µg/l
39. 1,3-Dichlorobenzene 2600 µg/l
40. 1,4-Dichlorobenzene 2600 µg/l
41. 3,3'-Dichlorobenzidine 0.077 µg/l

42.	4,4'-DDT	0.00059 µg/l
43.	4,4'-DDD	0.00084 µg/l
44.	4,4'-DDE	0.00059 µg/l
45.	Dieldrin	0.000144 µg/l
46.	Diethyl Phthalate	120000 µg/l
47.	Dimethyl Phthalate	2900000 µg/l
48.	2,4-Dimethylphenol	**
49.	2,4-Dinitrophenol	14264 µg/l
50.	Di-n-Butyl Phthalate	12100 µg/l
51.	2,4-Dinitrotoluene	9.1 µg/l
52.	1,2-Diphenylhydrazine	0.54 µg/l
53.	Endrin Aldehyde	0.81 µg/l
54.	Endosulfan Sulfate	2.0 µg/l
55.	Ethylbenzene	28718 µg/l
56.	Fluoranthene	370 µg/l
57.	Fluorene	14000 µg/l
58.	Heptachlor	0.000214 µg/l
59.	Heptachlor Epoxide	0.00011 µg/l
60.	Hexachlorobenzene	0.00077 µg/l
61.	Hexachlorobutadiene	49.7 µg/l
62.	Hexachlorocyclopentadiene	17000 µg/l
63.	Hexachloroethane	8.85 µg/l
64.	Indeno(1,2,3-cd)Pyrene	0.0311 µg/l
65.	Isophorone	600 µg/l
66.	Lindane [Hexachlorocyclohexane (g-BHC-Gamma)]	0.0625 µg/l
67.	Methyl Bromide (Bromomethane)	4000 µg/l
68.	Methyl Chloride (Chloromethane)	**
69.	Methylene Chloride	†
70.	2-Methyl-4,6-Dinitrophenol	765 µg/l
71.	3-Methyl-4-Chlorophenol	**
72.	Nitrobenzene	1900 µg/l
73.	N-Nitrosodimethylamine	8.12 µg/l
74.	N-Nitrosodi-n-Propylamine	**
75.	N-Nitrosodiphenylamine	16.2 µg/l
76.	PCB-1016	0.00045 µg/l
77.	PCB-1221	0.00045 µg/l
78.	PCB-1232	0.00045 µg/l
79.	PCB-1242	0.00045 µg/l
80.	PCB-1248	0.00045 µg/l
81.	PCB-1254	0.00045 µg/l
82.	PCB-1260	0.00045 µg/l
83.	Phenanthrene	**
84.	Phenol	4,600,000 µg/l
84.	Pyrene	11,000 µg/l
85.	1,1,2,2-Tetrachloroethane	10.8 µg/l
85.	Tetrachloroethylene	8.85 µg/l
87.	Thallium	48 (6.3) µg/l ‡
88.	Toluene	200000 µg/l
89.	1,2-Trans-Dichloroethylene	**
90.	1,1,2-Trichloroethane	41.99 µg/l
91.	Trichloroethylene	80.7 µg/l
92.	2,4,6-Trichlorophenol	6.5 µg/l
93.	1,2,4-Trichlorobenzene	**
94.	Vinyl Chloride	525 µg/l

Notes:

** Numeric limits are not specified. These pollutants are addressed in 391-3-6-.06.

† EPD has proposed to the Board of Natural Resources changing numeric limits for methylene chloride from unspecified to 1600 µg/l consistent with EPA's National Toxics Rule.

‡ EPD has proposed to the Board of Natural Resources changing numeric limits for thallium from 48 to 6.3 µg/l consistent with EPA's National Toxics Rule.

IV Site specific criteria for the following chemical constituents will be developed on an as-needed basis through toxic pollutant monitoring efforts at new or existing discharges that are suspected to be a source of the pollutant at levels sufficient to interfere with designated uses:

1. Asbestos

V Instream concentrations of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) must not exceed 0.0000012 µg/l under long-term average stream flow conditions.

(e) Applicable State and Federal requirements and regulations for the discharge of radioactive substances shall be met at all times.

Point Source Control Efforts

Georgia DNR's management has promoted continuing improvement in the quality of return flows from permitted point sources in the basin. During the past twenty-five years, the majority of our municipal wastewater treatment plants were constructed or updated to meet state and/or federally mandated effluent standards. State and federal construction grants and the citizens of local municipalities funded these projects. This massive construction program has been so successful that over 90% of all these facilities in Georgia are currently meeting their effluent limits. We must protect our investments in these facilities and in the State's water quality.

The history of construction improvements for permitted dischargers within the Oconee basin is summarized in the following table:

HUC 03060102

1958	Stephens County Middle School installed a septic tank system with subsurface sand filters.
Unknown	City of Clayton installed an Imhoff Tank.
1969	Milliken & Company Humphrey Plant 3 acre pond system built by others.
1971	Stephens County High School aerated pond system constructed.
1971	City of Toccoa built two lagoon systems for $795,300.
1972	Center For Spiritual Awareness built a septic tank system for $10,000.
1972	City of Clayton installed a 0.16 MGD activated sludge package plant.
1974	Milliken & Company Avalon Plant built 0.025 MGD package plant with polishing pond for $54,000.
1989	City of Clayton installed a 0.4 MGD extended aeration activated sludge plant for $1,012,549.
1991	City of Clayton expanded their activated sludge system to treat 0.8 MGD for $525,000.
1997	City of Clayton sludge handling and disinfection systems upgraded plus new lab building and equipment for $1,369,471.
1999	City of Toccoa built the 0.41 MGD Toccoa Creek Wastewater Treatment Facility and the 2.54 MGD Eastanoolee Creek Facility for $10,000,000. These plants utilize activated sludge and ultraviolet disinfection.
1999	Center For Spiritual Awareness septic tank system cleaned and checked for $5,365.

HUC 03060103

1962	Hartwell Powerplant wastewater treatment septic tank constructed for $39,978.
1963	Milliken & Company Newton Plant spray pond built by others. Typically only discharges when drained for cleaning.

1968 Hartwell Powerplant wastewater system redirected from tailrace to a disposal field for $5,000.

1976 City of Lincolnton built a 0.26 MGD extended aeration package plant for approximately $650,000.

1989 Engelhard Corporation Hartwell Operations built physical/chemical treatment systems for more than $123,000.

1999 City of Lincolnton upgraded and expanded to 0.52 MGD activated sludge process for $2,235,000.

HUC 03060104

1966 Milliken & Company Sibley Plant built a spray pond for $20,988. The pond typically only discharges when drained for cleaning.

1970 City of Comer built an aeration cell and stabilization pond system for $250,000.

1971 City of Elberton built the Fortson Creek and Falling Creek WPCPs for $968,308. Both plants had a capacity of 0.6 MGD and utilized the extended aeration activated sludge process.

