GEORGIA
WATER PLANNING

Regional Water Plan

UPPER OCONEE

JUNE 2023

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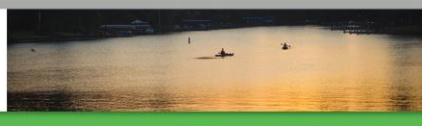

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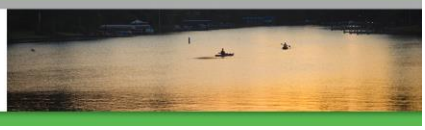

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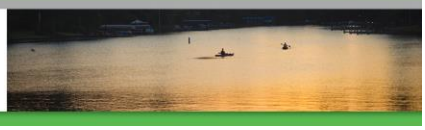


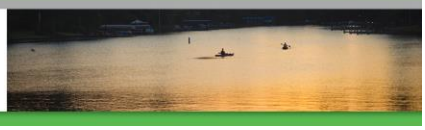
Acknowledgements

Georgia Environmental Protection Division (GAEPD), Jacobs, and the Georgia Water Planning and Policy Center at Albany State University gratefully acknowledge the cooperation, courtesy, and contributions of the following members of the Upper Oconee Regional Water Planning Council. The Council members volunteered their time and talents for Council Meetings, Joint Council Meetings, and countless virtual meetings and conference calls during the development of this Regional Water Plan.

Name	City	County
Active Members (2023)		
Charles S. Armentrout	Athens-Clarke	Athens-Clarke
Hunter Bicknell	Jefferson	Jackson
Stuart A. Cofer	Bogart	Oconee
Melvin Davis	Watkinsville	Oconee
Jennifer Davis	Dublin	Laurens
Pat Graham	Braselton	Barrow
Danny Hogan	Dexter	Laurens
Kevin Little	Monroe	Walton
Jim Luke	Bogart	Oconee
W. Rabun Neal	Greensboro	Greene
Senator Bill Cowsert		Ex-Officio
Representative Terry England		Ex-Officio
Previous or Inactive Members		
Larry J. Eley	White Plains	Greene
Alan Foster	Eatonton	Putnam
Linda S. Gantt	Watkinsville	Oconee
Patrick H. Hardy, Sr.	Madison	Morgan
Charles H. Jordan	Sandersville	Washington
Bill Ross	Statham	Barrow
Benjamin R. Tarbutton	Sandersville	Washington
Greg Thompson	Monroe	Walton

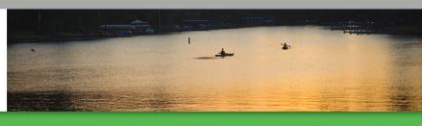
Acronyms

AAD-MGD	annual average demand in million gallons per day
AAF-MGD	annual average flow in million gallons per day
ACCG	Association of County Commissioners of Georgia
AG	Agricultural Water Withdrawal (Permittee Category)
BMP	best management practice
BP	balance priorities
CMOM	capacity, management, operation, and maintenance
CR	conservation and reuse capacity
CST	Construction Stormwater (Permittee Category)
DA	data management
DCA	Department of Community Affairs
DCH	Department of Community Health
DNR	Department of Natural Resources
DO	dissolved oxygen
FERC	Federal Energy Regulatory Commission
FOG	fats, oils, and grease
GADNR	Georgia Department of Natural Resources
GAEPD	Georgia Environmental Protection Division of GADNR
GAWP	Georgia Association of Water Professionals
GC	Golf Course Water Withdrawal (Permittee Category)
GEFA	Georgia Environmental Finance Authority
GEMA	Georgia Emergency Management Agency
GGCSA	Georgia Golf Course Superintendents Association
GGIA	Georgia Green Industry Association
GLUT	Georgia Land Use Trends



GMA	Georgia Municipal Association
gpd	gallons per day
gpf	gallons per flush
gpm	gallons per minute
GRWA	Georgia Rural Water Association
GSWCC	Georgia Soil and Water Conservation Commission
GWPPC	Georgia Water Planning & Policy Center
I/I	inflow and infiltration
IND	Industrial Water Withdrawal (Permittee Category)
INDST	Industrial Stormwater (Permittee Category)
INDWW	Industrial Wastewater (Permittee Category)
LAS	land application system
lb/yr	pounds per year
MG	million gallons
MGD	million gallons per day
mg/L	milligrams per liter
µg/L	micrograms per liter
MOA	Memorandum of Agreement
MP	Management Practices
MS4	Municipal Separate Storm Sewer System (Permittee Category)
MU	Municipal Water Withdrawal (Permittee Category)
MUST	Municipal Stormwater (Permittee Category)
MUWW	Municipal Wastewater (Permittee Category)
MWh	megawatt-hour
NARSAL	Natural Resources Spatial Analysis Laboratory
NESPAL	National Environmentally Sound Production Agriculture Laboratory

NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
O&M	operation and maintenance
O.C.G.A.	Official Code of Georgia Annotated
OSSM	On-Site Sewage Management System
RC	Regional Commission
RC&D	Resource Conservation and Development
RS	revenue strategies
SD	Safe Dams Program
SSO	Sanitary Sewer Overflow
TMDL	total maximum daily load
µg/L	micrograms per liter
UGA	University of Georgia
USDA	United States Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	Underground Storage Tank (Permittee Category)
WC	water conservation (Management Practice Category)
WCIP	Water Conservation Implementation Plan
WQ	water quality (Management Practice Category)
WRD	Wildlife Resources Division of GADNR
WS	water supply (Management Practice Category)
WTP	water treatment plant
WW	wastewater (Management Practice Category)
WWTP	wastewater treatment plant



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EXECUTIVE SUMMARY

Executive Summary

This Regional Water Plan lays out a roadmap for implementing specific measures designed to ensure wise use and management of the Region's water over the next 35 years. It focuses on four areas:

1. Water Conservation—Responsible use of public resources.
2. Water Supply—Optimal management of water supplies and systems.
3. Wastewater—Reliable means for wastewater treatment and reuse.
4. Water Quality—Environmental improvements through reduced pollution.

This Plan assesses the Region's current and future water and wastewater needs and describes 35 management practices that can be implemented through collaboration between local, regional, and state entities. It also presents realistic and measurable benchmarks to track short-term and long-term progress toward implementing the management practices.

Introduction

The Georgia Environmental Protection Division (GAEPD), with oversight from the Georgia Water Council, developed the first Comprehensive State-wide Water Management Plan (State Water Plan), which was adopted by the Georgia General Assembly in January 2008. The State Water Plan included a provision to create 10 water planning regions across the state, each guided by a regional water planning council. (An eleventh region and council, covering the Atlanta metro area, already existed.) Part of the mission of each council was to create a Regional Water Plan for submittal to GAEPD by the end of September 2011. The State Water Plan calls for the Regional Water Plans to be reviewed and revised every 5 years.

The Upper Oconee Regional Water Planning Council (the Council) prepared this Regional Water Plan for the Upper Oconee Water Planning Region which includes 13 counties and 62 incorporated municipalities (See Figure ES-1). The original Regional Water Plan was completed and adopted by GAEPD in 2011 and subsequently updated and adopted by GAEPD in 2017. This third iteration was completed in 2023.

The Region contains portions of the Oconee, Ocmulgee, Ogeechee, Savannah, and Altamaha river basins and includes various groundwater aquifer systems, particularly the crystalline rock aquifer systems, the Cretaceous aquifer system, and the Floridan aquifer. Surface water and groundwater supply roughly equal proportions of the Region's water demands.

Figure ES-1 Location Map of Upper Oconee Water Planning Region

Process

The Upper Oconee Regional Water Planning Council represents a cross-section of public and private stakeholders within the Region's 13 counties: Baldwin, Barrow, Athens-Clarke, Greene, Hancock, Jackson, Laurens, Morgan, Oconee, Putnam, Walton, Washington, and Wilkinson. The Council adopted the following vision and goals (Table ES-1) to guide the development of this Regional Water Plan:

Vision: *Create a regional plan that focuses on managing water as a critical resource vital to our health, economic, social, and environmental wellbeing. Build trusting partnerships with neighboring regions and develop an educated and engaged citizenry that embraces sound water management.*

Table ES-1 Goals for the Regional Water Plan

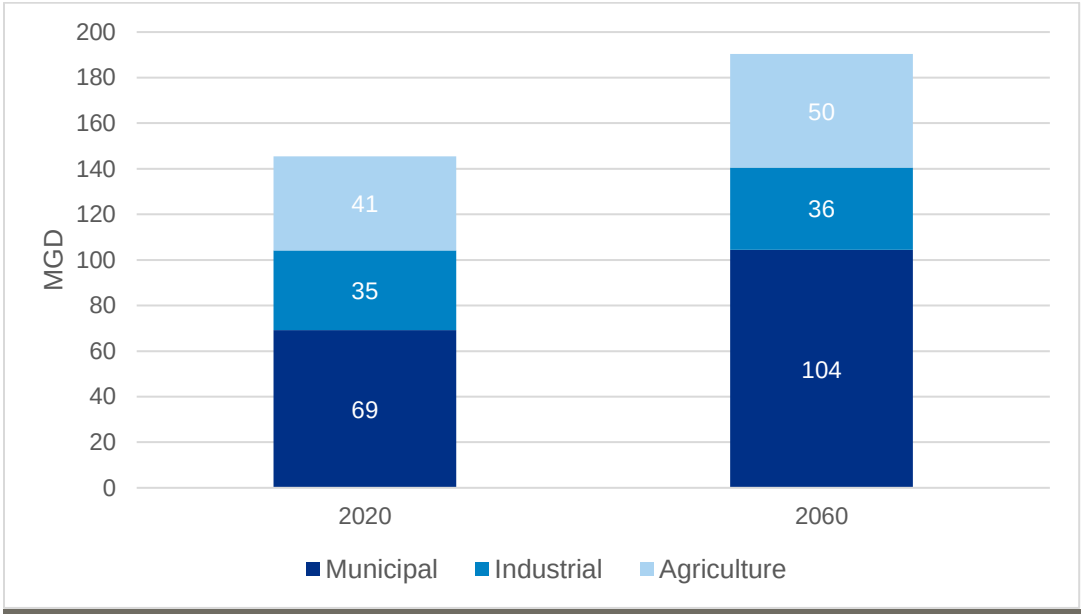
Number	Goal
1	Promote alternatives and technologies that conserve, reuse, return, and recycle water within the Upper Oconee region.
2	Ensure that management practices balance economic development, recreation, and environmental interests.
3	Educate stakeholders in the region on the importance of water quality and managing water as a resource including practices such as water conservation and increased water efficiency.
4	Encourage the development of and accessibility to data and information to guide management decisions.
5	Identify programs, projects, and educational messages to reduce non-point source pollution to protect water quality in lakes and streams.
6	Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency.
7	Identify and plan measures to ensure sustainable, adequate water supply to meet current and predicted long-term population, environmental, and economic needs.

Eleven full council meetings were held between February 2009 and September 2011 to develop the original Regional Water Plan. Five full council meetings were held between March 2016 and June 2017 to conduct the first review and revision of the Regional Water Plan. Seven full council meetings were held between March 2020 and June 2023 to conduct this review and revision of the Plan. Council meetings included representation from state agency staff, local government and utility staff, and interested stakeholders. For the 2011 plan development and 2017 review and revision, additional subcommittee meetings were held as needed, to address specific topics such as the water and wastewater per capita demands, agricultural water demand forecasts, and the selection of management practices. Results and recommendations from subcommittee meetings were discussed and approved during full council meetings.

