

Bulloch County  
Brooklet  
Portal  
Register  
Statesboro

# Comprehensive Water Supply Management Plan

Rutherford & Associates  
Savannah, Georgia  
2000

The Coastal Georgia Regional Development Center prepared the preliminary draft of this report. Bulloch County then employed Rutherford & Associates to complete the plan.

Rutherford & Associates used the preliminary draft prepared by the Coastal Georgia Regional Development Center as a basis and then added pertinent information to arrive at this report.

The Bulloch County Comprehensive Water Supply Management Plan has been reviewed and approved by the Georgia Environmental Protection Division (EPD) – July 2001.

# Georgia Department of Natural Resources

205 Butler Street, S.E., East Floyd Tower, Atlanta, Georgia 30334

Lonice C. Barrett, Commissioner  
Harold F. Reheis, Director  
Environmental Protection Division  
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July 27, 2001

Honorable Wayne Groover, Vice Chairman  
Bulloch County Board of Commissioners  
Post Office Box 347  
Statesboro, Georgia 31405

Dear Commissioner Groover:

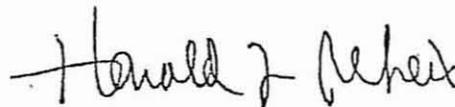
In April of 1997, the Georgia Environmental Protection Division (EPD) announced, produced and distributed a document entitled An Interim Strategy for Managing Saltwater Intrusion in Southeast Georgia. That document outlined a process that EPD would employ to develop a long-term strategy for addressing the water supply needs of coastal Georgia while minimizing or arresting the saltwater encroachment and intrusion phenomena known to be occurring along the Georgia and South Carolina coasts. One important element of that strategy was the requirement that each of the 24 counties in the affected areas (as defined by EPD) would develop a comprehensive county water supply plan. In June 1997, EPD distributed an outline of a set of minimum criteria for these plans. In 1998 the Legislature approved funds to partially support the development of these plans in 22 of the 24 counties, and EPD and the Department of Community Affairs developed a process whereby funds would be distributed to these counties to assist them in producing their water supply plans. According to the time line established by EPD in the Interim Strategy, the plans were to be completed by the county by December, 2000. As of May, 2001, each of the 24 counties has submitted final plans.

With this letter I wish to thank you and your constituents in Bulloch County for successfully completing your water supply plan. EPD's review of your plan has found that it meets the State's minimum requirements. The data and information you have provided in your plan will allow EPD to begin the integration process which will lead to the production of a long-term regional plan for managing water to meet future water supply needs in coastal Georgia by December 2005. This process will require a "union" of your water supply plan and those of your neighboring counties.

The process will also require that we utilize many of the findings from the "sound science" initiative also defined in the Interim Strategy. You and your constituents will continue to be an indispensable part of this integration process, and we will consult with you in many different forums as the process unfolds.

Again, my sincere thanks to you for your invaluable contributions to effective management of coastal Georgia's water resources.

Sincerely,



Harold Reheis  
Director

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## I. INTRODUCTION

### General Description of the Plan

The Georgia Environmental Protection Division (EPD) issued its *Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer of Southeast Georgia* in April 1997 to address saltwater intrusion that threatens future groundwater supplies in Savannah and Brunswick, and potentially other areas of Southeast Georgia. As part of its strategy, EPD required Bulloch County and 23 other counties in the region that utilize the Upper Floridan Aquifer to develop a comprehensive water supply management plan that assesses water demand, water supply sources, and wastewater management (see *Map 1* in Appendix A).

This plan characterizes past and present water use, projects future water needs, assesses future water supply options, and serves as a decision-making tool for local elected officials and Georgia EPD. *The goal of the plan is to manage and conserve Bulloch County's present and future water resources in order for reasonable residential, commercial, agricultural, and industrial growth to occur in the future, and to protect the quality of groundwater for use by future generations.* This plan should be updated every five years to address changing circumstances that affect water use in the county and its municipalities.

Specifically, the Bulloch County Comprehensive Water Supply Management Plan examines the following aspects of water use in Bulloch County:

- Past, present, and future water demand for the domestic/commercial, industrial, and agricultural sectors
- Present and future water system management
- Present and future wastewater treatment and disposal
- Future water supply options and conservation measures

Bulloch County and its aquifer users have identified the following principles as critical in the Bulloch County Water Supply Management Plan.

- (1) Continue to utilize the Floridan Aquifer to meet domestic water demand.
- (2) Continue to allow current and future industrial usage of the Floridan Aquifer with proper conservation and water saving principles employed by each industrial user.
- (3) Continue to utilize the Floridan Aquifer for agricultural irrigation purposes.
- (4) Employ "Best Management Practices" for agricultural irrigation systems. This can be accomplished by the County Extension Service working closely with the agricultural community.

- (5) Seek legislative and financial assistance from State and Federal agencies to facilitate the use of surface water impoundments to utilize minor streams and capture rainfall run-off to reduce usage and dependence on the Floridan Aquifer for agricultural practices.
- (6) Develop a countywide water conservation education program and utilize municipalities, school system, civic organizations and county extension service to inform citizens about conservation principles and practices.
- (7) Seek assistance from state EPD and the University of Georgia College of Agriculture and Environmental Sciences to determine the viability of the Cretaceous Aquifer in the Coastal Plain as an alternative or supplemental source of fresh water for agricultural purposes.
- (8) Seek assistance from Georgia Southern University in further study of the Cretaceous aquifer, promotion of wastewater effluence irrigation, and development of a countywide conservation program.
- (9) Determine, with state and federal assistance, the true availability of surface water from the Ogeechee River as a viable alternative or supplemental source of fresh water.
- (10) The County will establish a committee of Floridan Aquifer users to monitor implementation of this plan and to promote water conservation principles and practices.

This plan covers unincorporated Bulloch County and the municipalities of Statesboro, Brooklet, Portal, and Register.

### **The Problem— Saltwater Intrusion**

The Upper Floridan Aquifer is the primary source of drinking and industrial process water for Bulloch County and the other 23 Southeast Georgia counties required to prepare comprehensive water supply management plans. The aquifer underlies Southeast Georgia, most of Southwest Georgia, Coastal South Carolina, a portion of Southern Alabama, and Florida. Secondary aquifers include the Surficial, Upper and Lower Brunswick (Miocene), and Lower Floridan.

Most groundwater management issues in Coastal Georgia relate to lateral or upward movement of the freshwater-saltwater interface in the Upper Floridan Aquifer. Due to over pumping, a reversal of the seaward hydraulic gradient has caused lateral encroachment of seawater in the aquifer at the north end of Hilton Head Island, South Carolina, and vertical intrusion of saltwater in the aquifer at Brunswick, Georgia. Numerous US Geological Survey documents describe the saltwater intrusion problem in detail.

## Advisory/Technical Committee

In order to develop a comprehensive water supply management plan for Bulloch County that addresses the interests of all stakeholders, the Bulloch County Commission established an advisory/technical committee to guide the plan development process. This committee was comprised of county and city elected officials; public drinking water and wastewater managers; citizens; industrial, business, agricultural, and environmental representatives; and other interests. In addition, a public meeting was held during the plan development process to gain community input. *Table 1-1* lists the advisory/technical committee members and their interests or organizations.

**Table 1-1**  
**Bulloch County Comprehensive Water Supply Management Plan**  
**Advisory/Technical Committee Members**

Committee Member	Interest
Joe Aldrich	Brooklet Mayor (former)
Hal Averitt	Statesboro Mayor
Fred G. Blicht, Jr.	Citizen
Jack A. Brannen	Citizen
Glenn Bray	County Health Department
Bill Brown	Portal Mayor
Peggy Chapman	Chamber of Commerce
Steve Collins	Forest Heights Country Club
James Darrell	Georgia Southern University
Guy Deal	Citizen
Milan Degvansky	Georgia Southern University
Terry Gerrald	Citizen
Joe Grooms	Brooklet Mayor
John Harris	Citizen
Wes Harris	Cooperative Extension Service
Steve James	Grinnell Corporation
Wayne Johnson	Statesboro Water Department
Bill Kelly	Citizen
Bob Kim	Grinnell Corporation
Richard Mellett	Georgia Southern University
Mason Moorer	County Board of Education
Joe Mosely	Statesboro Planning Director
James Oates	Register Mayor

<b>Committee Member</b>	<b>Interest</b>
Wayne Paulk	Cooper Tools/H.K. Porter Wiss
Wayne Robins	Cooper Tools/H.K. Porter Wiss
James Reichard	Georgia Southern University
Glenn Rogers	Cooper Tools/H.K. Porter Wiss
Tommy Rogers	Fisher Rosemont Petroleum/Brooks
Bill Smith	County Commissioner
Bob Smith	County Environmental Manager
Becky Taylor	County Planner
Andy Welch	County Planner
Scott Wood	County Manager

### **County Overview**

Located 40 miles west of Savannah, Bulloch County covers 688 square miles and includes the municipalities of Brooklet, Portal, Register, and Statesboro. *Map 2* in Appendix A illustrates these jurisdictional boundaries, as well as the primary roads serving Bulloch County, including Interstate 16, US Route 80, US Route 301, US Route 25, State Route 119, and State Route 67. The county seat of government is Statesboro, which is the largest municipality in Bulloch County and home to Georgia Southern University, the third largest university in Georgia. *Map 3* in Appendix A highlights the county's major rivers and streams, which include the Ogeechee River (a state-designated protected river which forms the county's eastern boundary), Mill Creek, Lotts Creek, Little Lotts Creek, Upper Black Creek, and Lower Black Creek. Bulloch County is surrounded by Bryan County to the south, Effingham and Screven Counties to the east, Jenkins County to the north, and Emanuel, Candler, and Evans Counties to the west. Statesboro is located approximately 55 miles from Savannah and 122 miles from Macon. The different water systems in the county utilize groundwater from the Floridan aquifer system.

Although becoming more urbanized, Bulloch County contains a significant amount of agricultural land and is predominantly rural in character. As indicated in the Bulloch County Comprehensive Plan, 40 percent of the county's unincorporated area (432,000 acres) should remain in agriculture through 2015. In 1999, Bulloch County was the number one row crop county in the state of Georgia with 106,000 acres. In addition, 50 percent of the county's unincorporated area should remain in forestry, while projections indicate that less than five percent will be developed (residential, commercial, industrial, etc.) by 2015.

Due to the significant amount of agriculture in and around the county, agricultural-related services are important to the Bulloch County economy. Georgia Southern University also plays a major role in the local economy and generates demand for retail trade and services

to meet the needs of over 15,000 students, faculty, and staff. In and around Statesboro, industry / manufacturing represents a growing sector of the county's economy, and three industrial parks are operated in Statesboro. Major private sector employers in Bulloch County include a Wal-Mart Distribution Center, Briggs & Stratton, Viracon, and Grinnell. The East Georgia Regional Medical Center will play a major role in the local and regional economy. The county has 64 manufacturers with over 4,609 employees. Bulloch County is 100% Freeport tax exempt from ad valorem taxes for inventories of finished goods, raw materials in process and furnished goods held by distributors and manufacturers but destined for out-of-state shipment. The Statesboro-Bulloch Chamber of Commerce and the Development Authority of Bulloch County promote economic development opportunities for the entire county.

The county government is conducted through an elected Board of Commissioners. The County employs a Manager to assist in implementation of policies and to oversee day-to-day operations. The City of Statesboro employs a City Manager to assist its Mayor and Council in daily operations. The cities of Brooklet, Portal, and Register, conduct business through a Mayor and Council form of government and each employs a city clerk for assistance.

### **County climate, hydrology, and hydrogeological setting**

The average daily temperature in Bulloch County is 65.5 degrees Fahrenheit. Average daily low is 54.0 degrees Fahrenheit and average daily high is 77.1 degrees Fahrenheit. Precipitation average is 46.68 inches annually.<sup>1</sup> Average monthly rainfall from 1961-1990 is shown in Table 1-2.

<i>Month</i>	<i>Rainfall (In Inches)</i>
January	3.99
February	3.93
March	4.08
April	3.01
May	4.09
June	4.85
July	5.45
August	5.53
September	3.64
October	2.31
November	2.43
December	3.38
<b>TOTAL</b>	<b>46.68</b>

<sup>1</sup> Data from 1961 – 1990. Source: Natural Resources Conservation Service, National Water and Climate Center.

Surface water sources of the county are depicted on the Hydrology of Bulloch County map in Appendix A. The Ogeechee River would be the only surface source that might serve as a potential water supply. Due to potential problems with low-flow and poor water quality, this is not a viable surface water supply source. The large number of creeks throughout the county does present possible opportunities for impoundments to be utilized as part of the overall agricultural irrigation system.

The northern portion of Bulloch County lies within the Tifton Upland, a generalized topographic division of the Coastal Plain province. The Tifton Upland ranges from about 120 to 400 feet in altitude and is characterized by rolling hills and both gentle and deeply incised valleys.

Bulloch County also lies within the Coastal Terraces. The Coastal Terraces boundary of the Tifton Upland is the approximate down dip edge of the Gulf Trough. The Trough is narrow, generally less than 5 miles wide, but as much as 10 miles wide in central Georgia and near the Florida and Georgia state line.

The Gulf Trough (a depressed segment of the earth's crust bounded on at least two sides by faults) is caused by high-angle faulting that was active during much of the time of the deposition of rocks that make up the Floridan aquifer system. Within the depressed segments (grabens) are thick accumulations of low permeability, clastic (rock) sediments and argillaceous (clay or clay minerals) carbonate rocks.

The Trough has a pronounced effect on the hydrology of the aquifer system, as the fine clastic material in the trough impedes groundwater flow. The water quality, as mineralized water, is associated with evaporites downgradient from the trough. Because of large quantities of recharge and discharge in the flow system upgradient from the Gulf Trough, water is low in dissolved solids and is moderately hard.

Groundwater flow in the Floridan aquifer system is partially impeded by the Gulf Trough as a result of two mechanisms. First, near-vertical displacement of rocks along the faults of the graben system has juxtaposed rocks of lower permeability against the more permeable rocks of the aquifer system. Second, within the graben system, the aquifer system consists of relatively low permeability material, which decreases the aquifer system's effective thickness.

The area of highest recharge to the aquifer system prior to development was chiefly updip and upgradient from the Gulf Trough, where the aquifer system is exposed or thinly covered and least confirmed. In this area, recharge occurred in the topographically high areas, either directly into the exposed or thinly covered Upper Floridan.

The small quantity of flow passing downgradient through the Upper and Lower Floridan aquifers across the Gulf Trough, compared to the total flow in the area upgradient from the trough, further supports the existence of an active but nearly isolated flow system in the Floridan Aquifer upgradient from the Gulf Trough. The Gulf Trough, however, has been

determined to be an area where development potential is small, because of the low transmissivities that would result in large localized water level decline.

The Sound Science Initiative Study of the Floridan aquifer system that is being conducted by the state EPD should shed more light on this prominent geological structure as to whether or not it has an impact on the ground-water flows of the Floridan aquifer system. As a result of the study, it may be that withdrawal upgradient of the trough has no impact on the withdrawal downgradient of the trough. If so, then the opportunity for salt water intrusion in the upgradient areas of the trough would be greatly minimized. This does not, however, remove the possibility of water level declines in areas of the Gulf Trough resulting in reduced water quality.

Preliminary seismic results from the Sound Science Initiative Study indicate that the Gulf Trough is present in Bulloch County. There does appear to be some influence of the Trough at work in Bulloch County. See map in Appendix A for area of the Gulf Trough.

EPD and USGS have studied a number of different aquifers within the Coastal Plain. The interbedded sands and clays of the Cretaceous units of the Coastal Plain form a number of aquifers and confining units. Seven such Cretaceous aquifers in the Coastal Plain have been identified and designated aquifers A<sub>1</sub> through A<sub>7</sub>. These aquifers are rarely tapped due to the ease of obtaining water from the shallower Floridan aquifer system. There have been no studies of the Cretaceous aquifer in Bulloch County. There have been studies in neighboring counties.

Aquifer A<sub>1</sub> extends into Screven County. In 1976, 1.5 million gallons per day were pumped from this aquifer for industrial use in Screven County.

Other aquifers available for use are the Dublin, Midville and Dublin-Midville aquifer systems. Two wells in Screven County drilled in the Dublin aquifer in the mid-1960s and late 1971 yielded up to 1,500 gallons and 1,750 gallons a minute, respectively.

The Millhaven site, located in northeastern Screven County, was studied during 1991 – 1994. This study was to determine groundwater flow and stream-aquifer relations in the vicinity of the Savannah River Site. The test site consisted of a 1,452-foot deep core-hole drilled into sediments of the late Cretaceous age. Five test wells were developed at depths ranging from 50 to 1,300 feet. Test well 3 was in the lower zone of the Upper Floridan aquifer. It produced over 207 gallons a minute when pumped. Test well 4 was in the lower Dublin aquifer and it produced 76 gallons a minute when pumped. Test well 5 was in the lower Midville aquifer and only produced about 15 gallons a minute when pumped.

The Millers Pond test site in northeastern Burke County was constructed in 1991 – 1992 to characterize the geologic, hydrologic, and water quality characteristics of a multi-aquifer system in Coastal Plain sediments. Seven test wells were developed ranging in depth from 80 to 735 feet. The test wells were screened in the Upper Three Runs aquifer, Dublin

aquifer system and the Midville aquifer system. Three wells in the Dublin aquifer system produced from 12 to 41 gallons a minute. Three wells in the Midville aquifer system produced from 65 to 178 gallons a minute. One well was drilled in the Upper Three Runs aquifer and it only produced 8 gallons a minute.

## II. BULLOCH COUNTY POPULATION PROJECTIONS

Bulloch County's population has grown steadily since the 1970s, increasing approximately 84% from 1980 to 2000. *Table 2-1* lists the actual or projected population from 1980 to 2000 for Bulloch County and the municipalities of Statesboro, Brooklet, Portal, and Register. Statesboro has experienced the largest population increase among the county's municipalities. This growth can be attributed to such factors as an increase in student enrollment at Georgia Southern University, annexation, and an influx of economic development activity into the city and surrounding area.

It should be noted that Georgia Southern University's 2,750 on-campus residents and an additional 7,000 students living off-campus in Statesboro are included in the city's population figures, beginning in 1995. Statesboro population figures prior to 1995 may not reflect the total Georgia Southern population. Approximately 4,000 commuter students, who permanently live in Bulloch County or the surrounding region, are not included in Statesboro's population figures.

*Table 2-2* lists the projected population for the county and each municipality in 1997. Data to determine present water use were either collected for this year or estimated, based on these population figures.

*Table 2-3* lists the projected population from 2000 to 2050 for Bulloch County and each municipality. Bulloch County and Statesboro are expected to experience a tremendous population increase during the next 50 years, growing 149 percent and 163 percent, respectively. Part of this growth is based on a projected two percent annual increase in Georgia Southern University's student enrollment (the university is presently under a two percent annual growth cap).

It should be noted that economic impacts and other factors that affect population figures and related water use are difficult to assess for a 50-year period. For example, changes in student enrollment patterns at Georgia Southern University, the conversion of agricultural lands to residential use, or the opening or closing of industrial facilities can affect population growth in both the municipalities and unincorporated area. For this reason, the comprehensive water supply management plan should be revised on a regular basis to account for new population data and significant events and policy changes that affect Bulloch County and its municipalities.

The East Georgia Regional Medical Center will have a profound impact on population growth. As the Medical Center grows and truly becomes a regional provider in medical services, health care professionals and the related employment and residential impacts will occur.

**Table 2-1  
Bulloch County Population, 1980-2000**

<b>Jurisdiction</b>	<b>1970</b>	<b>1980</b>	<b>1985</b>	<b>1990</b>	<b>1995</b>	<b>2000*</b>	<b>Increase 1980-2000</b>
Bulloch County (total)	32,183	35,785	37,400	43,125	59,078	65,675	84%
Brooklet	683	1,035	1,150	1,013	1,204	1,193	15%
Portal	643	694	700	522	740	795	15%
Register	NA	195	195	195	286	286	47%
Statesboro+	14,616	14,866	15,670	15,854	30,520	35,170	137%
Unincorporated Bulloch County	16,241	18,995	19,685	25,541	26,328	28,231	49%

+Includes Georgia Southern University's 2,750 on-campus students and approximately 7,000 off-campus students living in Statesboro, for years 1995-2000, plus 2% projected increase in 2000

\*Projected

NA: Not available

Source: 1980-1990: US Census; Bulloch County 1995-2000: Coastal Georgia RDC estimate; municipal 1995: The Georgia County Guide, municipal 1997-2000: Coastal Georgia RDC estimate

**Table 2-2  
1997 Bulloch County Population**

<b>Jurisdiction</b>	<b>1997 Population</b>
Bulloch County (total)	61,631
Brooklet	1,171
Portal	753
Register	270
Statesboro+	32,635
Unincorporated Bulloch County	26,802

+Includes Georgia Southern University's 2,750 on-campus students and approximately 7,000 off-campus students living in Statesboro

Source: Coastal Georgia RDC estimate

**Table 2-3  
Projected Bulloch County Population, 2000-2050**

<b>Jurisdiction</b>	<b>2000</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>Projected Increase, 2000-2050</b>
Bulloch County (total)	65,675	78,810	94,572	113,486	136,183	163,419	149%
Brooklet	1,193	1,267	1,341	1,415	1,489	1,563	31%
Portal	795	934	1,073	1,212	1,351	1,490	87%
Register	286	341	395	450	505	559	95%
Statesboro+	35,596	43,346	52,771	61,509	76,807	93,639	163%
Unincorporated Bulloch County	27,805	32,923	38,992	48,900	56,031	66,168	138%

+ Includes 2% growth increase for Georgia Southern students (only accounts for students living on-campus or within Statesboro)

Source: Coastal Georgia RDC estimate; Rutherford & Associates



### III. WATER USE INVENTORY AND PROJECTION— BACKGROUND

#### EPD Groundwater Withdrawal Permits

EPD issues groundwater withdrawal permits for all industrial, municipal, and agricultural uses withdrawing more than 100,000 gallons of groundwater per day (based on an annual use average). *Table 3-1* lists the five groundwater withdrawal permits for industrial and municipal users in Bulloch County in 1998, including permitted monthly and yearly average withdrawal per day. The permitted monthly average withdrawal allows a groundwater user to meet seasonal peak flow demand, but the permitted yearly average withdrawal (gallons per day) cannot be exceeded over the course of a year. Groundwater withdrawal permits are classified by EPD as municipal (e.g., Statesboro), industrial (e.g., Grinnell Flow Control), or agricultural (e.g., farms and golf courses). EPD has issued 412 agricultural groundwater withdrawal permits as of November 1998, but these are not included in *Table 3-1*. Each of the five non-agricultural permitted users withdraw groundwater from the Upper Floridan Aquifer.

#### EPD Safe Drinking Water Permits

EPD issues safe drinking water permits for all water systems with at least 15 connections (i.e., residences) or serving more than 25 individuals at least 60 days per year. These systems are commonly referred to as community or non-community water systems. *Table 3-2* lists the 91 safe drinking water permits in Bulloch County in 1998, including the population served by each water system as most recently reported to EPD. It should be noted that population figures date from 1989 to 1998 and may not reflect the present population served by the system. Types of water suppliers and users covered by safe drinking water permits include large and small municipal water systems, such as those operated by Statesboro and Register; industrial facilities (with more than 25 employees or on-site customers), such as Grinnell, that supply their own water for industrial processes and use a portion for employee and/or customer consumption; community water systems serving residential subdivisions, mobile home parks, and other residential uses not supplied by municipal water systems; and non-community water systems, designated by EPD as transient or non-transient, serving schools, businesses, parks, and other non-residential uses not supplied by municipal water systems. Domestic wells serving individual residences and "non-public" wells that serve less than 15 residences or 25 individuals do not require EPD safe drinking water permits.

**Table 3-1**  
**Bulloch County Industrial and Municipal Groundwater Withdrawal Permits**  
 (Issued by Georgia EPD as of December 1998)

Permitted Facility	Permit Type	Permitted Monthly Average Withdrawal (MGD)	Permitted Yearly Average Withdrawal (MGD)
Georgia Southern University	Municipal	1.000	0.503
City of Statesboro	Municipal	4.218	3.700
Town of Brooklet	Municipal	0.215	0.200
H.K. Porter/Wiss*	Industrial	0.200	0.170
Grinnell Flow Control*	Industrial	1.008	1.008
<b>TOTAL</b>		6.641	5.581

\*The Standard Industrial Classification (SIC) code for these facilities is 33 – Primary Metals.  
 Source: Georgia EPD, 1999

**Table 3-2**  
**Safe Drinking Water Permits in Bulloch County (1998)**

Permitted System	Type of Water System (EPD Classification)	Population Served
Brooklet*+	Community	1,013
Nevils Water Association	Community	156
Portal*	Community	690
Register*	Community	211
Statesboro*+	Community	25,641
Georgia Southern University+	Community	3,100
Southeast Bulloch High School	Non-Community Non-Transient	675
Stilson Elementary School	Non-Community Non-Transient	455
Willow Hill Elementary School	Non-Community Non-Transient	222
Leefield Water Association	Community	96
Mixon's Mobile Village	Community	91
Forest Heights Subdivision	Community	566
Grove Lakes Subdivision	Community	783
Johnson Mobile Home Park	Community	175#
Parkwood Motel and Restaurant	Non-Community Transient	75
Grinnell Flow Control Corp.+	Non-Community Non-Transient	661

<b>Permitted System</b>	<b>Type of Water System (EPD Classification)</b>	<b>Population Served</b>
The Barn Mobile Home Park	Community	138
Lake Collins Estates	Community	143
Bulloch Academy	Non-Community Non-Transient	400#
Lanier Mobile Home Park	Community	96
Tankersley Subdivision	Community	42
Windfield Subdivision	Community	122
Hazelwood Subdivision	Community	312
Country Club Hills/Pine Forest	Community	224
Forest Hills Subdivision	Community	185
Country Lakes Estates MHP	Community	140
Riverside Estates	Community	65
New Hope Subdivision	Community	82
Robbins Packing Company	Non-Community Non-Transient	75
Frankville Water Association	Community	25
Coach House Estates MHP	Community	234
Colonial Heights Subdivision	Community	101
Cypress Lake Mobile Home Park	Community	63
Mill Creek Estates	Community	78
Lakeside Estates	Community	70
Newtons Mobile Home Village	Community	65
Thomas Village	Community	49
Westchester Subdivision	Community	172
Ogeechee Riverview POA	Non-Community Transient	60
Frinks Trailer Park	Community	43
The Loxcreen Company, Inc.	Non-Community Non-Transient	50
Bulloch County School Bus Garage	Non-Community Transient	225
Zetterower Mobile Home Park	Community	47
Woodland Mobile Estates	Community	101
Northside Junior High School	Non-Community Non-Transient	300
Cooper Wiss Industries, Inc.+	Non-Community Non-Transient	300
Georgian Walk Subdivision	Community	390#
Eldora Farms Subdivision	Community	291

<b>Permitted System</b>	<b>Type of Water System (EPD Classification)</b>	<b>Population Served</b>
Mill Creek Landing	Community	94
Meadow Lakes Plantation Subdivision	Community	195#
Westridge Subdivision	Community	100
Hodges Subdivision	Community	65
Deerfield Subdivision	Community	133
Northwood Subdivision	Community	151
Cedarwood Mobile Home Park	Community	177#
Chance's Mobile Home Park	Community	146
Williford Trailer Park	Community	52
Po-Jo's Gas N Go	Non-Community Transient	100
Old Mill Pond Subdivision	Community	86#
Bird Road Trailer Park	Community	100
Timberland Points	Community	127
Hunters Point Subdivision	Community	533#
Southern Comfort Subdivision	Community	229#
On the Pond Subdivision	Community	169#
English Oaks Mobile Home Park	Community	52
Olney Station	Community	270
Plantation Mobile Estates	Community	37
Yorktown Subdivision	Community	78
Horizons West Subdivision	Community	400#
Dry Branch Village	Community	156
Taylor's Creek Mobile Home Park	Community	52
Lundy Trailer Park	Community	47
Country Walk Subdivision	Community	340#
LA Pacific Statesboro Sawmill	Non-Community Non-Transient	65
Gallop Mobile Home Park	Community	30
Heritage Mobile Home Park	Community	78
Westside Mobile Home Park	Community	68
Oak Hill Mobile Home Park	Community	26
Middleground Plantation	Community	151#

Permitted System	Type of Water System (EPD Classification)	Population Served
Pretoria Station/Brookwood Subdivision	Community	335#
Westover Subdivision	Community	179#
Bradford Place	Community	244#
Inman Lakes Subdivision	Community	30
Oasis, Inc.	Non-Community Transient	100
Bulloch South, Inc.	Non-Community Transient	98
Old Indian Trail WS	Community	60
Westboro Apartments	Community	94#
Cody Lane Mobile Home Park	Community	32
Greenwood Trailer Park	Community	65
Willow Pond	Community	138#
W.M. Sheppard Lumber Company	Non-Community Non-Transient	125

\*Municipal water system

+Permitted groundwater user (>100,000 gallons per day withdrawal)

#Revised population figure provided by water system management

Source: Georgia EPD, 1998

### Assessing Bulloch County's Water Demand

As part of EPD's comprehensive water supply management plan requirements, each county must assess past, present, and future water demand. Groundwater is the primary source of water in Bulloch County. Approximately three million gallons of surface water are used per day for agricultural irrigation; however, much of this surface water is pumped from ponds that are at least partially recharged by groundwater. For the purpose of this plan, Bulloch County water demand is analyzed for the following categories of wells and water systems, based on EPD's groundwater management regulatory structure and present water withdrawal and use in the county:

- Industrial wells
  - Provide industrial process water to industrial facilities not connected to municipal water systems
  - May require EPD groundwater withdrawal permit and EPD safe drinking water permit
- Agricultural/golf course irrigation wells
  - Serve agricultural operations (crop irrigation and livestock watering), and golf courses not connected to municipal water systems
  - May require EPD groundwater withdrawal permit

- Surface water systems for agricultural and golf course irrigation
  - Serve agricultural operations, and golf courses not connected to municipal water systems
  - May require EPD surface water withdrawal permit
- Georgia Southern University's water system
  - Provides water for multiple campus uses
  - Requires EPD groundwater withdrawal permit and EPD safe drinking water permit
- Municipal water systems
  - Serve residential, commercial, and industrial customers inside and, in some cases, outside municipal boundaries
  - May require EPD groundwater withdrawal permit, and require EPD safe drinking water permit
- Non-municipal community water systems
  - Serve residential subdivisions and other small residential areas not connected to municipal water systems
  - Provide water to at least 15 residences or 25 individuals
  - Usually do not require EPD groundwater withdrawal permit, but require EPD safe drinking water permit
- Non-community water systems
  - Serve businesses, schools, and other non-residential facilities not connected to municipal water systems
  - Provide water to at least 25 individuals more than 60 days per year
  - Usually do not require EPD groundwater withdrawal permit, but require EPD safe drinking water permit
- "Non-public wells"
  - Serve residences and non-residential facilities not connected to municipal water systems
  - Provide water to 2-14 residences or less than 25 individuals
  - Usually do not require EPD groundwater withdrawal permit
- Domestic wells
  - Serve individual residences not connected to municipal water systems or "non-municipal community water systems"
  - Usually do not require EPD groundwater withdrawal permit

Water use is inventoried in the following sections for the users of each type of water system or well identified above. The following information is addressed in each section:

- Past and present water demand (1985 and 1997)
- Future water demand (2000 - 2050)
- Water system management

## IV. WATER USE INVENTORY AND PROJECTION — INDUSTRIAL WELLS

### Description

This section addresses industrial facilities that are not connected to municipal water systems but utilize their own wells on-site for industrial process water, as well as water for employee and customer consumption and other needs. An industrial facility that withdraws more than 100,000 gallons of groundwater per day requires an EPD groundwater withdrawal permit. In Bulloch County, Cooper Tools (H.K. Porter/Wiss) and Grinnell presently require this permit. *Map 4* in Appendix A indicates the location of these industrial facilities.