1974 Homer Housing Authority built a 0.0065 MGD septic tank/subsurface sand filter and chlorination system.

1986 City of Crawford built sedimentation lagoons.

1988 City of Royston constructed a wastewater treatment plant.

1993 Elberton Utilities upgraded and expanded the Falling Creek WPCP to 0.9 MGD for $1,031,938.

HUC 03060105

1993 City of Thomson - McDuffie County built the 0.2 MGD Mattox Creek Land Application System for $1,000,000.

HUC 03060106

1939 Fort Gordon constructed a 4 MGD trickling filter plant for $261,000.

1963 Gracewood State School and Hospital built a 0.05 MGD trickling filter treatment plant for $342,357.

1966 DSM Chemicals North America, Inc. in Augusta built an activated sludge treatment plant.

1967 City of Augusta constructed a primary treatment system for $4,536,000.

1970 Fort Gordon installed sludge drying beds for $50,000.

1972 DSM Chemicals North American, Inc. in Augusta expanded their activated sludge treatment system.

1972 Columbia County constructed the Crawford Creek WPCP activated sludge treatment system.

1973 Columbia County constructed the Reed Creek WPCP activated sludge treatment system.

1975 DSM Chemicals North America, Inc. in Augusta expanded and upgraded their activated sludge system.

1975	City of Augusta built a secondary treatment facility for $2,795,000.
1980	City of Hephzipah took operational control of a wastewater treatment system originally constructed by the Richmond County School Board for an estimated $500,000.
1982	City of Augusta built wastewater laboratory and shop for $2,190,000.
1982	Gracewood State School and Hospital upgraded their trickling filter system for $195,000.
1983	City of Augusta Phase I upgraded their treatment system for $ $11,000,000.
1984	Columbia County expanded and upgraded the Reed Creek WPCP.
1986	City of Augusta Phase II upgraded their system for $11,000,000.
1988	Columbia County built the Little River WPCP, an activated sludge treatment system.
1990	City of Augusta added equalization and centrifuges for $7,400,000.
1990	Columbia County expanded the Reed Creek WPCP.
1990	DSM Chemicals North America, Inc. in Augusta built an expansion and upgraded to tertiary treatment.
1990	Fort Gordon upgrades for $50,000.
1991	Fort Gordon grit trap added for $50,000.
1992	Fort Gordon upgraded trickling filter media for $150,000.
1992	City of Augusta generators phase I $371,800.
1992	Columbia County Crawford Creek WPCP expanded.
1994	Columbia County Reed Creek WPCP upgraded.
1994	City of Augusta generators phase II $512,679.
1995	Fort Gordon WPCP chlorination system upgraded for $12,000.
1996	Gracewood State School and Hospital upgraded with new comminutor, grit chamber and chlorination unit for $86,841.
1996	Columbia County Reed Creek WPCP added dechlorination system.
1996	City of Augusta built phase I constructed wetlands treatment system for $6,778,527.
1997	City of Augusta added a belt filter press for $60,696.
1998	City of Augusta rehabilitated the WPCP pump station for $102,985.
1998	Columbia County Crawford Creek WPCP upgraded by connecting an overflow point to the Little River WPCP collection system. The Little River WPCP expanded.
1998	City of Augusta upgraded their clarifier and disinfection system for $581,000.
1999	City of Augusta pump station rehabilitation and Phase II constructed Wetlands system for $5,501,450.
1999	Columbia County Reed Creek WPCP upgraded.

HUC 03060108

1949	City of Thomson - McDuffie County constructed Brier Creek WPCP using primary sedimentation with anaerobic digestion.
1957	City of Waynesboro built a trickling filter system.
1966	J. M. Huber Corporation built Wrens Plant Impound with thickener and 16 acre impound.
1970	City of Thomson - McDuffie County upgraded the Brier Creek WPCP to extended aeration process and expanded to 1 MGD.
1981	ECC International in Wrens constructed a physical/chemical treatment system for $525,000.
1987	City of Thomson - McDuffie County upgraded the Brier Creek WPCP with a new extended aeration system including dechlorination and post aeration for $3,000,000.
1987	City of Waynesboro WPCP expanded and upgraded for > $1,000,000.
1990	J. M. Huber Corporation installed a additional hydro-separator and switched from lime-polymer system to a polymer aided acidic system for solids removal.
1991	City of Waynesboro WPCP expanded and upgraded.
1995	ECC International in Wrens expanded their impound capacity for $385,000.

HUC 03060109

1929	Citgo Asphalt Refining Company built a oil/water separator and sand filter treatment system.
Around 1960	City of Savannah acquired the Travis Field WPCP from the US Army to serve a small portion of west Chatham County.
1968	International Paper built a solids removal system consisting of primary clarification and sludge dewatering for $354,300.
1970	Hercules Incorporated separated sewers from storm sewers and installed an oil/water separator.
1972	Hercules Incorporated installed a secondary treatment system.
1972	City of Savannah Travis Field 0.75 MGD activated sludge WPCP built.
1973	International Paper added an aerated stabilization basin for $6,117,000.
1974	City of Savannah constructed the 20 MGD President Street WPCP activated sludge system and the 3 MGD Wilshire WPCP.
1974	City of Tybee Island extended aeration WPCP built for $2,000,000.
1974	Garden City 1 MGD extended aeration WPCP built for $600,000.
1975	International Paper rehabilitated pumps for $28,000.
1976	Gulfstream Aerospace Corporation built a physical/chemical treatment system for $300,000.
1976	Hercules Incorporated installed clarifier and thickener.

1978	Hercules upgraded their aerated lagoon.
1980s	Hercules increased contaminated stormwater holding capacity.
1984	City of Savannah President Street WPCP upgraded by adding a belt press.
1985	City of Pooler/Bloomingdale built an overland flow treatment system.
1985	Gulfstream Aerospace Corporation WPCP upgraded by adding sand and carbon filters and plate and frame filter presses for $200,000.
1986	International Paper added aerators to aerated stabilization basin for $262,000.
1987	Fort James Corporation Savannah River Mill constructed an activated sludge process WPCP for $16,030,000.
1987	International Paper replaced centrifuge with four screw presses for $1,600,000.
1988	City of Savannah Travis Field WPCP discharge moved to Savannah River.
1988	City of Savannah President Street WPCP ash lagoon discharges capped and flow diverted to head of plant. Four WPCPs closed (Wilmington Park, Islandwood, Cloverdale and Seagate) and their flows pumped to President Street plant.
1989	City of Savannah President Street incinerators upgraded for $ 10,000,000.
1989	City of Savannah Wilshire WPCP expanded to 4.5 MGD and upgraded to activated sludge system and discharge moved to the Savannah River.
1989	International Paper replaced influent and effluent lines to aerated stabilization basin for $4,289,000.
1989	Fort James WPCP upgraded for $2,700,000.
1989	Atlantic Wood Industries constructed a groundwater extraction and treatment system for $60,000.
1990	Atlantic Wood Industries system upgraded with the addition of a polymer system and two larger oil/water separators for $120,000.
1990	Fort James WPCP upgraded by adding a second secondary clarifier, another sludge press and tertiary filters for $5,270,000.
1992	International Paper added: seven aerators to aerated stabilization basin, baffle curtains and nutrient addition system for $1,292,000.
1995	City of Savannah President Street WPCP expanded to 27 MGD and upgraded.
1995	City of Tybee Island WPCP upgraded with automatic bar screen and odor control system for $350,000.
1996	Gulfstream Aerospace Corporation WPCP upgraded by adding: equalization, ultraviolet-peroxide oxidation system, lamella clarifier, upflow sand filter, and air stripper for $838,000.
1996	City of Savannah Travis Field WPCP activated sludge system upgraded and expanded to 1.5 MGD for $2,300,000. Discharge moved to Savannah River.
1997	Atlantic Wood Industries system upgraded by adding an oxidation system that uses hydrogen sulfide and ozone.

1997	City of Savannah President Street WPCP upgraded with belt filter presses and a dissolved air floatation system for more than $3,000,000.
1998	International Paper a carbon dioxide neutralization system for $115,000.
1998	City of Savannah President Street WPCP upgraded to treat 2.5 MGD of flow to reuse standards and irrigate the Savannah Harbor Golf Club for $1,150,000.
1998	City of Savannah Wilshire WPCP solids handling system upgraded.
1999	Hercules rehabilitated their clarifiers and installed a new oil recovery system.

NPDES Permits for Discharges in the Savannah River Basin

FACILITY NAME	NPDES #	PERMITTED FLOW (MGD)	MAJOR	COUNTY	RECEIVING STREAM
A&M PRODUCTS INC	GA0036811			JEFFERSON	JORDAN CR
AIR LIQUID AMERICA CORP	GA0046230			CHATHAM	SAVANNAH RV
ALBION KAOLIN COMPANY	GA0002470			RICHMOND	GRINDSTONE BR
AONIA WTP	GAWP10000			WILKES	UPTON CR
ARCADIAN FERTILIZER L.P.	GA0002071		Y	RICHMOND	SAVANNAH RV
ARMY COE (HARTWELL POWERPLANT)	GA0037516			HART	SAVANNAH RV
ARMY COE (R.RUSSEL POWERPLANT)	GA0037524			ELBERT	CLARKS HILL LAKE
ATHENS YMCA CAMP TALLULAH	GA0034339			RABUN	TRIB TO TALLULAH FALLS LAKE
ATLANTIC WOOD IND	GA0047783			CHATHAM	SAVANNAH RV
AUGUSTA BUTLER CREEK	GA0037621	46.100	Y	RICHMOND	BUTLER CR
AUGUSTA WTP	GA0046957	0000.000		RICHMOND	OATES CRK TRIB. TO BUTLER
BANKS CO ELEM SCHOOL	GA0033871	0.006		BANKS	HUDSON RV TRIB
BANKS CO MOUNTAIN CR WTP	GAWP10000			BANKS	
BIG A ELEM SCHOOL	GA0033855			STEPHENS	WARDS CR
BOWMAN POND	GA0021067	0.090		ELBERT	FORT CR
BUDGET INN SAVANNAH	GA0034096	0.023		CHATHAM	SPRINGFIELD CANAL
C. E. MINERALS	GA0035742			LINCOLN	LLOYDS CR/LITTLE RV
CAMP CHATTOOGA	GA0033961	0.006		RABUN	TALLULAH FALLS LAKE