Water and Wastewater Demands

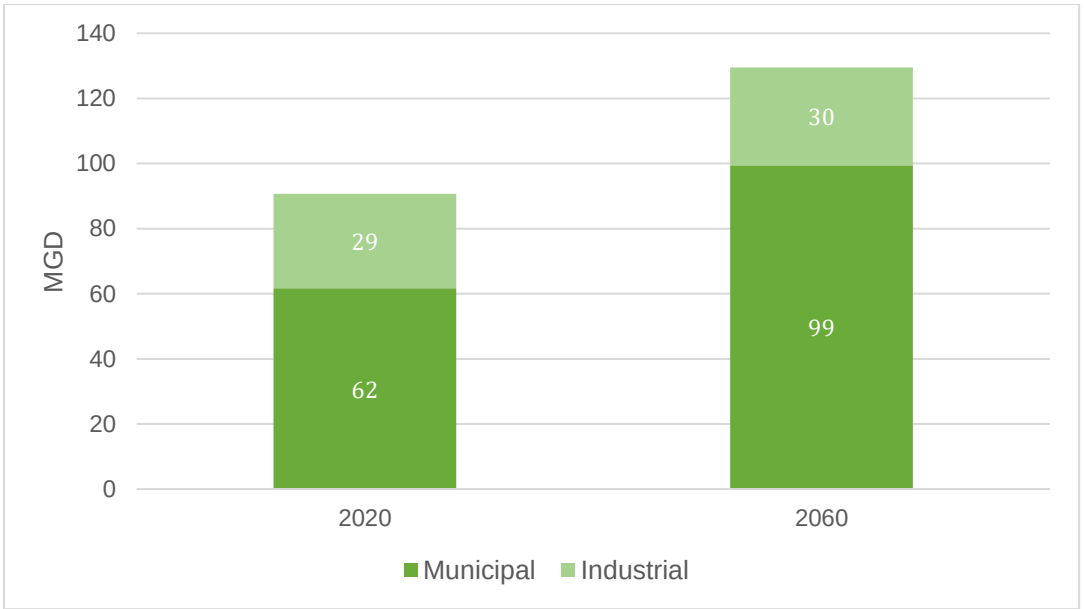
As shown in Figure ES-2, major water uses, based on the 2020 water demand forecast, are for municipal water supply (69 MGD or 47 percent), industrial use (36 MGD or 25 percent), and agricultural use (41 MGD or 28 percent). Both industrial and agricultural water demands are expected to increase throughout the planning horizon (i.e., through 2060); however, municipal water supply will remain the largest demand in the Region in 2060, comprising 54 percent or 104 MGD of the total (CDM, 2017). Other uses forecasted for 2060 include industrial use (19 percent) agricultural use (26 percent), and thermoelectric energy generation (1 percent). Municipal and industrial water demands are projected to increase steadily from approximately 105 million gallons per day (MGD) in 2020 to 140 MGD in 2060.

Figure ES-3 shows the results of the wastewater flow forecast for 2020 and 2060 by sector. About three-quarters of total wastewater flow in 2020 and 2060 is from municipal uses and the remainder from industrial uses, with the total wastewater flow for both municipal and industrial uses projected to be 130 MGD in 2060.



Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (CDM, 2022).
Note: Values represent forecasted annual average demand (AAD) and include dry year (75th percentile) agricultural demands.

Figure ES-2 Water Demand Forecast per Sector



Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (CDM, 2022).
Note: Values represent forecasted annual average flow (AAF-MGD).

Figure ES-3 Wastewater Flow Forecast

Major Findings

The GAEPD developed Resource Assessments for the State's river basins and major aquifers that examine three resource conditions:

- **Surface Water Quality (Assimilative Capacity)** — the capacity of Georgia's surface waters to accommodate pollutants without unacceptable degradation of water quality, i.e., without exceeding State water quality standards or harming aquatic life.
- **Surface Water Quantity** — the capacity of surface water resources to meet water supply needs for municipal, industrial, agricultural, and thermoelectric power use as well demand for assimilation of treated wastewater.
- **Groundwater Quantity** — the estimated range of sustainable yield for prioritized groundwater resources based on existing data.

The Resource Assessments applied current and projected demands to identify modeled conditions that do not meet a Resource Assessment metric. These conditions indicate potential challenges in resource availability. A potential challenge means that the existing or future conditions exceed the Resource Assessment metric, e.g., the sustainable yield of a specific groundwater aquifer is exceeded, indicating a potential "challenge" in groundwater availability in that area.

In addition, an analysis of existing permitted capacity (for water and wastewater facilities) versus future demands was conducted to identify potential water or wastewater infrastructure "needs". A need means that the current permitted capacity of water or wastewater treatment facilities, respectively, is less than the future forecast demands, e.g., the permitted capacity of a wastewater treatment plant in 2060 is less than the forecast wastewater demand for that year.

Table ES-2 summarizes the potential water resource challenges and needs identified for each County within the Region.

The evaluation of the Resource Assessments with projected future consumption shows only limited challenges in meeting future water demands for water supply and for assimilation of treated wastewater in the Region. Water quality challenges are indicated by modeled and measured chlorophyll *a* levels in Lakes Oconee and Sinclair, resulting from excess nutrients due to a combination of point source and nonpoint source pollutant loads from wastewater discharges and land use activities. Additional nutrient controls will be required to meet the lakes' chlorophyll *a* standards and protect drinking water supplies, recreational activities on the lakes, and the associated economic benefits for the Region.

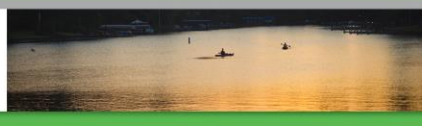


Table ES-2 Summary of Potential Water Resource Challenges and Infrastructure Needs by County

County	Ground-water Availability	Surface Water Availability	Municipal Water Permitted Capacity	Municipal Permitted Wastewater Capacity	Water Quality – Dissolved Oxygen Assimilative Capacity	Water Quality – Impaired Waters
For more details see:	*Section 5.1*	*Table 5-3*	*Table 5-5*	*Table 5-7*	*Figure 5-4*	*Sections 3.2.1 and 3.3.2*
Baldwin						Yes
Barrow		Yes				Yes
Athens-Clarke						Yes
Greene				Yes		Yes
Hancock			Yes			Yes
Jackson				Yes		Yes
Laurens					Yes	Yes
Morgan					Yes	Yes
Oconee				Yes		Yes
Putnam						Yes
Walton		Yes				Yes
Washington					Yes	Yes
Wilkinson		Yes				Yes
Total Counties	**0**	**3**	**1**	**3**	**3**	**13**

Notes: "Yes" indicates that there is a potential challenge or infrastructure need at a facility or a water quality issue in the indicated county. "Challenge" is defined as a condition where, under current or projected demands, modeled conditions do not meet a Resource Assessment metric. "Need" is indicated in counties where the current permitted water or wastewater capacity is lower than the project demand. For Water Quality – Impaired Waters, "Yes" indicates that exceedances of water quality criteria or violations of water quality standards were observed in some waters in the county.

Recommended Management Practices

The State Water Plan defines management practices as reasonable methods, considering available technology and economic factors, for managing water demand, water supply, return of water to water sources, and prevention and control of pollution of the waters of the State. The Council ultimately selected 35 management practices within the following categories: Water Conservation (10 management practices), Water Supply (7 management practices), Wastewater (8 management practices), and Water Quality (10 management practices). Management practices were selected to address water resource challenges or infrastructure needs and to align with the Region's visions and goals. Management practices were fully reviewed and revised in 2017. The Council recognizes that the management practices are generally robust and still applicable. However, due to the number of vacant seats during this round of revision, the Council was concerned that representation and knowledge of the region would not be sufficient to fully revise the management practices. Therefore, 2023 revisions of this section were limited to updates of outdated information.

Due to the diversity of water users and land uses across the basin, the Council recognized that a "one size fits all" approach to management practices was not appropriate. Therefore, the Council developed a diverse set of management practices that may be applied to address more localized, sub-regional water supply, wastewater, or water quality issues.

The Council used a prioritization process to assign a benefit ranking to each management practice. The top two management practices in each category are as follows:

- Water Conservation: (1) Encourage conservation pricing and (2) Develop water conservation goals.
- Water Supply: (1) Expand existing reservoirs and (2) Construct new water supply reservoirs.
- Wastewater: (1) Encourage implementation of centralized sewer in developing areas where density warrants and (2) Encourage development of local wastewater master plans/Evaluate wastewater treatment and disposal options to meet future demands.
- Water Quality: (1) Encourage comprehensive land use planning and (2) Encourage local government participation in construction erosion and sediment control.

The Council also developed short-term and long-term actions for implementing all management practices and identified the parties responsible for implementation. The bulk of implementation actions fall to local governments and utilities and their respective Regional Commissions (RCs); however, extensive support for initial activities, in particular, will be needed from State entities, such as the GAEPD. In addition, the Council compiled a list of recommendations to the State for actions that will support implementation of the Plan. It also established measurable, achievable, realistic, and time-phased benchmarks for implementing this Regional Water Plan; for example, progress in implementation of the short-term actions is recommended to be measured using an annual survey and improvements in water quality monitoring results will be measured using the GAEPD water quality database.

Overview of Plan Sections

Table ES-3 presents an overview of the Sections of this Regional Water Plan.

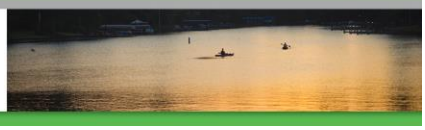


Table ES-3 Overview of the Regional Water Plan

Section	Title	Overview
1	Introduction	Introduction of Regional Water Planning process and the Council.
2	Upper Oconee Water Planning Region	Characteristics of the Region, including geography and watersheds, aquifers, population, and land cover.
3	Water Resources of the Upper Oconee Region	Major water uses and baseline water resource capacities.
4	Forecasting Future Water Resource Needs	Municipal, industrial, agricultural, and energy water use forecasts through 2060.
5	Comparison of Available Water Resource Capacities and Future Needs	Groundwater and surface water (quantity and quality) comparisons and identification of water resource challenges and infrastructure needs.
6	Addressing Water Needs and Regional Goals	Identified Management Practices to address future goals, water resource challenges, and infrastructure needs.
7	Implementing Water Management Practices	Management Practice implementation schedules, and roles of responsible parties. Recommendations to the State.
8	Monitoring and Reporting Progress	Benchmarks and measurement tools to track progress toward meeting goals and addressing shortfalls.
9	Bibliography	Supporting and referenced materials list.
App. A	Summary of Plan Updates	Table summarizing changes made to the 2017 Regional Water Plan during the 2023 plan review and revision process.
App. B	Flow Metrics for Recreation and Aquatic Species/Habitat in the Oconee River Basin	Table of potential flow metrics developed as part of a Regional Water Plan Implementation Seed Grant. Metrics included 42 different metrics at 21 locations related to aquatic species, habitat, and recreation such as fishing and boating.

SECTION 1

Introduction

Section 1 Introduction

Summary

Georgia is developing updated Regional Water Plans for the planning regions across the state to define sustainable practices to meet regional water resource needs through 2060.

The Council defined a vision and 7 goals to guide its evaluation and selection of management practices that best meet the Region's needs. These goals include sustainable strategies to support economic development, maintain or improve water quality, and provide water for both human and aquatic resource needs.

The 2004 Comprehensive State-wide Water Management Planning Act mandated the development of a state-wide water plan that supports a far-reaching vision for water resource management: "Georgia manages water resources in a sustainable manner to support the State's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens" (Official Code of Georgia Annotated [O.C.G.A.] 12-5-522(a)). The Georgia Environmental Protection Division (GAEPD), with oversight from the Georgia Water Council, was charged with developing the first Comprehensive State-wide Water Management Plan (State Water Plan), which was adopted by the Georgia General Assembly in January 2008.

The State Water Plan created 10 water planning regions across the State, each guided by a regional water planning council. Figure 1-1 illustrates the location of these regions relative to Georgia's river basins and counties. The preexisting eleventh planning region, the Metropolitan North Georgia Water Planning District (Metro Water District), represents 15 counties in the metropolitan Atlanta area. The Metro Water District was established in May 2001 by separate legislation and is discussed further in Section 7.3. Members of the regional water planning councils were appointed by the Governor, Lieutenant Governor, and Speaker of the House. Part of the mission of each council, including the Upper Oconee Regional Water Planning Council (the Council), was to submit the original Regional Water Plan (provided on September 30, 2011) and to participate in review and revision processes to update that plan in 5-year cycles.

Each Regional Water Plan recommends sustainable water management practices (MPs) designed to meet each region's needs through the year 2060 while coordinating with the Regional Water Plans of adjoining regional water planning councils for consistency across the state. As such, this Regional Water Plan

- provides an overview of the population, land cover, and municipalities of the Upper Oconee Water Planning Region (the Region) (Section 2),
- describes the Region's existing water resources and unique characteristics (Section 3),
- forecasts the Region's future water resources needs (Section 4),

- compares the Region's future needs with existing capacities to identify potential water resource issues, particularly any water challenges or needs (Section 5),
- reviews existing local and regional plans as part of an effort to select MPs to address these potential issues while still meeting the Region's goals (Section 6),
- establishes a roadmap for implementing the selected MPs (Section 7), and
- establishes benchmarks for measuring and reporting progress toward implementation (Section 8).

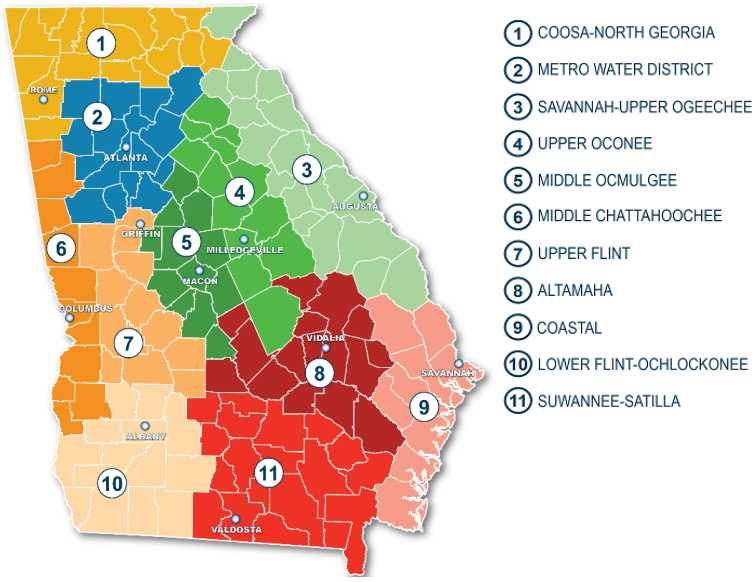


Figure 1-1 Regional Water Planning Councils

The original (2011) Regional Water Plan was an important first step toward achieving the vision and goals of the Region while recognizing the need for an adaptive management approach by revisiting the Regional Water Plan on a regular, 5-year cycle.