For the purpose of this plan, industry is limited to business operations that use water in a manufacturing/industrial process and includes the following:

- All industrial facilities that require EPD groundwater withdrawal permits
- Smaller industries that do not require EPD groundwater withdrawal permits
- Industrial parks or other facilities that may not necessarily use water for industrial processes but use or are expected to use more than 100,000 gallons per day for domestic-related uses

Industrial facilities that do not operate their own wells but are supplied water from municipal water systems (e.g., Fisher-Rosemont Petroleum) are addressed in *Section 7*. However, these facilities are considered when calculating total water needed for industrial use in Bulloch County (*Table 11-3*).

Grinnell is an iron foundry (SIC code 3321) specializing in gray iron pipe fittings. Grinnell holds an EPD permit to withdraw up to 1.008 million gallons of groundwater per day (annual average). The 560,000 square foot facility opened in 1969 and employs approximately 480 individuals. "Green sand," which consists of silica sand, bentonite clay, and small amounts of coal mixed with water, is used to create molds that are poured with molten iron to produce iron castings (induction furnaces are used to melt scrap steel, alloys, and iron returns into molten iron). A variety of hydraulic and mechanical equipment is used to form these sand molds and to clean and grind the iron castings to meet customer specifications. Grinnell uses water for employee consumption and sanitary sewer, "green sand" mixing (foundry process), wet dust collection equipment, cooling towers, and once-through cooling.

Cooper Tools (H.K. Porter/Wiss) (SIC code 3421) manufactures a variety of hand tools and is permitted to withdraw .170 million gallons of groundwater per day (annual average). The following four product lines are manufactured at its Statesboro plant: Plumb hammers and hatchets; Wiss scissors, shears, and snips; Wiss Aviation snips; and H.K. Porter bolt

cutters, cable cutters, and strap cutters. However, the plant is scheduled to close in 2000, and these product lines will be moved to other Cooper Tools facilities by that time. For the purpose of this plan, it is assumed that a new industrial operation will locate in this facility and future water use will be similar to Cooper's present use.

Smaller industrial facilities that utilize their own wells on-site for industrial process water but withdraw less than 100,000 gallons per day are presently limited in Bulloch County to approximately four facilities:

- Dixieland Materials (concrete)
- Conex (concrete)
- Sheppard Lumber Company
- Robins Packing

Based on water use estimates, these facilities combine to use approximately 25,000 gallons of water per day.

### **Past and Present Water Demand**

*Table 4-1* lists permitted daily groundwater withdrawal (based on a yearly average), 1985 average daily groundwater use, and 1997 average daily groundwater use for Bulloch County's two permitted industrial facilities. Cooper Tools and Grinnell combined to use 0.985 million gallons of groundwater per day in 1997, or about 98 percent of their total permitted daily withdrawal. Grinnell accounted for 0.780 million gallons of groundwater use per day during 1997, or 77 percent of its permit limit of 1.008 million gallons per day. Cooper Tools accounted for 0.205 million gallons of groundwater use per day during 1997, exceeding its permit limit of 0.170 millions gallons per day. Average daily water use at Grinnell was higher in 1997 than 1985, while no 1985 data are available for Cooper Tools to make a comparison. Data for maximum day use for each month for past and present industrial water demand are not available. Water conservation measures employed in the past are also not available.

Present conservation measures at Grinnell include the following:

- Recycling water for dust collection and the use of thermostat control equipment on once-through cooling water
- An air-cooled refrigerated chiller for core making equipment cooling
- Cooling towers for cooling all furnaces and related equipment

*Table 4-2* lists average daily groundwater use for each month of 1997 for Bulloch County's two permitted industrial facilities. Only data for 1997 is available for present peak summer and winter consumption rates. Peak 1997 water demand at Grinnell occurred during December, when 0.950 million gallons of water were used per day. Peak 1997 water demand at Cooper Tools occurred during September, when 0.243 million gallons of water were used per day. Maximum daily water use data are not available.

As mentioned above, small industries not requiring EPD groundwater withdrawal permits combined to use approximately 25,000 gallons per day in 1997, compared to approximately 20,000 gallons per day in 1985.

**Table 4-1**  
**Past and Present Bulloch County Industrial Groundwater Use**  
 Permitted Facilities (>100,000 gallons per day groundwater withdrawal)

<b>Permitted Facility</b>	<b>Permitted Yearly Average Withdrawal (MGD)</b>	<b>1985 Average Use (MGD)</b>	<b>1997 Average Use (MGD)</b>
Cooper Tools (H.K. Porter/Wiss)	0.170	?	0.205
Grinnell	1.008	0.648	0.780
<b>TOTAL</b>	1.178	?	0.985

Source: Cooper Tools and Grinnell

**Table 4-2**  
**Present Bulloch County Industrial Groundwater Use**  
 Permitted Facilities (>100,000 gallons per day groundwater withdrawal)  
 Average Daily Groundwater Use by Month (1997)

<b>Month</b>	<b>Average Daily Groundwater Use (MGD)</b>		
	<b>Cooper Tools</b>	<b>Grinnell</b>	<b>Total</b>
January	0.201	0.694	0.895
February	0.204	0.823	1.027
March	0.210	0.743	0.953
April	0.176	0.754	0.930
May	0.179	0.765	0.944
June	0.200	0.436	0.636
July	0.228	0.727	0.955
August	0.212	0.802	1.014
September	0.243	0.867	1.110
October	0.210	0.908	1.118
November	0.218	0.889	1.107
December	0.175	0.950	1.125
Annual	0.205	0.780	0.985

Source: Cooper Tools and Grinnell

## Future Water Demand

Table 4-3 lists projected future groundwater use through 2050 for Bulloch County's two permitted industrial facilities. Based on input from the Bulloch County Development Authority and the City of Statesboro, no additional large industrial facilities that would operate their own wells on-site are expected to locate in Bulloch County in the future. With the exception of the Grinnell and Cooper facilities and non-permitted businesses, future industrial activity is projected to occur within Bulloch County's industrial parks and/or in proximity to Statesboro's water system. These industrial water use projections are discussed in Section 7. However, the Bulloch County Commission could decide in the future to develop industrial parks in the unincorporated area of the county, and industrial water use estimates would need to be adjusted at that time.

Through 2050, it is expected that any expansion at Grinnell requiring additional water use will be offset by water conservation techniques. As a result, future water use at the facility is projected to remain similar to 1997 average daily use. Future conservation measures will likely include the use of cooling towers for air compressors, additional recycling of cooling or process water, and metering of water in high use areas.

As previously mentioned, Cooper Tools will be closing its Bulloch County facility in 2000. While future water use is not accounted for this particular industry, a new business may move into this facility. Based on this assumption, future water use is projected to be similar to Cooper Tools' 1997 average daily water use. Facility water use could increase or decrease, depending on the type of industry, size of operation, and the amount of water required for the particular industrial processes.

The number of smaller industrial facilities that utilize their own wells on-site for industrial process water but withdraw less than 100,000 gallons per day is expected to increase in proportion to the county population over the next 50 years. Total water use for these facilities is projected to increase from 27,000 gallons per day in 2000 to 300,000 gallons per day in 2050. However, these estimates could change depending on the type of small industrial facilities locating in Bulloch County and proximity to municipal water systems. This information is shown in Table 4-4.

### Monthly average & maximum day use for each month, peak summer/winter consumption

It is unrealistic to project these numbers because of the multiple unknown factors, such as effectiveness of water conservation and water reuse measures, technological advancements, types of industry, etc.

**Table 4-3**  
**Future Bulloch County Industrial Groundwater Use**  
 Permitted Facilities (>100,000 gallons per day groundwater withdrawal)

Permitted Facility	Projected Use (MGD)				
	2000	2010	2020	2030	2050
Cooper Tools+	0.205	0.205	0.205	0.205	0.205
Grinnell	0.780	0.780	0.780	0.780	0.780
New industry with own wells*	0.000	0.000	0.000	0.000	0.000
<b>TOTAL</b>	<b>0.985</b>	<b>0.985</b>	<b>0.985</b>	<b>0.985</b>	<b>0.985</b>

+Assumes that a new industry will move to the Cooper Tools facility and use a similar amount of water

\*As estimated by Bulloch County Development Authority, May 1999

Source: Cooper Tools, Grinnell, Bulloch County Development Authority/City of Statesboro, 1999

**Table 4-4**  
**Future Bulloch County Industrial Groundwater Use**  
 Small Facilities (<100,000 gallons per day groundwater withdrawal)

Projected Use (Gallons Per Day)				
2000	2010	2020	2030	2050
27,000	90,000	160,000	235,000	300,000

Source: Rutherford & Associates projection

**Water System Management**

**Table 4-5**  
**Bulloch County Industrial Water System Management**

Industry	Number of Wells	Well Source	Number of Storage Tanks	Storage Capacity
Cooper Tools	2	Upper Floridan Aquifer	2	400,000 gallons (200,000 each tank)
Grinnell	2	Upper Floridan Aquifer	1	400,000 gallons



## V. WATER USE INVENTORY AND PROJECTION— AGRICULTURE AND GOLF COURSES

### (Irrigation Wells and Livestock Watering)

#### Description

This section addresses agricultural operations and golf courses that utilize surface water or groundwater for irrigation or livestock watering. Agriculture has traditionally played a major role in Bulloch County's economy, and farms occupy a significant amount of the land in the county. Bulloch County gross farm income totaled \$95,226,000 in 1997. Major agricultural commodities in 1997 included cotton (43,000 acres), peanuts (21,000 acres), soybeans (19,000 acres), and corn (16,500 acres). The county also produces a number of beef cattle, poultry, and hogs.

Approximately 75,000 acres are intensively managed for agricultural purposes. According to the Bulloch County Cooperative Extension Service, 20 percent of this acreage utilizes irrigation. As illustrated on *Map 5* in Appendix A, most irrigated farmland in Bulloch County is located south and east of Statesboro.

Agricultural operations that withdraw more than 100,000 gallons of groundwater or surface water per day require an EPD withdrawal permit. As of January 1999, EPD had issued 412 permits to approximately 167 agricultural operations. These permits included 283 for surface water withdrawal, 114 for groundwater withdrawal, and 14 combined withdrawal. However, most of the surface water withdrawal in Bulloch County is from ponds that are partly filled with groundwater. Through its permits, EPD limits surface water usage to three million gallons per day and groundwater usage to four million gallons per day.

EPD considers golf courses to be an agricultural use for the purpose of groundwater management. Five golf courses, illustrated on *Map 6* in Appendix A, are presently operated in Bulloch County:

- Eagle Creek Golf Club
- Forest Heights Country Club
- Lakeview Golf Course and Driving Range
- Southern Links Golf Club
- Hacker's Golf Park (practice range)

#### Past and Present Water Demand

Agricultural producers presently utilize an application of six to ten inches of water per acre per year. For calculating water use, one acre-inch represents 27,000 gallons. Based on EPD withdrawal limits and application requirements, approximately 6,600 acres are irrigated with surface water, and 8,800 acres are irrigated with groundwater.

The University of Georgia recently completed flow surveys on 25 agricultural water systems in Bulloch County (groundwater and surface water). In each case, the actual flow was significantly less than pump capacity (approximately 68 percent on average). Also, 12 water systems selected to be checked were not in use. According to the Bulloch County Cooperative Extension Service, these findings indicate that potential use could be as low as 70 percent of EPD water withdrawal limits. This equates to approximately five million gallons per day withdrawal.

As indicated in Tables 5-1, 5-2, and 5-3, the US Geological Survey estimated total agricultural water use (agricultural irrigation, livestock watering, and golf course irrigation) to be 9.47 million gallons per day in 1997, compared to 5.34 million gallons per day in 1985. Excluding golf course water use, agricultural operations may have used 8.5 million gallons of groundwater and surface water per day in 1997. *Tables 5-4 and 5-5* indicate past and present water use by crop.

These US Geological Survey figures are considered conservative and are used as present agricultural water use estimates in this plan. It should be noted that it is difficult to accurately project agricultural water use, and EPD needs to update its current permits and methods for calculating the number of serviceable systems in use.

Bulloch County's five golf courses combined to use approximately 0.750 million gallons per day in 1997. As mentioned above, golf course water use estimates are included in the US Geological Survey agricultural water use figures. Bulloch County's golf courses utilize both surface water and groundwater for irrigation.

### **Future Water Demand**

The Bulloch County Cooperative Extension Service estimates that the present agricultural production crop mix will remain about the same over the next five years. Some Bulloch County farmers indicate that some farms will go to double crop production. Therefore, an increase in agricultural water use due to crop rotation could occur. The number of agricultural water systems could potentially increase, as EPD will allow, enhancing crop yield potential. The maximum increase in irrigated acreage is not expected to exceed 10,000 acres, bringing the total amount of irrigated agricultural acreage in Bulloch County to 25,000 acres. Agricultural water use beyond the next five years will depend on such factors as crop mix, irrigation practices, and the amount of agricultural acreage. For the purpose of this plan, future Bulloch County single crop agricultural water use, including golf courses, is projected to utilize irrigation equal to 10 inches per acre. Double crop irrigation is projected to utilize irrigation equal to 18 inches per acre.

Some future agricultural water demand could be met with water captured in impoundments. The use of impoundments would utilize the rainfall the county receives in the non-growing season and reduce the demand on groundwater.

Some new uses for groundwater in agricultural practices include aquaculture (catfish

farming) and vegetable crops. Kenaf, a fibrous crop that is a possible substitute for pulp trees, is being examined at the University of Georgia experimental stations. A new hybrid grain, pearl millet, is being considered as a crop that is drought-tolerant.

#### *Aquaculture*

In 1980, over 2,000 acres of ponds were used in commercial catfish production in Georgia. Farmers in Bulloch County have expressed an interest in catfish farming. Catfish farming requires a warm water environment for good growth. Optimum temperature is 85 degrees Fahrenheit. South Georgia has about 250 days when the water is above 60 degrees Fahrenheit. Ponds can be any size depending upon projected stocking rates. Depth of the water plays no part in determining the stock rate.

Pond sizes of approximately 10 acres seem to be the easiest to work and control water quality issues. A pond of 20 acres averaging 5 feet in depth will require approximately 16.3 million gallons of water to fill.<sup>2</sup> Water has to be added to the ponds periodically to replace water lost to evaporation. Assuming a one-inch loss of water per week to evaporation, approximately 3,847 gallons a day would be required to maintain the original depth of a 10-acre pond.<sup>3</sup>

#### *Kenaf*

Kenaf is being tested at several of the University of Georgia College of Agriculture and Environmental Science Branch Experiment stations. Kenaf is a tree-free paper made from a plant related to cotton and okra. Its historical roots go back thousands of years to ancient Africa, the Middle East, and Asia. The United States Department of Agriculture became interested in this environmentally-friendly source of paper pulp during the 1940s and early '50s when paper usage in the U.S. nearly doubled. To meet the demand, forest were being logged at a tremendous rate, so the USDA began looking for a non-wood alternative. After much research, the agency decided that kenaf was the best choice.

Kenaf compares favorably in quality with trees as a source of fibers for paper, and it yields more fiber per acre than southern pines grown in tree plantations. While trees can take 20 to 25 years to reach maturity, kenaf can be harvested in just five months. Another advantage of growing this tree-free substitute is that it is naturally resistant to most pests and disease. The plant crowds out weeds, reducing the need for herbicides.

Using kenaf as a source of paper pulp can help save natural resources and the energy needed to produce wood-based paper. In addition, it reduces pollution, and substituting it for tree fibers helps to preserve wildlife habitats that are lost in logging.

#### *Pearl Millet*

Pearl millet is a grain crop common to Africa and India. Pearl millet, a member of the grass family, grows in heights ranging from 3 to 16 feet. It produces a long, dark spike,

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<sup>2</sup> 5 ft. = 326,000 acres ft. x 5 ft. = 1,630,000 x 10 = 16,300,000 gallons

<sup>3</sup> 1 inch = 27,000 gallons/week x 52 weeks/year = 1,404,000/year = 3,847 gallons/day

resembling a cattail, which holds hundreds of small blue or white grains resembling pearls. There are two types of pear millet. One type produces grain and the other produces forage for cattle. Farmers in semi-arid parts of India and west Africa grow 64 million acres of pearl millet. Fifty million acres are for food, making it the world's fourth most important tropical food cereal.

Pearl millet might be an alternative to soybeans and corn, which to meet the demand in Georgia, have to be imported from the Midwest. The Georgia poultry industry consumption of soybeans is more than 15 times the amount grown in Georgia. Pearl millet could become a new cash crop for Georgia farmers and could ultimately reduce irrigation needs for farms in the future.

*Vegetable farming*

Vegetable farming is moving from Florida to Georgia. South Georgia enjoys similar climate to that of Florida. With irrigation, vegetable farming can be very productive and profitable for the farmers. In most cases, the farmers can get two vegetable crops a year with a growing season of approximately 270 days. Vegetable farming will become a large irrigation use in the future.

*Table 5-6* depicts future groundwater use for agriculture. *Table 5-7* indicates future water use by crop. It is estimated that at least one additional golf course will be developed in Bulloch County by 2020. As indicated in *Table 5-8*, total Bulloch County golf course water use is projected to increase to 0.900 million gallons per day by 2020. *Table 5-9* indicates total projected agricultural water use from surface and groundwater.

*Water conservation measures to be employed*

Water conservation measures will have to be employed in order to maintain reasonable use of the Floridan aquifer as a primary source of water. The county will have to develop a countywide conservation program for domestic and commercial usage. The county will have to work with local industries to assist them in efforts to reduce water usage. The agricultural community with support from the county will have to study and implement conservation practices as those discussed in the EPD report entitled *Irrigation Conservation Practices Appropriate for the Southeastern United States*.

**Table 5-1**

**US Geological Survey Estimated Bulloch County Agricultural Groundwater Use**

Agricultural Water Use	Average Daily Groundwater Use (MGD)				
	1980	1985	1990	1995	1997
Irrigation	3.81	3.24	1.61	6.16	6.16
Livestock	0.30	0.15	0.04	0.04	0.22
<b>TOTAL</b>	4.11	3.39	1.65	6.20	6.38

Source: US Geological Survey, 1998

**Table 5-2**  
**US Geological Survey Estimated Bulloch County Agricultural Surface Water Use**

Agricultural Water Use	Average Daily Surface Water Use (MGD)				
	1980	1985	1990	1995	1997
Irrigation	5.96	1.82	1.11	3.05	3.05
Livestock	0.14	0.13	0.24	0.22	0.04
<b>TOTAL</b>	<b>6.10</b>	<b>1.95</b>	<b>1.35</b>	<b>3.27</b>	<b>3.09</b>

Source: US Geological Survey, 1998

**Table 5-3**  
**US Geological Survey Estimated Bulloch County Agricultural Water Use (Total)**

Agricultural Water Use	Average Daily Total Water Use (MGD)				
	1980	1985	1990	1995	1997
Irrigation	9.77	5.06	2.72	9.21	9.21
Livestock	0.44	0.28	0.28	0.26	0.26
<b>TOTAL</b>	<b>10.21</b>	<b>5.34</b>	<b>3.00</b>	<b>9.47</b>	<b>9.47</b>

Source: US Geological Survey, 1998

**Table 5-4**  
**Past Water Use By Crop**

Acres per Crop and Water Use (MGD) per Crop: 1970 - 1985								
	1970		1975		1980		1985	
	Acres	Water Use	Acres	Water Use	Acres	Water Use	Acres	Water Use
Corn	1,200	0.89	6,000	4.452	7,200	5.342	5,000	3.71
Peanuts	450	0.334	1,200	0.89	1,400	1.038	3,000	2.226
Soybeans	150	0.111	500	0.371	1,800	1.335	2,000	1.484
Tobacco	300	0.222	700	0.519	800	0.593	700	0.519
Vegetables	50	0.066	100	0.133	150	0.199	250	0.333
Pecans	-	0	-	0	-	0	70	0.052
Pasture	50	0.037	50	0.037	200	0.148	200	0.148
<b>TOTAL</b>	<b>2,200</b>	<b>1.66</b>	<b>8,550</b>	<b>6.402</b>	<b>11,550</b>	<b>8.655</b>	<b>11,220</b>	<b>8.472</b>

Vegetables include cucumbers, squash, tomatoes, peppers, watermelons, and cantaloupes.

Source: Bulloch County

**Table 5-5  
Present Water Use Per Crop**

<b>Acres per Crop and Water Use (MGD) per Crop: 1990 - 1999</b>						
	<b>1990</b>		<b>1995</b>		<b>1999</b>	
	<i>Acres</i>	<i>Water Use</i>	<i>Acres</i>	<i>Water Use</i>	<i>Acres</i>	<i>Water Use</i>
Corn	5,000	3.710	1,800	1.335	1,200	0.890
Cotton	500	0.371	6,000	4.452	9,750	7.234
Peanuts	4,000	2.968	2,000	1.484	2,000	1.484
Soybeans	1,500	1.113	1,600	1.187	500	0.371
Tobacco	900	0.667	1,000	0.742	500	0.371
Vegetables	300	0.339	650	0.865	750	0.999
Pecans	130	0.096	200	0.148	300	0.222
Pasture	300	0.222	350	0.259	400	0.296
<b>TOTAL</b>	<b>12,630</b>	<b>9.486</b>	<b>13,600</b>	<b>10.472</b>	<b>15,400</b>	<b>11.867</b>

Vegetables include cucumbers, squash, tomatoes, peppers, watermelons, and cantaloupes.

Source: Bulloch County

**Table 5-6  
Bulloch County**

**Agricultural Water Demand for Single and Double Crop Use and Aquaculture**

<i>Year</i>	<i>Single crop</i>		<i>Double crop</i>		<i>Aquaculture</i>		<i>Total Daily Use (MGD)</i>
	<i>Acres</i>	<i>Water Use (MGD) <sup>1</sup></i>	<i>Acres</i>	<i>Water Use (MGD) <sup>2</sup></i>	<i>Acres</i>	<i>Water Use (MGD) <sup>3</sup></i>	
2000	14,650	10.870	750	0.999	30	0.115	11.984
2010	18,700	13.875	1,200	1.598	100	0.385	15.859
2020	21,400	15.879	2,000	2.664	200	0.769	19.312
2030	21,500	15.953	2,600	3.463	300	1.154	20.570
2040	22,200	16.472	3,500	4.662	400	1.539	22.673
2050	22,000	16.324	3,000	3.996	500	1.924	22.244

<sup>1</sup> Based on 10 inches irrigation for 120 day growing season

<sup>2</sup> Based on 18 inches irrigation for 270 day growing season

<sup>3</sup> Based on 3,847 gallons per day to maintain depth of 10-acre pond

Source: Rutherford & Associates

**Table 5-7  
Projected Water Use Per Crop**

<b>Acres per Crop and Water Use (MGD) per Crop: 2000 - 2050</b>												
	<b>2000</b>		<b>2005</b>		<b>2010</b>		<b>2015</b>		<b>2020</b>		<b>2025</b>	
	<i>Acres</i>	<i>Water Use</i>										
Corn	1,200	0.89	1,500	1.113	2,000	4.484	2,000	1.484	2,000	1.484	2,000	1.484
Cotton	9,750	7.234	11,000	8.162	12,000	8.904	12,000	8.904	12,000	8.904	11,000	8.162
Peanuts	2,000	1.484	2,500	1.855	3,000	2.226	4,000	2.968	5,000	3.71	6,000	4.452
Soybeans	500	0.371	500	0.371	500	0.371	500	0.371	500	0.371	500	0.371
Tobacco	500	0.371	500	0.371	200	0.148	-	0	-	0	-	0
Vegetables	750	0.999	1,000	1.332	1,200	1.598	1,600	2.131	2,000	2.664	23,500	3.33
Pecans	300	0.226	350	0.259	400	0.297	600	0.445	700	0.519	800	0.593
Pasture	400	0.297	500	0.371	600	0.445	1,000	0.742	1,200	0.89	1,500	1.113
<b>TOTAL</b>	<b>15,400</b>	<b>11.872</b>	<b>17,850</b>	<b>13.834</b>	<b>19,900</b>	<b>18.473</b>	<b>21,700</b>	<b>17.045</b>	<b>23,400</b>	<b>18.542</b>	<b>45,300</b>	<b>19.505</b>

<b>Acres per Crop and Water Use (MGD) per Crop: 2000 - 2050 (Cont.)</b>										
	<b>2030</b>		<b>2035</b>		<b>2040</b>		<b>2045</b>		<b>2050</b>	
	<i>Acres</i>	<i>Water Use</i>								
Corn	2,000	1.484	2,000	1.484	2,000	1.484	2,000	1.484	2,000	1.484
Cotton	9,000	6.678	7,000	5.194	5,000	3.71	4,000	2.968	3,000	2.226
Peanuts	7,000	5.194	8,000	5.936	11,000	8.162	12,000	8.904	12,000	8.904
Soybeans	500	0.371	500	0.371	500	0.371	500	0.371	500	0.371
Tobacco	-	0	-	0	-	0	-	0	-	0
Vegetables	2,600	3.463	3,000	3.996	3,500	4.662	3,500	4.662	3,000	3.996
Pecans	1,000	0.742	1,000	0.742	1,200	0.89	1,300	0.964	1,500	1.113
Pasture	2,000	1.484	2,100	1.558	2,500	1.855	3,000	2.226	3,000	2.226
<b>TOTAL</b>	<b>24,100</b>	<b>19.416</b>	<b>23,600</b>	<b>19.281</b>	<b>25,700</b>	<b>21.134</b>	<b>26,300</b>	<b>21.579</b>	<b>25,000</b>	<b>20.320</b>

Vegetables include cucumbers, squash, tomatoes, peppers, watermelons, and cantaloupes. Acreage of vegetable crops will be determined by market and other economic conditions.