FACILITY NAME	NPDES #	PERMITTED FLOW (MGD)	MAJOR	COUNTY	RECEIVING STREAM
CARNESVILLE WPCP	GA0035734	0.075		FRANKLIN	STEPHENS CR
CENTER FOR SPIRITUAL AWARE	GA0022403	0.004		RABUN	LAKE RABUN TRIB
CENTRAL OF GEORGIA R/R	GA0002381			CHATHAM	OGEECHEE CANAL TO SAVANNAH RV
CITGO ASPHALT REFINING CO	GA0004332			CHATHAM	SAVANNAH RV
CLAYTON WPCP	GA0020923	0.800		RABUN	STEKOA CREEK TRIBUTARY
COATS AMERICAN INC	GA0002038		Y	STEPHENS	EASTANOLLEE CR
COLUMBIA CO CRAWFORD	GA0031984	1.500	Y	COLUMBIA	CRAWFORD CR
COLUMBIA CO HEALTH DEPT	GA0049735			COLUMBIA	KIOKEE CR
COLUMBIA CO LITTLE RIVER	GA0047775	1.500	Y	COLUMBIA	SAVANNAH RIVER
COLUMBIA CO REED	GA0031992	4.600	Y	COLUMBIA	REED CR
COLUMBIA CO WTP	GAWP10000			COLUMBIA	SAVANNAH RV
COMBUSTION ENG GRAVES MT	GA0035742			LINCOLN	
COMER POND	GA0021598	0.090		MADISON	SOUTH FORK BROAD RIVER TR
COMMERCE DAVIS HOUSE	GA0032646	0.067		BANKS	CROOKED CREEK TRIB
COMMERCE HOLIDAY INN	GA0032638	0.040		BANKS	CROOKED CREEK TRIB
COMMERCE NORTHSIDE	GA0026247	1.050	Y	JACKSON	BEAVER DAM CR TRIB
CRAWFORD EASTSIDE WPCP	GA0033693	0.030		OGLETHORPE	GROVE CRK TRIB. TO BROAD
CRAWFORD WTP	GAWP10000	0000.000		OGLETHORPE	UNNAMED TRIB TO LONG CRK
CSR AGGREGATES RICHMOND	GA0037231			RICHMOND	PHINZY DITCH
CSX TRANSPORTATION INC	GA0046167			ELBERT	UNNAMED TRIB TO BEAVERDAM CR
DANIELSVILLE	GA0048224	0.075		MADISON	SOUTH FORK BROAD RV
DAVIDSON MINERAL PROP STEPHEN	GA0036773			STEPHENS	NORTH FORK/BROAD RV
DHR GRACEWOOD HOSPITAL WTP	GA0022161	0.500		RICHMOND	SPIRIT CR

FACILITY NAME	NPDES #	PERMITTED FLOW (MGD)	MAJOR	COUNTY	RECEIVING STREAM
DHR GRACEWOOD SCH REC WPCP	GA0047279	0.003		COLUMBIA	CLARK HILL RES TRIB
DIT SRA#112/I-75 VISITOR	GA0033278	0.015		CHATHAM	KNOXBORO CR TRIB
DIT SYLVANIA WELCOME STAT	GA0030287	0.015		SCREVEN	SAVANNAH RV
DNR ELIJAH CLARK STATE PA	GA0032701	0.046		LINCOLN	CLARK HILL RESERVOIR
DNR HART STATE PARK	GA0049972	0.007		HART	LAKE HARTWELL
DNR MISTLETOE STATE PARK	GA0049425	0.027		COLUMBIA	CLARK HILL RESERVOIR
DNR TUGALOO STATE PARK	GA0033260	0.003		FRANKLIN	LAKE HARTWELL
DOGWOOD LANE MHP TOCCOA	GA0034282	0.020		STEPHENS	OGGS BRANCH TRIB
DOT REST AREA #81/FRANKLI	GA0023621	0.015		FRANKLIN	INDIAN CR
DOT REST AREAS #62&#63	GA0047325	0.020		COLUMBIA	
DSM CHEMICALS AUGUSTA INC	GA0002160		Y	RICHMOND	SAVANNAH RV
E.M. INDUSTRIES INC	GA0034355			CHATHAM	SAVANNAH RV
EASTANOLLEE ELEM SCHOOL	GA0033863			STEPHENS	EASTANOLLEE CR
ECC INTERNATIONAL WRENS	GA0048101			JEFFERSON	RAYBURN BR
EFFINGHAM ELEM SOUTH	GA0046990	0.015		EFFINGHAM	UNNAMED TRIB TO BLACK CRE
ELBERTON FALLING CR	GA0025682	0.900		ELBERT	FALLING CREEK TRIB
ELBERTON FORTSON CR	GA0025631	0.600		ELBERT	FORTSON CR TRIB
ENGELHARD CORP CHATHAM	GA0048330			CHATHAM	SAVANNAH RV
FORT HOWARD CORP	GA0046973		Y	EFFINGHAM	SAVANNAH RV
FRANKLIN CO HIGH SCHOOL	GA0034231			FRANKLIN	STEPHEN CR-BROAD RV
FRANKLIN SPRINGS POND	GA0050172	0.100		FRANKLIN	HAYNES CR TRIB
GAF CORP SAVANNAH PLT	GA0003841			CHATHAM	SAVANNAH RV
GARDEN CITY WPCP	GA0031038	2.000	Y	CHATHAM	SAVANNAH RV

FACILITY NAME	NPDES #	PERMITTED FLOW (MGD)	MAJOR	COUNTY	RECEIVING STREAM
GEORGIA BAPTIST ASSEMBLY	GA0034169	0.025		STEPHENS	LAKE LOUISE
GEORGIA PACIFIC CORP	GA0047007			CHATHAM	SAVANNAH RV
GEORGIA PACIFIC GYPSUM	GA0001961			CHATHAM	SAVANNAH RV
GEORGIA POWER TALLULAH	GA0004162			HABERSHAM	TALLULAH RV
GEORGIA POWER TUGALO	GA0004189			HABERSHAM	TUGALO RV
GEORGIA POWER VOGTLE	GA0026786		Y	BURKE	SAVANNAH RV
GEORGIA POWER YONAH	GA0004197			STEPHENS	TUGALO RV
GULFSTREAM AEROSPACE CORP	GA0003255			CHATHAM	PIPE MAKERS CL
HARBOR LIGHT MARINA	GA0025321	0.005		HART	LAKE HARTWELL
HARLEM WPCP	GA0020389	0.250		COLUMBIA	UCHEE CR
HARTWELL WPCP	GA0020885	1.250	Y	HART	CEDAR CR TRIB
HEARDMONT NURSING HOME	GA0022276	0.012		ELBERT	BERTRAM CR
HEPHZIBAH WPCP	GA0049433	0.080		RICHMOND	LITTLE SPIRIT CR TRIB
HERCULES	GA0026867			CHATHAM	DUNDEE CL
HERTY FOUNDATION SAVANNAH	GA0002402			CHATHAM	DUNDEE CANAL
HOMER HOUSING AUTHORITY	GA0030031	0.007		BANKS	BLUE POND CR
HUNT WESSON	GA002399			CHATHAM	
INTERMARINE USA	GA0003671			CHATHAM	SAVANNAH RV
INTERNATIONAL PAPER CO	GA0037711			BURKE	TRIB TO MCBEAN CR
INTERNATIONAL PAPER COMPANY	GA0002801		Y	RICHMOND	SAVANNAH RV
KEMIRA	GA0003646		Y	CHATHAM	SAVANNAH RV
KING DIVISION OF SPARTAN MILLS	GA0004049			RICHMOND	SAVANNAH RV
LAKE BURTON HATCHERY	GA0029840			RABUN	LAKE BURTON
LAVONIA WPCP	GA0047589	1.320	Y	FRANKLIN	BEAR CR TO UNAWATTI TRIB