During the 2016–2017 plan update process, the original (2011) Regional Water Plan was reviewed and revised, as necessary, for the Upper Oconee Region based on updated regional water demand forecasts, updated resource assessment modeling, and evaluations of potential challenges in water availability and water quality, and revised management practices recommended by the Council to either address future water resource management needs or to refine or clarify the practices. This current update builds upon the original 2011 Regional Water Plan and 2017 update. A table is provided in Appendix A that identifies the portions of the plan that have been updated and provides a short explanation for why the update was made (for instance, a change in circumstance in the region, or an update to the technical work such as updated projections or forecast).

1.1 The Significance of Water Resources in Georgia

Of all Georgia's natural resources, none is more important to the future of the State than water. The wise use and management of water is critical to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens. Georgia has abundant water resources, with 14 major river systems and multiple groundwater aquifer systems. These waters are shared natural resources as streams and rivers run through many political jurisdictions. Rainfall that occurs in one region of Georgia may replenish the aquifers used by

communities many miles away. Nonetheless, while water in Georgia is abundant, it is not an unlimited resource and must be carefully and sustainably managed to meet long-term water needs.

Since water resources and their uses vary greatly across the State, selection and implementation of management practices on a regional and local level is the most effective way to ensure that current and future needs for water supply and water quality are met. Therefore, the State Water Plan calls for the preparation of ten regional water development and conservation plans (Regional Water Plans). This Regional Water Plan prepared and updated for the Upper Oconee Water Planning Region by the Upper Oconee Regional Water Planning Council describes the regionally appropriate water management practices to be employed in Georgia's Upper Oconee Water Planning Region over the next 35 years.

1.2 State and Regional Water Planning Process

The State Water Plan calls for the preparation of Regional Water Plans designed to manage water resources in a sustainable manner through 2050. It established the 10 regional water planning councils illustrated in Figure 1-1, including the Upper Oconee Council, and provided a framework for regional planning.

The original Regional Water Plan (2011) was prepared following the consensus-based planning process outlined in Figure 1-2, which integrated the input of regional water planning councils, local governments, and the public. GAEPD oversaw the planning process and, along with partner agencies, provided support to the councils. The primary role of each Council was to develop a Regional Water Plan and submit it to GAEPD for approval. The Council coordinated its efforts with councils adjacent to the Region. Specific roles and responsibilities for regional water planning councils are outlined in a Memorandum of Agreement (MOA) between each council, GAEPD and the Georgia Department of Community Affairs (DCA). As detailed in both the MOA and the Council's Public Involvement Plan, the process required and benefited from the input of other regional water planning councils, local governments, and the public.

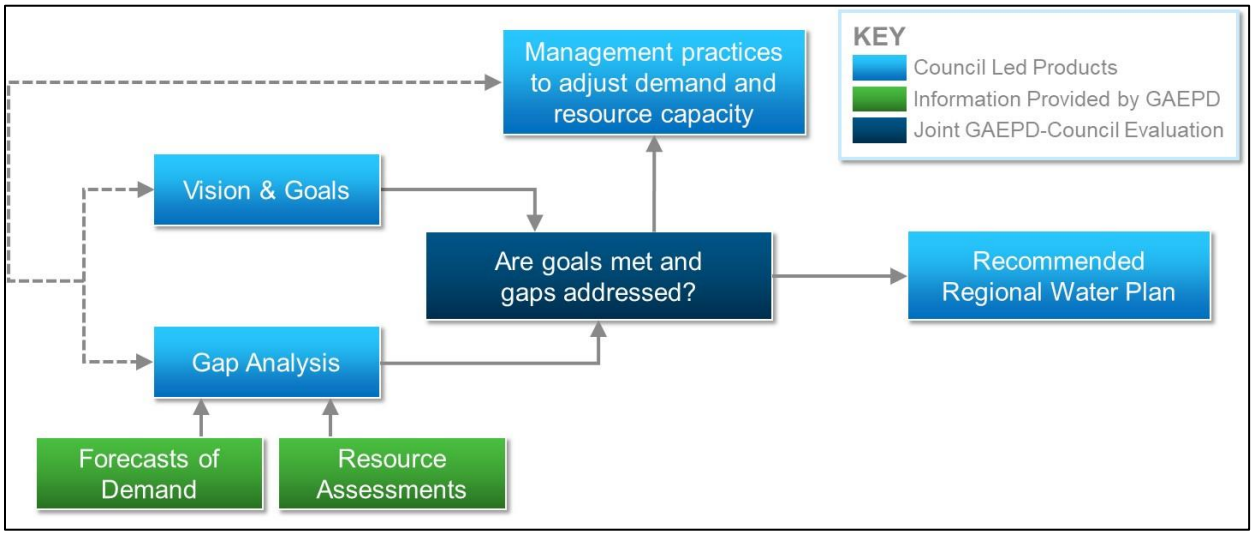


Figure 1-2 State Water Planning Process

The Council established a series of subcommittees which met and held conference calls throughout the original planning process to assist in development of specific elements of the Regional Water Plan. These included an executive, agriculture, media, and MP subcommittee. Results of subcommittee discussions and recommendations were presented at full Council meetings and aided in the development of specific elements of the Regional Water Plan.

For this plan update, a similar approach was followed including a review of the vision and goals, updates to the water and wastewater demands, updates to the resource assessments, and a re-evaluation of potential challenges associated with water supply and water quality. Public/local government input and coordination with other regional water planning councils also informed the plan update.

1.3 Upper Oconee Water Planning Region Vision and Goals

This Regional Water Plan update reflects extensive efforts on the part of the original and current participants of the Council. In developing the original (2011) plan, one of the Council's first responsibilities was to establish the vision and goals for water management in the Region; these components played a critical role in the evaluation and selection of MPs that would best meet the Region's needs. For this plan update, the Council re-affirmed the vision and goals that guided development of the original Regional Water Plan and guide this update:

Vision Statement

"Create a regional plan that focuses on managing water as a critical resource vital to our health, economic, social and environmental wellbeing. Build trusting partnerships with neighboring regions and develop an educated and engaged citizenry that embraces sound water management."

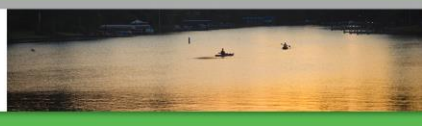
Figure 1-3 Goals for the Upper Oconee Region

Goals

The Upper Oconee Council identified 7 goals for the region (Figure 1-3). It is important to note that the goals presented here are not listed in order of priority, but rather were assigned a number to identify specific goals addressed as part of the water management practice selection process (Section 6).

More information regarding the region's Vision and Goals can be found at the Council's website.[1]

[1] https://waterplanning.georgia.gov/water-planning-regions/upper-oconee-water-planning-region



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SECTION 2

The Upper Oconee Water Planning Region

Section 2 Upper Oconee Water Planning Region

Summary

The Region covers approximately 5,000 square miles and includes 13 counties and 62 municipalities. Athens-Clarke County is the most populous county in the Region, while Hancock County is the least populated.

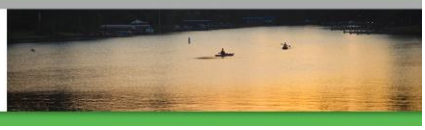
The Region, as shown in Figure 2-1, extends from Jackson County in northeast Georgia southeast approximately 150 miles to Laurens County in the Coastal Plain of south-central Georgia. The Region is approximately 5,000 square miles in size and had a population of 620,422 in 2020 (U.S. Census, 2020). The Region borders the Metro Water District to the northwest, the Altamaha Water Planning Region to the south, the Savannah-Upper Ogeechee Water Planning Region to the east, and the Middle Ocmulgee Water Planning Region to the west.

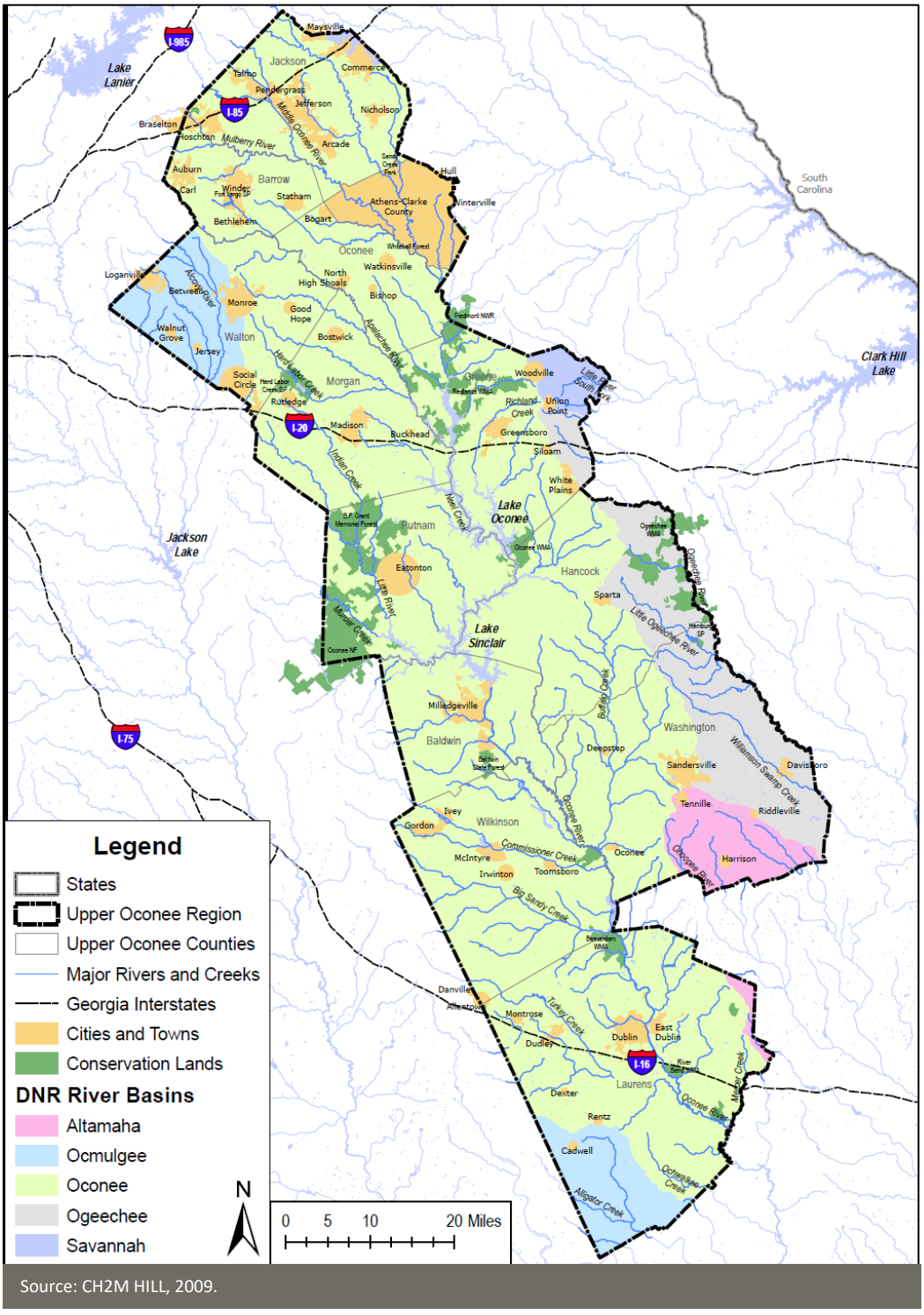
2.1 History and Geography

The Region has historical significance to the State, because it includes features such as the City of Athens—home to the University of Georgia (UGA)—and the City of Milledgeville, which was the capital of Georgia during the Civil War and one-time home of acclaimed novelist Flannery O'Connor (Jackson, 1988; Gordon, 2009). In 1785, Georgia became the first state to charter a state-supported university when UGA was incorporated by an act of the General Assembly; the university's location was selected in 1801 to be along the banks of the Oconee River in Athens-Clarke County (UGA, 2010). In the late 18th century, the Oconee and Apalachee rivers were designated by treaty as the State of Georgia's western boundary with Creek Indian lands. In the 19th century, due to the topography along the Ocmulgee and Oconee Rivers, the presence of their headwaters in southeast and northeast Atlanta, respectively, and Milledgeville's importance during the Civil War, General Sherman's "March to the Sea" after the Battle of Atlanta generally followed these waterways as his troops made their way southward to Savannah (Clark, 1999; National Park Service 2022, UGA, 2008a).