Source: Bulloch County

**Table 5-8  
Projected Bulloch County Golf Course Water Use (Irrigation)**

<b>Projected Use (MGD)</b>				
<b>2000</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2050</b>
0.750	0.750	0.900	0.900	0.900

Source: Bulloch County Cooperative Extension Service / Coastal Georgia RDC projection

**Table 5-9  
Projected Bulloch County Agricultural Use  
(Groundwater and Surface water)**

	<b>2000</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>
Surface	3.270	3.770	4.200	4.500	4.750	5.000
Groundwater	11.245	13.591	15.975	17.988	19.707	23.053
TOTAL	14.515	17.361	20.175	22.488	24.457	28.053

Source: Rutherford & Associates

## VI. WATER USE INVENTORY AND PROJECTION — GEORGIA SOUTHERN UNIVERSITY'S WATER SYSTEM

### Description

Georgia Southern University (GSU), the third largest university in Georgia, is located in Statesboro along State Route 67 (see *Map 7* in Appendix A). With a 1997 total student enrollment of 13,965 and 1,768 faculty and staff, GSU houses 2,750 students on its campus. Approximately 7,000 students live off-campus in Statesboro, and 4,000 students commute from Bulloch County and the surrounding region. While GSU has grown tremendously over the past several years, a two percent annual growth cap is now in place.

The university operates its own water system and is permitted by EPD to withdraw 0.503 million gallons of groundwater per day, based on a yearly average. Sewer service and limited water service are provided by the City of Statesboro.

### Past and Present Water Demand

*Table 6-1* lists GSU's permitted daily groundwater withdrawal (based on a yearly average), 1985 average daily groundwater use, and 1997 average daily groundwater use. GSU used 0.375 million gallons of groundwater per day in 1997, or approximately 75 percent of its permitted daily withdrawal. Water use has remained fairly constant from 1985 to 1997, despite an increase in student enrollment.

*Table 6-2* lists GSU's average daily groundwater use for each month of 1997, in addition to per capita use. Peak 1997 water demand occurred during September, when 0.575 million gallons of water were used per day. Although this figure exceeds the yearly average daily groundwater withdrawal permit limit, GSU is allowed to average one million gallons of daily groundwater withdrawal over the course of a month. GSU's per capita water use (gallons per person per day) averaged 63 gallons during 1997, ranging from an average of 31 gallons per person per day in December, to 96 gallons per person per day in September (these months correspond with Christmas Break and the beginning of Fall Semester, respectively). The sum of the number of students living on-campus, 25 percent of students living off-campus, and 25 percent of faculty and staff is divided by GSU's 1997 average daily water use (0.375 million gallons) to derive per capita water use. This calculation assumes that a student or staff member living off-campus will only account for 25 gallons of on-campus water use per day, while an on-campus resident will account for 100 gallons per day.

**Table 6-1  
Past and Present Georgia Southern University Groundwater Use**

<u>Permitted</u> Yearly Average Daily Withdrawal (MGD)	1985 Average <u>Use</u> (MGD)	1997 Average <u>Use</u> (MGD)
0.503	0.380	0.375

Source: Georgia Southern University, Physical Plant Division

**Table 6-2  
Georgia Southern University Groundwater Use by Month (1997)**

Month	Average Daily Groundwater Use (MGD)	Per Capita Use (Gallons Per Day)+
January	0.279	47
February	0.284	47
March	0.305	51
April	0.474	79
May	0.418	70
June	0.418	70
July	0.481	80
August	0.356	59
September	0.575	96
October	0.458	76
November	0.260	43
December	0.187	31
Annual	0.375	63

+Georgia Southern University per capita use based on population of 2,750 on-campus residents plus 2,804 (25%) of 11,215 off-campus students, and 442 (25%) of 1,768 faculty and staff

Source: Georgia Southern University, 1998

### **Future Water Demand**

Table 6-3 lists GSU's projected student enrollment and groundwater use through 2050. These population figures are based on an estimated two percent annual increase in the number students living off-campus, in addition to a ten percent increase in the number of on-campus residents in 2020 and 2050. GSU representatives indicate that no residential development is scheduled on campus for the near future. These population and water use figures may increase or decrease, however, depending on modifications to the existing two percent growth cap or changes in student enrollment projections, campus expansion plans, or water service operations.

**Table 6-3  
Projected Future Georgia Southern University Population and Water Use**

<b>Year</b>	<b>Projected On-Campus Student Population</b>	<b>Projected Off-Campus Student Population</b>	<b>Projected Total Enrollment</b>	<b>Projected Water Use (MGD)</b>
2000	2,750	11,888	14,638	0.386
2010	2,750	14,266	17,016	0.427
2020	3,025	17,119	20,144	0.493
2030	3,025	20,543	23,568	0.551
2050	3,330	28,760	32,090	0.710

Source: Coastal Georgia RDC estimate in consultation with GSU staff



## VII. WATER USE INVENTORY AND PROJECTION — MUNICIPAL WATER SYSTEMS

### Description

This section addresses municipal water systems that serve residential, commercial, and industrial customers inside and outside municipal boundaries. All of Bulloch County's municipalities (Statesboro, Brooklet, Portal, and Register) operate municipal water systems. The water service area for each municipal water system is indicated on *Maps 8-11* in Appendix A.

Statesboro and Brooklet withdraw more than 100,000 gallons of groundwater per day and require EPD groundwater withdrawal permits, in addition to EPD safe drinking water permits. Statesboro is permitted to withdraw 3.700 million gallons of groundwater per day (yearly average), while Brooklet is permitted to withdrawal 0.200 million gallons of groundwater per day. Portal is expected to require an EPD groundwater withdrawal permit within the next 20 years.

While each municipal water system serves residential and commercial customers, Statesboro is the only municipality that provides water to industrial facilities (defined as a business using water in an industrial/manufacturing process). Statesboro provides water to three industrial parks, and total industrial water use is expected to increase significantly in the future (see *Table 7-7*). The other three Bulloch County municipalities are not expected to provide water to industrial facilities in the near future.

### Past and Present Water Demand

*Tables 7-1* through *7-5* list the maximum daily water use for past water use for Brooklet, Portal, Register, Statesboro and unincorporated Bulloch County from 1970 - 1985. Any conservation measures employed during this time are not known. All estimates prepared by Rutherford & Associates. *Table 7-6* lists permitted daily groundwater withdrawal (based on a yearly average), 1985 average daily groundwater use, and 1997 average daily groundwater use for each municipality. Overall, Bulloch County's municipal water systems combined to use 3.270 million gallons of groundwater per day in 1997, compared to approximately 1.288 million gallons per day in 1985.

*Tables 7-7*, *Table 7-8*, *Table 7-9*, and *Table 7-10* list average daily groundwater use for each month of 1997, in addition to per capita water use, for Statesboro, Brooklet, Portal, and Register, respectively. Per capita water use for each municipality is calculated by dividing average daily water use by the projected 1997 municipal population or estimated number of residential customers.

<i>Table 7-1: City of Statesboro</i>						
<i>Maximum Daily Use and Per Capita for 1970, 1980, 1985</i>						
<i>(Water use reported in 000 thousands)</i>						
	1970		1980		1985	
	Population: 14,616		Population: 14,866		Population: 15,670	
	<i>Daily Total Water Use</i>	<i>Per Capita Water Use</i>	<i>Daily Total Water Use</i>	<i>Per Capita Water Use</i>	<i>Daily Total Water Use</i>	<i>Per Capita Water Use</i>
Jan	0.830	57	0.850	57	0.9	57
Feb	0.850	58	0.850	57	1	64
Mar	0.920	63	0.950	64	1.05	67
Apr	1.020	70	1.050	71	1.08	69
May	1.200	82	1.220	82	1.25	80
June	1.300	89	1.350	91	1.4	89
July	1.325	91	1.400	94	1.475	94
Aug	1.300	89	1.250	84	1.3	83
Sept	1.100	75	1.100	74	1.15	73
Oct	0.965	66	0.900	61	0.98	63
Nov	0.850	58	0.890	60	0.875	56
Dec	0.800	55	0.850	57	0.875	56
Average	1.038	71	1.055	71	1.11	71

<i>Table 7-2: City of Portal</i>						
<i>Maximum Daily Use and Per Capita for 1970, 1980, 1985</i>						
<i>(Water use reported in 000 thousands)</i>						
	1970		1980		1985	
	Population: 643		Population: 694		Population: 700	
	<i>Daily Total Water Use</i>	<i>Per Capita Water Use</i>	<i>Daily Total Water Use</i>	<i>Per Capita Water Use</i>	<i>Daily Total Water Use</i>	<i>Per Capita Water Use</i>
Jan	0.052	81	0.053	76	0.055	79
Feb	0.054	84	0.055	79	0.056	80
Mar	0.055	86	0.06	86	0.061	87
Apr	0.059	92	0.061	88	0.063	90
May	0.062	96	0.065	94	0.065	93
June	0.065	101	0.071	102	0.07	100
July	0.069	107	0.073	105	0.072	103
Aug	0.065	101	0.073	105	0.074	106
Sept	0.062	96	0.068	98	0.067	96
Oct	0.058	90	0.064	92	0.063	90
Nov	0.057	89	0.058	84	0.062	89
Dec	0.05	78	0.055	79	0.06	86
Average	0.059	92	0.063	91	0.064	91

<i>Table 7-3: Unincorporated Bulloch County</i>						
<i>Maximum Daily Use and Per Capita for 1970, 1980, 1985</i>						
<i>(Water use reported in 000 thousands)</i>						
	1970		1980		1985	
	Population: 16,241		Population: 18,995		Population: 19,685	
	<i>Daily Total Water Use</i>	<i>Per Capita Water Use</i>	<i>Daily Total Water Use</i>	<i>Per Capita Water Use</i>	<i>Daily Total Water Use</i>	<i>Per Capita Water Use</i>
Jan	0.90	55	1.20	63	1.250	64
Feb	1.15	71	1.25	66	1.300	66
Mar	1.25	77	1.45	76	1.500	76
Apr	1.35	83	1.47	77	1.550	79
May	1.40	86	1.60	84	1.650	84
June	1.50	92	1.75	92	1.875	95
July	1.65	102	1.95	103	2.080	106
Aug	1.70	105	1.75	92	1.800	91
Sept	1.60	99	1.70	89	1.650	84
Oct	1.15	71	1.55	82	1.600	81
Nov	1.00	62	1.35	71	1.400	71
Dec	0.94	58	1.20	63	1.250	64
Average	1.299	80	1.519	80	1.575	80

Estimate per capita for unincorporated county 80 gpd based upon comparable usage from municipalities in Bulloch County.

<i>Table 7-4: City of Brooklet</i>						
<i>Maximum Daily Use and Per Capita for 1970, 1980, 1985</i>						
<i>(Water use reported in 000 thousands)</i>						
	1970		1980		1985	
	Population: 683		Population: 1,035		Population: 1,150	
	<i>Daily Total Water Use</i>	<i>Per Capita Water Use</i>	<i>Daily Total Water Use</i>	<i>Per Capita Water Use</i>	<i>Daily Total Water Use</i>	<i>Per Capita Water Use</i>
Jan	0.052	76	0.085	82	0.092	80
Feb	0.054	79	0.086	83	0.095	83
Mar	0.056	82	0.088	85	0.097	84
Apr	0.058	85	0.090	87	0.099	86
May	0.061	89	0.092	89	0.100	87
June	0.065	95	0.093	90	0.110	96
July	0.068	100	0.095	92	0.115	100
Aug	0.067	98	0.097	94	0.105	91
Sept	0.062	91	0.090	87	0.100	87
Oct	0.057	83	0.089	86	0.099	86
Nov	0.055	81	0.088	85	0.095	83
Dec	0.053	78	0.087	84	0.093	81
Average	0.059	86	0.090	87	0.100	87

**Table 7-5: City of Register**  
**Maximum Daily Use and Per Capita for 1970, 1980, 1985**  
**(Water use reported in 000 thousands)**

	1980		1985	
	Population: 195		Population: 195	
	Daily Total Water Use	Per Capita Water Use	Daily Total Water Use	Per Capita Water Use
Jan	0.01	51	0.011	56
Feb	0.011	56	0.012	62
Mar	0.013	67	0.012	62
Apr	0.013	67	0.013	67
May	0.014	72	0.014	72
June	0.015	77	0.015	77
July	0.018	92	0.017	87
Aug	0.017	87	0.016	82
Sept	0.016	82	0.015	77
Oct	0.015	77	0.014	72
Nov	0.012	62	0.013	67
Dec	0.011	56	0.011	56
Average	0.014	72	0.014	72

Register not incorporated in 1970.

**Table 7-6**  
**Bulloch County Municipal Water Systems: Average Daily Groundwater Use**

Municipality	Permitted Yearly Average Withdrawal (MGD)	1985 Average Withdrawal (MGD)+	1997 Average Withdrawal (MGD)
Statesboro*	3.700	1.110	3.076
Brooklet*	0.200	0.100	0.102
Portal	--	0.064	0.069
Register	--	0.014	0.023
<b>TOTAL</b>	3.900	1.288	3.270

\* Municipal water system requiring groundwater withdrawal permit from EPD (> 100,000 gpd withdrawal)

+Coastal Georgia RDC estimate

Source: 1997 use— Statesboro, Brooklet, Portal, Register

**Table 7-7: Statesboro Groundwater Use by Month (1997)**

Month	Average Daily Groundwater Use (MGD)	Per Capita Use (Gallons Per Day)+
January	2.867	83
February	2.744	79
March	2.826	81
April	3.170	92
May	3.218	94
June	3.093	90
July	3.470	102
August	3.315	97
September	3.565	105
October	3.203	93
November	2.910	84
December	2.511	71
Annual	3.076	89

+Based on estimated 1997 population served (31,600), excluding 0.257 mgd water provided to industrial park customers

Source: City of Statesboro, 1999

**Table 7-8: Brooklet Groundwater Use by Month (1997)**

Month	Average Daily Groundwater Use (MGD)	Per Capita Use (Gallons Per Day)+
January	0.104	88
February	0.092	78
March	0.100	86
April	0.115	98
May	0.110	94
June	0.108	92
July	0.117	100
August	0.104	89
September	0.112	96
October	0.098	83
November	0.089	76
December	0.071	61
Annual	0.102	87

+Based on 1997 population of 1,171

Source: Town of Brooklet, 1999

**Table 7-9: Portal Groundwater Use by Month (1997)**

Month	Average Daily Groundwater Use (MGD)	Per Capita Use (Gallons Per Day)+
January	0.063	84
February	0.066	87
March	0.055	73
April	0.074	99
May	0.071	95
June	0.067	89
July	0.077	102
August	0.073	97
September	0.083	111
October	0.073	97
November	0.066	87
December	0.060	80
Annual	0.069	92

+based on 1997 population of 753

Source: Town of Portal, 1999

**Table 7-10: Register Groundwater Use by Month (1997)**

Month	Average Daily Groundwater Use (MGD)	Per Capita Use (Gallons Per Day)+
January	0.019	70
February	0.018	65
March	0.023	86
April	0.026	96
May	0.020	75
June	0.027	99
July	0.033	120
August	0.028	105
September	0.027	100
October	0.022	81
November	0.016	60
December	0.019	70
Annual	0.023	86

+based on 1997 population of 270

Source: Town of Register, 1999

### *Statesboro*

As indicated in *Table 7-2*, Statesboro's municipal water system used 3.076 million gallons of groundwater per day in 1997, compared to an estimated 1.11 million gallons of groundwater per day in 1985. Presently, Statesboro provides water to 9,100 customers inside and outside of its municipal boundary, including approximately 38 industrial park customers and 1,100 other non-residential customers. Peak 1997 water demand occurred during September, when 3.565 million gallons of groundwater were used per day. The 1997 per capita water use (based on an annual average) for Statesboro's municipal water system (excluding industrial water use) is estimated to be 89 gallons per person per day.

Statesboro's municipal water system serves three industrial parks: Gateway Regional, Perimeter Center, and Holland (see *Map 4* in Appendix A). In addition, the Airport Industrial Park and a proposed park occupying 450 acres will be provided municipal water. Industrial water use is concentrated in these three industrial parks; however, a significant amount of commercial and government uses presently occupy these parks. From June 1998 to July 1999 (water use for 1997 is not available), the three industrial parks combined to use 0.257 million gallons of groundwater per day on average. The occupants of Gateway Regional used 0.216 million gallons per day, compared to Perimeter Center's use of 0.013 million gallons per day and Holland's use of 0.027 million gallons per day. Briggs & Stratton accounted for 66 percent of Statesboro's industrial water use, followed by Viracon (14 percent) and Fisher Petroleum/Brooks (nine percent).

### *Brooklet*

As indicated in *Table 7-3*, Brooklet's municipal water system used an estimated 0.102 million gallons of groundwater per day in 1997, compared to 0.100 million gallons of groundwater per day in 1985. Presently, Brooklet's municipal water system serves 465 customers inside the municipal boundary. Brooklet does not provide water to any industrial customers. Peak 1997 water demand occurred during July, when 0.117 million gallons of groundwater were used per day. The 1997 per capita water use (based on an annual average) for Brooklet's municipal water system is estimated to be 87 gallons per person per day.

### *Portal*

As indicated in *Table 7-4*, Portal's municipal water system used an estimated 69,000 gallons of groundwater per day in 1997, compared to 64,000 gallons of groundwater per day in 1985. Presently, Portal's municipal water system serves 285 total customers, including 104 outside the municipal boundary. Portal does not provide water to any industrial customers. Peak 1997 water demand occurred during September, when 83,000 gallons of groundwater were used per day. The 1997 per capita water use (based on an annual average) for Portal's municipal water system is estimated to be 92 gallons per person per day.

## Register

As indicated in *Table 7-5*, Register's municipal water system used an estimated 23,000 gallons of groundwater per day in 1997, compared to 14,000 gallons of groundwater per day in 1985. Presently, Register's municipal water system serves 80 customers, including two customers outside the municipal boundary. Register does not provide water to any industrial customers. Peak 1997 water demand occurred during July, when 33,000 gallons of groundwater were used per day. The 1997 per capita water use (based on an annual average) for Brooklet's municipal water system is estimated to be 86 gallons per person per day.

There are no intergovernmental agreements at this time.

## Future Water Demand

*Table 7-6* indicates the projected future water demand for each Bulloch County municipal water system. Municipal water use in Bulloch County is projected to increase from 3.536 million gallons per day in 2000 to 7.698 million gallons per day in 2050. Average daily water use for Statesboro's municipal water system is projected to more than double between 2000 and 2050, while average daily water use for Portal and Register should nearly double during this time period.

Future water use is calculated by using a per capita consumption of 120 gallons per day and the projected population for future years. However, the extension of water lines into unincorporated areas, provision of water service to residents presently served by non-municipal water systems or domestic wells, provision of water to new industrial or commercial facilities, and unexpected population growth may affect these future water use projections.

As indicated in *Table 7-7*, industrial water use in Statesboro is projected to increase from 0.276 million gallons per day in 2000 to 1.200 million gallons per day by 2020. Statesboro could experience industrial growth over the next fifty years that could push industrial water use near 3.700 million gallons per day by 2050. These figures were projected with considerable input from the Bulloch County Development Authority. *Table 7-8* indicates the available or proposed acreage and the type of industry for each of five industrial parks. Nearly 1,200 acres are available or proposed for industrial park development. *Table 7-9* provides an overview of the municipal water systems in Bulloch County.

There are opportunities to expand the Statesboro system into Register and Portal as development continues to occur along those transportation corridors. An intergovernmental agreement could be entered into at the appropriate time.

**Table 7-6  
Future Bulloch County Municipal Groundwater Use:  
Municipal Water Systems**

Municipality	Projected Use (MGD)				
	2000	2010	2020	2030	2050
Statesboro: Total	4.547	5.931	7.533	9.156	14.937
Statesboro: Non-Industrial	4.271	5.201	6.333	7.381	11.237
Brooklet	0.143	0.152	0.161	0.170	0.187
Portal	0.095	0.112	0.129	0.145	0.179
Register	0.034	0.041	0.047	0.054	.0637
<b>TOTAL</b>	<b>4.543</b>	<b>5.506</b>	<b>6.670</b>	<b>7.750</b>	<b>11.670</b>

Source: Coastal Georgia RDC estimate; Rutherford & Associates estimate

**Table 7-7  
Future Bulloch County Industrial Park Groundwater Use;  
Statesboro Municipal Water System**

Industrial Park	Projected Use (MGD)				
	2000	2010	2020	2030	2050
Gateway Regional Park	0.255	0.366	0.425	0.500	0.850
Perimeter Center Park	0.017	0.061	0.125	0.175	0.750
Holland Park	0.034	0.103	0.200	0.400	1.000
Airport Park	0.000	0.100	0.200	0.300	0.450
Future (Unnamed) Park	0.000	0.100	0.250	0.400	0.650
<b>TOTAL</b>	<b>0.276</b>	<b>0.730</b>	<b>1.200</b>	<b>1.775</b>	<b>3.700</b>

Source: City of Statesboro, Bulloch County Development Authority, 1999; Rutherford & Associates estimate

**Table 7-8  
Bulloch County Industrial Park Summary  
(Statesboro Municipal Water System)**

<b>Industrial Park</b>	<b>Industry Description</b>	<b>Available Acreage (1999)</b>
Gateway Regional Park	Heavy industry and commercial	100.4 acres
Perimeter Center Park	Commercial and light industry	56 acres
Holland Park	Heavy industry and commercial	400 acres
Airport Park	Light industry and commercial	183 acres
Future (Unnamed) Park	Unknown	450 acres (Proposed)

Source: Coastal Georgia RDC estimate

Monthly average & maximum day use for each month, peak summer/winter consumption  
It is unrealistic to project these numbers because of the multiple unknown factors, such as effectiveness of water conservation and water reuse measures, technological advancements, types of industry, etc.

### Water System Management

**Table 7-9  
Bulloch County Municipal Water System Overview**

<b>Municipality</b>	<b>Number of Wells</b>	<b>Water Production Capacity (MGD)</b>	<b>Water Source</b>	<b>Water Storage Capacity</b>
Brooklet	2	?	Upper Floridan Aquifer	.200 million gallons (1 storage tank)
Portal	2	?	Upper Floridan Aquifer	90,000 gallons (2 storage tanks)
Register	2	?	Upper Floridan Aquifer	2 storage tanks
Statesboro	6	6,850 gallons per minute	Upper Floridan Aquifer	1.400 million gallons (4 storage tanks)

Source: Coastal Georgia RDC interviews with municipal staff, 1999

The United States Geologic Survey (USGS) has conducted numerous studies of the Floridan aquifer system in Southeast Georgia. These studies are made available to the Georgia Environmental Protection Division (EPD) for their review. Water quality is good for the Floridan aquifer system as used in Bulloch County. Numerous studies, relied on for sources in development of this plan, indicate that water quality is not an issue. All public water systems are required to complete Consumer Confidence Reports (CCR). The CCR was mandated by the U.S. Environmental Protection Agency and contains information on the quality of drinking water provided by the public systems.

It became apparent that some limitations on additional withdrawal from the Floridan Aquifer system were appropriate in some parts of Coastal Georgia to protect the quality of public water supplies. The Interim Strategy was developed and implemented to address these issues and to study the safe yield of groundwater sources through the Sound Science Initiative. Until the Sound Science Initiative concludes, the safe yield of groundwater sources cannot be determined or planned for by local governments.

The Georgia Department of Natural Resources Environmental Protection Division (EPD) is the state agency that has statutory authority to regulate water use through a permitting system. This system requires permits for all withdrawals of surface water or groundwater that exceed 100,000 gallons per day. EPD issues Safe Drinking water permits for systems withdrawing less than 100,000 gallons per day.

It became apparent that some limitations on additional withdrawal from the Floridan Aquifer system were appropriate in some parts of Coastal Georgia to protect the quality of public water supplies. The Interim Strategy was developed and implemented to address these issues and to study the safe yield of groundwater sources through the Sound Science Initiative. Until the Sound Science Initiative concludes, the safe yield of groundwater sources cannot be determined or planned for by local governments.

Wellhead protection programs are critical to reduce the potential to impact groundwater quality. The county in partnership with the County Health Department should make sure that all wells in service in the county are part of a wellhead protection program.

The existing permitted systems have the capabilities to exceed their permitted withdrawal amount. However, since a permit exists for each system, the likelihood of exceeding the permit is minimal. There may be alternative water sources that can be utilized after further study. The Cretaceous aquifer may serve as a viable source of water to reduce the County's overall dependence on the Floridan aquifer. The Dublin and Midville aquifers may provide some limited amount of supply. However, it is important to continue to study the alternative aquifers prior to becoming dependent on them only to find that there may be a problem.

Service areas include the municipalities and the numerous community systems. The potential for interconnection will occur as development continues to spread throughout the county. Interconnection will be one alternative to expand the system capabilities.

The Ogeechee River would be the only surface source that might serve as a potential water supply. Due to potential problems with low-flow and poor water quality, this is not a viable surface water supply source. Information on the ability of the Ogeechee River to meet a specified withdrawal amount is available from EPD. A surface water withdrawal permit is needed to utilize water from any of the state's many surface sources. Information concerning safe yield and water quality could be obtained.

As to source protection measures for surface water, many communities are now or will soon be required to meet certain stormwater discharge criteria. The quality of surface streams can be negatively impacted by poor stormwater management practices. This is an area that rural counties will begin addressing in the near future.

Any public water systems utilizing surface water in the future would have a system capabilities analysis at that time.

## VIII. WATER USE INVENTORY AND PROJECTION — NON-MUNICIPAL COMMUNITY WATER SYSTEMS

### Description

This section addresses "non-municipal community water systems," defined as water systems that serve residential subdivisions and other small residential areas not connected to municipal water systems. In addition, these systems serve more than 15 residences or 25 individuals and require an EPD safe drinking water permit. EPD considers municipal water systems as community systems for the purpose of safe drinking water permitting; however, municipal water systems are reviewed separately in this plan.

The list of Bulloch County non-municipal community water systems in *Table 8-1* is based on *Table 3-2* (1998 EPD safe drinking water permits). Sixty-nine non-municipal community water systems serving rural residential subdivisions, mobile home parks, or other residential uses were permitted in Bulloch County in 1998. The approximate locations of most of these non-municipal community water systems are indicated on *Map 12* in Appendix A.

### Past and Present Water Demand

*Table 8-1* lists the present population served by each non-municipal community water system and the estimated gallons of water used per day from each system. It is assumed that 100 gallons of water are used per person per household per day. In total, an estimated 10,464 persons in Bulloch County are served by non-municipal community water systems and use approximately 1.046 million gallons of water per day. It should be noted that the reported population served by each non-municipal community water system can range in date from 1989 to 1998 and may not reflect the present population served by a system (revised figures based on direct contact with system managers are noted in the table). In addition, a small number of non-municipal community water systems may not be permitted through EPD, so overall water use may be underestimated.

Based on Bulloch County's 1985 population, an estimated 6,350 persons were served by non-community water systems in the county in 1985, using a total of 0.635 million gallons of groundwater per day (assuming 100 gallons per person per day).