FACILITY NAME	NPDES #	PERMITTED FLOW (MGD)	MAJOR	COUNTY	RECEIVING STREAM
LEE ARRENDALE CORR INST	GA0022209	0.250		HABERSHAM	TRIB TO HUDSON RV
LINCOLN CO WTP	GAWP10000			LINCOLN	
LINCOLNTON WPCP	GA0049450	0.260		LINCOLN	REEDY CR TRIB
MARTIN MARIETTA AGGR	GA0002909			RICHMOND	SAVANNAH RV
MARTIN MARIETTA CAMAK QUARRY	GA0002321			WARREN	MIDDLE CR
MARTIN MARIETTA HOMER QUARRY	GA0046213			BANKS	UNNAMED TRIB/HUDSON RV
MARTIN MARIETTA MATL INC	GA0037346			COLUMBIA	LITTLE KIOKEE CR
MEARL CORP	GA0031011			HART	BOYD CR/CEDAR CR
MEARL CORPORATION	GA0046221			HART	CEDAR CR
MILLIKEN	GA0024368			STEPHENS	BIG TOMS CR TRIB
MILLIKEN & CO NEWTON PLANT	GA0035637			HART	FOREST CR
MILLIKEN & COMPANY	GA0024643			STEPHENS	DICKS CR
MILLIKEN SIBLEY MILL	GA0024627			FRANKLIN	SHOAL CR
NANCY HART INTERMED CARE	GA0031232			ELBERT	BROAD RV
OGLETHORPE CO BD OF ED	GA0045977	0.010		OGLETHORPE	UNNAMED TRIB. TO BROOKS C
OGLETHORPE CO BD OF ED	GA0045969	0.010		OGLETHORPE	UNNAMED TRIB. TO INDIAN C
OLIN CORPORATION AUGUSTA	GA0003719			RICHMOND	SAVANNAH RV
PCS NITROGEN FERTILIZER LP	GA0002356		Y	CHATHAM	SAVANNAH RV
PERIDOT CHEMICALS	GA0002925			RICHMOND	SAVANNAH RV
PINE FOREST S/D PORT WENT	GA0034801	0.040		CHATHAM	BLACK CR
POOLER/BLOOMINGDALE REG	GA0047066	0.980		CHATHAM	HARDIN CANAL
RICHMOND CO SPIRIT CR	GA0047147	2.240	Y	RICHMOND	SPIRIT CRK TRIB/ SAV. RV
RINCON	GA0046442	0.500		EFFINGHAM	SWEIGOFFER CRK TRIB/ MILL
ROYSTON WPCP	GA0021491	0.500		FRANKLIN	HANNAH CR
S.R. 56 WTP	GAWP10000			BURKE	

FACILITY NAME	NPDES #	PERMITTED FLOW (MGD)	MAJOR	COUNTY	RECEIVING STREAM
SARDIS WPCP	GA0020893	0.100		BURKE	CHANDLER MILL BR
SAVANNAH ELEC EFFINGHAM	GA0003883		Y	EFFINGHAM	SAVANNAH RV
SAVANNAH ELEC RIVERSIDE	GA0003751			CHATHAM	SAVANNAH RV
SAVANNAH ELEC WENTWORTH	GA0003816			CHATHAM	SAVANNAH RV
SAVANNAH ELECTRIC & POWER CO	GA0047708			CHATHAM	SPRINGFIELD CANAL TO SAVANNAH RV
SAVANNAH PRESIDENT ST	GA0025348	27.000	Y	CHATHAM	SAVANNAH R.
SAVANNAH SUGAR REFINERY	GA0003611			CHATHAM	SAVANNAH RV
SAVANNAH TRAVIS FIELD	GA0020427	1.000	Y	CHATHAM	SAVANNAH RV
SAVANNAH WILSHIRE/WINDSOR	GA0020443	4.500	Y	CHATHAM	VERNON RV
SAVANNAH WTP	GAWP10000			CHATHAM	ST. AUGUSTINE CR
SAVANNAH YACHT CLUB	GA0033189			CHATHAM	WILMINGTON RV
SNYDER BROTHERS	GA0032123			STEPHENS	TRIB TO CARNES CR
SOLUTIA INC	GA0002178			RICHMOND	BUTLER CR
SOUTH CAROLINA ELECTRIC	GA0003786			RICHMOND	SAVANNAH RV
SOUTHERN AGGREGATES COLUMBIA	GA0036790			COLUMBIA	LITTLE KIOKEE CR
SOUTHERN STATES PHOSP & FERTIL	GA0002437			CHATHAM	KAYTON CANAL TO SAV RV
SPRINGFIELD	GA0020770	1.500		EFFINGHAM	EBENEZER CR
STEPHENS CO HIGH SCHOOL	GA0049042			STEPHENS	EASTANOLLEE CR
STONE CONTAINER CORP	GA0002798		Y	CHATHAM	SAVANNAH RV
SYLVANIA WPCP	GA0021385	1.510	Y	SCREVEN	BUCK CR
TALLULAH FALLS SCHOOL	GA0035441	0.005		HABERSHAM	TALLULAH RV
THERMAL CERAMICS INC	GA0002488			RICHMOND	ROCKY CR
THIELE KAOLIN HOBBS	GA0032981			WARREN	BIG BRANCH TO BRIER CR
THOMSON WPCP	GA0020974	2.500	Y	MCDUFFIE	WHITES CR

FACILITY NAME	NPDES #	PERMITTED FLOW (MGD)	MAJOR	COUNTY	RECEIVING STREAM
TIGNALL	GA0046141			WILKES	TANYARD BR
TOCCOA CREEK	GA0021806	0.410		STEPHENS	TOCCOA CR TO TUGALOO RIVE
TOCCOA EASTANOLLEE CR	GA0021814	1.450	Y	STEPHENS	EASTANOLLEE CR TO TUGALOO
TOCCOA FALLS COLLEGE	GA0025798	0.093		STEPHENS	TOCCOA FALLS CREEK
TOCCOA WTP	GAWP10000	0000.000		STEPHENS	TOCCOA CR
TYBEE ISLAND	GA0020061	1.000	Y	CHATHAM	SAVANNAH RV
UNION CAMP CORPORATION	GA0001988		Y	CHATHAM	SAVANNAH RV
USA FT GORDON	GA0003484		Y	RICHMOND	BUTLER CR-SPIRIT CR
USA HUNTER AFB STP	GA0027588		Y	CHATHAM	FORREST RV
USRY POND WTP	GAWP10000			MCDUFFIE	
WASHINGTON WPCP	GA0031101	4.000	Y	WILKES	ROCKY CR
WAYNESBORO WPCP	GA0020231	2.000	Y	BURKE	MCINTOSH CREEK TRIB
WRENS WPCP	GA0021857	0.480		JEFFERSON	BRUSHY CR

Support of Designated Uses for Rivers, Streams, and Lakes in the Savannah River Basin, 1998-1999

Rivers/Streams Supporting Designated Uses

BASIN/STREAM (Data Source)	LOCATION	WATER USE CLASSIFICATION	MILES
SAVANNAH RIVER BASIN			
HUC 03060102			
Chattooga River (1,31)	Stateline to Lake Tugaloo (Rabun Co.)	Wild/Scenic	36
Coleman River (4)	Tributary to Tallulah River (Rabun Co.)	Fishing	5
Davidson Creek (4)	Tributary to Panther Creek near Tallulah Falls (Habersham/Stephens Co.)	Fishing	6
Holcomb Creek (4)	Headwaters to Billingsley Creek (Rabun Co.)	Fishing	4
Hoods Creek (4)	Headwaters to Walnut Fork (Rabun Co.)	Fishing	3
Little Toccoa Creek (4)	Tributary to Toccoa Creek, Toccoa (Stephens Co.)	Fishing	4
Moccasin Creek (4)	Tributary to Lake Burton (Rabun Co.)	Fishing	5
Panther Creek (1,4)	Upstream Lake Yonah (Habersham/Stephens Co.)	Fishing	9
Sarahs Creek (4)	Headwaters to Rd. S 884 (Rabun Co.)	Fishing	5
Tallulah River (1)	Upstream Lake Burton (Rabun Co.)	Fishing	11
Tiger Creek (4)	Headwaters to Pole Bridge Creek near Clayton (Rabun Co.)	Fishing	8
Toccoa Creek (4)	Stephens County	Fishing	5