2.1.1 Local Governments

Local governments in the Region include 13 counties and 62 incorporated municipalities with jurisdictional authority, as illustrated in Figure 2-1 and listed in Table 2-1. These local governments are responsible for land use and zoning decisions that affect local water resources management. Many local governments are also responsible for the planning, operation, and management of water and wastewater infrastructure.





Source: CH2M HILL, 2009.

Figure 2-1 Counties and Cities in the Upper Oconee Region

Table 2-1 Upper Oconee Counties, Cities, and Towns

County	Cities and Towns
Baldwin	Milledgeville[a]
Barrow	Auburn, Bethlehem, Braselton, Carl, Statham, Winder[a]
Athens-Clarke	Athens[a], Bogart, Winterville
Greene	Greensboro[a], Siloam, Union Point, White Plains, Woodville
Hancock	Sparta[a]
Jackson	Arcade, Braselton, Commerce, Hoschton, Jefferson[a], Maysville, Nicholson, Pendergrass, Talmo
Laurens	Allentown, Cadwell, Dexter, Dudley, Dublin[a], East Dublin, Montrose
Morgan	Bostwick, Buckhead, Madison[a], Rutledge
Oconee	Bogart, Bishop, North High Shoals, Watkinsville[a]
Putnam	Eatonton[a]
Walton	Between, Good Hope, Loganville, Jersey, Monroe[a], Social Circle, Walnut Grove
Washington	Davisboro, Deepstep, Harrison, Oconee, Riddleville, Sandersville[a], Tennille
Wilkinson	Allentown, Danville, Gordon, Irwinton[a], Ivey, McIntyre, Toomsboro
Note: [a] County Seat.	

2.1.2 Watersheds and Water Bodies

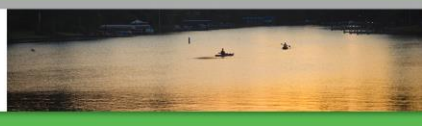
While primarily centered on the Upper Oconee River basin, the Region also includes portions of four other river basins as shown in Figure 2-1. Section 3 describes the Region's water use classifications and impaired waters. The headwaters of the Oconee River originate in Hall County, just upstream of the Region, where the Middle Oconee and North Oconee Rivers originate. These two rivers flow independently for 55-65 miles before merging below Athens to form the Oconee River. The latter flows south for another 220 miles to its confluence with the Ocmulgee River to form the Altamaha River, just downstream of the Region.

From the junction of the North and Middle Oconee Rivers, the Oconee River flows for about 20 miles to the northern end of Lake Oconee, a 19,050-acre reservoir formed by Wallace Dam. Immediately downstream of Lake Oconee is 15,330-acre Lake Sinclair behind Sinclair Dam (located approximately 5 miles upstream of Milledgeville). Both impoundments are used for hydropower generation. Georgia Power Company (Georgia Power) pumps water from Lake Sinclair upstream to Lake Oconee as needed to generate additional hydropower at Wallace Dam, a pumped-storage project.

2.1.3 Physiography and Groundwater Aquifers

The Region is characterized by a moist and temperate climate with mean annual precipitation ranging from 47 inches in the lower basin to 56 inches in the basin headwaters. The driest months are September and October, and the wettest month is March (GAEPD, 1998).

The Region encompasses parts of two physiographic provinces: the Piedmont and Coastal Plain. The Piedmont province is characterized by low hills and narrow valleys, while the Coastal Plain

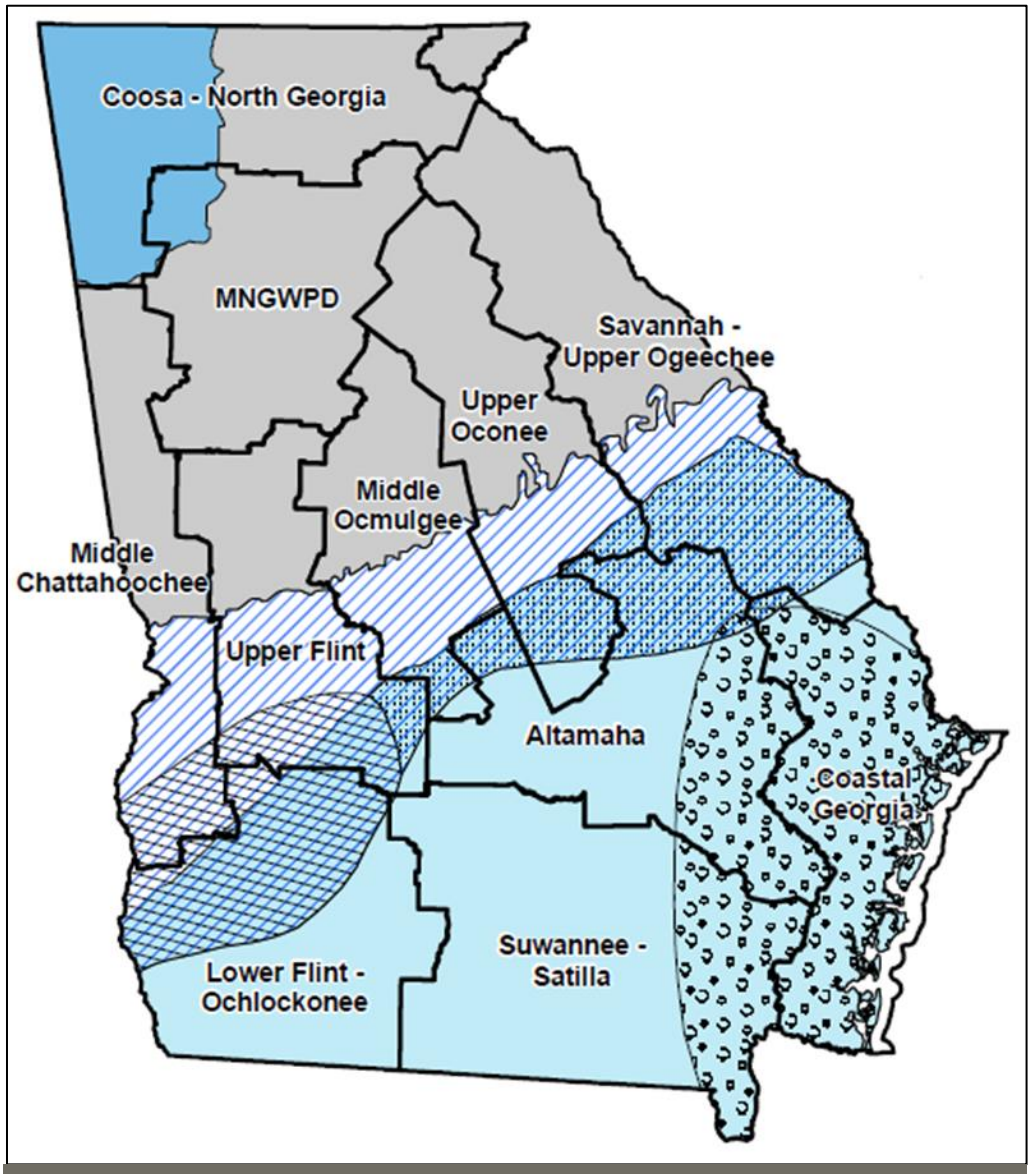


is characterized by flatter terrain and sandy soils. The Fall Line forms the boundary between the two provinces. Streams flowing across the Fall Line, as the name implies, can undergo abrupt changes in gradient that are marked by the presence of rapids and shoals. Geomorphic characteristics of streams also differ between the Piedmont and Coastal Plain provinces. In the Coastal Plain, streams typically lack the riffles and shoals common to streams in the Piedmont and exhibit greater floodplain development and increased sinuosity.

The Region includes portions of three aquifer systems that were prioritized for determination of sustainable yield by GAEPD. These aquifers are the Crystalline rock aquifer systems, the Cretaceous aquifer system, and the Floridan aquifer (Figure 2-2). The Piedmont portion of the Region includes the Crystalline rock aquifer. These aquifer systems occur in metamorphic and igneous rocks where secondary porosity and permeability has developed as a function of differential weathering along discontinuities. Enlargement of discontinuities provides discreet pathways for groundwater storage and flow. The intersection and interconnection of these features creates localized aquifer systems within the bedrock that are dependent on many variables of each rock unit. Although these aquifer systems do not typically provide significant quantities of groundwater over the Region, local topographic and geologic conditions are conducive to development of discreet aquifer systems with sufficient sustainable yield to supplement water supply. These aquifer systems are typically local in extent, and the yield and groundwater chemistry can be affected by localized water use and climate. However, if properly managed these aquifer systems can provide drought-resistant sources of groundwater to supplement surface water supplies.

The Coastal Plain portion of the Region includes the Cretaceous aquifer system and Floridan aquifers. As shown in Figure 2-2, the Cretaceous aquifer systems crop out in a narrow band just south of the Fall Line. These aquifer systems, primarily comprised of the Providence and Eutaw-Dublin aquifers, are geologically older than the Floridan aquifer and serve as a major source of water in the northern third of the Coastal Plain. These aquifer systems primarily consist of a wedge-shaped package of sand and gravel that thickens and dips to the southeast with local layers of clay and silt that function as confining to semi-confining.

The Region lies in the portion of the Floridan aquifer system comprised of primarily unconsolidated coarse-grained clastic sands and gravels. Only a small portion of the Floridan aquifer is located within the Region and is primarily used for domestic purposes and is less productive than other parts of the aquifer. The Floridan aquifer system is one of the most productive groundwater storage areas in the United States. The Floridan supplies about 70 percent of the groundwater used in the Upper Oconee and serves as a major water source throughout the Coastal Plain of Georgia. Wells in this aquifer are generally high-yielding and are extensively used for irrigation, municipal supplies, industry, and private domestic supply.



Source: GAEPD, 2009.

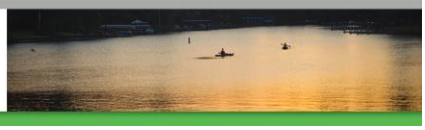
Figure 2-2 Groundwater Aquifers

2.2 Characteristics of the Region

The Region's population, employment, and land use are briefly discussed in the following sub-sections. Also included is an examination of regional and local planning organizations.

2.2.1 Population

The total population for the 13-county Region was estimated at 620,422 in 2020 (U,S, Census, 2020). Athens-Clarke County is the most populated county in the Region, with 128,489 residents.



Walton, Barrow, and Jackson Counties also have populations greater than 70,000; however, the remaining 9 counties in the Region have populations below 50,000. The 4 most populous counties represent approximately 62 percent of the total population in the Region.

2.2.2 Employment

Based on Department of Labor and U.S. Census Bureau estimates, the Region's employment is dominated by the government, health care, services, manufacturing, retail, and construction sectors. The estimated total employment in the Region was 271,345 in 2019 (Georgia Department of Labor). The unemployment rate for the Region was 3.4 percent at that time compared to 3.5 percent unemployment statewide.

The Region includes five of Georgia's higher learning institutions which contribute significantly to the economy of the communities in which they are located. They are UGA, Georgia College and State University, Athens Technical College, Heart of Georgia Technical College, and Sandersville Technical College.

2.2.3 Land Use

Figure 2-3 illustrates the diverse land cover distribution within the Region in 2015. Athens-Clarke County is the most urbanized county in the Region; land cover in the balance of the northern counties have a suburban or rural residential mix composed of low-intensity urban, forested lands, and row crop/pasture lands. With the exception of limited pockets of urban land around Eatonton and Milledgeville, most of the lands in the central portion of the Region contain forest, row crop/pasture, or clearcut/sparse vegetation.

The land cover distribution in the lower third of the Region is even less developed; Washington and Laurens Counties have a large percentage of land used for row crops or as pasture lands. Unique to Wilkinson and Washington Counties are large pockets of quarries, mining, or rock outcrops found in the headwaters of Big Sandy Creek, along Commissioner's Creek, Buffalo Creek, and the Oconee River. Wide riverine corridors of forested wetlands are relatively common in the lower third of the Region and parallel the Oconee River, Black Creek, Little Ohoopee Creek, and the Ogeechee River.