**Table 8-1  
Present Bulloch County Non-Municipal Community Water System  
Groundwater Use**

Based on EPD Safe Drinking Water Permits (1998)

<b>Permitted Non-Municipal Community Water System</b>	<b>Population Served (Number Persons)</b>	<b>Gallons of Water Used per Day*</b>
Nevils Water Association	156	15,600
Leefield Water Association	96	9,600
Mixon's Mobile Village	91	9,100
Forest Heights Subdivision	566	56,600
Grove Lakes Subdivision	783	78,300
Johnson Mobile Home Park	175#	17,500
The Barn Mobile Home Park	138	13,800
Lake Collins Estates	143	14,300
Lanier Mobile Home Park	96	9,600
Tankersley Subdivision	42	4,200
Windfield Subdivision	122	12,200
Hazelwood Subdivision	312	31,200
Country Club Hills/Pine Forest	224	22,400
Forest Hills Subdivision	185	18,500
Country Lakes Estates MHP	140	14,000
Riverside Estates	65	6,500
New Hope Subdivision	82	8,200
Frankville Water Association	25	2,500
Coach House Estates MHP	234	23,400
Colonial Heights Subdivision	101	10,100
Cypress Lake Mobile Home Park	63	6,300
Mill Creek Estates	78	7,800
Lakeside Estates	70	7,000
Newtons Mobile Home Village	65	6,500
Thomas Village	49	4,900
Westchester Subdivision	172	17,200
Frinks Trailer Park	43	4,300
Zetterower Mobile Home Park	47	4,700
Woodland Mobile Estates	101	10,100
Georgian Walk Subdivision	390#	39,000

<b>Permitted Non-Municipal Community Water System</b>	<b>Population Served (Number Persons)</b>	<b>Gallons of Water Used per Day*</b>
Eldora Farms Subdivision	291	29,100
Mill Creek Landing	94	9,400
Meadow Lakes Plantation Subdivision	195#	19,500
Westridge Subdivision	100	10,000
Hodges Subdivision	65	6,500
Deerfield Subdivision	133	13,300
Northwood Subdivision	151	15,100
Cedarwood Mobile Home Park	177#	17,700
Chance's Mobile Home Park	146	14,600
Williford Trailer Park	52	5,200
Old Mill Pond Subdivision	86#	8,600
Bird Road Trailer Park	100	10,000
Timberland Points	127	12,700
Hunters Point Subdivision	533#	53,300
Southern Comfort Subdivision	229#	22,900
On the Pond Subdivision	169#	16,900
English Oaks Mobile Home Park	52	5,200
Olney Station	270	27,000
Plantation Mobile Estates	37	3,700
Yorktown Subdivision	78	7,800
Horizons West Subdivision	400#	40,000
Dry Branch Village	156	15,600
Taylor's Creek Mobile Home Park	52	5,200
Lundy Trailer Park	47	4,700
Country Walk Subdivision	340#	34,000
Gallop Mobile Home Park	30	3,000
Heritage Mobile Home Park	78	7,800
Westside Mobile Home Park	68	6,800
Oak Hill Mobile Home Park	26	2,600
Middleground Plantation	151#	15,100
Pretoria Station/Brookwood Subdivision	335#	33,500
Westover Subdivision	179#	17,900
Bradford Place	244#	24,400

Permitted Non-Municipal Community Water System	Population Served (Number Persons)	Gallons of Water Used per Day*
Inman Lakes Subdivision	30	3,000
Old Indian Trail WS	60	6,000
Westboro Apartments	94#	9,400
Cody Lane Mobile Home Park	32	3,200
Greenwood Trailer Park	65	6,500
Willow Pond	138#	13,800
<b>TOTAL</b>	<b>10,464</b>	<b>1,046,400</b>

\*Calculation is based on 100 gallons of water used per day per person

#Revised population figure provided by water system management

Source: Georgia EPD, 1998

### Future Water Demand

Table 8-2 lists projected future water use for Bulloch County non-municipal community water systems. These estimates are based on the present number of individuals served by non-municipal community water systems as compared to total county population. Assuming the present rate of use, the number of non-municipal community water systems and the amount of water used by these systems will nearly double between 2000 and 2050. However, as Bulloch County becomes more urbanized, many of the existing and future areas served by community water systems may connect to municipal water systems, and water use would be less than the figures projected in Table 8-2.

The Bulloch County Commission could consider the development and operation of county-owned community water systems for residential areas in the future. Potential water use from these systems is included in the Table 8-2 projections. County-owned systems could potentially serve areas presently provided water from individual domestic wells or private community water systems.

**Table 8-2  
Projected Future Bulloch County Non-Municipal Community Water System  
Groundwater Use**

Projected Use (MGD)				
2000	2010	2020	2030	2050
1.115	1.342	1.669	2.118	3.308

Source: Coastal Georgia RDC estimate; Rutherford & Associates estimate

## IX. WATER USE INVENTORY AND PROJECTION — NON-COMMUNITY WATER SYSTEMS

### Description

This section addresses non-community water systems, which provide water to non-residential facilities not connected to municipal water systems and require an EPD safe drinking water permit for serving more than 25 individuals at least 60 days per year. EPD classifies safe drinking water permits for non-community water systems as transient (e.g., parks, shopping centers, restaurants) or non-transient (e.g., schools, industrial facilities).

The list of Bulloch County non-community water systems in *Table 9-1* is based on *Table 3-2* (1998 EPD safe drinking water permits). Fifteen non-community water systems were permitted in Bulloch County in 1998. The approximate locations of most of these systems are indicated on *Map 13* in Appendix A.

### Past and Present Water Demand

*Table 9-1* lists the present population served by each of 15 non-community systems and the estimated gallons of water used per day from each system. It is assumed that 25 gallons of water are used per person per day per non-community facility. In total, an estimated 3,025 persons are served by transient and non-transient non-community water systems and use approximately 75,625 gallons of water per day. As is the case with non-municipal community water systems, the reported population served by each non-community water system can range in date from 1989 to 1998 and may not reflect the present population served by a system. In addition, some water systems may be operating in the county without an EPD safe drinking water permit.

Based on Bulloch County's 1985 population, an estimated 1,836 persons were served by non-community water systems in the county in 1985, using a total of 45,892 gallons of groundwater per day (assuming 25 gallons per person per day).

### Future Water Demand

*Table 9-2* lists projected future water use for Bulloch County non-community water systems. These estimates are based on the present number of individuals served by non-community water systems as compared to total county population. Assuming the present rate of use, the number of non-community water systems and the amount of water used by these systems will nearly double between 2000 and 2050. These projections will decrease if present and future non-residential facilities throughout the county are connected to municipal water systems.

**Table 9-1**  
**Present Bulloch County Non-Community Water System Groundwater Use**  
 Based on EPD Safe Drinking Water Permits (1998)

<b>Permitted Non-Community Water System</b>	<b>Population Served</b>	<b>Gallons of Water Used per Day*</b>
Southeast Bulloch High School	675	16,875
Stilson Elementary School	455	11,375
Willow Hill Elementary School	222	5,550
Bulloch Academy	400#	10,000
Robbins Packing Company	75	1,875
The Loxcreen Company, Inc.	50	1,250
Northside Junior High School	300	7,500
LA Pacific Statesboro Sawmill	65	1,625
W.M. Sheppard Lumber Company	125	3,125
Ogeechee Riverview POA	60	1,500
Parkwood Motel and Restaurant	75	1,875
Bulloch County School Bus Garage	225	5,625
Po-Jo's Gas N Go	100	2,500
Oasis, Inc.	100	2,500
Bulloch South, Inc.	98	2,450
<b>TOTAL</b>	<b>3,025</b>	<b>75,625</b>

\*Calculation is based on 25 gallons of water used per day per person

#Revised population figure provided by water management staff

Source: Georgia EPD, 1998

**Table 9-2**  
**Projected Future Bulloch County Non-Community Water System Groundwater Use**

<b>Projected Use (MGD)</b>				
<b>2000</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2050</b>
0.081	0.110	0.125	0.140	0.200

Source: Rutherford & Associates estimate

## X. WATER USE INVENTORY AND PROJECTION — DOMESTIC WELLS AND NON-PUBLIC WELLS

### Description

This section addresses domestic wells that provide water for individual residences not connected to municipal water systems or non-municipal community water systems. In addition, "non-public" wells that provide water to 2-14 residences or less than 25 individuals are considered in these calculations. The number of present domestic and non-public well users in Bulloch County was calculated by subtracting the known number of individuals served by other types of water systems from the county's 1997 population (61,631 - 45,293). Approximately 16,338 individuals are served by domestic or non-public wells. This equates to over one-quarter of Bulloch County's population in the unincorporated area.

### Past and Present Water Demand

Assuming daily water use equals 100 gallons per person, Bulloch County's estimated 16,338 domestic and non-public well users presently consume 1.633 million gallons of water per day. Based on Bulloch County's 1985 population, an estimated 9,915 persons were served by domestic wells in Bulloch County in 1985, collectively using a total of 0.991 million gallons of groundwater per day (assuming 100 gallons per person per day).

### Future Water Demand

Table 10-1 lists projected future water use for Bulloch County domestic and non-public well users. These estimates are based on the present number of individuals served by domestic wells as compared to total county population. Assuming the present rate of use, the number of domestic and non-public wells and the amount of water produced by these wells will nearly double between 2000 and 2050. However, as population density increases in Bulloch County, many of these domestic wells will likely be replaced with municipal water systems or non-municipal community water systems.

**Table 10-1  
Projected Future Bulloch County Domestic Well Use**

Projected Use (MGD)				
2000	2010	2020	2030	2050
1.741	2.013	2.305	2.589	3.308

Source: Coastal Georgia RDC estimate



## XI. WATER USE INVENTORY AND PROJECTION — BULLOCH COUNTY SUMMARY

### Past and Present Water Demand

*Table 11-1* summarizes total daily Bulloch County water withdrawal in 1997 for the various categories of wells and water systems described in the previous sections. In total, Bulloch County accounted for 16.881 million gallons of groundwater and surface water per day in 1997 (surface water is limited to agricultural operations). Bulloch County water use during 1997 can be characterized as follows:

- Combined domestic and commercial uses accounted for 36 percent total water use
- Industries that operate their own wells (with or without groundwater withdrawal permits), which include Cooper Tools and Grinnell, accounted for six percent total water use
- Agricultural operations and golf courses accounted for approximately one-half of water use (surface water and groundwater)
- Bulloch County's municipal water systems (Brooklet, Portal, Register, Statesboro), which provide water to approximately one-half of the county's residents, combined to account for 20 percent total water use (this figure includes domestic/commercial and industrial use)
- Georgia Southern University, which provides water to 2,750 on-campus residents and over 11,000 commuter students and faculty, accounted for two percent total water use
- Non-municipal water systems, which serve over one-tenth of the county's residents, accounted for six percent total water use
- Domestic wells serving individual residences, which provide water to over one-quarter of the county's residents, accounted for ten percent total water use
- Non-community water systems serving non-residential uses accounted for less than one percent total water use

*Table 11-2* summarizes total daily Bulloch County groundwater and surface water withdrawal in 1985, based on estimates, for the various categories of wells and water systems described in the previous sections. Compared to 1997. Bulloch County accounted for approximately 9.586 million gallons of water per day in 1985, which is 7.3

million gallons less per day than during 1997.

*Table 11-3* compares total daily Bulloch County groundwater and surface water withdrawal in 1985 and 1997 for domestic/commercial, industrial, and agricultural uses. The figures in this table for domestic/commercial uses exclude water provided to industry by municipal water systems. Likewise, the figures for industrial uses include industry connected to municipal water systems (e.g., Gateway Industrial Park). The following is a comparison of Bulloch County water use between 1985 and 1997:

- Total water use increased 76 percent between 1985 and 1997
- Total industrial water use (including industry served by municipal water systems) increased 51 percent between 1985 and 1997
- Domestic/commercial water use increased 80 percent between 1985 and 1997
- Agricultural water use increased 77 percent between 1985 and 1997 (the actual increase may be less than reported in this plan)

*Table 11-4* provides a comparative view of Bulloch County groundwater and surface water use in 1980, 1985, 1990, 1995, and 1997, as compiled by the US Geological Survey. The USGS water use categories are defined as follows:

- *Public Supply:* Water withdrawn by public and private water suppliers and delivered to various users (including non-municipal community water systems)
- *Domestic and Commercial:* Self-supplied water used for household purposes and commercial uses
- *Industrial and Mining:* Water used for such purposes as fabrications, processing, washing, and cooling in facilities that manufacture products
- *Irrigation:* Water withdrawn for crops, large nurseries, athletic fields, and golf courses
- *Livestock:* Water withdrawn for poultry, horses, cattle, hogs, and catfish farms
- *Thermoelectric:* Water withdrawn for use at thermoelectric power plants

The USGS estimates are fairly similar to the data presented in the previous sections of this water plan. The USGS estimated lower figures for domestic/commercial/public supply (1.5 million gallons per day less) and total water use.

## Future Water Demand

Total future groundwater and surface water use in Bulloch County is projected to increase from 17.341 million gallons per day in 2000 to 24.640 million gallons per day in 2050. This represents a 42 percent increase over a 50-year period, or approximately one percent per year on average. *Table 11-5* provides the projected average daily groundwater use for each water use category for the following years: 2000, 2010, 2020, 2030, and 2050.

Municipal water systems are projected to see the largest water use increase over this 50-year period. Water supplied by municipal water systems for industrial use is projected to increase 200 percent, while municipal water for other uses is projected to increase 111 percent.

**Table 11-1  
Present Total Bulloch County Water Use (1997)**

Well/Water System Category	1997 Residential Population Served	1997 Average Use (MGD)
Permitted Industrial Wells	--	0.985
Non-Permitted Industrial Wells	--	0.025
Georgia Southern University Water System	2,750	0.375
Municipal Water Systems (industrial use only)	--	0.257
Municipal Water Systems (residential, commercial, other uses only)	32,079	3.013
Non-Municipal Community Water Systems	10,464	1.046
Non-Community Water Systems	--	0.076
Domestic Wells/Non-Public Wells	16,338	1.634
Agricultural Irrigation Wells (incl. golf courses)	--	6.200
Agricultural Surface Water Systems (incl. golf courses)	--	3.27
<b>TOTAL</b>	<b>61,631</b>	<b>16.881</b>

Source: Georgia EPD and Coastal Georgia RDC projections

**Table 11-2  
1985 Total Bulloch County Water Use**

<b>Water/Water System Category</b>	<b>1985 Residential Population Served (estimated)</b>	<b>1985 Average Use (MGD) (estimated)</b>
Permitted Industrial Wells	--	0.818
Non-Permitted Industrial Wells	--	0.020
Georgia Southern University Water System	2,750	0.380
Municipal Water Systems (industrial use only)	--	0.000
Municipal Water Systems (residential, commercial, other uses only)	17,715	1.288
Non-Municipal Community Water Systems	6,350	0.635
Non-Community Water Systems	--	0.046
Domestic Wells/Non-Public Wells	10,585	1.059
Agricultural Irrigation Wells (incl. golf courses)	--	3.39
Agricultural Surface Water Systems (incl. golf courses)	--	1.95
<b>TOTAL</b>	<b>37,400</b>	<b>9.586</b>

Source: Georgia EPD and Coastal Georgia RDC projections

**Table 11-3  
Total Bulloch County Water Use Summary:  
Domestic/Commercial, Industrial, Agricultural Uses, 1997 v. 1985**

<b>Type of Use</b>	<b>1997 Average Use (MGD)</b>	<b>1985 Average Use (MGD) (Estimated)</b>
Domestic/Commercial	6.144	3.408
Industrial	1.267	0.838
Agriculture	9.470	5.340
<b>TOTAL</b>	<b>16.881</b>	<b>9.586</b>

Source: Georgia EPD, Coastal Georgia RDC projections

**Table 11-4**  
**US Geological Survey Estimate of Bulloch County Groundwater Use:**  
**1980, 1985, 1990, 1995, 1997**

Water Use Category	Average Daily Groundwater Use (MGD)				
	1980	1985	1990	1995	1997
Public Supply	2.87	1.32	4.46	5.22	2.92
Domestic/ Commercial	1.46	1.49	1.50	1.62	1.75
Industry/Mining	0.46	0.80	1.12	0.93	0.91
Irrigation	3.81	3.24	1.61	6.16	6.16
Livestock	0.30	0.15	0.04	0.04	0.04
Thermoelectric	--	--	--	--	--
<b>TOTAL</b>	<b>8.90</b>	<b>7.00</b>	<b>8.73</b>	<b>13.97</b>	<b>11.78</b>

Source: US Geological Survey, 1998

**Table 11-5**  
**US Geological Survey Estimate of Bulloch County Surface Water Use:**  
**1980, 1985, 1990, 1995, 1997**

Water Use Category	Average Daily Surface Water Use (MGD)				
	1980	1985	1990	1995	1997
Public Supply	--	--	--	--	--
Domestic/ Commercial	--	--	--	--	--
Industry/Mining	--	--	--	--	--
Irrigation	5.96	1.82	1.11	3.05	3.05
Livestock	0.14	0.13	0.24	0.22	0.22
Thermoelectric	--	--	--	--	--
<b>TOTAL</b>	<b>6.10</b>	<b>1.95</b>	<b>1.35</b>	<b>3.27</b>	<b>3.27</b>

Source: US Geological Survey, 1998

Table 11-6 shows projected water use for Bulloch County by category. Table 11-7 compares the projected water use in 2050 without conservation measures to water projected water use with conservation measures, based on a 20 percent reduction in use.

**Table 11-6  
Projected Future Bulloch County Water Use: 2000 – 2050**

Water Use Category	Average Daily Groundwater Use (MGD)				
	2000	2010	2020	2030	2050
Permitted Industrial Wells	0.985	0.985	0.985	0.985	0.985
Non-Permitted Industrial Wells	0.027	0.090	0.160	0.235	0.300
Georgia Southern University Water System	0.386	0.427	0.493	0.551	0.710
Municipal Water Systems (industrial use only)	0.276	0.730	1.200	1.775	3.700
Municipal Water Systems (residential, commercial, other uses only)	4.543	5.506	6.670	7.750	11.670
Non-Municipal Community Water Systems	1.115	1.342	1.669	2.118	3.308
Non-Community Water Systems	0.081	0.110	0.125	0.140	0.200
Domestic Wells / Non-Public Wells	1.741	2.013	2.305	2.589	3.308
Agricultural Irrigation Wells (incl. golf courses and aquiculture)	12.734	16.609	20.212	23.573	23.144
Agricultural Surface Water Systems (incl. golf courses)	3.270	3.770	4.200	4.500	5.000
<b>TOTAL</b>	<b>25.158</b>	<b>31.582</b>	<b>38.019</b>	<b>44.216</b>	<b>52.325</b>

Source: Rutherford & Associates

**Table 11-7  
Comparison of Water Use With and Without Conservation**

<b>Water Use Category</b>	<b>Without Conservation</b>	<b>With Conservation (20% reduction in use)</b>
	<b>2050</b>	<b>2050</b>
Permitted Industrial Wells	0.985	0.788
Non-Permitted Industrial Wells	0.300	0.24
Georgia Southern University Water System	0.710	0.568
Municipal Water Systems (industrial use only)	3.700	2.96
Municipal Water Systems (residential, commercial, other uses only)	11.670	9.336
Non-Municipal Community Water Systems	3.308	2.646
Non-Community Water Systems	0.200	0.160
Domestic Wells / Non-Public Wells	3.308	2.646
Agricultural Irrigation Wells (incl. golf courses and aquiculture)	23.144	18.515
Agricultural Surface Water Systems (incl. golf courses)	5.000	4.000
<b>TOTAL</b>	<b>52.325</b>	<b>42.059</b>



## XII. BULLOCH COUNTY WASTEWATER SUMMARY

Statesboro presently operates the only municipal wastewater treatment plant in Bulloch County. In addition to serving residential and commercial customers, Statesboro provides sewer service to three industrial parks, Cooper Tools (operates its own water system), and Georgia Southern University (operates its own water system).

The Statesboro WPCP's average daily wastewater discharge during 1997 was 3.56 million gallons per day. *Table 12-1* indicates the average daily wastewater discharge for each month of 1997. Peak wastewater flow for 1997 occurred during December, when 4.986 million gallons of wastewater were discharged per day. As indicated in *Table 12-2*, Statesboro's wastewater flow is projected to increase from 3.862 million gallons per day in 2000 to 8.269 million gallons per day in 2050. Statesboro's WPCP has a current capacity of 10.0 million gallons per day. Average treatment flow during 1999 has been just under 4.0 million gallons per day. Statesboro WPCP discharges into Little Lotts Creek.

The Bulloch County municipalities of Brooklet, Portal, and Register utilize private septic systems for wastewater treatment and disposal. These municipalities combined to produce 0.155 million gallons of septic discharge per day in 1997. *Table 12-2* indicates the current population served by on-site systems. As indicated in *Table 12-3*, the average daily septic discharge from Bulloch County's municipalities is projected to increase 60 percent over the next 50 years. *Table 12-4* indicates the projected population to be served by on-site systems. With the exception of Statesboro, future municipal wastewater flows are considered to be 80% of projected water use.

Grinnell Corporation maintains the only industrial wastewater treatment system in Bulloch County. As noted above, Cooper Tools, the other major industrial water user in Bulloch County, is provided sewer service by Statesboro. Grinnell's uses wastewater treatment for sanitary discharge only and averaged 25,000 gallons per day 1997. Non-contact cooling water is the only other water flow from plant. Discharging to an unnamed tributary of Wilson Creek, Grinnell's wastewater flows had been reduced to roughly 15,000 gallons per day in late 1999. Future industrial wastewater demand is indicated in *Table 12-7*.

The present discharge to septic systems in Bulloch County for all uses is approximately 2.284 million gallons per day. This figure includes the following:

- 0.155 million gallons per day for residential uses associated with municipal water systems (Brooklet, Portal, Register)
- 0.837 million gallons per day for residential uses associated with non-municipal community water systems
- 0.061 million gallons per day for non-residential uses associated with non-community water systems
- 1.231 million gallons per day for residential uses associated with domestic wells and non-public wells

Table 12-4 lists the projected total discharge to septic systems for all uses in Bulloch County from 2000 to 2050. Discharge to septic systems is expected to increase to 5.292 million gallons per day during this time period. However, with increased density, many residential areas will need to upgrade to more advanced wastewater systems.

**Table 12-1  
Statesboro WPCP  
1997 Average Daily Wastewater Discharge**

<b>Month</b>	<b>Average Daily Total Discharge (MGD)</b>
January	3.491
February	4.670
March	3.783
April	2.647
May	2.905
June	2.289
July	3.254
August	3.931
September	2.997
October	2.980
November	4.786
December	4.986
Annual	3.560

Source: City of Statesboro

**Table 12-2  
Bulloch County Population Served by On-Site Systems, 1990-1995**

<b>Jurisdiction</b>	<b>1990</b>	<b>1995</b>
Bulloch County	27,271	28,558

Source: Rutherford & Associates

**Table 12-3  
Grinnell 1997 Average Daily Wastewater Flow (Sanitary Discharge)**

Month	Average Daily Flow (MGD)
January	0.026
February	0.025
March	0.026
April	0.025
May	0.025
June	0.026
July	0.026
August	0.026
September	0.025
October	0.029
November	0.024
December	0.022
Annual	0.025

Source: Grinnell Corporation, March 2000

**Table 12-4  
Bulloch County Municipal Wastewater Flows  
(Based on 80 Percent Projected Future Water Use)**

Municipality	Projected Flow (MGD)				
	2000	2010	2020	2030	2050
Statesboro+	3.862	4.745	6.026	7.325	11.950
Brooklet*	0.114	0.121	0.128	0.136	0.150
Portal*	0.076	0.089	0.103	0.116	0.143
Register*	0.027	0.033	0.037	0.043	0.051

+Wastewater treated by municipal WPCP

\*Wastewater treated by individual septic systems

Source: Rutherford & Associates

**Table 12-5  
Projected Bulloch County Population Served by On-site Systems, 2000-2050**

	2000	2010	2020	2030	2040	2050
Bulloch County	37,870	45,887	55,580	64,586	80,152	97,251

Source: Coastal Georgia RDC estimate; Rutherford & Associates

**Table 12-6  
Unincorporated Bulloch County Future Total Septic System Discharge**

<b>Projected Discharge (MGD)</b>				
<b>2000</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2050</b>
2.669	3.160	3.743	4.694	6.352

Source: Rutherford & Associates

**Table 12-7  
Projected Future Industrial Wastewater Discharge**

<b>Projected Discharge (MGD)</b>				
<b>2000</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2050</b>
0.809	0.860	0.916	0.976	1.028

Source: Rutherford & Associates

### **XIII. FUTURE WATER SUPPLY OPTIONS AND CONSERVATION MEASURES**

The water plan advisory/technical committee considered several conservation measures and alternative water supply sources for Bulloch County and its municipalities. Suggested practices, some of which are already being implemented, are listed below. It should be noted that Bulloch County's present groundwater withdrawals are not capped, and the water plan advisory/technical committee was not asked to identify "reduction strategies" to meet or maintain a water use cap. If a cap is placed on Bulloch County water use in the future, it appears that the most practical way to reduce water use is through conservation measures, which is a similar opinion held by surrounding counties. A supplemental water supply may be available from the Cretaceous aquifer system.

The water plan advisory/technical committee concluded that surface water, such as the Ogeechee River, was not a viable source of water supply for Bulloch County, due to flow variability and distance from existing municipal and industrial water users. The opportunity for surface water use from the Ogeechee River is not realistic due to low water flow and poor water quality. A dam or reservoir would be difficult to construct, due to topography and availability of land. The Miocene Aquifer could be used for irrigation purposes, but it is less reliable in Bulloch County than in coastal areas.

Water conservation measures will have to be employed in order to maintain reasonable use of the Floridan aquifer as a primary source of water. The county will have to develop a countywide conservation program for domestic and commercial usage. The county will have to work with local industries to assist them in efforts to reduce water usage. The agricultural community with support from the county will have to study and implement conservation practices as those discussed in the EPD report entitled *Irrigation Conservation Practices Appropriate for the Southeastern United States*.

#### Municipal Conservation Measures:

- Brooklet completed a leak detection study a couple of years ago, and completed several water system improvements in past year.
- Effective July 1, 2000, Statesboro utilizes an increasing rate structure for use. The more water a user consumes, the higher the cost per unit.
- Statesboro has a water conservation program, which is administered through code enforcement.
- Statesboro's unaccounted water use has been reduced from ten percent to approximately four percent over the past ten years (hydrant use not accounted for, except in fire situations).

- Statesboro has separate meters for residential irrigation; reduction of this use can be targeted separately from other residential uses.
- Statesboro employs a leak detection device on new/replaced meters (the city replaces \$18,000 worth of meters each year @\$33 per meter).

Georgia Southern University Conservation Measures:

- Statesboro effluent from its wastewater treatment plant, located two miles from campus, could be used for irrigation (GSU's largest water-related issue is to identify alternative water sources for irrigation purposes).
- GSU uses water-efficient fixtures in new construction and renovations.

Industrial Conservation Measures:

- Bulloch County and Statesboro could attract new industry that would use effluent as a water source (such as turf farms, which builds on Bulloch County's existing agriculture).
- Present conservation measures at Grinnell include the following:
  - Recycling water for dust collection and the use of thermostat control equipment on once-through cooling water
  - An air-cooled refrigerated chiller for core making equipment cooling
  - Cooling towers for cooling all furnaces and related equipment
- It would not be difficult for industry to use effluent for water use, particular for use in cooling towers.

Agricultural/Golf Course Conservation Measures:

- Statesboro effluent from wastewater treatment plant could be used for golf course irrigation (Southern Links and Forest Heights are about 5 miles away); Statesboro would have to install an effluent storage tank at its WPCP if effluent was used as a irrigation water source, due to variability in flow.

- Statesboro WPCP is not located near major agricultural areas; wastewater effluent could be transported to farms but would be costly.
- Potential water savings and related costs have been identified in an EPD report entitled *Irrigation Conservation Practices Appropriate for the Southeastern United States*. The most important point in this report is that farmers should conduct an irrigation efficiency audit to determine where improvements in irrigation practices could occur.

### Conservation Education

Bulloch County and Statesboro should establish a public education program on water conservation and be the lead partners in promoting water conservation.

### Infrastructure Upgrade

The City of Statesboro will have to expand its wastewater re-use capabilities. In planning for such, the City should investigate opportunities for effluent use at the University, on golf courses, or on agricultural fields.

### Water Reuse

As the county and cities continue to grow and wastewater treatment is expanded and effluent quality improves, there will be opportunities for water reuse. These opportunities would most easily be met for domestic irrigation needs. However, there might be an industrial opportunity for reclaimed water to become part of the process water. Agricultural irrigation also provides an opportunity for water reuse.



## **XIV. Implementation Schedule**

### **2000 –2010 implementation**

- Revise this plan with new information from the Sound Science Initiative.
- Establish water conservation education programs at the county level.
- Begin study of the Cretaceous aquifer as an alternative or supplemental source for the Floridan aquifer.
- Study feasibility of impoundments for rainfall or reservoir for the Ogeechee River.
- Continue to work with farm community to promote conservation and best Management Practices for agricultural lands.
- Work closely with University of Georgia's agricultural programs to investigate different crops that are less water dependent.
- Develop stronger relationship with Georgia Southern University for conservation program development and implementation.
- Examine opportunities for water reuse of the effluent from the City of Statesboro.
- Encourage the location of non-water dependent industries.
- Develop and implement programs to achieve 5% water reduction in industrial and agricultural uses.
- Implement new technological irrigation advances. The County should coordinate these efforts with the farmers. Some of the farms in the county could be pilot or test sites for new, improved irrigation equipment.
- Implement wellhead protection programs.

### **2010 - 2020 implementation**

- Prepare full update to water supply management plan.
- Continue to promote conservation efforts.
- Undertake the procurement of funds (grants or other) to construct impoundments.
- Examine opportunities for water reuse for the remainder of the county, including agriculture.
- Begin implementing the results of the alternative aquifer studies.
- Develop and implement programs to achieve 10% water reduction in industrial and agricultural uses.