BASIN/STREAM (Data Source)	LOCATION	WATER USE CLASSIFICATION	MILES
Walnut Fork (4)	Headwaters to Hoods Creek (Rabun Co.)	Fishing	4
Warwoman Creek (4)	Finney Creek to Sarah's Creek (Rabun County)	Fishing	6
Wildcat Creek (4)	Headwaters to SR 197 (Rd. S874) (Rabun Co.)	Fishing	6
HUC 03060103			
Pistol Creek (1)	Headwaters to Clarks Hill Lake near Tignall (Wilkes/Lincoln Co.)	Fishing	8
Savannah River (1)	Hwy. 368 to Coldwater Creek (Elbert Co.)	Recreation	6
HUC 03060104			
Bear Creek (1)	SCS Pond to Unawatti Creek, Lavonia (Franklin Co.)	Fishing	1
Bear Creek (1)	Lavonia	Fishing	1
Beaverdam Creek (1)	Commerce	Fishing	5
Broad River (1)	Hwy. 77 to Clarks Hill Lake (Elbert Co.)	Fishing	24
Hannah Creek (1)	Royston to Broad River (Franklin/Madison Co.)	Fishing	8
Little Bear Creek (1)	Tributary to Unawatti Creek, Lavonia (Franklin Co.)	Fishing	1
Middle Fork Broad River (4)	Dicks Creek to upstream Lake Russell (Stephens Co.)	Fishing	4
North Fork Broad River (4)	Habersham/Stephens Co. Line to Old Rock Quarry Rd. near Toccoa (Stephens Co.)	Fishing	5
Unawatti Creek (1)	Downstream Lavonia	Fishing	6
HUC 03060105-None			
HUC 03060106			
Butler Creek (1)	Boardmans Pond to SR56, South Augusta (Richmond Co.)	Fishing	8
Crawford Creek (1,2)	Downstream Columbia Co. WPCP to Tudor Branch	Fishing	2
Grindstone Branch (1)	Rhodes Pond to Spirit Creek, Hephzibah (Richmond Co.)	Fishing	1

BASIN/STREAM (Data Source)	LOCATION	WATER USE CLASSIFICATION	MILES
Kiokee Creek (1)	Greenbrier Creek to Savannah River near Evans (Columbia Co.)	Fishing	6
McBean Creek (1)	Poorly Branch to Savannah River (Richmond/Burke Co.)	Fishing	14
Phinizy Ditch (1)	Augusta (Richmond Co.)	Fishing	2
Savannah River (1,31)	Johnsons Landing to Brier Creek (Screven Co.)	Fishing/Drinking Water	26
Spirit Creek (1)	Marcum Branch to McDade Pond (Richmond Co.)	Fishing	14
HUC 03060108			
Beaverdam Creek (1)	McDonald Branch to Brier Creek, near Sylvania (Screven Co.)	Fishing	5
HUC 03060109			
St. Augustine Creek (1)	Walthour Swamp to Front River near Port Wentworth (Effingham/Chatham Co.)	Fishing	7

Rivers/Streams Partially Supporting Designated Uses

BASIN/STREAM (Data Source)	LOCATION	WATER USE CLASSIFICATION	CRITERION VIOLATED	EVALUATED CAUSE(S)	ACTIONS TO ALLEVIATE	MILES	305(b)	303(d)	Priority
SAVANNAH RIVER BASIN									
HUC 03060102									
Toccoa Creek (1)	Little Toccoa Creek to Lake Hartwell (Stephens Co.)	Fishing	FC	M,UR	City of Toccoa's overflowing manholes is being addressed through State & Federal enforcement actions. EPD will address nonpoint source (urban runoff) through a watershed protection strategy.	3	X	X	3
Warwoman Creek (1)	Sarah's Creek to Chattooga River (Rabun Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	4	X	X	3
West Fork Chattooga River (1,4)	Rabun County	Wild/Scenic	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	6	X	X	3
HUC 03060103									
Cedar Creek (1,2)	Downstream Hartwell WPCP to Little Cedar Creek (Hart Co.)	Fishing	Zn	M	Hartwell constructed land application system and eliminated discharge 8/99.	8	X	X	2
Reed Creek (1)	Upstream Lake Hartwell (Hart Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	5	X	X	3
Savannah River (1,11,31)	Lake Hartwell to Lake Russell (Hart/Elbert Co.)	Recreation	DO	Dam Release	Dam Release. EPD will continue to work with the Corps of Engineers to assess and implement feasible actions.	8	X	3	2
HUC 03060104									
Beaverdam Creek (1)	Downstream Commerce (Jackson Co.)	Fishing	DO	M	Commerce in compliance with permit limits. Model predicts dissolved oxygen violations at low flows. Georgia transmitted TMDL to EPA 2/00.	1	X	3	1
Broad River (1)	SR 281 to Scull Shoal Creek near Danielsville (Madison Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	5	X	X	3
Crawford Creek (1)	Upstream Lake Hartwell near Lavonia (Franklin Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	4	X	X	3

BASIN/STREAM (Data Source)	LOCATION	WATER USE CLASSIFICATION	CRITERION VIOLATED	EVALUATED CAUSE(S)	ACTIONS TO ALLEVIATE	MILES	305(b)	303(d)	Priority
HUC 03060105									
Little River (1)	Kettle Creek to Rocky Creek (Wilkes Co.)	Fishing	FCG	NP	EPD will address nonpoint sources through a watershed protection strategy. Note: Fish Consumption Guidelines due to mercury in fish tissue.	23	X	X	3
Little River (1)	Rocky Creek to Clarks Hill Lake (Wilkes Co.)	Fishing	FC,FCG	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy. Note: Fish Consumption Guidelines due to mercury in fish tissue.	8	X	3,X	3
Rocky Creek (1,2,9)	Washington to Little River (Wilkes Co.)	Fishing	Bio	UR	EPD will address nonpoint sources (urban runoff) through a watershed protection strategy.	12	X	X	3
HUC 03060106									
Jones Creek (2)	Tributary to Savannah River near Evans (Columbia Co.)	Fishing	FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy. Columbia Co. has applied for an areawide stormwater permit.	3	X	3	3
Reed Creek (2)	Bowen Pond to Savannah River (Columbia Co.)	Fishing	FC	UR	EPD will address nonpoint sources (urban runoff) through a watershed protection strategy. Columbia Co. has applied for an areawide stormwater permit.	1	X	3	3
Savannah River (1,11,30)	Clarks Hill Lake to Stevens Creek Dam (Columbia Co.)	Fishing	DO,FCG	Dam Release,NP	Dam Release. EPD will address nonpoint sources through a watershed protection strategy. Note: Fish consumption guidelines due to mercury in fish tissue.	9	X	3,X	2,3
Savannah River (1,30)	Stevens Creek Dam to US Hwy 78/278 (Columbia/Richmond Co.)	Drinking Water	DO,FCG,FC	Dam Release,UR	Dam Release. EPD will address nonpoint sources (urban runoff) through a watershed protection strategy. Note: Fish consumption guidelines due to mercury in fish tissue.	9	X	3,X	2,3
Savannah River (1)	US Hwy. 78/278 to Johnsons Landing (Richmond/Burke/Screven Co.)	Fishing	FCG	NP	EPD will address nonpoint sources through a watershed protection strategy. Fish consumption guidelines due in part to natural source of mercury.	78	X	X	3

BASIN/STREAM (Data Source)	LOCATION	WATER USE CLASSIFICATION	CRITERION VIOLATED	EVALUATED CAUSE(S)	ACTIONS TO ALLEVIATE	MILES	305(b)	303(d)	Priority
Spirit Creek (1)	McDade Pond to Savannah River (Richmond Co.)	Fishing	FC	UR	Urban runoff is being addressed in the EPD Stormwater Management Strategy. An areawide stormwater permit was issued to Augusta/Richmond County on 4/20/95.	7	X	X	3
HUC 03060108									
Brier Creek (1)	Hwy 305 to Savannah River (Burke/Screven Co)	Fishing	FCG	NP	EPD will address nonpoint sources through a watershed protection strategy. Note: Fish Consumption Guidelines due to mercury in fish tissue.	45	X	X	3
Brushy Creek (1)	SR 80 (Rd. S1571) west Wrens to Brier Creek (Jefferson/Burke Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	15	X	X	3
Reedy Creek (1)	Warren Co. line to Brier Creek near Wrens (Jefferson Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	12	X	X	3
Whites Creek (1)	Downstream Thomson WPCP (McDuffie Co.)	Fishing	Tox	M	Thomson under Order to meet whole effluent toxicity & TRC limits by 5/99. Paying stipulated penalities for not meeting permit requirements.	2	X	3	2
HUC 03060109									
Pipemaker Canal (1)	Walthour Creek to Confluence with Savannah River (Effingham/Chatham Co.)	Fishing	FCG	NP	EPD will address nonpoint sources through a watershed protection strategy. Fish consumption guidelines due in part to natural source of mercury.	13	X	X	3
Savannah River (1,10)	Brier Creek to Tide Gate (Screven/Effingham/Chatham Co.)	Fishing/Drinking Water/Coastal Fishing	FCG	NP	EPD will address nonpoint sources through a watershed protection strategy. Fish consumption guidelines due in part to natural source of mercury.	84	X	X	3

*Indicates minimal data set.