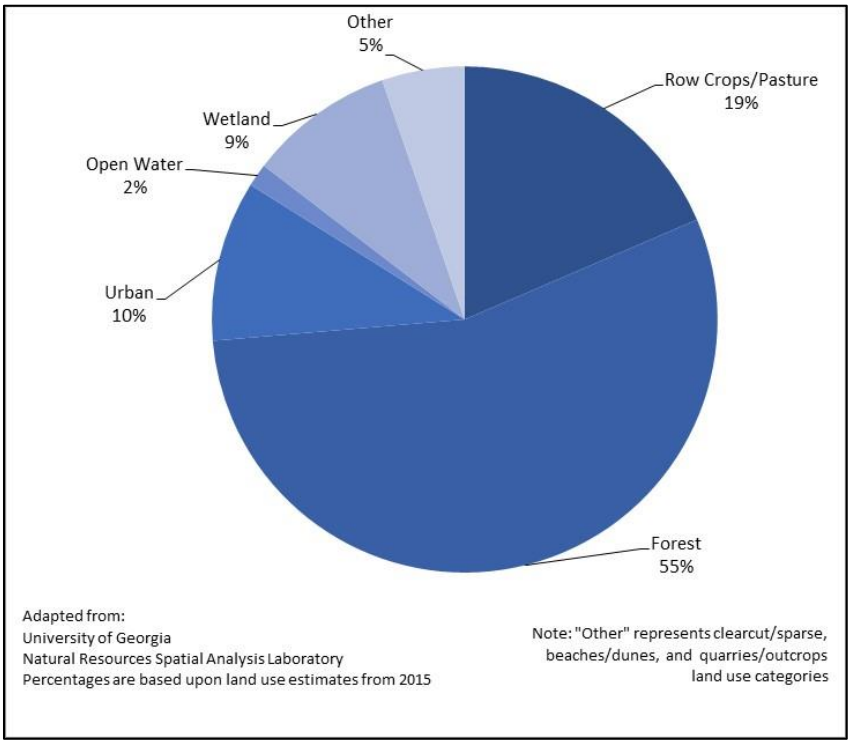


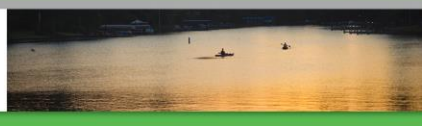
Figure 2-3 2015 Land Cover in the Upper Oconee Region

2.3 Local Policy Context

The Region includes portions of four Regional Commissions (RCs): Northeast Georgia, Central Savannah River Area, Middle Georgia, and Heart of Georgia-Altamaha (See Table 2-2). Georgia's 12 RCs are quasi-governmental regional planning organizations established by the Georgia Planning Act (O.C.G.A. 50-8-32) and managed under Georgia law by their member local governments to serve regions that share similar economic, physical, and social characteristics. The RCs, working with the Department of Community Affairs (DCA), assist communities with a variety of planning issues, including local government planning, economic development, sustainable growth planning, and grant preparation and administration. Each RC reviews local comprehensive land use plans and can help coordinate connections between growth and water planning.

Table 2-2 Regional Commissions by County

Commissions	Counties
Northeast Georgia	Athens-Clarke, Barrow, Greene, Jackson, Morgan, Oconee, Walton
Central Savannah River Area	Hancock, Washington
Middle Georgia	Baldwin, Putnam, Wilkinson
Heart of Georgia - Altamaha	Laurens



Local governments develop ordinances, policies, and plans to meet the requirements of State and Federal water resource regulations. For example, communities with existing stormwater permits within the Region have developed local requirements for erosion and sediment control, post-construction runoff control, and other regulatory programs. Local governments can be contacted directly for access to their individual ordinances, policies, and plans.

SECTION 3

Water Resources of the Upper Oconee Region

Section 3 Water Resources of the Upper Oconee Region

This Section summarizes existing conditions in the Region, including existing water usage by sector (i.e., municipal industrial, agriculture, and energy production), surface water and groundwater availability, and water quality conditions.

Summary

The Resource Assessments indicate that most streams in the Region have sufficient assimilative capacity. But, select segments of the Oconee River and its smaller tributaries have exceeded their available assimilative capacity. A few water supply facilities have potential challenges with surface water availability under current water use conditions.

GAEPD has established chlorophyll a standards for Lake Oconee and Lake Sinclair. Modelled and measured chlorophyll a levels demonstrate that reductions in total phosphorous loading to the lakes is needed.

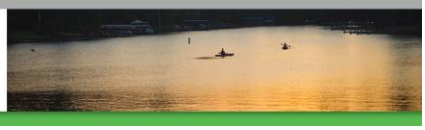
GAEPD has evaluated 1,171 stream miles in the Region; of these, 70 percent are not currently supporting their designated use, primarily due to impaired biological communities (fish or macroinvertebrates) or due to high fecal coliform levels.

3.1 Major Water Use in Region

Major water use and water returns are summarized for the Upper Oconee Region based on data compiled by USGS in the report, *Water Use in Georgia by County for 2015 and Water-Use Trends, 1985-2015*, (USGS, 2019). For planning purposes, "water withdrawal" is defined as removal of water from a water source for a specific use. Depending on the type of use, a portion of the withdrawn water is not returned to a water source as a measurable discharge. "Water consumption" (or consumptive use) is the difference between the amount of water withdrawn from a water source and the amount returned. USGS reports water use for four major water use sectors:

- **Municipal**—water withdrawn by public and private water suppliers and delivered for a variety of uses (such as residential, commercial, and light industrial).
- **Industrial**—water used for fabrication, processing, washing, and cooling at facilities that manufacture products, including steel, chemical and allied products, paper, and mining. These industrial categories use the largest amount of water of all the industrial classifications in Georgia.
- **Energy**—water used to generate electricity, mainly for cooling purposes at thermoelectric plants. Water returns vary depending on the cooling technology used by each plant.
- **Agriculture**—water for crop irrigation, which covers more than 95 percent of Georgia's irrigated land. Nursery water use, animal operations and golf courses with agricultural water use permits are not included in the forecasts, but estimates of current use are available and provided in the supplemental document titled *Agricultural Water Demand Forecast for the Upper Oconee Region*, which is available on the Council website.[2]

[2] https://waterplanning.georgia.gov/water-planning-regions/upper-oconee-water-planning-region



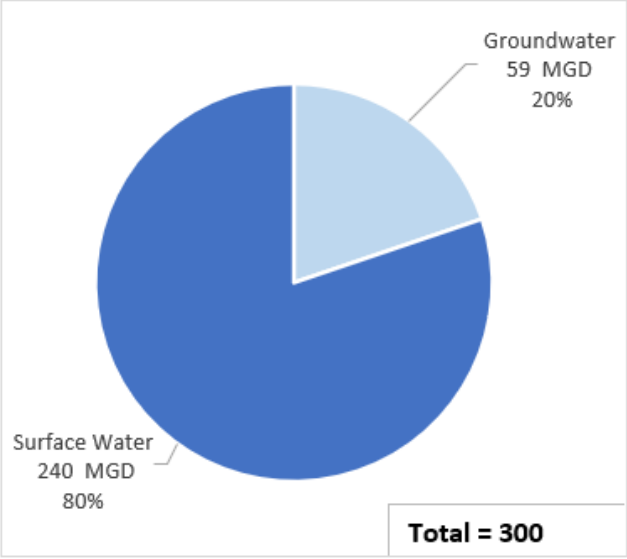
As shown in Figure 3-1, surface water is the predominant source of water in the Region. In 2015, surface water and groundwater withdrawals to supply the four major water use sectors totaled approximately 300 million gallons per day (MGD) on an annual average demand (AAD) basis. The annual average demand (AAD) value is the total amount of water withdrawn in a year from surface and ground water sources divided by 365 days.

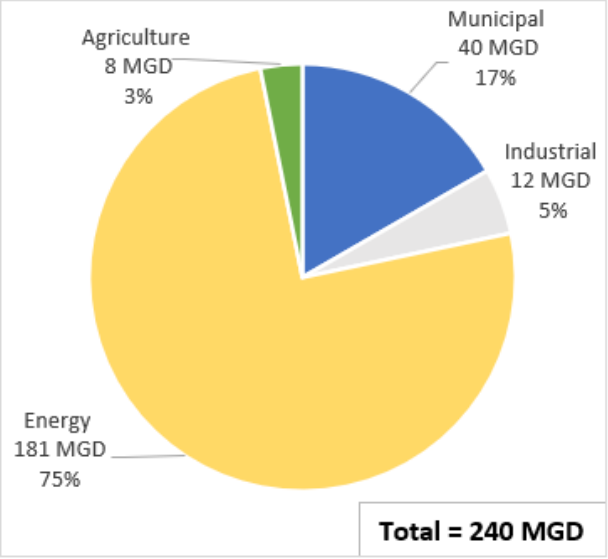
Figure 3-2 shows the surface water withdrawal in 2015 by major water withdrawal sector. Thermoelectric energy production was the largest water withdrawal category (75 percent), followed by municipal withdrawal (17 percent). However, retirement of Plant Branch was completed in 2018 and that facility is not included in the future water demand forecast (Section 4) or the conditions assessment (Section 5).

Figure 3-3 shows groundwater withdrawals in 2015 by major sector. The leading groundwater use in the Region is industrial (49 percent), then municipal (29 percent), followed by agriculture (22 percent). The main groundwater supply sources for the Region are the Cretaceous and Crystalline rock aquifers. However, the Crystalline rock aquifer system provides very limited amounts of water because of its geologic limitations.

Surface water returns for the Region are summarized in Figure 3-4. In 2015, a total of 190 MGD was returned. At that time, 56 percent of surface water returned was from the energy sector, 24 percent from industry, and 19 percent from public wastewater treatment facilities. Surface water returns from the energy sector have decreased with the retirement of Plant Branch.

Throughout the planning process and in the Resource Assessments, existing agricultural water use, onsite sewage treatment, and LASs were considered to be consumptive, which is a conservative assumption. Although water may ultimately return to its source from these applications, it is not considered to be returned within a time frame that allows for it to offset the impact of related withdrawals.

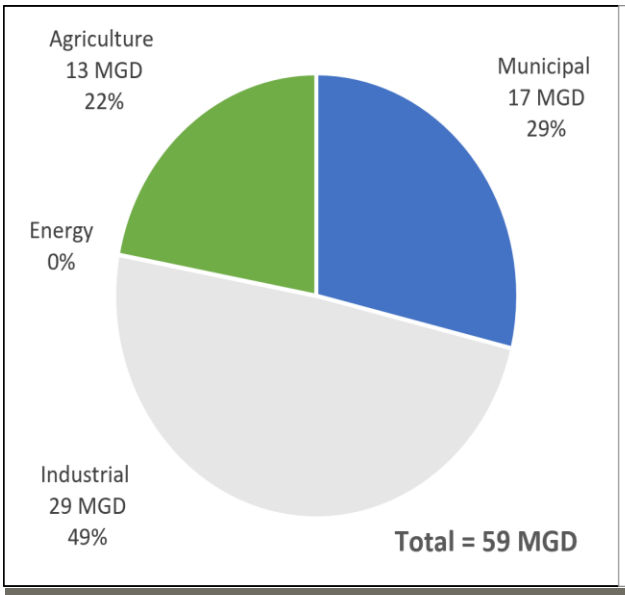


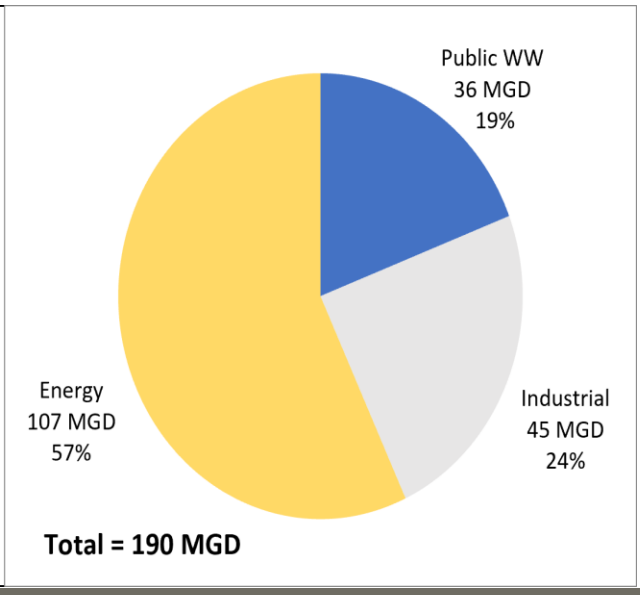


Data Source: USGS Water Use in Georgia 2015.
Note: Values shown in figures reflect current updated values.

Figure 3-1 2015 Water Supply by Source

Figure 3-2 2015 Surface Water Supply by Sector

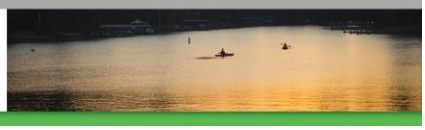




Data Source: USGS Water Use in Georgia 2015.
Note: Values shown in figures reflect current updated values.