### **2020 - 2050 implementation**

- Continue to promote conservation programs.
- Continue to investigate different crops for agricultural production.
- Develop and implement programs in 2030 to achieve 20% reduction in water use for industrial and agricultural users.
- Review and update the Comprehensive Water Supply Management Plan.



## **XIV. Appendices**

### **A. Maps**

Location of the Gulf Trough

Geographic Extent of the Floridan Aquifer

Geographic Extent of the Cretaceous Aquifer

Dublin and Dublin-Midville Aquifer Systems

24 Georgia Counties Covered by the EPD Interim Groundwater Strategy

Bulloch County: Major Roads and Municipalities

Major Rivers: Bulloch County

Bulloch County Industry

Irrigated Agricultural Land: Bulloch County

Bulloch County Golf Courses

Georgia Southern University

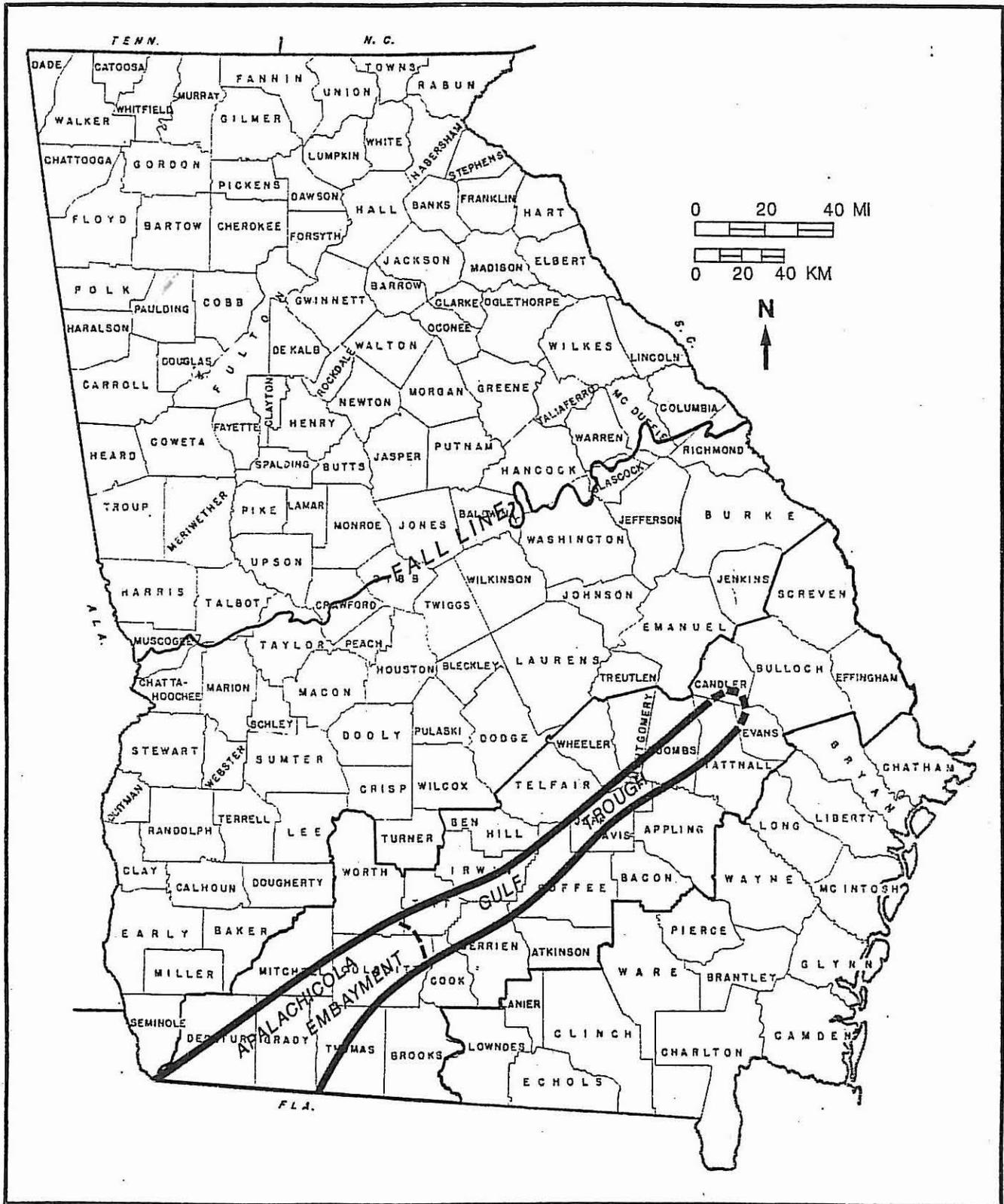
Municipal Water Service Area: Town of Brooklet

Municipal Water Service Area: Town of Portal

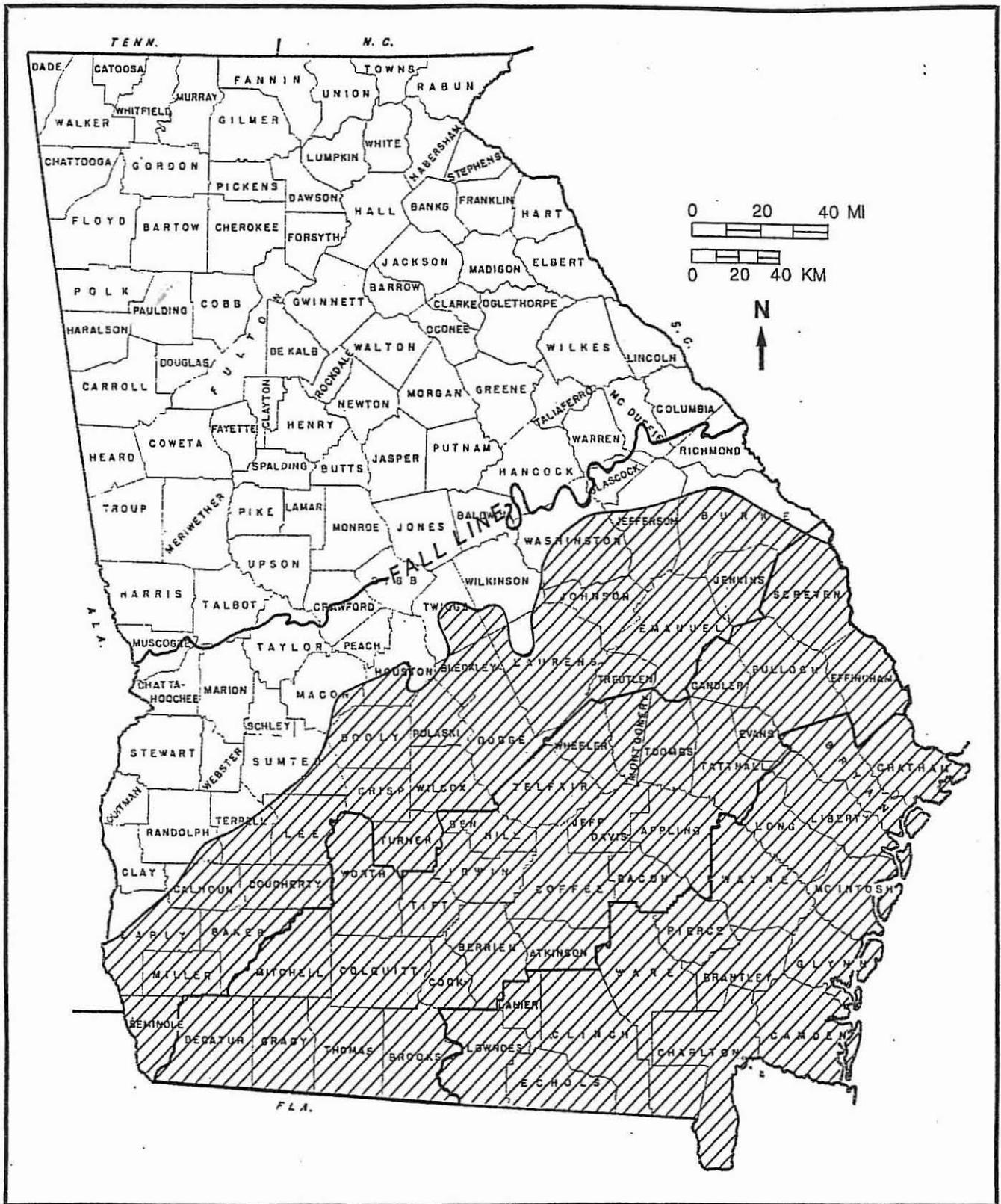
Municipal Water Service Area: Town of Register

Selected Non-Municipal Community Water Systems

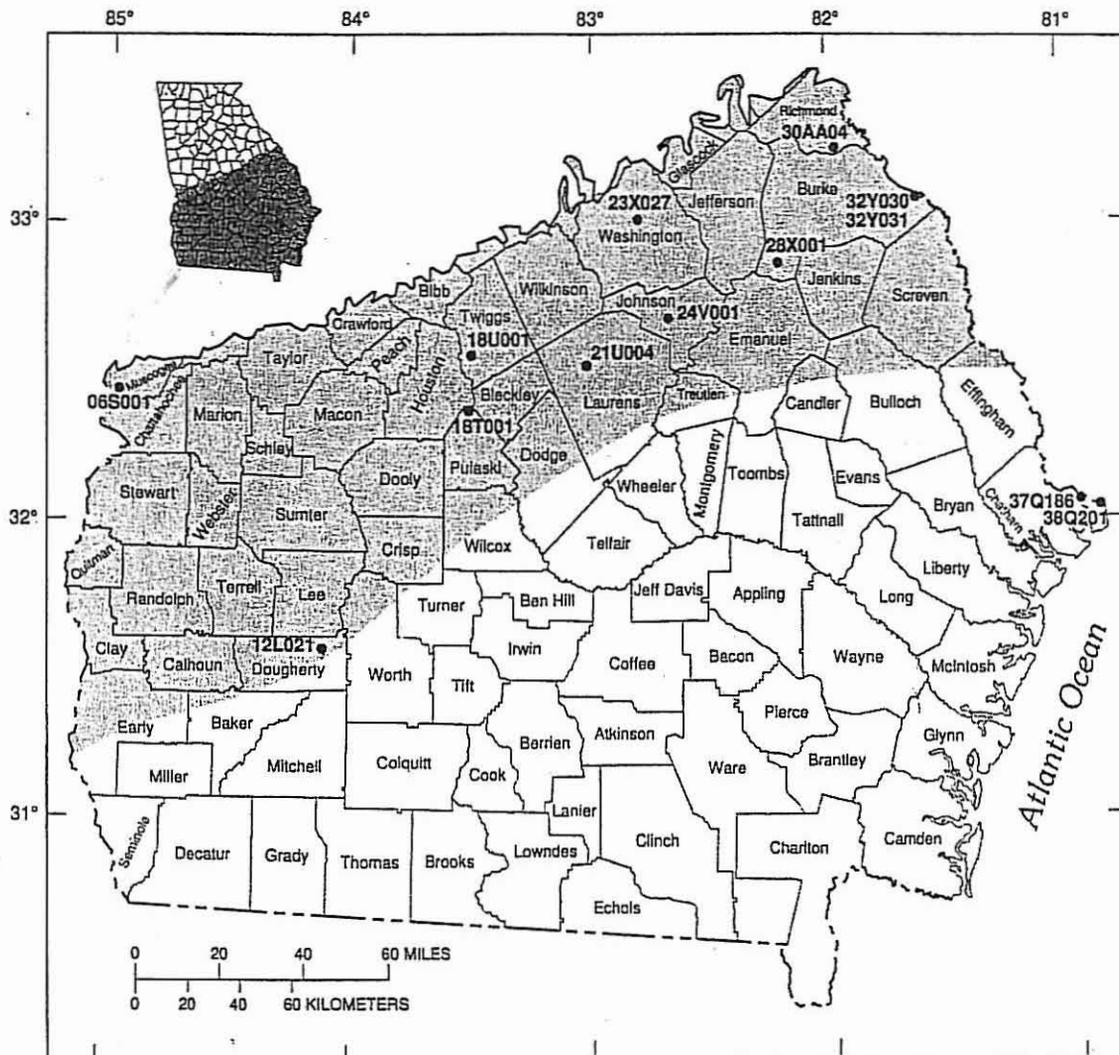
Selected Non-Community Water Systems



Approximate location of the Gulf Trough and Apalachicola Embayment  
 Source: Kellam and Gorday, 1990.



Geographic extent of the Floridan aquifer system. Shaded area indicates aquifer. Source: Kellam and Gorday, 1990.



Base modified from U.S. Geological Survey  
State base map

### EXPLANATION



CRETACEOUS AQUIFER SYSTEMS



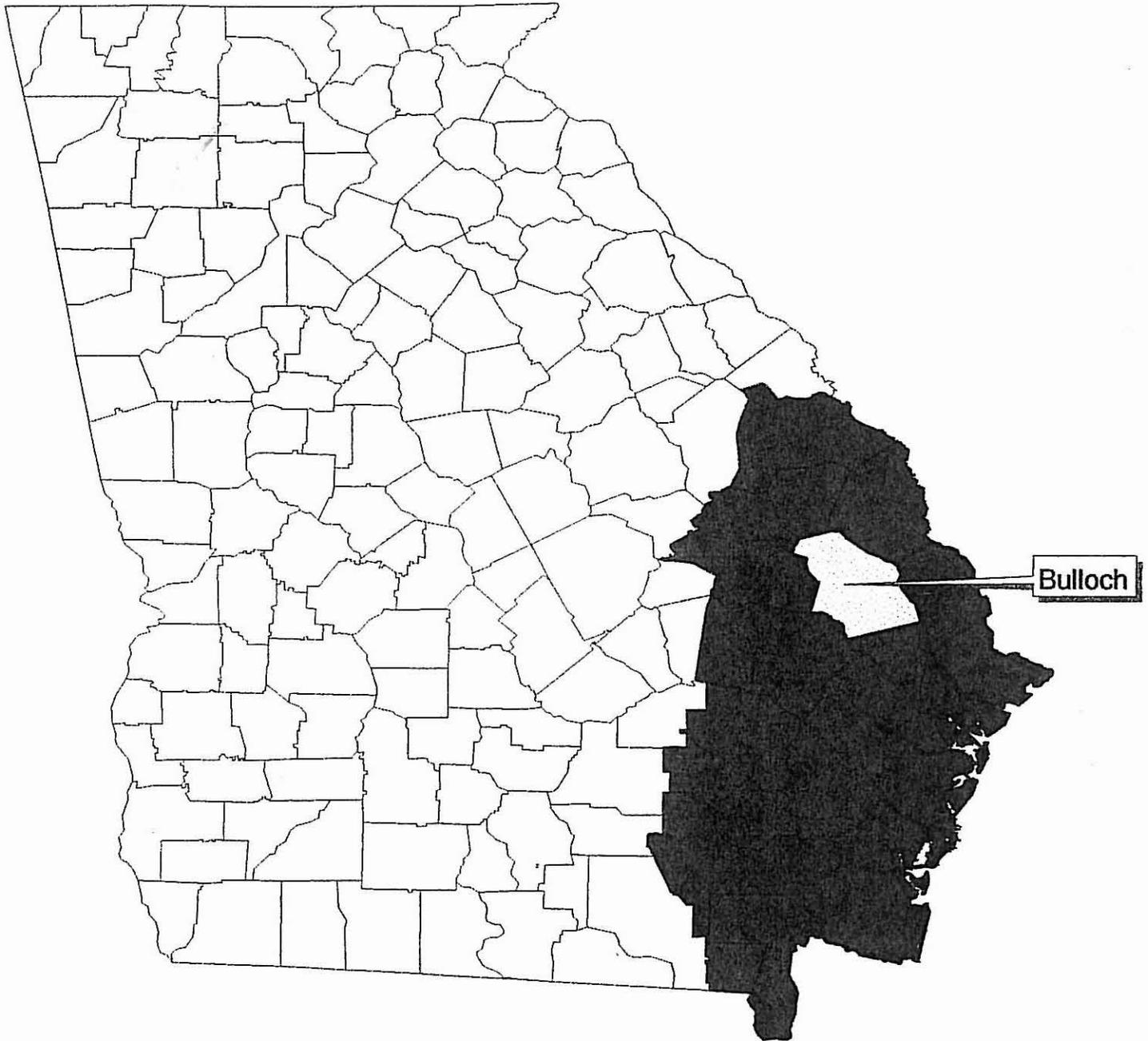
21U004 OBSERVATION WELL AND IDENTIFICATION NUMBER

Location of Cretaceous aquifer system and observation wells.

Source: *Groundwater Conditions in Georgia, 1999*. Open-File Report 00-151, US Department of the Interior, USGS, in cooperation with GA DNR-EPD, GA Geologic Survey, Albany Water, Gas, and Light Commission, City of Brunswick, Glynn County, Cressler, 2000.

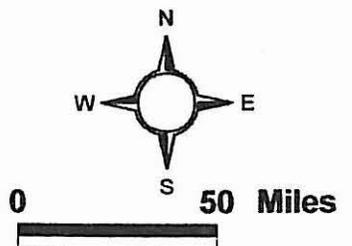


# 24 Georgia Counties Covered by the EPD Interim Groundwater Strategy

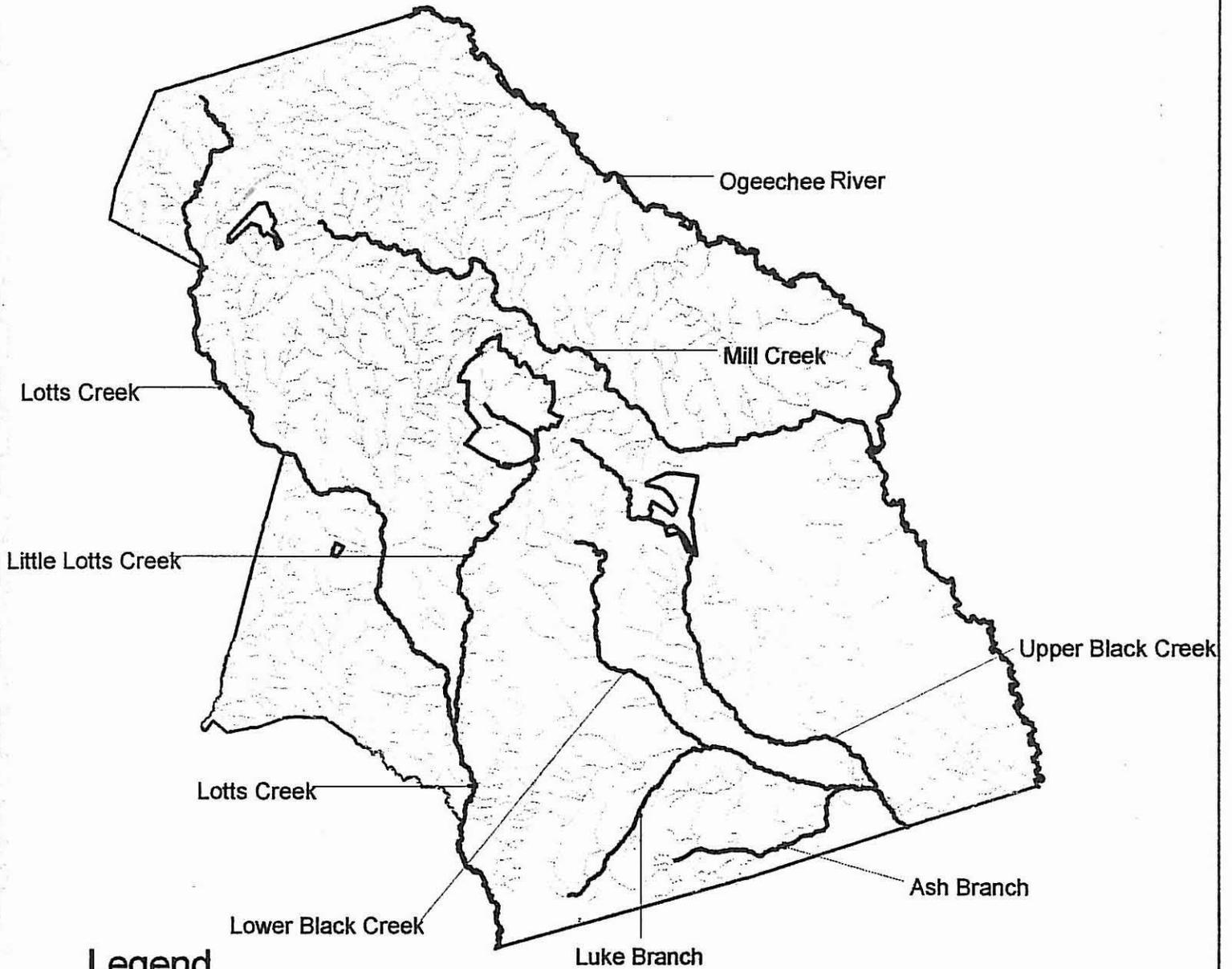


Source: Base map compiled from 1990 U.S. Bureau of the Census Tiger files.  
Disclaimer: This map is intended for general planning purposes only.  
Produced: 2.23.00

*Coastal Georgia*  
**Regional Development Center**  
Planning & Government Services 2000



# Major Rivers Bulloch County

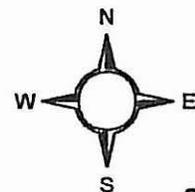


## Legend

-  Municipalities
-  County Boundary
-  Major Rivers
-  Secondary Rivers

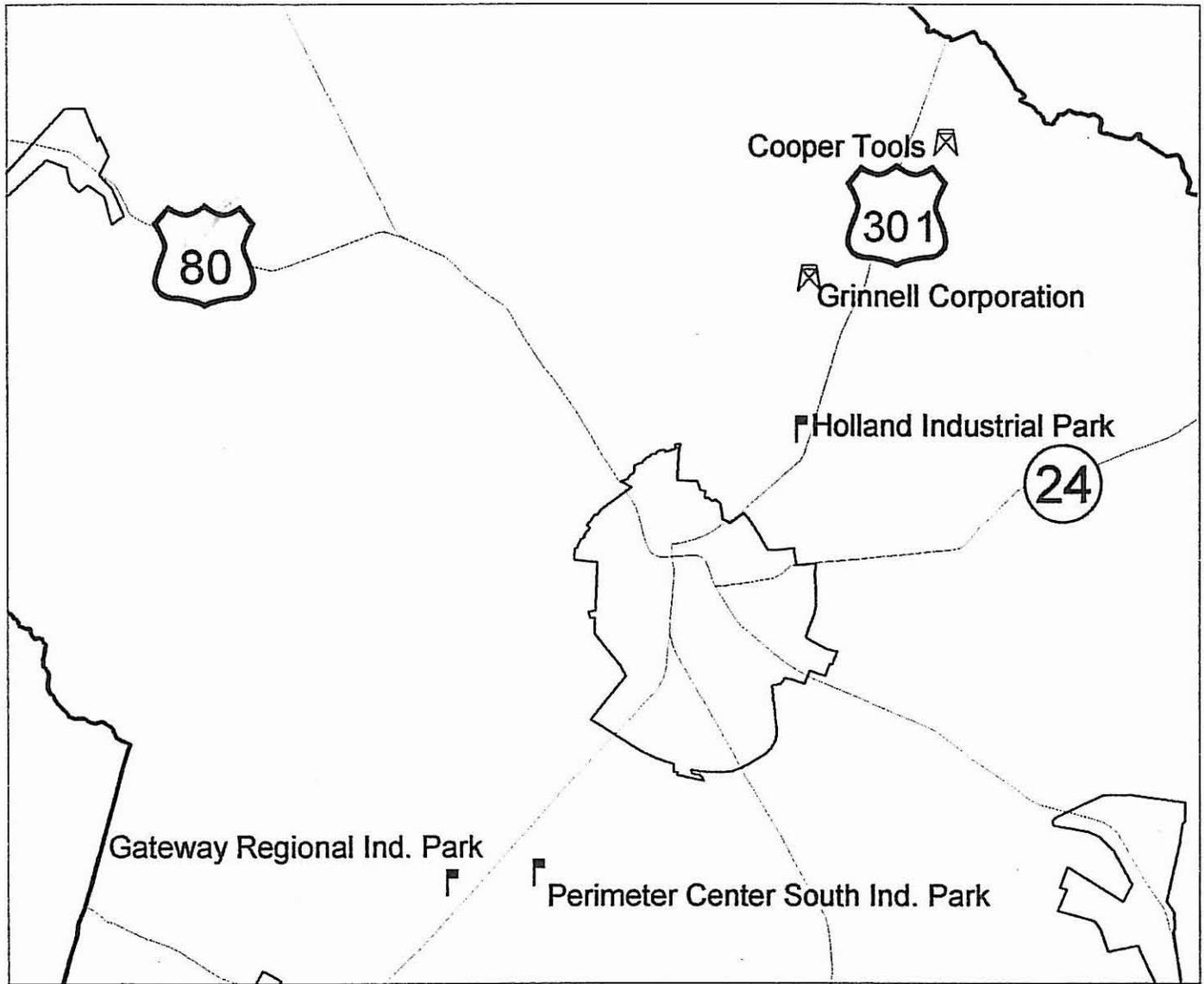
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Disclaimer: This map is intended for general planning purposes only.  
Produced: 2.23.00

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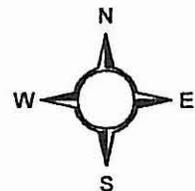
0  9 Miles

# Bulloch County Industry



## Legend

	Private Water
	Statesboro Provides Water
	Municipalities
	Major Roads



Source: Base map compiled from 1990 U.S. Bureau of the Census Tiger files.  
 Disclaimer: This map is intended for general planning purposes only.  
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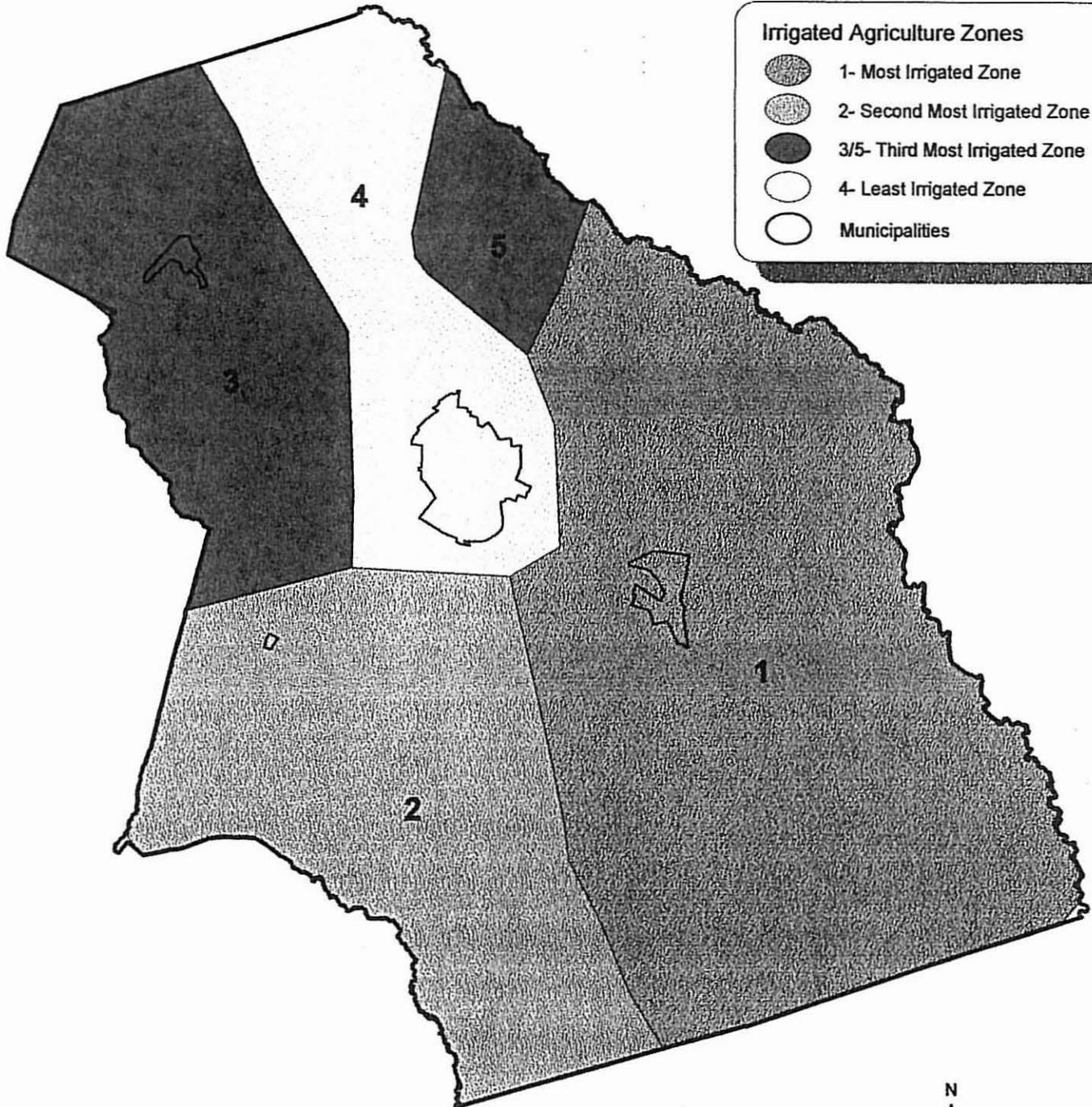