Criterion Violated Codes (Column 4)

Bio	=	Biota Impacted
Cd	=	Cadmium
Cu	=	Copper
DO	=	Dissolved Oxygen
FC	=	Fecal Coliform Bacteria
FCG	=	Fish Consumption Guidelines
Hg	=	Mercury
Pb	=	Lead
Temp	=	Temperature
Tox	=	Toxicity Indicated
Zn	=	Zinc
*	=	Minimal Database

Evaluated Cause Codes (Column 5)

CSO	=	Combined Sewer Overflow
Dam Release		
I1	=	Industrial Facility
M	=	Municipal Facility
NP	=	Nonpoint Sources/ Unknown Sources
UR	=	Urban Runoff/Urban Effects

Rivers/Streams Not Supporting Designated Uses

BASIN/STREAM (Data Source)	LOCATION	WATER USE CLASSIFICATION	CRITERION VIOLATED	POTENTIAL CAUSE(S)	ACTIONS TO ALLEVIATE	MILES	305(b)	303(d)	Priority
SAVANNAH RIVER BASIN									
HUC 03060102									
Eastanollee Creek (1,2,3)	Toccoa to Lake Hartwell (Stephens Co.)	Fishing	Zn,FC,Cu,Tox	M,UR,I1	City of Toccoa's overflowing manholes is being addressed through State & Federal enforcement actions. The permit for Toccoa Eastanollee Cr. WPCP contains a limit for Cu and requires Zn monitoring for future evaluation. EPD will address nonpoint source (urban runoff) through a watershed protection strategy. Coats American under order. Toxicity to be addressed through construction of a wetlands system scheduled for completion 9/1/99. Wetlands system completed but not operating at design yet. Failed WET test 12/99.	14	X	3,X	2
Shoal Creek (1)	Pooles Creek to Lake Hartwell, Parkertown (Hart Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	1	X	X	3
Stekoa Creek (1)	Clayton to Chattooga River (Rabun Co.)	Fishing	FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy.	14	X	3	3
HUC 03060103									
Beaverdam Creek (1)	Confluence of North & South Beaverdam Creeks to Savannah River near Elberton (Elbert Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	22	X	X	3
Cedar Creek (1)	Little Cedar Creek to Savannah River near Montevideo (Hart Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	4	X	X	3
Cold Water Creek (1)	SR 77 to Little ColdWater Creek near Ruckersville(Elbert Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	6	X	X	3
Fortson's Creek (2)	Elberton to Beaverdam Creek (Elbert Co.)	Fishing	FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy.	4	X	3	3

BASIN/STREAM (Data Source)	LOCATION	WATER USE CLASSIFICATION	CRITERION VIOLATED	POTENTIAL CAUSE(S)	ACTIONS TO ALLEVIATE	MILES	305(b)	303(d)	Priority
HUC 03060104									
Bear Creek (1)	Downstream Lavonia WPCP (Franklin Co.)	Fishing	DO	M	Lavonia in compliance with permit. Under schedule to meet total residual chlorine limit by 6/2/99 and BOD & ammonia 6/2/2000. Georgia transmitted TMDL to EPA 02/00.	2	X	3	1
Clark Creek (1)	Greensboro Branch to Long Creek near Tignall (Wilkes Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	6	X	X	3
Falling Creek (1)	Dry Fork Creek to Broad River near Fortsonia (Elbert Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	4	X	X	3
Hudson River (1)	Mountain Creek to Webb Creek near Homer (Banks Co.)	Fishing	FC	UR,M	EPD will address nonpoint source (urban runoff) through a watershed protection strategy. The Homer Housing Authority has installed an upgraded chlorination system.	13	X	X	3
Hudson River (1)	Black Creek to Nails Creek near Fort Lamar (Franklin/Madison Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	8	X	X	3
Middle Fork Broad River (1)	Nancy Town Creek to Hunters Creek (Banks/Franklin Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	13	X	X	3
No. Fork Broad River (1)	Unawatti Creek to Broad River near Carnesville (Franklin Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	5	X	X	3
So. Fork Broad River (1)	Brush Creek to Beaverdam Creek near Comer (Madison Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	3	X	X	3
So. Fork Broad River (1)	Clouds Creek to Fork Creek near Carlton (Madison/Oglethorpe Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	7	X	X	3

BASIN/STREAM (Data Source)	LOCATION	WATER USE CLASSIFICATION	CRITERION VIOLATED	POTENTIAL CAUSE(S)	ACTIONS TO ALLEVIATE	MILES	305(b)	303(d)	Priority
HUC 03060105									
Little River (1)	Confluence of N. & S. Forks to Kettle Creek near Washington (Taliaferro/Wilkes Co.)	Fishing	FC,FCG	NP	EPD will address nonpoint sources through a watershed protection strategy. Note: FCG is a partial support. Fish consumption guidelines due to mercury in fish tissue.	6	X	X	3
Middle Creek (1)	Childers Creek to Big Creek (trib. to Clark Hill Lake), near Wrightsboro (McDuffie Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	6	X	X	3
HUC 03060106									
Butler Creek (1)	Phinizy Ditch to Savannah River, Augusta (Richmond Co.)	Fishing	DO,FC,Se	M,UR	Augusta under A.O. to improve WPCP O&M. Phase II of the wetlands system is to be completed by 10/1/2000. Urban runoff is being addressed in the EPD Stormwater Management Strategy. An areawide stormwater permit was issued to Augusta/Richmond County on 4/20/95.	3	X	3,X	2
Reed Creek (1)	Rd. S1727 to Bowen Pond near Martinez (Columbia Co.)	Fishing	FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy. Columbia County has applied for an areawide stormwater permit.	8	X	3	3
Rocky Creek (1)	SR 56 to below New Savannah Road, Augusta (Richmond Co.)	Fishing	FC,Tox	UR,I2	Urban runoff is being addressed in the EPD Stormwater Management Strategy. An areawide stormwater permit was issued to Augusta/Richmond County on 4/20/95. Southern Wood Piedmont site under remediation.	2	X	3,X	2
Uchee Creek (1)	Tudor Branch to upstream Little River near Evans (Columbia Co.)	Fishing	FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy. Columbia County has applied for an areawide stormwater permit	3	X	X	3
HUC 03060108									
Brier Creek (1)	Big Brier Creek to Sweetwater Creek near Thomson (McDuffie Co.)	Fishing	FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	3	X	X	3

BASIN/STREAM (Data Source)	LOCATION	WATER USE CLASSIFICATION	CRITERION VIOLATED	POTENTIAL CAUSE(S)	ACTIONS TO ALLEVIATE	MILES	305(b)	303(d)	Priority
HUC 03060109									
Buck Creek (1)	Downstream Sylvania WPCP to Savannah River (Screven Co.)	Fishing	DO,Cu	M	Sylvania completed Individual Control Strategy in 1994 and is in compliance with permit. Sylvania WPCP passed WET test 5/95. NPDES permit has limits for CN & Zn. In compliance with permit limits.	12	X	2	1
Ebenezer Creek (1,4)	Long Bridge to Savannah River near Springfield (Effingham Co.)	Fishing	DO	NP	Multiagency study ongoing to address issues and implement solutions.	6	X	3	2
Runs Branch (Ebenezer Creek) (1)	Cowpen Creek to Little Ebenezer Creek near Clyo (Effingham Co.)	Fishing	DO,FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	11	X	X	2

*Indicates minimal data set.