Figure 3-3 2015 Groundwater Supply by Sector

Figure 3-4 2015 Surface Water Returns by Sector



3.2 Current Conditions Resource Assessments

GAEPD developed three Resource Assessments: (1) surface water quality (assimilative capacity), (2) surface water availability, and (3) groundwater availability. The Resource Assessments determined the capacity of water resources to meet demands for water supply and to accommodate corresponding wastewater discharge needs without unreasonable impacts. For surface water quality, the assessment looks at the dynamics of dissolved oxygen in streams and nutrients in lakes. For surface water availability, the assessment identifies shortages in the amount of water needed to meet water supply demands and to assimilate treated wastewater. The groundwater assessment looks at groundwater levels and yields.

The Resource Assessments were completed on a resource basis (river basins and aquifers), but are summarized here as they relate to the Region. The following Section describes the Resource Assessments results used to define "baseline conditions" and the state of the basin under current uses and demands. Full details of each Resource Assessment can be found on the Georgia Water Planning website (https://waterplanning.georgia.gov).

In the context of the Resource Assessments, a potential "challenge" is defined as a condition where the modeled existing or future conditions exceed the Resource Assessment metric. For example, if the estimated sustainable yield of a specific groundwater aquifer is exceeded, then there would be a "challenge" in groundwater availability in that area. Similarly, if an existing water quality standard for nutrient loadings to a lake is exceeded, then there would be a potential water quality "challenge" for that location. By contrast, a potential "need" (discussed in Section 5) is defined as a condition where the current permitted capacity of water or wastewater treatment facilities, respectively, is less than the future forecast demands (i.e., there may be a need for new or upgraded infrastructure). For example, a potential "need" would occur if the permitted capacity of a wastewater treatment plant is 10 MGD and the forecast demand is 20 MGD.

3.2.1 Surface Water Quality (Assimilative Capacity)

The Surface Water Quality (Assimilative Capacity) Assessment estimates the capacity of Georgia's surface waters to accommodate (assimilate) pollutants without harming aquatic life or humans who contact the waterbody via recreational or other activities. A water body assimilates pollutants by chemical and biological processes that break compounds down as well as physical processes that bind compounds to sediment. Those processes can depend, in part, on streamflow levels, and low streamflows generally decrease a water body's assimilative capacity.

Pollutants enter waterbodies from permitted discharges of treated wastewater (point sources) and via stormwater runoff from different activities on lands in the watershed (nonpoint sources). Point sources are managed through practices that are different from those applied to nonpoint sources. As permit limits are tightened to manage pollutant loading from point sources, nonpoint sources become a larger proportion of the load, increasing the importance of nonpoint source management. Pollutant loads decrease a water body's assimilate capacity and overloading a water body with pollutants will result in violations (exceedances) of water quality standards.

Water quality standards define the uses of a water body and set pollutant limits to protect those uses. The Assimilative Capacity Resource Assessment evaluated the capacity of surface waters to accommodate pollutants without violating water quality standards. The assimilative capacity results for the existing conditions focus on dissolved oxygen (DO), nutrients (specifically nitrogen and phosphorus), and chlorophyll *a* (the green pigment found in algae, which serves as an indicator of lake water quality and indicates nutrient enrichment). Fish and other aquatic organisms need oxygen to survive; therefore, DO standards have been established to protect aquatic life. Nutrients are required for plant production, which provides food for aquatic organisms; however, if nutrient concentrations are too high, algal blooms can occur, negatively affecting the safe recreational use of the water and potentially impacting taste and odor in water supplies.

The Assimilative Capacity Resource Assessment evaluated the impact of current wastewater and stormwater discharges, combined with current withdrawals, land use, and meteorological conditions, on DO, nutrients, and chlorophyll *a* on the assimilative capacity of stream segments that receive wastewater discharges. For current conditions, municipal and industrial wastewater discharges are evaluated as operating at their full permitted discharge levels (flow and effluent discharge limits as of 2019). The waters in the Region have a daily average DO standard of ≥5 milligrams per liter (mg/L). GAEPD recognizes that waters in the Coastal Plain may have naturally occurring low DO (less than 5mg/L); limited flexibility is allowed in these cases within a range of 10 percent; if DO is naturally below 3 mg/L, the regulations allow for an additional 0.1 mg/L DO deficit.

The model indicates that the majority of modeled stream segments in the Upper Oconee basin have “good” to “very good” available assimilative capacity for DO under critical conditions. Table 3-1, Figure 3-5 and Figure 3-6 show the results of the modeling. Assimilative capacity can range from “very good” to “exceeded.” In the baseline modeling, results indicate that estimated instream DO levels are below the DO water quality criteria in portions of the mainstem of the Oconee River downstream of the confluence of Turkey Creek in Laurens County, indicating that available assimilative capacity in this reach has been exceeded. Results also indicate that smaller tributaries such as Little Cedar Creek in the Altamaha Basin, Fulsome Creek Tributary in the Ogeechee Basin, and Shoal Creek, White Oak Creek, the Little River, as well as an unnamed tributary to Big Indian Creek in the Oconee Basin are exceeding their available assimilative capacity. These modeled exceedances may be due to discharges from wastewater treatment plants into low-flow streams. Additional data may need to be collected for these streams to confirm these potential impairments. The results also indicate that expansions of facilities near streams with limited or no assimilative capacity may require future upgrades to wastewater treatment plants (WWTPs) discharging to these tributaries.

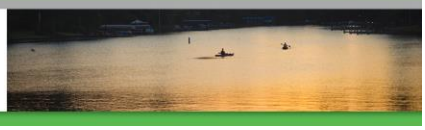


Table 3-1 Assimilative Capacity for DO in Upper Oconee Region

Basin	Available Assimilative Capacity (Total Mileage)							Total River Miles Modeled in the Region
	Very Good (≥1.0 mg/L)	Good (0.5 to <1.0 mg/L)	Moderate (0.2 to < 0.5 mg/L)	Limited (>0.0 to <0.2 mg/L)	At Assimilative Capacity (0.0 mg/L)	Exceeded (<0.0 mg/L)	Un-modeled	
Altamaha	0	3	11	6	8	2	0	30
Ocmulgee	39	4	4	9	0	0	0	55
Oconee	407	176	31	20	1	14	0	649
Ogeechee	21	58	27	2	0	1	4	113
Savannah	1	0	0	0	0	0	0	1

Source: GAEPD, 2019.

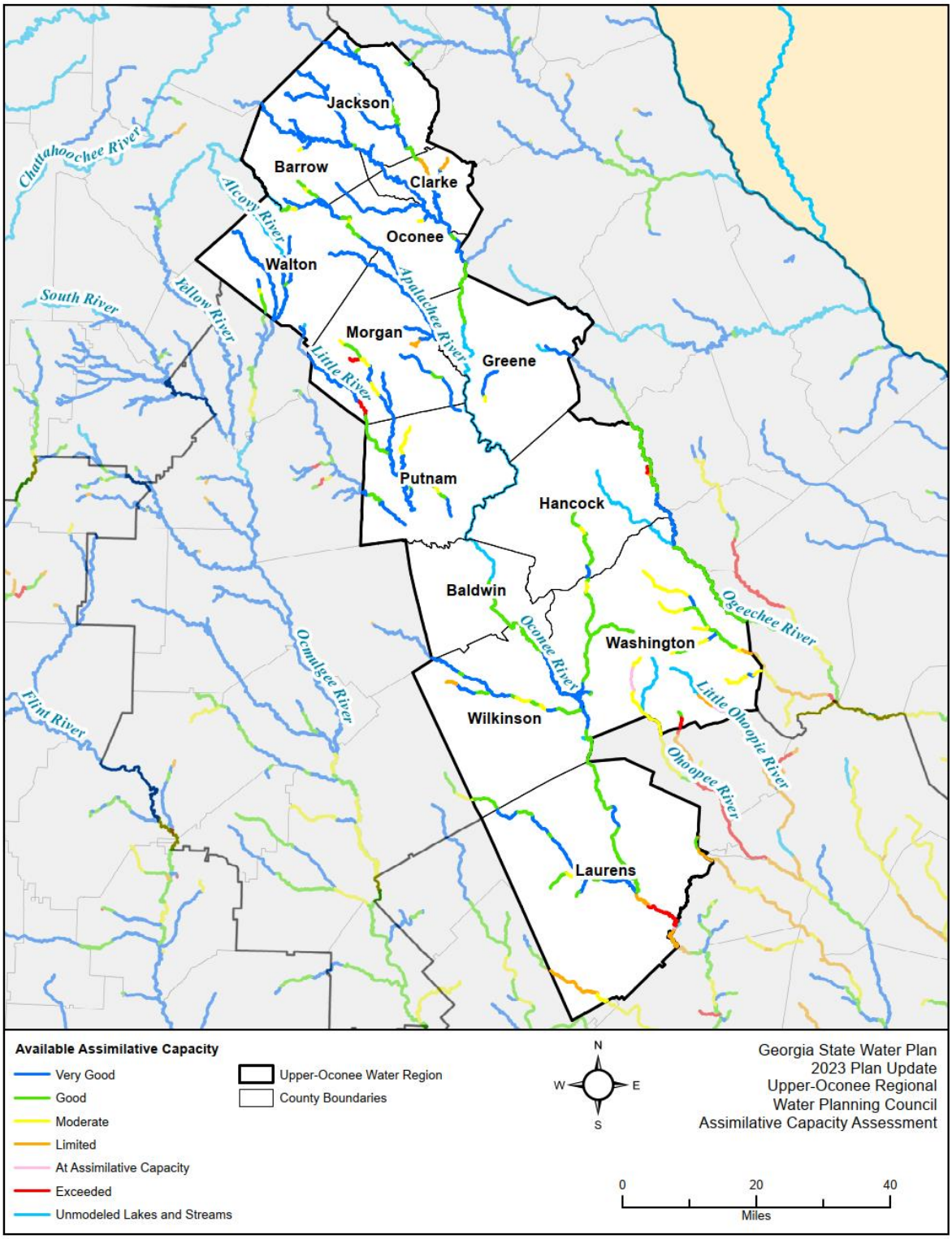
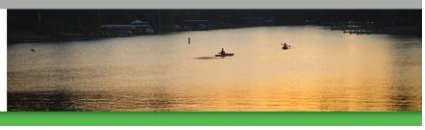
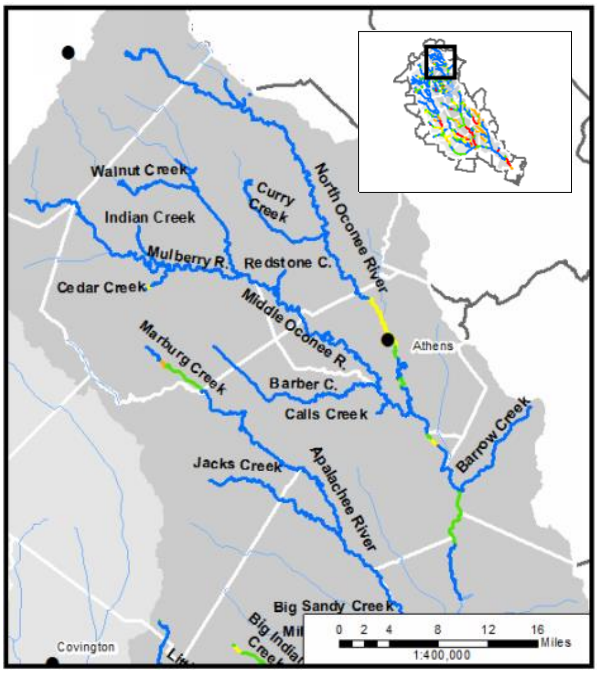


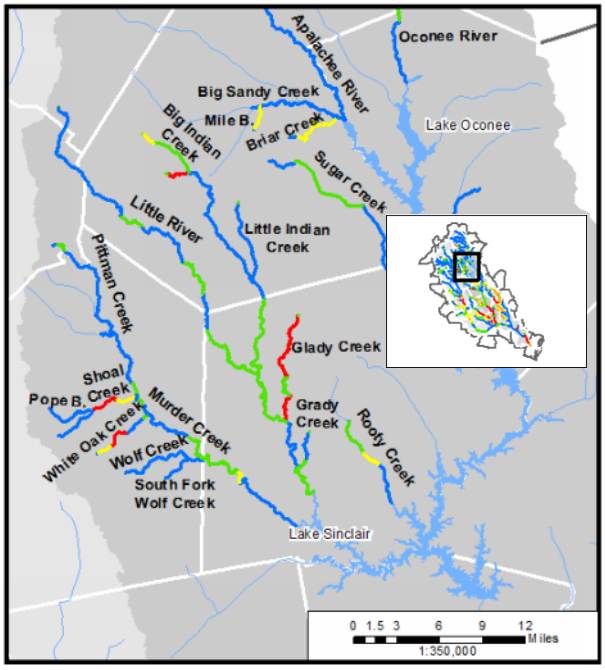
Figure 3-5 Results of Assimilative Capacity Assessment – DO under Current Permit Conditions – Entire Council Region