# Irrigated Agricultural Land Bulloch County

## Legend

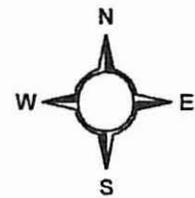
### Irrigated Agriculture Zones

-  1- Most Irrigated Zone
-  2- Second Most Irrigated Zone
-  3/5- Third Most Irrigated Zone
-  4- Least Irrigated Zone
-  Municipalities

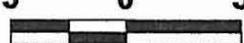


Source: Base map compiled from 1990 U.S. Bureau of the Census Tiger files.  
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Produced: 2.23.00

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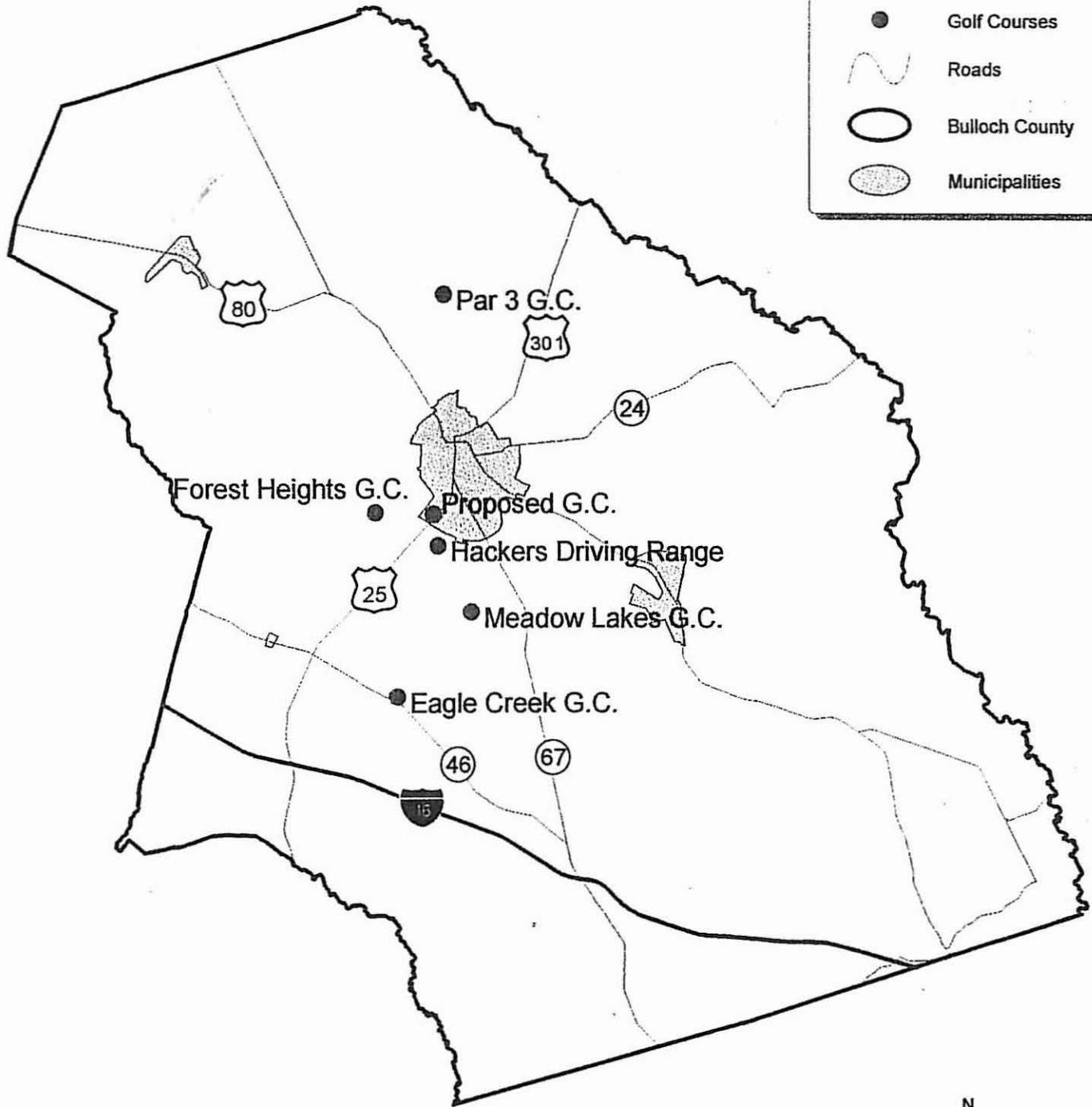
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# Bulloch County Golf Courses

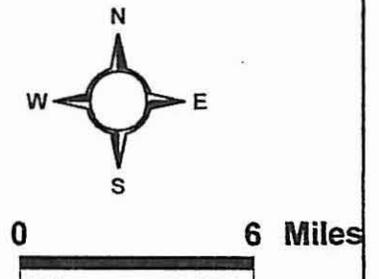
## Legend

●	Golf Courses
~	Roads
○	Bulloch County
◉	Municipalities

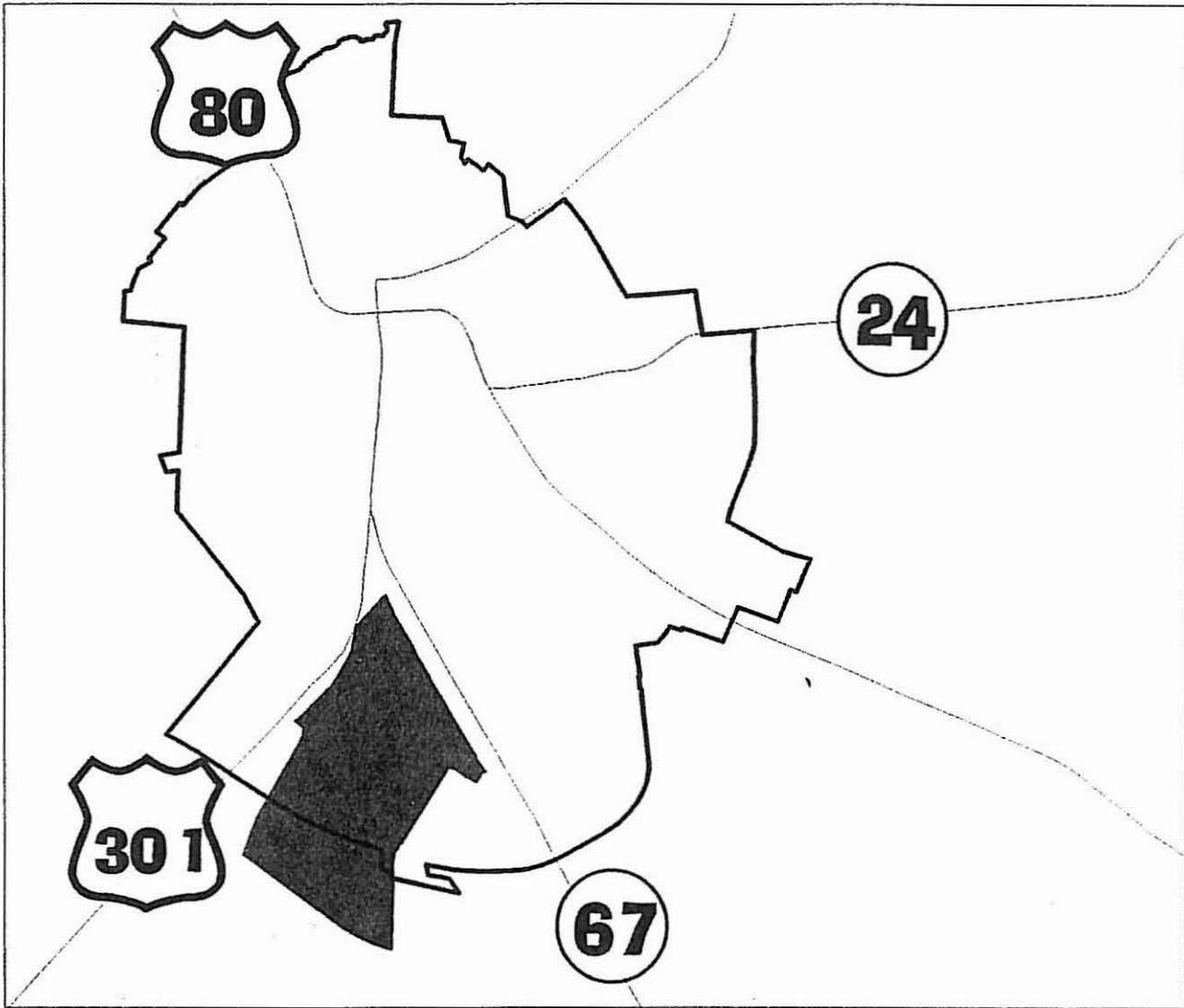


Source: Base map compiled from 1990 U.S. Bureau of the Census Tiger files.  
Disclaimer: This map is intended for general planning purposes only.  
Produced: 2.23.00

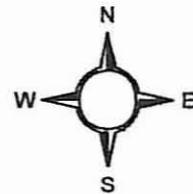
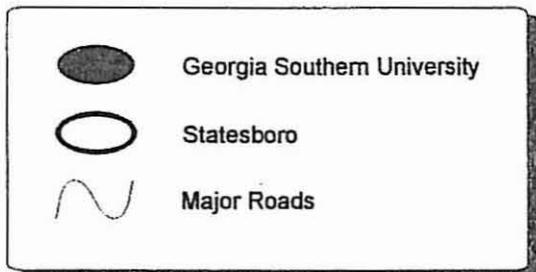
*Coastal Georgia*  
**Regional Development Center**  
Planning & Government Services 2000



# Georgia Southern University



## Legend

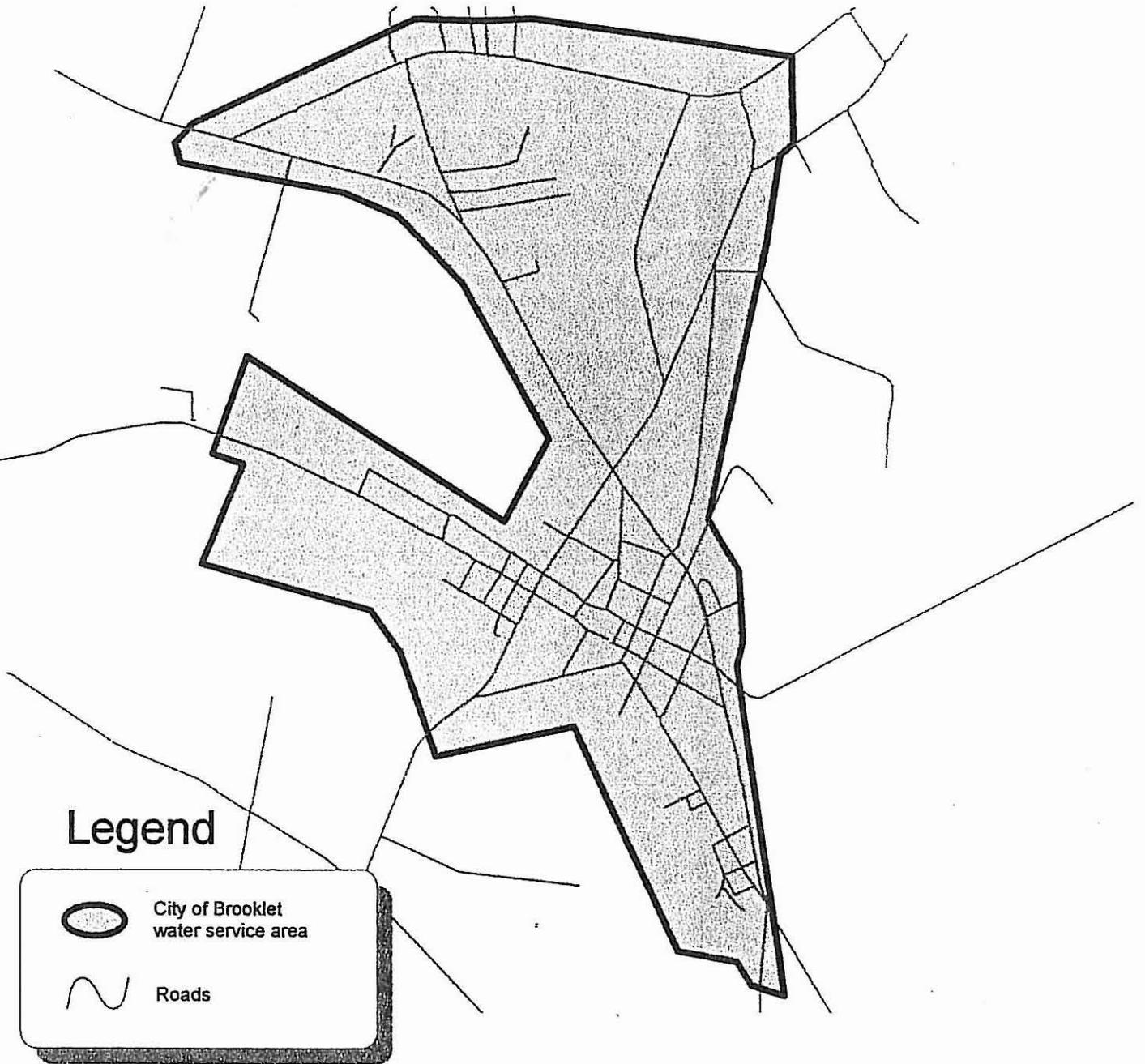


Source: Base map compiled from 1990 U.S. Bureau of the Census Tiger files.  
Disclaimer: This map is intended for general planning purposes only.  
Produced: 2.23.00

*Coastal Georgia*  
**Regional Development Center**  
Planning & Government Services 2000

0  2 Miles

# Municipal Water Service Area City of Brooklet



## Legend



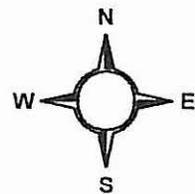
City of Brooklet  
water service area



Roads

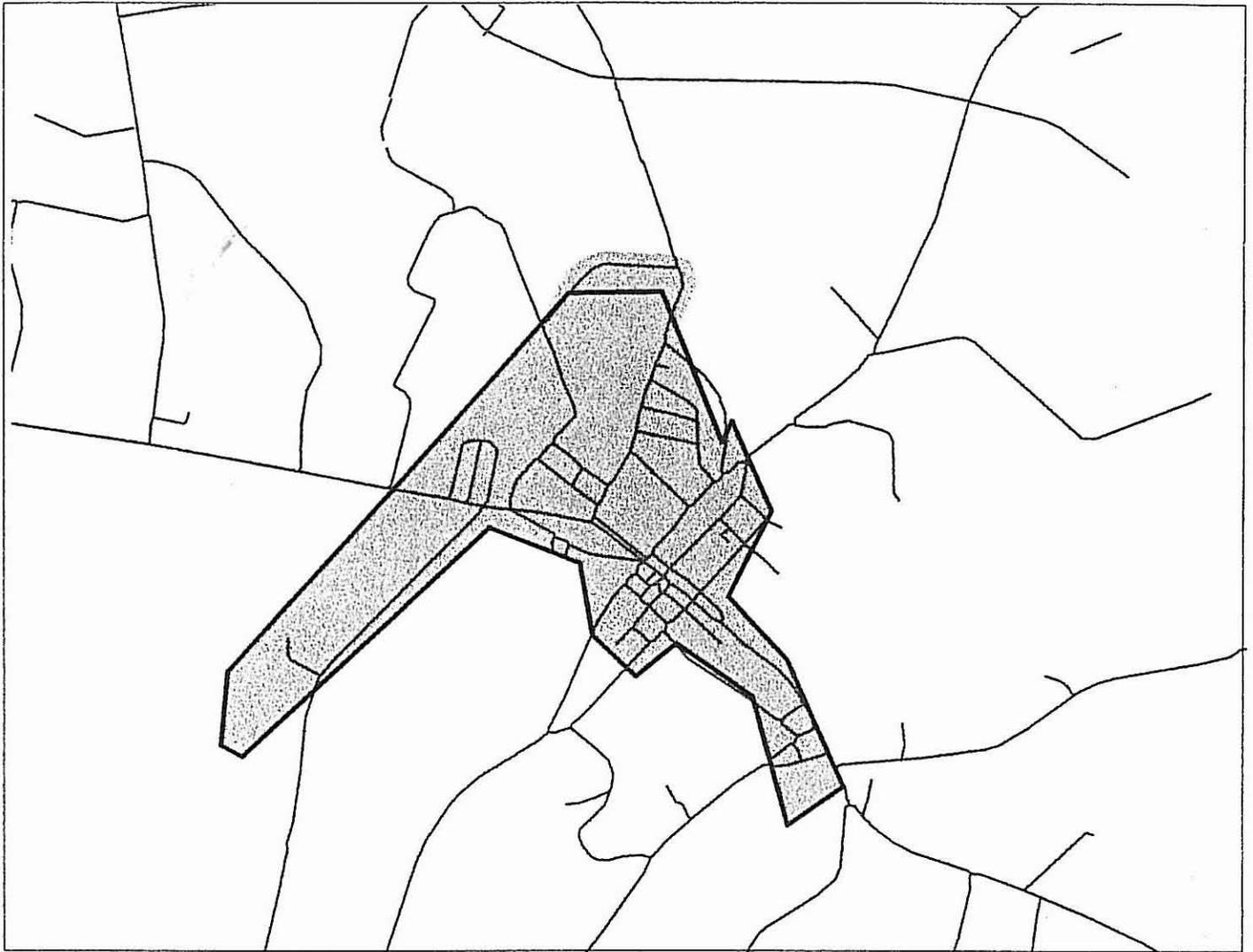
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Disclaimer: This map is intended for general planning purposes only.  
Produced: 2.23.00

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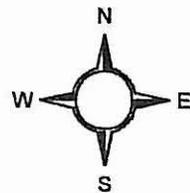
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# Municipal Water Service Area Town of Portal



## Legend

	Water Service Area
	Portal Roads
	Portal Boundary

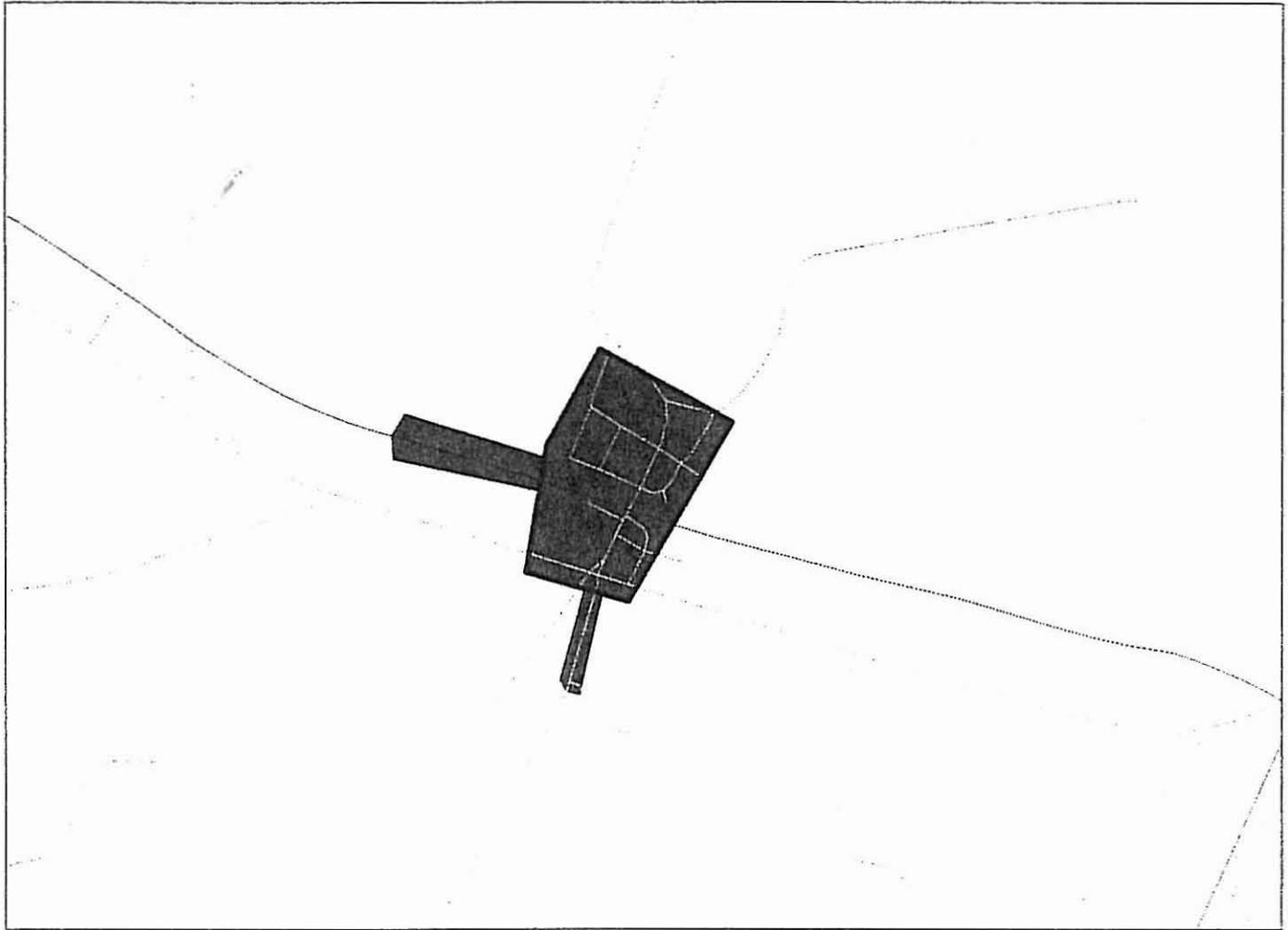


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Disclaimer: This map is intended for general planning purposes only.  
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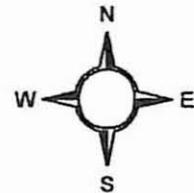
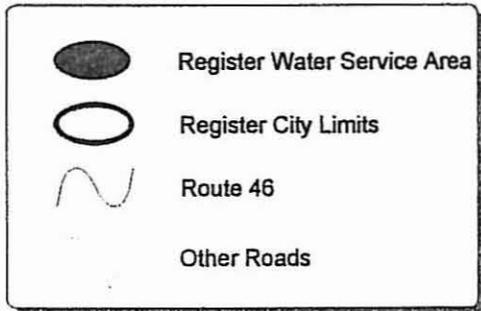
*Coastal Georgia*  
**Regional Development Center**  
Planning & Government Services 2000



# Municipal Water Service Area Town of Register



## Legend

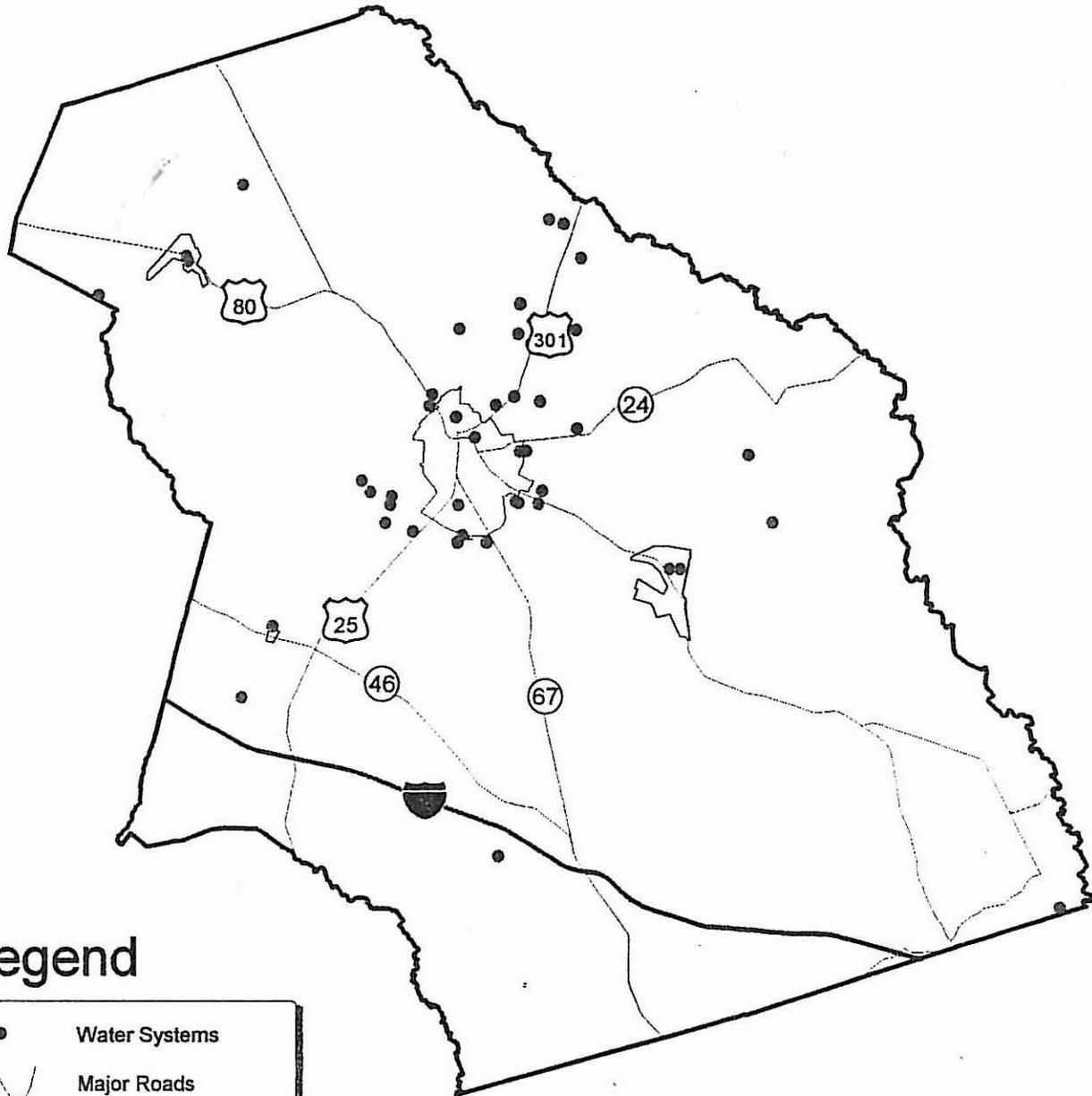


Source: Base map compiled from 1990 U.S. Bureau of the Census Tiger files.  
Disclaimer: This map is intended for general planning purposes only.  
Produced: 2.23.00

*Coastal Georgia*  
**Regional Development Center**  
Planning & Government Services 2000

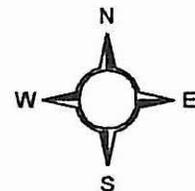
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# Selected Non-Municipal Community Water Systems



## Legend

●	Water Systems
~	Major Roads
○	Municipalities
○	County Border

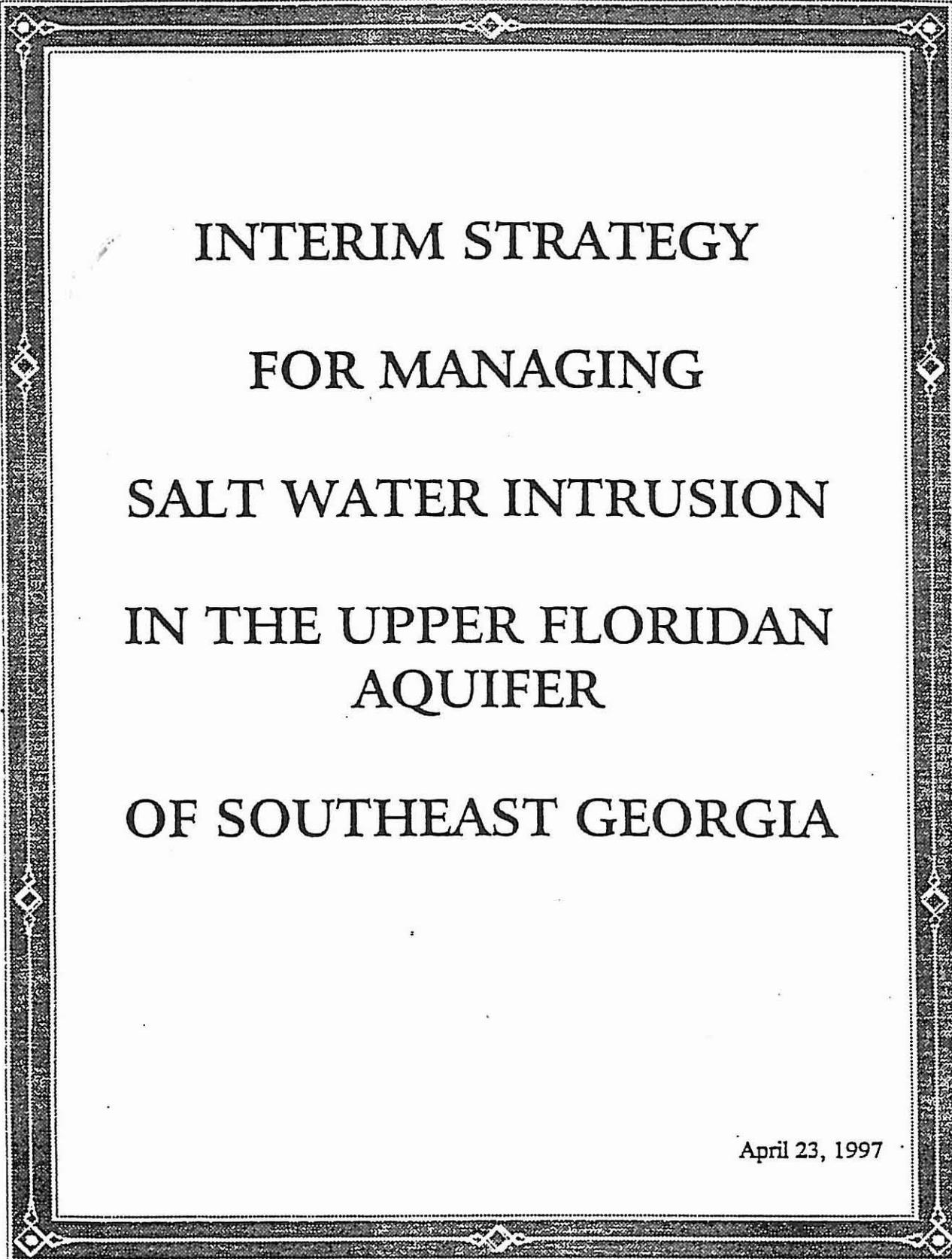


Source: Base map compiled from 1990 U.S. Bureau of the Census Tiger files.  
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*Coastal Georgia*  
**Regional Development Center**  
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0 7 Miles

**B. EPD Interim Strategy and Minimum Requirements**



INTERIM STRATEGY  
FOR MANAGING  
SALT WATER INTRUSION  
IN THE UPPER FLORIDAN  
AQUIFER  
OF SOUTHEAST GEORGIA

April 23, 1997

# INTERIM STRATEGY FOR MANAGING SALT WATER INTRUSION IN THE UPPER FLORIDAN AQUIFER OF SOUTHEAST GEORGIA

April 23, 1997

## Executive Summary

The Georgia Environmental Protection Division's objective is to STOP THE INTRUSION OF SALT WATER before municipal water supply wells on Hilton Head Island, South Carolina and Savannah, Georgia are contaminated, and to prevent an existing salt-water problem at Brunswick, Georgia from worsening. Salt water intrusion into the Upper Floridan Aquifer threatens ground water supplies in the Hilton Head-Savannah and Brunswick areas. Intrusion rates, however, are quite slow, being more than a hundred years to reach Savannah. To accomplish this objective, EPD will do the following:

- (1) 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.
- (3) Create one or more advisory committees. 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 Glynn County, Chatham County, and 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.

## Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer

- (6) Allow on an interim basis increases in ground water withdrawals in the areas of southeast Georgia that have little impact on salt water intrusion problems.
- (7) Encourage and promote water conservation and reduced ground water usage wherever feasible, throughout southeast Georgia.

### **Introduction**

The Upper Floridan Aquifer of southeast Georgia is susceptible to salt water intrusion. The aquifer is a primary source of drinking and industrial process water throughout 24 counties of the region. The United States Geological Survey (USGS) estimates 1995 ground water use in the area to be about 359 million gallons per day (Mgd).

EPD believes only a small portion of the aquifer is susceptible to salt water intrusion. There is one confirmed source of salt water and two additional suspected sources of salt water threatening Savannah. A salt water wedge exists on the northern end of Hilton Head Island; this wedge is slowly moving beneath the Island toward Savannah. Further south near the eastern end of Bull Island in South Carolina, geologic conditions favorable for ocean water to enter the aquifer also exist. Some wells in this area have higher than expected salinity. Based on ground water modeling, the United States Geological Survey (USGS) reports that salt water may be entering the aquifer offshore from Tybee Island. Salt water, originating from deeply buried brines currently is intruding the aquifer at Brunswick. Further south in the St. Marys-Fernandina Beach area, the USGS reports that salt water intrusion conditions are similar to those at Brunswick; some wells in northern Florida have been abandoned because of salt water problems.

In February of 1996, EPD proposed a draft Interim Strategy to protect the Upper Floridan Aquifer in twenty-four southeast Georgia counties from salt water intrusion. In the draft Interim Strategy, EPD subdivided southeast Georgia into three subareas (i.e., northern, central, and southern), which were separated because of geological information (Figure 1). The proposed Interim Strategy could be carried out within the confines of EPD's existing statutory authority. Minimal regulations were proposed for the northern and southern subareas. For the central subarea, EPD proposed that permittee meet certain standards of water-use efficiency, use alternate sources of water, or trade ground water allocations. If the proposed Interim Strategy were carried out as it was originally presented, the net result would be equivalent to a 12-Mgd reduction in ground water withdrawals in Chatham County. The bulk of the actual reductions, however, would have been in counties other than Chatham.

Between early March and mid-April 1996, EPD held nine public meetings to solicit comments, and received over four hundred written and oral responses. One of the primary comments was that

*Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer*

the impacts (costs vs. benefits) of the proposed Interim Strategy needed clarification. There was the perception that the proposed Interim Strategy could create adverse economic impacts on some categories of users. The remaining comments generally fell into six categories; as follows (in no particular order):

- (1) There was a need for comprehensive water supply planning in southeast Georgia.
- (2) The level of scientific knowledge needed to be expanded, particularly with respect to locations where salt water is entering the aquifer, and where and when salt water would reach Georgia users. Moreover, there were considerable misconceptions about the geological nature of the salt water intrusion problem.
- (3) Sources of water that are alternate to the Upper Floridan Aquifer need to be identified, described, and tested.
- (4) There was the perception that the proposed Interim Strategy was unfair to some categories of users, particularly those that are not close to the aquifer drawdown areas in Chatham and Glynn counties.
- (5) The relationship between Georgia, Florida, and South Carolina needed clarification. Clarification was particularly needed with respect to each state's expectation of the others.
- (6) The information base on agricultural water use was too poor to be used for meaningful ground water management purposes.

After receiving the comments, it was clear to EPD that the draft proposed Interim Strategy required considerable rethinking, and that a non-regulatory perspective should be one of the avenues investigated. To achieve this, EPD contracted with the School of Policy Studies of Georgia State University (GSU). The GSU principal investigators had backgrounds in environmental economics and interstate water negotiations. GSU completed its analysis on October 1, 1996, and recommended that EPD's Interim Strategy pursue a policy of Rational (or expanded) Use.

The primary thrust of GSU's proposal was that a policy of Rational Use would be conducive to economic development. GSU pointed out that salt water intrusion velocities were very low. Therefore, a nominal user fee could be instituted to replace those wells in Chatham and Glynn counties, when such wells became salty in the future. The user fees would be placed in a fund and allowed to grow by accruing interest. By the time salt water actually began to contaminate wells in either Chatham or Glynn counties, the fund would be more than adequate to construct surface water treatment plants, construct engineered barriers to salt water intrusion, or to develop other aquifers.

## Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer

A number of stakeholders expressed concerns that such a policy would deplete the aquifer. Some of those expressing this viewpoint requested that EPD pursue a policy of "sustainable use" (i.e., a policy that when implemented would result in withdrawal reductions of sufficient magnitude to ensure that continued use of the Upper Floridan Aquifer at such reduced use levels would not result in any further movement of the salt water wedge). Some stakeholders commented that EPD should expand upon the economic analysis that GSU had attempted. Many stakeholders were supportive of using fees to expand the level of scientific knowledge. Based on public comments, EPD decided not to pursue a policy which would allow the aquifer to become salty at Chatham County, or which would allow any further salting of the aquifer in Glynn County.

After considering all of the oral and written comments received, EPD released a proposed Revised Interim Strategy on December 20, 1996. Three public meetings were held on the proposal in January 1997 and approximately 90 oral and written comments were received. Many comments contradicted one another, for example, some stakeholders advocated pumpage reductions whereas other stakeholders advocated no pumpage reductions. Nevertheless, there were several consistent themes; among them:

- Scientific studies should be colleague reviewed.
- EPD should aggressively promote water conservation.
- The requirement of comprehensive water supply planning should be expanded to all of southeast Georgia on an accelerated schedule.
- EPD should solicit ideas from technical advisory committees.
- 1995 or 1996 pumping levels might not be hydrologically appropriate for establishing permit caps.
- Water conservation or reductions in pumpage could be more readily achieved via incentives.
- EPD should allow flexibility in permits in those areas where pumpage is capped, if total withdrawals do not exceed the cap.

### New Geological Information

Since first proposing the Interim Strategy in February, 1996, EPD has embarked on a \$1,500,000 five-year study. The purpose of this study is to better define the mechanics of salt water intrusion and to identify those areas that would be most susceptible to intrusion. At the time of this writing deep wells have been constructed on Tybee Island, and are in progress at St. Marys. Several shallow wells also have been drilled at Hilton Head Island. During the summer and fall of 1996, about two dozen separate ground water modeling runs were performed. Some newly developed information includes:

- (1) Under 1985 pumping conditions (the date to which the USGS models are calibrated), the salt water wedge could reach the center of the cone of depression at Savannah in about 120-270

## Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer

years from now (from the vicinity of Bull Island or from northern Hilton Head Island, respectively). At Brunswick, the plume occupies about 2.8 square miles and may be growing.

- (2) Under expanded pumping scenarios, where withdrawals are consistent with population increases, only two areas within the central subarea are susceptible to salt water intrusion; namely Hilton Head-Chatham County and eastern Glynn County. Increasing pumping would result in salt water reaching these areas more rapidly. All other parts of the central subarea should continue to have fresh ground water.
- (3) The Upper Floridan Aquifer is not susceptible to depletion because ground water withdrawn by pumping is replaced by lateral and vertical inflow. After more than 100 years of pumping, the Aquifer remains completely full. Continued pumping at reasonable growth rates would result in salt water slowly reaching currently unaffected fresh water supply wells in these two areas.
- (4) Based on USGS modeling, there would have to be about a 60-65 Mgd reduction in pumpage in Chatham County and about a 100% reduction in Glynn County and all remaining central subarea counties maintaining constant pumpage (i.e., no increases) to halt salt water intrusion. As long as there is significant pumping in southeast Georgia, salt water intrusion is irreversible.
- (5) Other than accelerated salt water intrusion, there are no known or expected environmental impacts associated with increased pumpage. No surface water bodies or habitat would be affected.
- (6) Within the central subarea, the further pumpage is away from Chatham and Glynn counties, the less would be the impact on the potentiometric surface and salt water intrusion. For example, ground water models performed by the USGS at EPD's request suggest that one gallon of ground water pumped at Savannah has about the same impact on salt water intrusion at the northern end of Hilton Head Island as about 100 gallons pumped at Sylvania or about 25 gallons pumped at Brunswick.

### Impacts of the Strategies Proposed To Date

There have been several salt water intrusion mitigation strategies proposed to date. For each strategy, EPD had the USGS perform a modeling run, using either the EPD Coastal Model, the RASA Model, the Brunswick Vicinity Model or the Savannah Vicinity Model. All models were developed by the USGS and follow USGS modeling protocols; all are interrelated and information can be cross-compared. Using the USGS models, EPD estimated the impact of each of the proposed

*Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer*

strategies on salt water intrusion; that is, how much would intrusion be quickened or slowed if that strategy were employed. The results are presented in Table 1.

EPD has authorized and provided funding to the USGS to publish these model runs with accompanying assumptions. This publication will conform to USGS colleague-review procedures.

## **INTERIM STRATEGY**

### **General**

This Interim Strategy is intended to continue the process of protecting the Upper Floridan Aquifer of southeast Georgia from salt water intrusion. Once implemented, the Interim Strategy will continue until December 31, 2005. During the time that the Interim Strategy is in effect, EPD will work with a broad-based stakeholder advisory committee on information exchange, and will encourage and accept input from the committee on matters related to both the implementation of the Interim Strategy and development of a final strategy. EPD also would cooperate with other public and private entities to develop comprehensive water supply plans, and to gather water use, engineering, and geologic information. The outcome will be the development of a final strategy (by December 31, 2005) which is a broadly understood and supported, and which will stop salt water intrusion at Hilton Head, Savannah, and Brunswick and also allow additional ground water withdrawals in the 24 counties of southeast Georgia.

When fully implemented the Interim Strategy will:

- (1) Develop the information needed to assist Georgia's stakeholders with the development and implementation of a final strategy that will acceptably address salt water intrusion and encroachment problems along Georgia's coast.
- (2) Recognize the importance of all users throughout southeast Georgia.
- (3) Promote conservation of ground water throughout southeast Georgia.
- (4) Develop comprehensive water supply plans throughout southeast Georgia.
- (5) Develop feasibility studies (with economic analysis) of engineered barriers, redistributed pumpage, and alternate sources of water in the central subarea.
- (6) Develop expanded scientific studies throughout southeast Georgia.
- (7) Minimize restrictions on those users that have minimal impact on salt water intrusion.
- (8) Allow reasonable expanded use of the Upper Floridan Aquifer in those areas of southeast Georgia where such use has been found, based on sound science, to not have a significant influence on salt water encroachment in Chatham County or salt water intrusion in Glynn County.

## Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer

- (9) Utilize input from stakeholder advisory committees to develop planning, science, and feasibility scopes of work.

For the purposes of managing the Upper Floridan Aquifer, EPD will continue to subdivide southeast Georgia into three separate subareas as shown in Figure 1. Based on information provided in USGS Professional Paper 1403-D, ground water pumping in the northern subarea has little or no impact on salt water intrusion; the impact of pumpage in the southern subarea on salt water intrusion is not known; ground water pumpage in the central subarea impacts salt water intrusion.

Based on currently available scientific information and EPD's interpretation of the results of recent USGS modeling runs, EPD cannot demonstrate that pumping from the Upper Floridan Aquifer in the northern and southern subareas will significantly affect the movement of the salt water intrusion towards Chatham County or the upward movement of salt water in Glynn County. EPD will therefore not cap withdrawals in these subareas at any specific level, but will allow reasonable additional pumping from the aquifer until such time as it can be shown that such withdrawals exercise unacceptable adverse influence on the two problem areas.

For the central subarea, exclusive of Chatham and Glynn counties and defined portions of Bryan and Effingham counties, the Interim Strategy would permit some limited increases in withdrawals for those counties that have comprehensive water supply plans. [Note: EPD estimates that through 2005, total new ground water withdrawals in the central subarea would be about 15 Mgd, an increase of about 6 percent over current use. This would include issuing permits for those applications currently in review as well as new permit applications.] For Chatham and Glynn counties and defined portions of Bryan and Effingham counties (see Figure 2), the Interim Strategy would be based on the principle of "No Impact of Salt Water Intrusion on Existing Users". Ground water withdrawals in this area would be capped at some defined levels, and withdrawals from the Upper Floridan Aquifer in Chatham County would be reduced by at least 10 Mgd by December 31, 2005. The effect of this capping will be that at the end of the interim period, Chatham, Bryan and Effingham counties will still have a reliable source of fresh water for at least 100 years. On the other hand, salt water is already impinging on some existing Glynn County water supply wells; therefore capping of ground water use in Glynn County will better protect the existing users and should provide them with access to the aquifer for at least 50 years or more.

Depending on the scientific information gathered during the period that the Interim Strategy is in effect, it may be appropriate in the Final Strategy to limit or restrict ground water withdrawals in the northern and southern subareas. The decision to do this, however, would not be made until 2005 as the Final Strategy is being developed.

Scientific studies and comprehensive water supply planning cost money. Such money could be obtained through direct appropriations or through user fees. EPD believes that user fees are most appropriate as the users receive the direct benefit of having a reliable long-term water supply.

## Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer

However, the final decision regarding the best mechanism to fund studies and to conduct planning, rests with the General Assembly and the Governor. This matter should be dealt with by the General Assembly in the 1998 legislative session.

Assuming the General Assembly and the Governor support a fee based system during the 1998 legislative session, it is likely that EPD will recommend a nominal and equitable user fee be assessed on all permitted users in all three subareas. It is also likely that EPD will recommend that the proceeds from the fees be used, (1) to provide for comprehensive water supply planning, (2) to perform scientific studies to monitor and predict salt water intrusion, and (3) to perform feasibility studies of redistributing pumpage, of obtaining water from sources other than the Upper Floridan Aquifer, and of creating engineered barriers to salt water intrusion.

Finally, EPD will likely recommend that until the Final Strategy is developed, fee money only be used for the development of comprehensive water-supply plans, the gathering of scientific studies, and the performing of such feasibility studies. Some or all of these thoughts may be modified prior to the General Assembly's consideration of the matter next year.

Implementation of this strategy, however, will require some changes in State laws and EPD's Rules. Interested legislators have introduced a resolution to the 1997 Session of the General Assembly to create a Study Committee. The purpose of the Study Committee is to hold hearings, to receive recommendations on legislation to protect southeast Georgia from salt water intrusion, and to identify a mechanism for funding further studies and planning. Based upon the strategy and the Study Committee findings, implementing legislation may be introduced in the 1998 session of the General Assembly. If the General Assembly and the Governor concur, then EPD would begin collecting fees and using them to carry out the Interim Strategy.

EPD would conduct regular (at least yearly) progress meetings to update stakeholders on new monitoring information, technological advances, and so forth. EPD would continue to coordinate with the St. Johns River Water Management District in Florida and the South Carolina Department of Health and Environmental Control to establish consistent salt water intrusion protection measures across state boundaries.

### Water-Supply Planning

EPD recognizes that local comprehensive water-supply planning is critical to prudent management of the Upper Floridan Aquifer in southeast Georgia. Such plans should be prepared utilizing public participation and should, at a minimum, address the following issues for each county:

- Historical water use perspective.
- Review of existing water supply needs and options studies.

## Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer

- Current water management practices.
- Identification of possible sources of water other than the Upper Floridan Aquifer.
- Quantification of existing ground and surface water usage.
- Conservation efforts.
- Population, land use projections, and water demand projections to 2050.
- Development of water-supply management options.
- Implementation schedules.

To ensure that the plans are consistent in content, format, and methods, EPD will distribute a detailed water supply plan outline by May 30, 1997.

New withdrawal permit applications from the Upper Floridan Aquifer will be reviewed by EPD for all southeast Georgia counties, except in Chatham, Glynn, and the southern portions of Bryan and Effingham counties, effective January 1, 1997. However, comprehensive water supply planning is extremely important for southeast Georgia. Therefore, EPD will not issue new municipal, industrial, and agricultural Upper Floridan Aquifer ground water permits, after December 31, 2000, to applicants in any county of the 24 county area which has not developed a comprehensive water supply plan and had it approved by EPD.

Agricultural water use information is lacking. This is particularly significant as agriculture is a rapidly expanding user group in southeast Georgia (an estimated 200% increase in permitted usage between 1985 and 1995). To expand the level of knowledge of this important user group, EPD will work with agricultural interests to develop a statistically valid yearly estimate of agricultural water uses for each southeast Georgia county, and a program to educate agricultural water users on best management practices to conserve irrigation water.

EPD would contract to develop an general educational program on irrigation best management practices and irrigation-water conservation.

### Conservation

EPD will regulate Upper Floridan Aquifer ground water withdrawals in Chatham County so that at least 10 Mgd of the 14.59 Mgd reductions identified by the Savannah/Chatham County Metropolitan Planning Commission's (MPC) Comprehensive Water Supply will be achieved by December 31, 2005.

EPD expects the pulp and paper industry to carry out those ground water conservation measures identified in the 1995 Institute of Paper Science and Technology Study.

## Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer

After January 1, 2001, EPD will only issue any new or expanded permits for municipal ground water supply, where the local government has developed water-conservation ordinances, including ultra-low flow plumbing requirements, audits to find out transmission losses, and so forth. This would apply to users in all three subareas.

After January 1, 2001, EPD will only allow new or expanded agricultural use of ground water for those owners who have taken a course on irrigation best management practices and irrigation water conservation. This would apply to users in all three subareas.

After January 1, 2001, EPD will only allow new or expanded industrial use of ground water for those owners who have developed a water conservation plan. This would apply to users in all three subareas.

EPD encourages Chatham and Glynn counties, along with those portions of Bryan and Effingham counties where ground water is fully capped, to use surface water or shallow aquifers for future water supply. In these areas EPD will also require water users, wherever feasible, to substitute surface water, treated wastewater, or water from shallow aquifers for golf course irrigation and non-contact cooling water currently being withdrawn from the Upper Floridan Aquifer.

EPD recognizes that incentives can be conducive to conservation, especially for those users that would have to make capital improvements.

### Permitting (Upper Floridan Aquifer, only)

- During the period in which the Interim Strategy is in effect, EPD, in consultation with the affected permittees, will reasonably adjust some existing municipal and industrial ground water withdrawal permits to a yet to be determined level. A review of EPD's permits shows that some permits are for rates that greatly exceed actual usage.
- Inactive ground water use permits will be canceled. This would apply to all three subareas.
- A significant amount of the 10 Mgd of reduced Upper Floridan Aquifer ground water use will come from voluntary reductions by Union Camp. Union Camp has agreed to reduce its permitted withdrawal by 6.5 Mgd, which is the equivalent of its prorata share of industrial ground water pumping in Chatham County. In conjunction with that, EPD will also reduce Union Camp's ground water withdrawal permit by 1.9 Mgd (from 28.5 Mgd to 26.6 Mgd) in order to eliminate unused capacity made available by increased water use efficiencies achieved by Union Camp. Union Camp's permit thus will be further reduced from 26.6 Mgd to 20.1 Mgd by December 31, 2005.

## Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer

Union Camp has made a further commitment to transfer 2.5 Mgd in ground water capacity if it is needed by other permittees for domestic growth. Union Camp will make this capacity available for transfer (assuming surface water treatment plant capacity is available to replace this quantity of water) after EPD develops suitable guidance governing such transfers.

- EPD believes that certain water use practices are no longer wise for the Upper Floridan Aquifer. These include golf course irrigation and non-contact cooling water. EPD will not issue any new permits for golf-course irrigation or non-contact cooling water, where alternate sources of water exist. This would apply to users in all three subareas.
- EPD will not issue any new ground water withdrawal permits in Chatham or Glynn counties without associated reductions in water usage elsewhere within the county. If consistent with EPD approved, comprehensive local water supply plans, EPD would consider allowing the transfer of some or all of a permitted ground water withdrawal from one user to others, provided such transfer shifts pumpage away from the deepest portions of the potentiometric cone of depression. (See "Reallocation of Water" for further details.)
- On the basis of ground water modeling that has been performed, EPD will cap future withdrawals from the Upper Floridan Aquifer in those portions of Bryan and Effingham counties that have the same hydrodynamic impact on salt water intrusion as Chatham County withdrawals. The affected areas generally are those portions of Bryan County southeast of Fort Stewart and those portions of Effingham County south of Georgia Highway #119. EPD, however, will consider public water supply applications in these areas which have been submitted to EPD before April 23, 1997 or for which project applications have been submitted to the local zoning board before April 23, 1997.
- EPD will establish the permit limit for each individual Upper Floridan Aquifer permit holder in Chatham, Glynn and those capped portions of Bryan and Effingham counties. The modified annual permitted withdrawal limit will be based upon an evaluation of annual reported ground water withdrawals over the interval from 1990 to 1996. In most instances, caps are expected to be based upon the highest annual reported ground water withdrawal during that period.
- EPD will not issue water withdrawal permits or safe drinking water permits for the development or construction of new public water systems in the Chatham County or Glynn County cap areas after April 23, 1997, if the source of water supply is the Upper Floridan Aquifer, with the possible exception of transfers which shift pumpage away from the cone of depression. This also applies to the Bryan County and Effingham County cap areas except as provided for in the preceding paragraphs. EPD will continue to evaluate the issuance, modification and renewal requests for permits to operate a public water system for existing

## Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer

systems and for new systems that had initiated the permitting process prior to the implementation of this strategy.

- For public water systems using less than 0.10 Mgd in Chatham and Glynn counties and in the capped portions of Bryan and Effingham counties, EPD will modify existing Safe Drinking Water permits to require the permittee to begin metering and reporting their water use by December 31, 1998.
- For all 24 counties covered by this strategy, any request for the expansion of a public water system would require the submittal, approval and implementation of a water conservation plan. Also, metering of the water system and water use monitoring will be required (all sources, treatment facilities and service connections). After December 31, 2000, EPD would not approve or permit any new project for development or construction within the counties which have not developed comprehensive water supply plans and had them approved by EPD.
- EPD will not necessarily permit all new additional withdrawals within the central subarea. For applications received after April 23, 1997, new ground water withdrawal permits within the central subarea, outside the capped areas, will only be issued after EPD has assessed the impact on salt water intrusion on other users. EPD would perform similar assessments on withdrawal permit applications that average 1 Mgd or more in the northern and southern subareas.
- With the exception of Glynn and Chatham counties and capped portions of Bryan and Effingham counties, EPD will limit total new permitted withdrawals in the counties covered by this strategy to 10% above the USGS's estimate of 1995 ground water use for the entire 24 counties. This limit is equivalent to 36 Mgd, and would apply to all three subareas. This value will be periodically reassessed as new scientific information is developed.

### Reallocation of Water

Reductions in Upper Floridan Aquifer ground water use will occur as a result of conservation, source substitution, and other means. As such reductions opportunities are identified, EPD will modify permits (in consultation with permittees) to reduce permit limits to agreed upon levels over agreed upon periods of time. In consultation with the permittee and other Upper Floridan Aquifer stakeholders in the affected area, EPD will consider reallocating this unused capacity in one or more of the following ways:

- Permanently remand the reclaimed water to the Upper Floridan Aquifer unencumbered so that it contributes to the maintenance of the potentiometric surface.

## Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer

- Temporarily remand the reclaimed water to the Upper Floridan Aquifer until such time as municipal water needs (as identified in the EPD approved regional/local water supply plan) is such that this reclaimed water can be allocated to municipal water users in "the affected area." Again priority will be given to reallocations that have the effect of redistributing pumpage to points further away from the centers of established cones of depression, and to reallocations to areas where surface water is not economically available.
- Distribute to municipal water supply system(s) within the previously described area in a fashion outlined in EPD approved regional (or local) water supply plan. Priority will be given to such reallocations that have the effect of redistributing pumpage to points further away from the centers of established cones of depression, and to reallocations to areas where surface water is not economically available. However, EPD will not reallocate ground water in such amounts that would prevent the attainment of a total 10 Mgd reduction in use in Chatham County by December 31, 2005.

### Sound Science

EPD currently is in the second year of a five-year program to expand knowledge of ground water and geology in the 24 county area. The USGS is participating in these studies as a cooperator. In addition, using state appropriations, EPD personnel are drilling approximately two dozen additional monitoring wells in Southeast Georgia, EPD is also financing the construction of some monitoring wells in the Hilton Head and Bull Island area of South Carolina. The five-year program is designed to establish an early warning system of salt water monitoring wells, evaluate alternate sources of water to the Upper Floridan Aquifer, and expand EPD's version of the USGS ground water models into South Carolina and Florida. EPD will continue to pursue these scientific investigations.

During the public meetings that were held on the draft Interim Strategy, a number of stakeholders requested an expansion of scientific studies to more precisely locate the position of fresh water-salt water interface, to more precisely identify the locations where salt water is entering the aquifer, to more precisely predict the velocity and route of salt water movement, to perform feasibility studies of possible engineered barriers to salt water intrusion or pumpage redistribution, and to more precisely assess the impact of withdrawals in the northern and southern subarea on salt water intrusion in the central subarea and vice versa.