Criterion Violated Codes (Column 4)

Bio	=	Biota Impacted
Cd	=	Cadmium
Cu	=	Copper
DO	=	Dissolved Oxygen
FC	=	Fecal Coliform Bacteria
FCG	=	Fish Consumption Guidelines
Hg	=	Mercury
Pb	=	Lead
Se	=	Selenium
Temp	=	Temperature
Tox	=	Toxicity Indicated
Zn	=	Zinc
*	=	Minimal Database

Potential Cause Codes (Column 5)

CSO	=	Combined Sewer Overflow
I1	=	Industrial Facility
M	=	Municipal Facility
NP	=	Nonpoint Sources/ Unknown Sources
UR	=	Urban Runoff/Urban Effects

Estuarine Waters Not Fully Supporting Designated Uses

ESTUARY NAME (Data Source)	LOCATION	WATER USE CLASSIFICATION	USE SUPPORT CATEGORY	CRITERION VIOLATED	POTENTIAL CAUSE(S)	SQUARE MILES AFFECTED	305(b)	303(d)	Priority
Savannah Harbor (1)	Hwy 17 to South Channel	Coastal Fishing	PS	FC	UR,M	4	X	3	3

Use Support Status (Column 4)

S = Supporting
PS = Partially Supporting
NS = Not Supporting

Criterion Violated Codes (Column 5)

Bio = Biota Impacted
Cd = Cadmium
Cu = Copper
DO = Dissolved Oxygen
FC = Fecal Coliform Bacteria
FCG = Fish Consumption Guidelines
Hg = Mercury
Pb = Lead
Temp = Temperature
Tox = Toxicity Indicated
Zn = Zinc
* = Minimal Database

Potential Cause Codes (Column 6)

CSO = Combined Sewer Overflow
I1 = Industrial Facility
M = Municipal Facility
NP = Nonpoint Sources/ Unknown Sources
UR = Urban Runoff/Urban Effects

Lakes/reservoirs Not Fully Supporting Designated Uses

LAKE NAME	LOCATION	SUPPORT CATEGORY	WATER USE CLASSIFICATION	CRITERION VIOLATED	POTENTIAL CAUSE(S)	ACRES AFFECTED	305(b)	303(d)	Priority
Clarks Hill Lake (1)	Lincoln and Columbia Counties	PS	Recreation	FCG	NP	69,999	X	X	3
Lake Burton (1)	Rabun County	PS	Recreation	FCG	NP	2,775	X	X	3
Lake Hartwell (1,11,31)	Tugaloo Arm - Hartwell	NS	Recreation	FCG	I2	55,950	X	3	NA
Lake Rabun (1)	Rabun County	PS	Recreation	FCG	NP	835	X	X	3
Lake Russell (1)	Elbert County	PS	Recreation	FCG	NP	26,650	X	X	3
Lake Tugaloo (1)	Rabun County	PS	Recreation	FCG	NP	598	X	X	3
Nancy Town Lake (1)	Habersham County	PS	Fishing	FCG	NP	8	X	X	3

*Indicates minimal data set.

Use Support Status (Column 3)

S = Supporting
PS = Partially Supporting
NS = Not Supporting

Criterion Violated Codes (Column 5)

Bio = Biota Impacted
Cd = Cadmium
Cu = Copper
DO = Dissolved Oxygen
FC = Fecal Coliform Bacteria
FCG = Fish Consumption Guidelines
Hg = Mercury
Pb = Lead
Temp = Temperature
Tox = Toxicity Indicated
Zn = Zinc
* = Minimal Database

Potential Cause Codes (Column 6)

CSO = Combined Sewer Overflow
I1 = Industrial Facility
M = Municipal Facility
NP = Nonpoint Sources/ Unknown Sources
UR = Urban Runoff/Urban Effects

Savannah River Basin Contact Information

Department of Community Affairs 60 Executive Park South, N.E. Atlanta, GA 30329 Phone: 404.679.4940 www.dca.state.ga.us	Coastal Georgia RDC PO Box 1917 Brunswick, GA 31521 Phone: 912.264.7363 www.dca.state.ga.us/publications/cg.html
Georgia Mountains RDC PO Box 1720 Gainesville, GA 30503 Phone: 770.538.2626 www.dca.state.ga.us/publications/gm.html	Northeast Georgia RDC 305 Research Drive Athens, GA 30605-2795 Phone: 706.369.5650 www.dca.state.ga.us/publications/neg.html
Heart of Georgia Altamaha RDC PO Drawer 1260 Baxley, GA 31515 Phone: 912.367.3648 www.dca.state.ga.us/publications/hga.html	Central Savannah River RDC PO Box 2800 Augusta, GA 30914-2800 Phone: 706.210.2000 www.dca.state.ga.us/publications/csra.html
Georgia Soil and Water Conservation Commission Region 2 PO Box 8024 Athens, GA 30603 Phone: 706.542.9233 www.gaswcc.org	Georgia Forestry Commission 5645 Riggins Mill Road Dry Branch, GA 31020 Phone: 478.751.3500 www.GFC.State.Ga.US/
DNR Wildlife Resources Division 2070 U.S. Highway 278, S.E. Social Circle, GA 30279 www.dnr.state.ga.us/dnr/wild	DNR Coastal Resources Division One Conservation Way Brunswick, GA 31520-8687 Phone: 912.264.7218 www.dnr.state.ga.us/dnr/coastal
DNR-EPD Air Protection Branch 4244 International Parkway, Suite 120 Atlanta, GA 30354 Phone: 404.363.7000	DNR-EPD Geological Survey Branch 19 Martin Luther King Jr. Drive Atlanta, GA 30334 Phone: 404.656.3214
DNR-EPD Hazardous Waste Management Branch 205 Butler Street SE, Suite 1154 East Tower Atlanta, GA 30334 Phone: 404.656.7802	DNR-EPD Land Protection Branch 4244 International Parkway, Suite 104 Atlanta, GA 30354 Phone: 404.362.2537
DNR-EPD Program Coordination Branch 205 Butler Street, SE, Suite 1152 East Tower Atlanta, GA 30334 Phone: 404.656.4713	DNR-EPD Water Protection Branch 4220 International Parkway, Suite 101 Atlanta, GA 30354 Phone: 404.675.6232
DNR-EPD Water Resources Branch 205 Butler Street SE, Suite 1058 East Tower Atlanta, GA 30334 Phone: 404.656.6328	DNR-EPD Brunswick District Office One Conservation Way Brunswick, GA 31520-8687 Phone: 912.264.7283

United States Environmental Protection Agency (EPA) Region 4, Water Management Division Atlanta Federal Center 61 Forsyth Street, SW Atlanta, GA 30303-3104 Phone: 404.562.9345 www.epa.gov/region4/	US Army Corps of Engineers, Savannah District PO Box 889 Savannah, GA 31402-0889 Phone: 912.652.5279 www.sas.usace.army.mil
US Army Corps of Engineers, Mobile District PO Box 2288 Mobile, AL 36628-0001 Phone: 334.690.2505 www.sas.usace.army.mil	US Army Corps of Engineers, Hartwell Project Resource Manager's Office PO Box 278 Hartwell, GA 30643 Phone: 888.893.0678 www.sas.usace.army.mil
US Army Corps of Engineers, Russell Project Resource Manager's Office 4144 Russell Dam Drive Elberton, GA 30635 Phone: 706.213.3400 www.sas.usace.army.mil	US Army Corps of Engineers, Thurmond Project Resource Manager's Office Route 1, Box 12 Clarks Hill, SC 29821 Phone: 864.333.1147 800.533.3478 ext. 1147 www.sas.usace.army.mil
United States Department of Agriculture Natural Resources Conservation Service Stephens Federal Building 355 East Hancock Avenue Athens, GA 30601-2769 Phone: 706.546.2272 www.ga.nrcs.usda.gov/ga/gaadm/dirso.htm	United States Geological Survey Water Resources Division Peachtree Business Center, Suite 130 3039 Amwiler Road Atlanta, GA 30360-2824 Phone: 770.903.9100 www.usgs.gov

with urban storm water issues and leaking and overflowing sanitary sewers) and private landowner actions (e.g., correcting failed septic systems; using best management practices in animal operations and land application of waste residuals). Other issues will require significant additional time and effort before they are addressed sufficiently (e.g., restoration of riparian zones and aquatic habitat). Some of these issues may require trial management efforts and adapting those efforts over time based on observations of what works well, particularly where there is no 100 percent effective solution evident at the time of strategy development. Future management should focus on the priorities among those continuing needs, as determined by communities and partners in management.

Additionally, continued growth in population is expected in the Savannah basin (see Section 2). This growth will place additional demands on water resources, and require corresponding responses in management. More people means more water use (drinking water, industrial consumption, irrigation), more storm water runoff (from impervious surfaces of new houses, roads, industries, businesses, and parking lots), and more contamination (sediment; nutrients; organic material; pesticides, herbicides, and other toxics). Therefore, it is essential that stakeholders continue to work together to plan and implement the most cost-effective ways of restoring and protecting water resources.

Blending Regulatory and Voluntary Approaches

Although the regulatory authorities of agencies such as EPD are important for protection and restoration of Georgia's waters, RBMP partners will continue to emphasize voluntary and cooperative approaches to watershed management. This will take time and be very challenging. Long-term protection means that the people, local governments, and businesses must learn collectively what is needed for protection and adapt their lifestyles and operations accordingly. Experience indicates that we are much more likely to buy into proposed management solutions in which we have a say and control over how we spend our time and money. The challenge in the future, therefore, is to continue to "build bridges" between regulatory and voluntary efforts, using each were they best serve the people and natural resources of Georgia.