SAVANNAH BASIN



OCONEE BASIN



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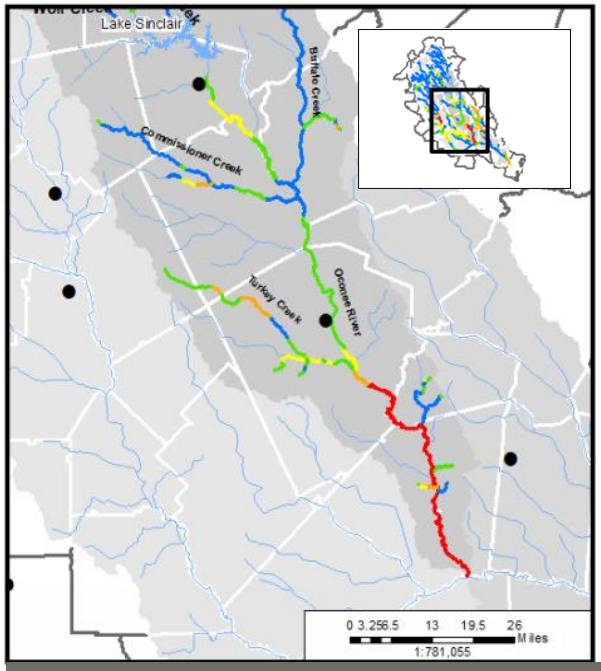
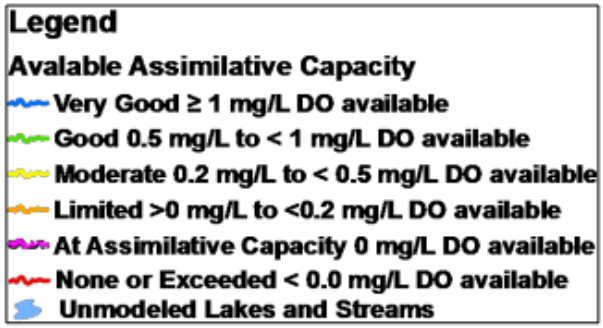




Source: GAEPD, 2017.

Figure 3-6 Results of Assimilative Capacity Assessment – DO under Current Permit Conditions by Basin

Since the last round of planning, GAEPD has established chlorophyll *a* standards for Lake Oconee and Lake Sinclair. Elevated levels of chlorophyll a indicate the presence of excess nutrients, which cause algal growth that can affect recreational water use and impact taste and odor in water supplies.[3]

Lake Oconee chlorophyll *a* standards include "shall not exceed" criteria for three different locations. At the following locations, monthly samples in the months of April – October cannot exceed the specified average concentrations more than once in a five-year period: 26 micrograms per liter (µg/L) at Oconee Arm at Highway 44; 15 µg/L at Richland Creek Arm; and 18 µg/L upstream from the Wallace Dam Forebay. The new Lake Sinclair chlorophyll *a* standards include criteria that shall not be exceeded more than once in a five year period criteria at three locations: Oconee River Arm Midlake cannot exceed average of 14 µg/L, Little River and Murder Creek Arm upstream from Highway 441 cannot exceed 14 µg/L, and upstream from the Sinclair Dam Forebay cannot exceed 10 µg/L.

Modeling was completed for Lakes Sinclair and Oconee for 2001 through 2012, a period which included both wet and dry years. The Lake Oconee current modeled chlorophyll response would have exceeded the standard at Lake Oconee – Highway 44 only in 2012. Lake Oconee modeled chlorophyll *a* response would have met the criteria for all years at the Wallace Dam Forebay (Dam Pool). The modeled chlorophyll *a* response would have met the new criteria for Lake Sinclair at Midlake and the Sinclair Dam Forebay (Dam Pool) for all the years modeled (see Section 5, Figure 5-5 and Figure 5-6 for current and future modeling results for Lakes Oconee and Sinclair).

Chlorophyll *a* was measured directly at three locations in each lake for the years 2013 – 2021. In Lake Sinclair, chlorophyll *a* criteria were exceeded for two locations in 2019 and 2020 (Little River and Midlake) and for 2019, 2020 and 2021 for the Dam Forebay location (Figure 3-7). In Lake Oconee, chlorophyll *a* criteria were exceeded in 2019 and 2020 at the Richland Creek Arm location and in 2020 at Highway 44 location (Figure 3-8). The Dam Forebay location met its criteria for all measured years.

Modeled and measured chlorophyll *a* levels in Lake Oconee were likely elevated due to point source nutrient loadings from the Athens and eastern metro Atlanta areas as well as loadings from agricultural sources (GAEPD, 2017c). To address point source loadings, GAEPD is now working with wastewater dischargers on reduced nutrient limits in certain permits.

[3] In the 2017 plan, results for chlorophyll a, total nitrogen, and total phosphorus loading for Lakes Sinclair and Oconee were compared to the standards for Lake Jackson. Located in the adjacent Middle Ocmulgee Water Planning Region, Lake Jackson has a growing season average chlorophyll *a* standard of 20 micrograms per liter (µg/L).

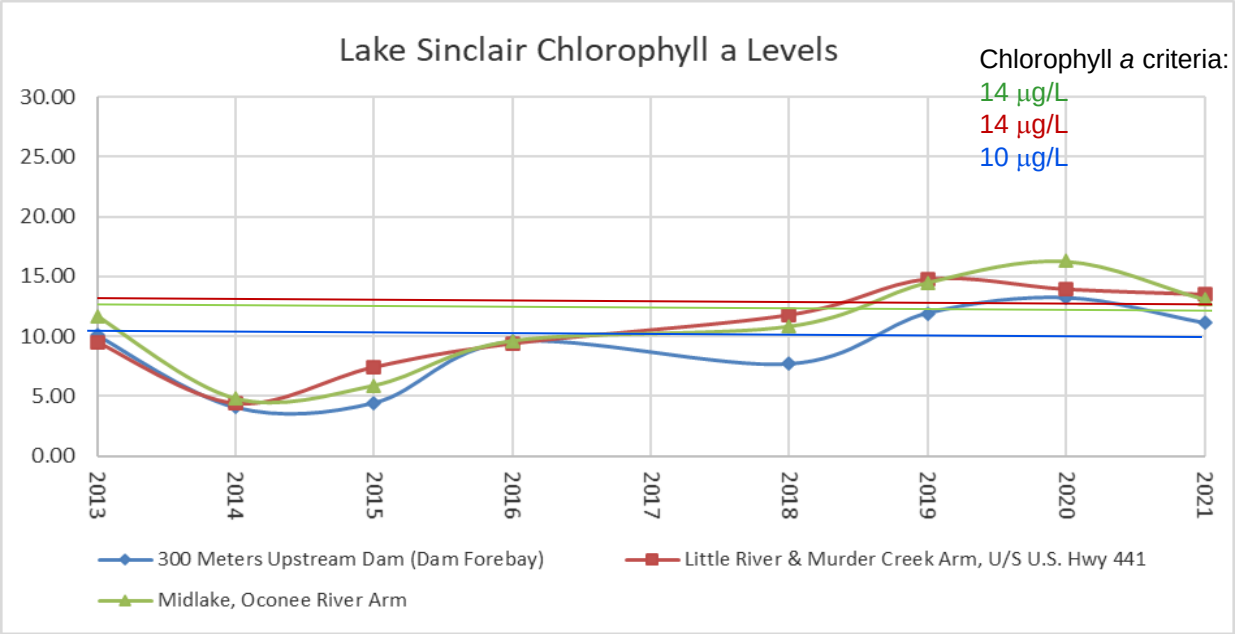


Figure 3-7 Measured Chlorophyll *a* in Lake Sinclair

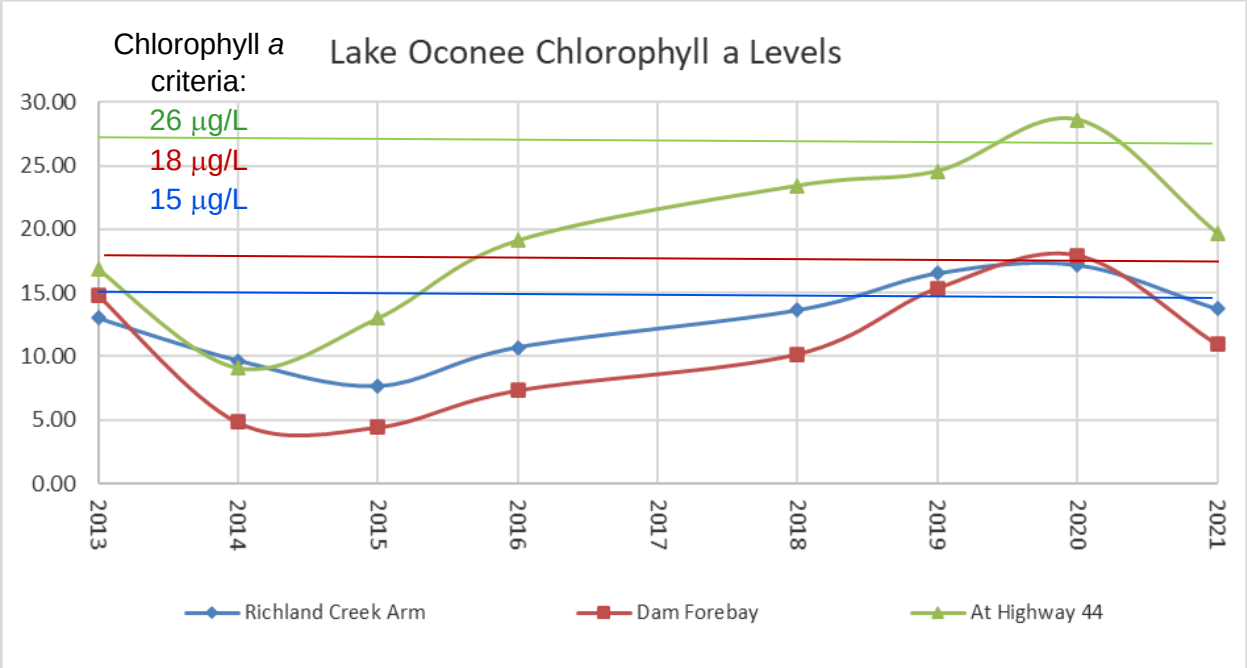


Figure 3-8 Measured Chlorophyll *a* in Lake Oconee

3.2.2 Surface Water Availability

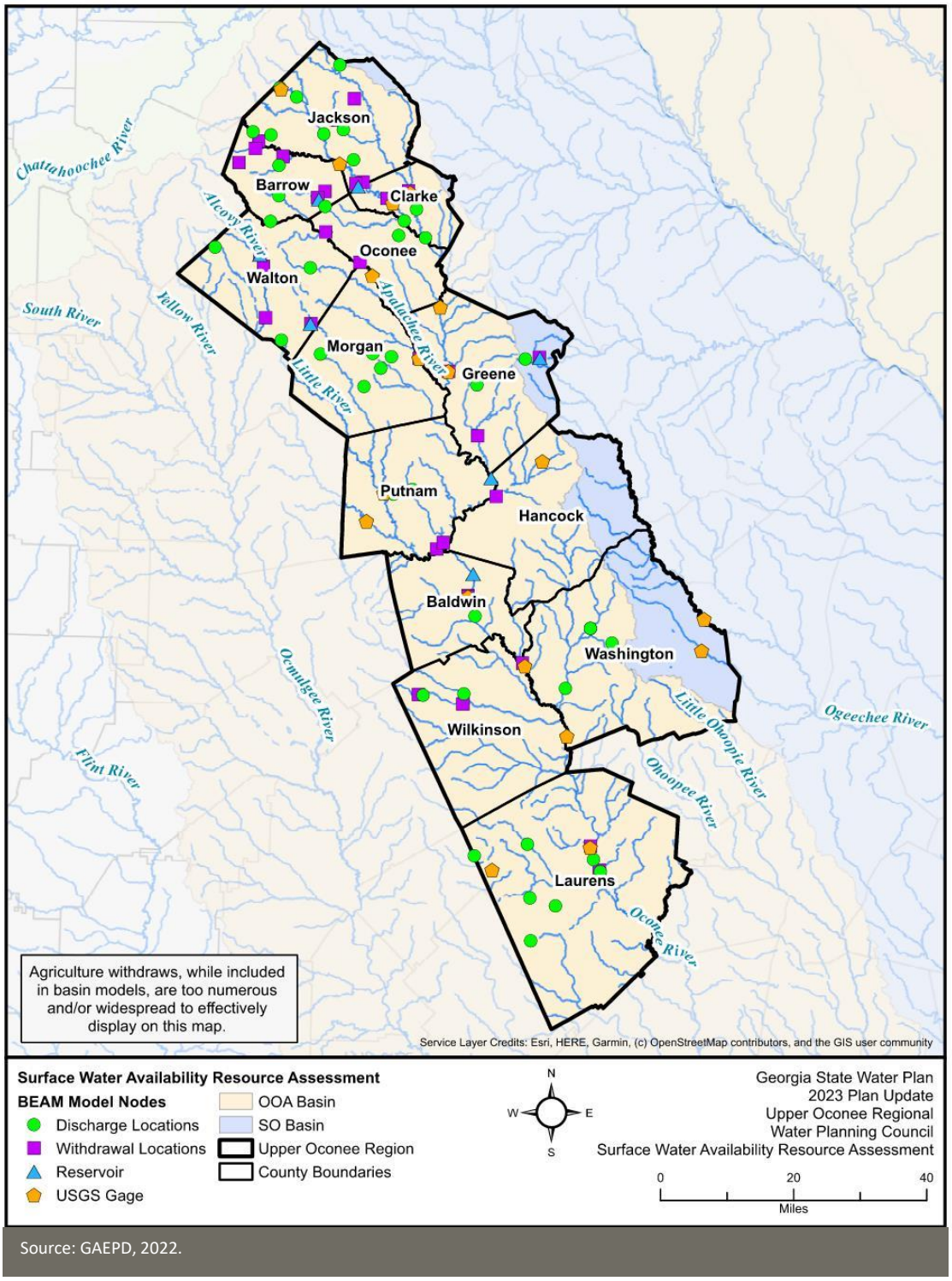
The Surface Water Availability Resource Assessment estimates the ability of surface water resources to meet current municipal, industrial, agricultural, and thermoelectric power water needs, as well as the needs of in-stream and downstream users. The assessment evaluated the impact of water consumption (withdrawals from a water body that are not returned to that water body) on stream flows at certain locations in each river basin.