Doing this would require expanded geological studies, possibly including offshore drilling, land and marine seismic surveys, and development of new salt water transport models. To achieve this and assuming funds are available for scientific studies, EPD also would perform additional geological and engineering studies, as recommended by a Technical Advisory Committee. The primary objective of these studies would be to obtain a more precise estimate of the time that salt

*Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer*

water will begin to contaminate currently fresh water wells and to establish the feasibility of methods that can be employed to prevent or slow such contamination.

Wherever possible, EPD will use the services of the USGS to take advantage of the USGS's ability to match offerings on a dollar for dollar basis.

**Conclusions**

**EPD's objective is to STOP THE INTRUSION OF SALT WATER before municipal water supply wells on Hilton Head Island and Savannah are contaminated, and to prevent an existing salt water problem at Brunswick from worsening.** Salt water intrusion into the Upper Floridan Aquifer threatens ground water supplies in the Hilton Head-Savannah and Brunswick areas. The implementation of the recommendations included in this interim Strategy will set the stage for the development of the final strategy by December 31, 2005.

# SUB-AREA DIVISIONS

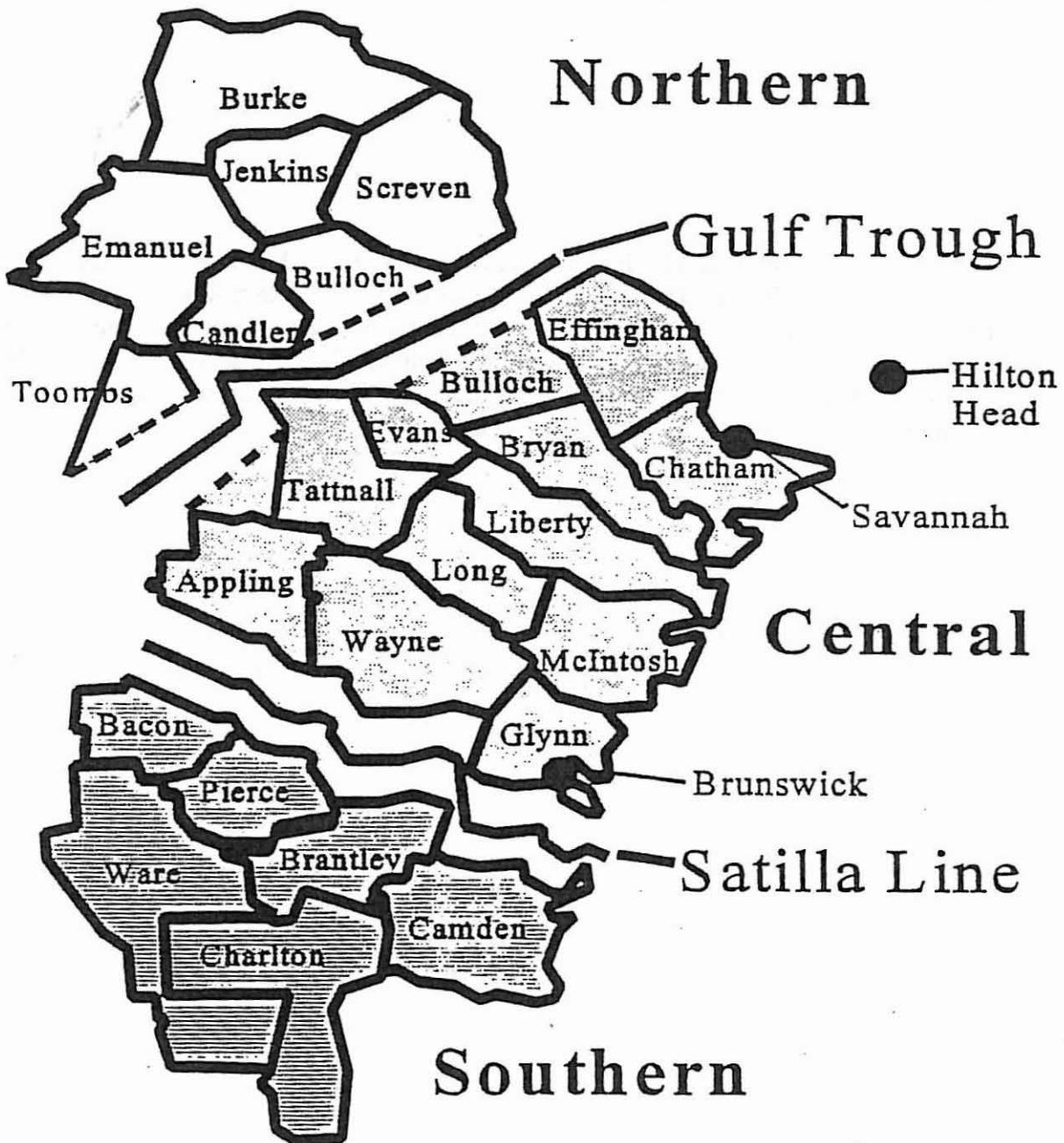
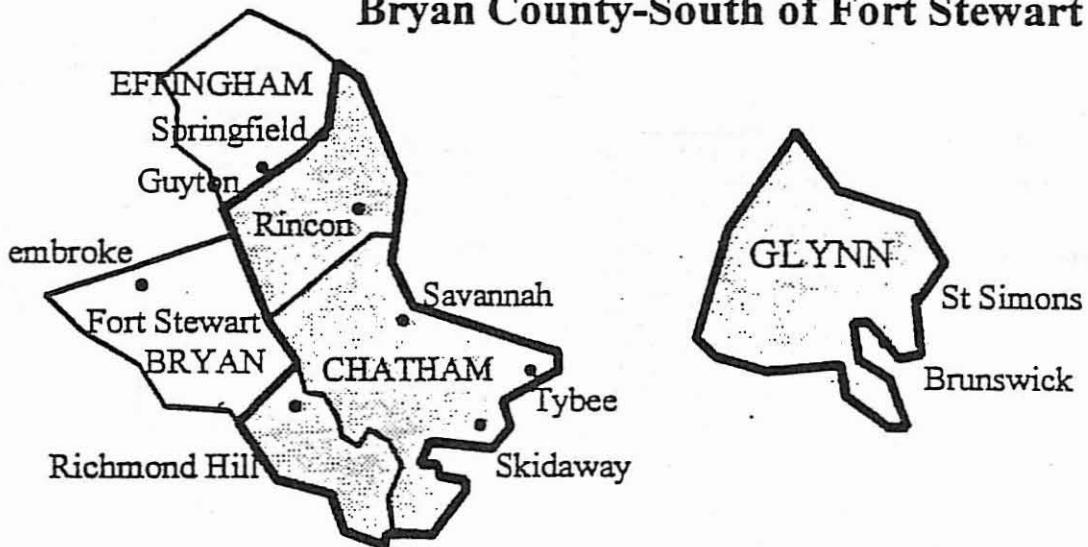


Figure 1

## CAPPED AREA

All of Chatham and Glynn counties  
Effingham County-South of Hwy 119  
Bryan County-South of Fort Stewart



*Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer*

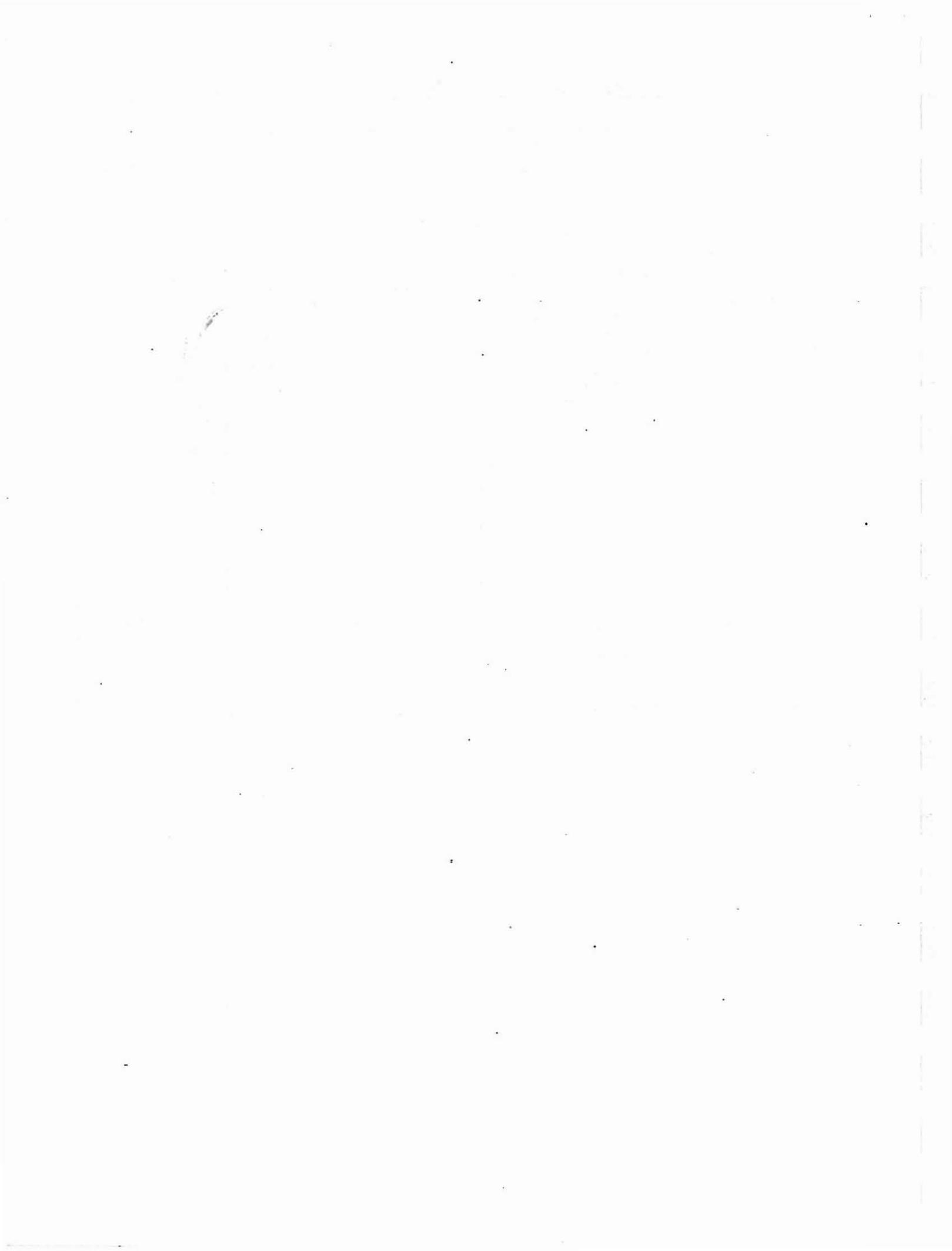
TABLE 1

RESULTS OF MODELING OF VARIOUS STRATEGIES

SITUATION / PLAN	ASSUMPTIONS	TRAVEL TIME FROM EAST END OF BULL ISLAND, S.C.; Years FROM 2005	TRAVEL TIME FROM N. END OF HILTON HEAD ISLAND, S.C.; Years FROM 2005	SIZE OF SALT WATER PLUME AT BRUNSWICK
1985 Conditions	Assume that 1985 pumping conditions continue until 2005.	=110 years	=260 years	About 41.5 Mgd of upward flux flow into Lower Floridan Aquifer; about 2.8 square miles currently contaminated.
SC DHEC Plan Applies to Chatham County only	20 Mgd reduction in Chatham County from 1995 pumping rates. Other counties not considered.	=150 years Pumpage from other counties not considered.	=370 years Pumpage from other counties not considered.	Not applicable.
EPD Interim Strategy (Initial Version) Applies to Central Subarea	145 gpd per person; Chatham County implements some of MPC Plan; pulp and paper industry implements IPST recommendations; golf course and cooling water use curtailed; water offsets implemented.	=120 years	=300 years	Upward flux flow into Lower Floridan Aquifer reduced by about 5.5 Mgd. Contaminated area of about 2.4 sq. mi.
MPC Plan Applies to all of Southeast Georgia	14.59 Mgd reduction in Chatham County from 1995 pumping rates. All other counties held at 1985 pumpage.	=130 yrs.	=360 yrs.	Upward flux flow into Lower Floridan Aquifer reduced by about 0.1 Mgd. Size of contaminated area essentially unchanged.
1985 x 110% Applies to all of Southeast Georgia	10% increase across the board for 1985 users.	=80 yrs	=240 yrs.	Upward flux flow into Lower Floridan Aquifer increases by about 2.7 Mgd. Contaminated area of about 3.0 sq. mi.
1985 x 90% Applies to all of Southeast Georgia	10% decrease across the board for 1985 users.	=140 yrs	=350 yrs	Upward flux flow into Lower Floridan Aquifer decreases by about 2.4 Mgd. Contaminated area of about 2.6 sq. mi.

*Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer*

<p>EPD Interim Strategy (second version)</p> <p>Applies to Central Subarea</p>	<p>Pumpage in Chatham and Glynn Counties capped at current levels; 15 Mgd in rest of Central Subarea to account for existing applications and reasonable growth in other counties (GSU growth rate projections).</p>	<p>= 110 yrs.</p>	<p>= 290 yrs. See note # 5.</p>	<p>Upward flux flow into Lower Floridan Aquifer decreases by 1.9 Mgd. Contaminated area of 2.7 sq. Mi.</p>
<p>Sustainable Use</p> <p>Applies to Central Subarea</p>	<p>Reduce pumpage in Chatham County to reverse gradient from Port Royal Sound. Reduce pumpage in Glynn County to reduce flux from Fernandina Permeable Zone into Lower Floridan Aquifer to 0 Mgd or to pre-development conditions, whichever is less.</p>	<p>To achieve permanent elimination of the salt-water threat, pumpage in Chatham County will have to be reduced about 60-65 Mgd from current pumping rates.</p>	<p>To achieve permanent elimination of the salt-water threat, pumpage in Chatham County will have to be reduced about 55-60 Mgd from current pumping rates.</p>	<p>Model indicates that there was upward flux flow from the Fernandina Permeable Zone into the Lower Floridan Aquifer prior to development. This suggest that there may have been salt-water intrusion in the Brunswick area prior to pumping. To return to pre-development conditions will require a 100% reduction in pumpage in Glynn County.</p>
<p>50 Mgd increase in Chatham County from current pumping rates.</p>	<p>Chatham County specifically requested an assessment of the impact of replacing surface water from the I&amp;D plant with ground water from the northwestern part of the County.</p>	<p>=60 yrs.</p>	<p>=180 yrs.</p>	<p>Not applicable</p>



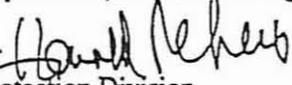
# Georgia Department of Natural Resources

205 Butler St. S.E. , East Floyd Tower, Atlanta, Georgia  
Lonica C. Barrett, Comm  
Harold F. Reheis,  
Environmental Protection

June 4, 1997

## MEMORANDUM

TO: County Commission Chairpersons (Southeast Georgia)

FROM: Harold F. Reheis, Director   
Georgia Environmental Protection Division

SUBJECT: Minimum Requirements of A Cooperative Comprehensive Water Supply Plan

One of the tenets of the *Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer of Southeast Georgia* is the requirement that each of the 24 counties covered by the strategy must develop a comprehensive local water supply plan to be reviewed and approved by the Environmental Protection Division by December 31, 2000. To assist with the development of a set of consistent comprehensive local water supply plans, EPD committed to producing and distributing guidelines upon which these plans should be based. I have attached a document entitled *Minimum Requirements of a Cooperative Comprehensive County-wide Water Supply Plan*. The document outlines the minimum requirements of these plans in a topical manner, and should be used to guide the development of your county's comprehensive local water supply plan.

My understanding is that there has been a fair amount of discussion in the region pertaining to how best to move forward with development of each of these plans. The discussions are reportedly centered around whether the plans should be developed by one entity to ensure consistency and uniformity, or developed separately by each county. I think this is a necessary and useful discussion, and it should continue with the attached minimum requirements as a basis. My staff is prepared to be an active participant in that discussion if that is your wish.

In 1996, EPD contracted with DRI/McGraw-Hill (an international demographics firm) to produce a set of long-term (through the year 2050) population and employment forecasts for the "whole county approximations" of Georgia's 14 river basins. That work has been completed, and once the results have been properly interpreted for the counties in your area, these data will be available to assist you with development of the water demand and wastewater sections of your comprehensive local water supply plan.

If these plans are to be developed, reviewed, and approved in a timely fashion, it is important that the planning effort get underway as soon as possible.

I appreciate your continuing cooperation as we move forward with the early stages of implementing the southeast Georgia ground water management strategy.

attachment

cc stake holders (w/attachment)

# MINIMUM REQUIREMENTS OF A COOPERATIVE COMPREHENSIVE COUNTY-WIDE WATER SUPPLY PLAN

## I. INTRODUCTION

- A. County Geographical/Geo-political Setting
- B. Climatological, Hydrological, and Hydrogeological Setting
- C. County/Region Economic Setting

## II. WATER DEMAND

### A. Past

- 1. Domestic/Commercial Water Demand (1970 - 1990)
  - a. Population Served
  - b. Annual Water Use Statistics (e.g., monthly average & maximum day use for each month, peak summer/winter consumption)
  - c. Water Conservation Measures Employed (with water savings by category)
- 2. Industrial Water Demand (1970 - 1990) - *municipal customers and self-supplied*
  - a. Standard Industrial Classifications Served (four digit SIC)
  - b. Water Use Statistics by SIC (e.g., monthly average & maximum day use for each month, peak summer/winter consumption)
  - c. Water Conservation Measures Employed (with water savings by category)
- 3. Agricultural Water Demand (1970 - 1990)
  - a. Major Crops Irrigated (with irrigated acreage for each crop)
  - b. Water Use by Crop
  - c. Water Conservation Measures Employed

### B. Present

- 1. Domestic/Commercial Water Demand (1990 - 2000)
  - a. Population Served
  - b. Annual Water Use Statistics (e.g., annual per capita use, monthly average & maximum day use for each month, per summer/winter consumption)
  - c. Water Conservation Measures Employed (with water savings by category)
- 2. Industrial Water Demand (1990 - 2000) - *municipal customers and self-supplied*
  - a. Standard Industrial Classifications Served (four digit SIC)
  - b. Water Use Statistics by SIC (e.g., monthly average & maximum day use for each month, peak summer/winter consumption)
  - c. Water Conservation Measures Employed (with water savings by category)
- 3. Agricultural Water Demand (1990 - 2000)
  - a. Major Crops Irrigated (with irrigated acreage for each crop)
  - b. Water Use by Crop
  - c. Water Conservation Measures Employed

### C. Future

- 1. Domestic/Commercial Water Demand (2010, 2020, 2030, and 2050)
  - a. Population to be Served (to be completed for each of the target years)

- b. Annual Water Use Statistics (e.g., annual per capita use, monthly average & maximum day use for each month, per summer/winter consumption)
  - c. Water Conservation Measures Employed (with water savings by category)
- 2. Industrial Water Demand (2010, 2020, 2030, and 2050) - *municipal customers and self-supplied*
    - a. Standard Industrial Classifications to be Served (four digit SIC)
    - b. Water Use Statistics by SIC (e.g., monthly average & maximum day use for each month, peak summer/winter consumption)
    - c. Water Conservation Measures Employed (with expected water savings by category)
- 3. Agricultural Water Demand (2010, 2020, 2030, and 2050)
    - a. Major Crops to be Irrigated (with irrigated acreage for each crop)
    - b. Water Use by Crop
    - c. Water Conservation Measures to be Employed (with expected water savings by category)

### III. WATER SUPPLY & SYSTEMS MANAGEMENT

#### A. Present

- 1. Ground Water Supply Sources
  - a. Source Identification,
  - b. Safe Yield of Source
  - c. Quality of Source
  - d. Source Protection Measures
  - e. Service Areas and Interconnections
  - f. System Capabilities
- 2. Surface Water Supply Sources
  - a. Source Identification
  - b. Safe Yield of Source
  - c. Quality of Source
  - d. Source Protection Measures
  - e. Service Areas and Interconnections
  - f. System Capabilities
- 3. Intergovernmental Cooperation

#### B. Future

- 1. Ground Water Supply Options
  - a. Source Identification, Quantity, and Quality
  - b. Safe Yield of Source
  - c. Quality of Source
  - d. Source Protection Measures
  - e. Service Areas and Interconnections
  - f. System Capabilities and Required Upgrades
- 2. Surface Water Supply Options
  - a. Source Identification, Quantity, and Quality
  - b. Safe Yield of Source

- c. Quality of Source
- d. Source Protection Measures
- e. Service Areas and Interconnections
- f. System Capabilities and Required Upgrades

3. Intergovernmental Cooperation Opportunities

IV. WASTEWATER TREATMENT AND DISPOSAL

A. Present

1. Wastewater Systems with Discharges (NPDES)

a. Domestic/Commercial Publically Owned

- (1) Population Served
- (2) Wastewater Flowrates
- (3) Receiving Streams
- (4) Permitted Discharge Limits
- (5) Type of Treatment Provided

b. Domestic/Commercial Privately Owned

- (1) Population Served
- (2) Wastewater Flowrates
- (3) Receiving Streams
- (4) Permitted Discharge Limits
- (5) Type of Treatment Provided

c. Industrial

- (1) Standard Industrial Classifications Served
- (2) Wastewater Flowrates
- (3) Receiving Streams
- (4) Permitted Discharge Limits
- (5) Type of Treatment Provided

2. Wastewater Systems with Land Treatment (LAS)

a. Domestic/Commercial Publically Owned

- (1) Population Served
- (2) Wastewater Flowrates
- (3) Total Acreage Utilized
- (4) Type of Pretreatment Provided

b. Domestic/Commercial Privately Owned

- (1) Population Served
- (2) Wastewater Flowrates
- (3) Total Acreage Utilized
- (4) Type of Pretreatment Provided
- (5) Biosolid Handling Methods

- c. Industrial
  - (1) Standard Industrial Classifications Served
  - (2) Wastewater Flowrates
  - (3) Total Acreage
  - (4) Type of Pretreatment Provided
  - (5) Biosolid Handling Methods

3. Water Reuse Systems

a. Domestic/Commercial Publically Owned

- (1) Population Served
- (2) Wastewater Flowrates
- (3) How Reclaimed Water Utilized
- (4) Type of Pretreatment Provided
- (5) Biosolid Handling Methods

b. Domestic/Commercial Privately Owned

- (1) Population Served
- (2) Wastewater Flowrates
- (3) How Reclaimed Water Utilized
- (4) Type of Pretreatment Provided
- (5) Biosolid Handling Methods

c. Industrial

- (1) Standard Industrial Classifications Served
- (2) Wastewater Flowrates
- (3) How Reclaimed Water Utilized
- (4) Type of Pretreatment Provided
- (5) Biosolid Handling Methods

4. Onsite Wastewater Treatment and Disposal

- a. Population Served
- b. Wastewater Flowrates

B. Future

1. Domestic/Commercial Demand

- a. Population to be served (community systems)
- b. Projected Wastewater Flowrates (community systems)
- c. Population to be served (onsite systems)
- d. Projected Wastewater Flowrates (onsite systems)
- e. Water Reuse Opportunities

2. Industrial Demand

- a. Standard Industrial Classification to be Served
- b. Projected Wastewater Flowrates
- c. Water Reuse Opportunities

**C. USGS Floridan Aquifer Studies**

- (1) *Geology and Ground-Water Resources of the Coastal Area of Georgia*, Bulletin 113, 1990, USGS, Clarke, Hacke & Peck.
- (2) *Hydrology of the Floridan Aquifer System in Southeast Georgia and Adjacent Parts of Florida and South Carolina*, USGS Professional Paper 1403-D, 1989, Krause & Randolph.
- (3) *Water-Supply Potential of the Floridan Aquifer System in Coastal Area of Georgia - A Digital Model Approach*, Bulletin 116, 1991, USGS, Randolph, Pernik & Garza.
- (4) *Water-Supply Potential of Major Streams and the Upper Floridan Aquifer in the Vicinity of Savannah, Georgia*, Report 92-629, 1992, USGS, Garza & Krause.

#### D. References

- (1) *Hydrogeology of the Dublin and Midville Aquifer Systems of East-Central Georgia*, Information Circular 74, 1985; GA DNR-EPD, GA Geologic Survey; Clark, Brooks, and Faye.
- (2) *Hydrogeologic Data and Aquifer Interconnection in a Multi-aquifer System in Coastal Plain Sediments Near Millhaven, Screven County, Georgia, 1991-95*. Information Circular 99, 1996; US Department of the Interior, USGS, US Department of Energy; Clarke, Falls, Edwards, Frederiksen, Bybell, Gibson, Gohn, and Fleming.
- (3) *Geologic, Hydrologic, and Water Quality Data for a Multi-aquifer System in Coastal Plain Sediments Near Millers Pond, Burke County, Georgia, 1992-93*, Information Circular 96, 1994; U.S. Department of the Interior, USGS, U.S. Department of Energy; Clarke, Falls, Edwards, Frederiksen, Bybell, Gibson, and Litwin.
- (4) *The Hydrogeology of the Coastal Plain Strata of Richmond and Northern Burke Counties, Georgia*, Information Circular 61, 1985; GA DNR-EPD, GA Geologic Survey; Gorday.
- (5) *The Lithostratigraphic Framework of the Uppermost Cretaceous and Lower Tertiary of Eastern Burke County, Georgia*, Bulletin 127, 1996; GA DNR-EPD, GA Geologic Survey; Huddleston and Summerour.
- (6) *Hydrogeology of the Gulf Trough – Apalachicola Embayment Area, Georgia*, Bulletin 94, 1990; GA DNR-EPD, GA Geologic Survey; Kellam and Gorday.
- (7) *Geologic, Hydrologic, and Water-Chemistry Data for a Multi-Aquifer System in Coastal Plain Sediments Near Girard, Burke County, Georgia, 1992-95*, Information Circular 100, 1996; US Department of the Interior, USGS, US Department of Energy; Leeth, Falls, Edwards, Frederiksen, and Fleming.
- (8) *Potentiometric Surface of the Upper Floridan Aquifer in Georgia and Adjacent Parts of Alabama, Florida, and South Carolina, May 1998, and Water-Level Trends in Georgia, 1990-98*, 1999; US Department of the Interior, GA DNR-EPD, GA Geologic Survey; Peck, Clarke, Ransom, and Richards.
- (9) *The Geohydrology of the Cretaceous Aquifer System in Georgia*, 1980; GA DNR-EPD, GA Geologic Survey; Pollard and Vorhis.
- (10) *Irrigation Conservation Practices Appropriate for the Southeastern United States*, 1998; GA DNR, GA Geologic Survey; Evans, Harrison, Hook, Privette, Segars, Smith, Thomas, and Tyson.

**E. Local Adoption Resolution**

STATE OF GEORGIA  
BULLOCH COUNTY

RESOLUTION

WHEREAS, the Georgia Environmental Protection Division (EPD) issued its *Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer of Southeast Georgia* in April, 1997, to address saltwater intrusion that threatens future groundwater supplies in Savannah and Brunswick, and potentially other areas in Southeast Georgia; and

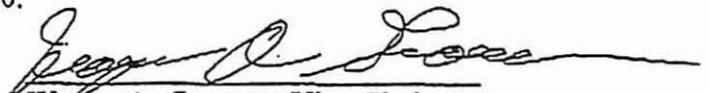
WHEREAS, as a part of its strategy, EPD required Bulloch County and 23 other counties in the region that utilize the Upper Floridan Aquifer to develop a comprehensive water supply management plan that assesses water demand, water supply sources, and wastewater management; and

WHEREAS, in order to develop a comprehensive water supply management plan for Bulloch County that addresses the interest of all stakeholders, the Bulloch County Board of Commissioners established an advisory/ technical committee composed of county and city elected officials; public drinking water and wastewater managers; citizens; industrial, business, agricultural, and environmental representatives; and other interests, to guide the plan development process; and

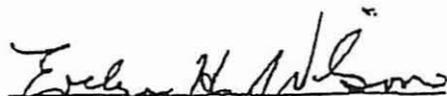
WHEREAS, the advisory/technical committee have now prepared a draft water supply management plan in accordance with the procedures and requirements set forth in EPD's *Interim Strategy*, including holding a public meeting during the plan development process to gain community input.

NOW, THEREFORE BE IT RESOLVED that the Bulloch County Board of Commissioners certify that requirements of EPD's *Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer of Southeast Georgia* have been met, and that the Comprehensive Water Supply Management Plan for Bulloch County, Brooklet, Portal, Register, and Statesboro is hereby authorized to be submitted to the Georgia Environmental Protection Division for formal review, comment, and recommendation before formal adoption by the Board of Commissioners as mandated by EPD.

SO RESOLVED, this 15<sup>th</sup> day of August, 2000.



Wayne A. Groover, Vice Chairman  
Bulloch County Board of Commissioners



Evelyn H. Wilson, Clerk

(seal)