8.2 Working to Strengthen Planning and Implementation Capabilities

Understanding One Another's Roles

Increasing awareness and understanding of the roles and capabilities of local, state, and federal partners is one of the keys to future success in basin management for the Savannah River. Lack of understanding can lead to finger pointing and frustration on the part of all involved. Increasing opportunities for stakeholders to develop this awareness and understanding should result in more effective management actions.

This basin plan provides one opportunity for stakeholders to increase their awareness of conditions in the basin and to learn about ongoing and proposed new management strategies. Within this context, stakeholders can develop a better understanding of certain roles and responsibilities. For example, this basin plan points out several areas where EPD has regulatory authority and corresponding duties, including:

- Establishing water quality use classifications and standards.
- Assessing and reporting on water quality conditions.
- Facilitating development of River Basin Management Plans.
- Developing TMDLs

- Implementation Plan Development through Regional Development Centers (RDCs)
- Issuing permits for point source discharges of treated wastewater, municipal storm water discharges as required, and land application systems.
- Issuing water supply permits.
- Enforcing compliance with permit conditions.

In many areas, however, organizations or entities other than EPD are responsible; for example,

- Septic tank permitting and inspection (County Health Departments) and maintenance (individual landowners).
- Land development (land use) and zoning ordinances (local governments).
- Sanitary sewer and storm water ordinances (local governments).
- Water supply source water protection ordinances (local governments).
- Urban storm water and drainage (local governments).
- Erosion and sediment control (local governments).
- Siting of industrial parks, landfills, and wastewater treatment facilities (local governments).
- Floodplain management (FEMA, local governments).
- Implementation of forestry best management practices (Georgia Forestry Commission with support from the American Forest and Paper Association, Georgia Forestry Association, The University of Georgia School of Forest Resources, Southeastern Wood Producers Association, and the American Pulpwood Association).
- Implementation of agricultural best management practices (landowners with support from state and federal agricultural agencies).
- Proper use, handling, storage, and disposal of chemicals (businesses, landowners, municipalities, counties, etc.).

These are but a few of the areas involved, but they illustrate how responsibilities are spread across many stakeholders in each basin. Additionally, other agencies and organizations—regional development centers; federal, state, and local technical assistance programs; citizens groups; and business associations—assist in planning and implementation in many of these areas. As stakeholders become more familiar with one another's responsibilities and capabilities, they will become increasingly aware of appropriate partners to work with in addressing their issues of concern.

Using the RBMP Framework to Improve Communication

Raising awareness frequently involves two-way communication. The RBMP framework's interactive planning and outreach sessions provide additional opportunities for two-way communication. For example, Basin Technical Planning Team meetings provide opportunities for partners to share information on their responsibilities and capabilities with each other. Similarly, River Basin Advisory Committee meetings and Stakeholder meetings provide opportunities for citizens, businesses, government agencies, associations, and others. to share information and learn from each other. Although these interactions often require considerable time, they are critical to the future

of management in the basin because they build the working relationships and trust that are essential to carrying out effective, integrated actions.

Continuing to Streamline Our Efforts

Increased coordination will also result if partners in this approach continue to streamline their efforts. There are many laws and requirements with related and complementary goals, e.g., Georgia's Growth Strategies Act, Planning Act, River Corridor Protection Act, Comprehensive Ground Water Management Plan, and River Basin Management Planning requirements, in addition to federal Clean Water Act water quality regulations and Safe Drinking Water Act source water protection requirements. Partners should continue to find ways to make actions under these laws consistent and complementary by eliminating redundancy and leveraging efforts. Again, partners can use the forums in the RBMP framework (e.g., river basin team and advisory committees) to discuss and implement ideas to streamline roles and make the best use of their funds and staff resources.

8.3 Addressing the Impacts from Continued Population Growth and Land Development

Supporting Consistent Implementation of Protection Measures

In addressing the impacts from anticipated population growth and increased land development in the basin, future managers will need to increase their understanding of roles and use forums to coordinate and develop more specific action plans. Historically, mitigating impacts from newly developed areas has been approached mostly on a case-by-case basis. Unfortunately, this approach has resulted in inconsistent planning and implementation of water resource protection measures. River basin planning offers an opportunity for a more consistent approach by making it easier for landowners, local governments, and businesses to work together at the watershed and basin levels.

One way that Georgia EPD will address this issue is by approving only new and expanding permits for water withdrawals and wastewater discharges that are consistent with the basin plan and that meet the intent of the Georgia Planning Act. Rather than waiting for the permit application process, however, local governments can work together and with EPD to work out some of these issues in advance. There are incentives for organizations such as the Georgia Water Pollution Control Association (WPCA), the Georgia Municipal Association (GMA), the Association of County Commissioners of Georgia (ACCG), and the Regional Development Centers (RDCs) to work out consistent methods to conduct watershed assessments in developing areas and to improve the implementation of protection measures as development occurs. EPD, DCA, and other partners can coordinate by facilitating discussion at RBMP meetings and supporting local initiatives aimed at this issue. An excellent example of this cooperative effort is the Georgia Water Management Campaign being facilitated by the Association of County Commissioners in cooperation with the Georgia EPD, the Georgia Municipal Association, and the Georgia Environmental Facilities Authority.

8.4 The Next Iteration of the Basin Cycle

Building on Previous, Ongoing, and Planned Efforts

As discussed above and in Section 7.3, there is more work to do to adequately restore and protect all of Georgia's water resources. After focusing on the implementation of this

plan, the Savannah River basin will enter into its second iteration of the basin management cycle (scheduled for April 2001). The next cycle will provide and opportunity to review issues that were not fully addressed during the first cycle and to reassess or identify any new priority issues. In other words, future management efforts can and should build on the foundation created by previous, ongoing, and already planned management actions.

Providing a Historical Reference for the Next Basin Planning Effort

Additional water resources management issues will also be addressed in the Comprehensive Water Resources Management Study for the Savannah River basin (SRB Study). The 1996 Water Resources Development Act authorized the U.S. Army Corps of Engineers to develop an updated plan addressing current and future needs in the basin, examine reallocation of storage at Corps of Engineers multipurpose projects, and develop a better management structure to deal with basin water resource issues. Potential water resources management issues to be addressed in the study include upper basin needs vs. downstream needs, water supply allocations, flood control, hydropower, water quality, habitat, aquatic plant control, and recreation.

The Reconnaissance phase of the comprehensive water resources management study for the basin was initiated in February 1998 and completed in July 1999. The final report will be completed in September 2003.

The Corps of Engineers is also coordinating this effort with various state and federal agencies including the states of Georgia and South Carolina, as well as Federal agencies such as the Environmental Protection Agency (EPA), US Geological Survey, and the Natural Resources Conservation Service.

Savannah Harbor Channel Deepening Project

Another concern that will be addressed during the next basin planning cycle is the environmental impacts of the proposed Savannah Harbor Deepening Project Georgia. Georgia Ports Authority is recommending a plan to increase the channel depth of the Port of Savannah from 42 to 48 feet to accommodate larger container vessels calling at the port. The potential environmental impacts could include increased salinity levels and decreased oxygen levels in the river and adjacent to the Savannah National Wildlife Refuge, loss of acres of saltwater wetlands, and increased chloride levels at the city of Savannah water intake on a tributary to the Savannah River. Construction on the project is scheduled to start in the fall of 2001 and be completed in the year 2005.

New Savannah Bluff Lock and Dam

Another future issue in the Savannah River basin is the continued operation and maintenance of the New Savannah Bluff Lock and Dam (NSBLD), which was constructed in 1937. The Army Corps of Engineers, Savannah District, initiated a study to review the current use of the NSBLD and recommend its future disposition to Congress. The project was authorized for the sole purpose of supporting commercial navigation along the Savannah River. Augusta-Richmond County currently operates the lock and the adjacent 50-acre public park and recreational area under an agreement with the Corps. The project currently provides water supply, recreation, tourism, and environmental benefits to the region. The study was completed in 2000 and a report was submitted to Congress for action. The Corps will rehabilitate the lock and dam and work with local governments in Geogia and South Carolina to establish a plan for operation of the project.

8.5 Priorities for Additional Data Collection

In 1997-1998 monitoring efforts were focused on the Savannah and Ogeechee River basins in accordance with the EPD basin planning schedule. Intensive monitoring will return to the Savannah basin in support of the next iteration of the basin planning cycle in 2002. Prior to this time, EPD and partners will develop a monitoring plan for the Savannah. The monitoring plan will have two manage components: general assessment of water quality status within the basin, and targeted assessment to address priority issues and concerns.