In this planning cycle, a new model – the Basin Environmental Assessment Model (BEAM) – was developed for use in planning and permitting. The new model allows evaluation of surface water availability at a much high level of resolution. A model for the Oconee-Ocmulgee-Altamaha River Basin provided results for this region and Figure 3-9 provides a schematic of the BEAM model and the evaluation nodes in the Upper Oconee region. The nodes in the schematic include all permitted water withdrawals and wastewater discharges (returns), for which the BEAM model can generate results on surface water availability. In prior planning cycles, model results were only generated at a few nodes in each basin.

Modeled stream flows were used to evaluate where water availability challenges were observed in model results using current demands. GAEPD identified locations with water availability challenges and provided results for metrics indicating when and by how much surface water was not available to meet the following needs (Table 3-2):

- Permitted water withdrawals (municipal, industrial, energy)
- Water to assimilate permitted wastewater discharges (municipal, industrial) based on the availability of water to meet the discharge flow requirements (i.e., 7Q10 flow, a metric commonly used to assess low flow conditions).[4]

[4] 7Q10 is a commonly applied metric for assessing low flow conditions. It is the lowest 7-day average flow that occurs on average once every 10 years. Additional information about low flow metrics is available from the Environmental Protection Agency at https://www.epa.gov/ceam/definition-and-characteristics-low-flows.



Source: GAEPD, 2022.

Figure 3-9 Surface Water Availability Assessment Nodes in the Region

Table 3-2 Metrics Reported from the BEAM Model

Metrics from BEAM Model	
Water Supply Availability	% time with flows below instream flow protection threshold
	Total volume of shortage (for the model period)
	Shortage volume in 2007-2008 drought
	Shortage volume in 2011-2012 drought
Wastewater Discharge Assimilation	% time with flows below 7Q10
	Total volume of shortage for the model period

Table 3-3 summarizes the results. Potential water supply availability challenges were seen in modeled results for four out of 30 water withdrawal facilities analyzed. Potential wastewater assimilation challenges were seen in modeled results for 27 out of 44 wastewater discharge facilities analyzed.

Table 3-3 Summary of Current Water Supply and Wastewater Assessment Results

	Facility Type	Number of permitted facilities analyzed	Number of permitted facilities with challenge indicated
Water Withdrawals	Municipal	22	4
	Industrial	6	0
	Energy	2	0
Wastewater Discharges[1]	Municipal	34	26
	Industrial	8	1
	Energy	2	0

Source: GAEPD
[1] Permitted direct discharges of wastewater are included in the evaluation but land application systems are not.

Detailed results for the four facilities where water supply challenges were observed are presented in Table 3-4. All are municipal withdrawal facilities and, except for Statham's permit 007-03-0407, have potential water supply challenges for a small percentage of the model period. The largest shortage is associated with Statham's permit associated with the Barber Creek reservoir; the shortage resulted, at least partially, because data on the reservoir's storage capacity was not available for BEAM modeling. The cities of Winder and Statham are currently working on additional water supply arrangements. For the City of Social Circle's facility, the shortage is small enough that it is not considered a concern for planning purposes.

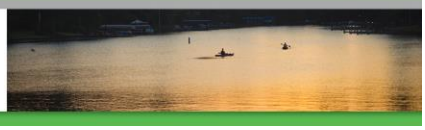


Table 3-4 Water Supply Challenges Indicated in Assessment Results: Current Demand

Facility (permit number)	Amount of time in model period[1]		Total volume of shortage (million gallons)[1]		
	Days with shortage	% of model period[1]	In model period	In 2007-08 drought	In 2011-12 drought
City of Social Circle (147-0410-01)	6	0.02%	1.1	0	0
City of Winder (007-0303-01)	255	0.87%	1131.18	418.89	118.96
City of Statham (007-0304-07)	22,454	76.84%	1026.79	49.18	40.63
City of Statham (007-0304-04)	609	2.08%	64.91	23.17	30.67

Source: GAEPD Tech Memo: Surface Water Resource Assessment Modeling and Result Interpretation, Dec. 2022.
Note:
[1] The full model period is 1939-2018. Shortage is calculated as total volume for full model period or for the drought period indicated. Each drought period includes the full two years listed.

Detailed results for the facilities where potential wastewater assimilation challenges were observed are shown in Table 3-5. Modeled flows were below the 7Q10 at one industrial wastewater treatment facility and 26 municipal wastewater treatment facilities. For most of these, the percentage of time with flows below the 7Q10 was small, which is expected from natural flow variation. Higher percentages indicate potential limitations on surface water availability with greater potential for violations of ambient water quality standards. GAEPD will use this information to guide communications with these facilities about future capacity and permit requirements.

GAEPD also funded a Regional Water Plan Implementation Seed Grant to develop information on instream uses such as fishing, boating, and aquatic life habitat in the Oconee River Basin. Results from the grant project include metrics for boating and aquatic life habitat that could be considered by the Council in future review and revision of this plan. Forty-two metrics were identified for application at 21 locations in the basin (9 USGS gages, 2 dams, and 10 boat ramps). Table 3-6 provides example metrics at each location and the full list of metrics is in Appendix B. Detailed information on project results can be obtained from the Georgia Water Policy and Planning Center's website[5] or from GAEPD.

[5] https://h2opolicycenter.org/projects/waters-of-the-oconee-river-basin/

Table 3-5 Wastewater Assimilation Challenges Indicated in Assessment Results: Current Demand

Permit Holder and Facility	Permit #	7Q10 Flow (cfs[1])	Days with shortage[2]	% of time[3]
Loganville (Loganville WPCP)	GA0020788	0.14	67	0.23
Athens-Clarke County (North Oconee WRF)	GA0021725	34.7	652	2.23
Braselton (Braselton WRF)	GA0038857	4.27	23	0.08
Winder (Cedar Creek WPCP)	GA0038776	1.22	-	1.44
Arcade (Arcade WRF)	GA0039110	41.1	-	0.84
Barrow County BOC (Barber Creek WRF)	GA0038733	0.15	844	2.89
Oconee County BOC (Rocky Branch WRF)	GA0038806	3.03	829	2.84
Athens-Clarke County (Middle Oconee WPCP)	GA0021733	47.43	320	1.10
Athens-Clarke County (Cedar Creek WPCP)	GA0034584	91.82	279	0.95
Winder (Marburg Creek WPCP)	GA0023191	1.29	634	2.17
Barrow County BOC (Tanners Bridge WPCP)	GA0039314	6.69	631	2.16
Monroe (Jack's Creek WPCP)	GA0047171	2.74	1066	3.65
Madison (Southside WPCP)	GA0023141	0.23	2152	7.36
Eatonton - Putnam Water & Sewer Authority (Eastside WPCP)	GA0032271	0.76	5972	20.44
Madison (Indian Creek WRF)	GA0038741	1.38	1515	5.18
Rutledge (Rutledge WPCP)	GA0025895	0.07	191	0.65
Social Circle (Little River WPCP)	GA0026107	0.02	37	0.13
Eatonton - Putnam Water & Sewer Authority (Westside WPCP)	GA0032263	0.08	1279	4.38
Cadwell (Cadwell WPCP)	GA0025887	0.18	718	2.46
Milledgeville (Milledgeville WPCP)	GA0030775	285.89	1402	4.80
Sandersville (Sandersville WPCP)	GA0032051	0.36	348	1.19
Tennille (City of Tennille WWTP)	GA0039357	15.1	320	1.10
Dublin (Dublin WPCP)	GA0025569	574.45	1878	6.43
Westrock Southeast, LLC	GA0032620	575.84	1923	6.58
Gordon (Gordon WPCP)	GA0020397	6.97	9515	32.56
Dudley (Dudley WPCP)	GA0023957	14.68	5868	20.08
Rentz (Rentz WPCP)	GA0037630	2.52	232	0.79

Source: GAEPD Tech Memo: Surface Water Resource Assessment Modeling and Result Interpretation, Dec. 2022.

Notes:

[1] 7Q10 is a commonly applied metric for assessing low flow conditions. It is the lowest 7-day average flow that occurs on average once every 10 years.

[2] The table does not include the facilities where no shortage was found. Municipal facilities: Maysville (Maysville WPCP; GA0032905); Jefferson (Central City WPCP; GA0023132); Jackson County Water & Sewer Authority (Middle Oconee WPCP; GA0002712); City of Hoschton (Hoschton WPCP; GA0035980); Oconee County (Calls Creek WPCP; GA0050211); City of Madison (Northside WPCP; GA0023159); City of Greensboro (South WPCP; GA0021351-1) and City of Dexter (Dexter WPCP; GA0048682). Industrial and thermoelectric facilities: KEMRON Environmental Services, Inc. (GA0050277-1 and GA0050277-2); Wayne Farms (GA0039390); Georgia Pacific (GA0047988); Imerys Clays Inc. Sandersville (GA0002135-1 and GA0002135-2); BASF Corporation (Gordon; GA0003271); and Georgia Power Co - Plant Branch (117-0390-01).

[3] % time is calculated as a proportion of the full model period (1939-2018).

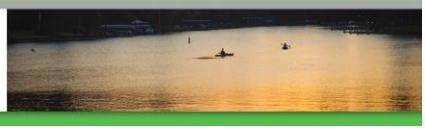


Table 3-6 Example Flow Metrics for Recreation and Aquatic Species and Habitat in the Oconee River Basin

Measurement location	Indicator	Example Metric
Aquatic species/habitats		
USGS 02217500 Middle Oconee R. near Athens, GA	Loss of deep, swift habitat in dry season	# days with flow <265 cfs, June-October
USGS 02217770 North Oconee R. at College St., Athens, GA	Connection to floodplain habitat	# flow events >800 cfs in winter, spring and summer of each year
Sinclair Dam, Oconee R.	Dam releases for downstream habitat	Monthly required releases, with higher minimum releases in spring, moderate flows in summer and early fall, and lower minimum releases in winter.
USGS 02223000 Oconee R. at Milledgeville, GA	Channel maintenance	# years with flows > 12,000 cfs
USGS 02223056 Oconee R. near Oconee, GA	Fish reproduction in oxbow habitat	# days with flow above 3,000 cfs, March-May
USGS 02223056 Oconee R. near Oconee, GA	Connection to floodplain habitat	# days with flow above 5,000 cfs, November-March
Recreation (boating)		
USGS 02217475 Middle Oconee R. near Arcade, GA	Runnable for nonmotorized boating	# days with flows between 300-2400 cfs, March - October. Applies from Tallassee Shoals to Ben Burton Park.
USGS 02217770 North Oconee R. at College St., Athens, GA	Runnable for nonmotorized boating	# days with gage height between 4.2 feet and 8 feet, March - October. Applies from Dudley Park to Whitehall Road.
USGS 02218300 Oconee R. near Penfield, GA	Passable for motorized boating	# days with gage height greater than 5 feet, March - October. Applies from Barnett Shoals Dam and Lake Oconee
USGS 02219000 Apalachee R. near Bostwick, GA	Runnable for nonmotorized boating	# days with flow above 175 cubic feet per second (cfs), March - October. Applies between Hwy 441 and Pot Leaf Shoals.
L. Oconee and L. Sinclair boat ramps	Developed boat access	# of days with lake level above 428.4 feet. Applies at Lawrence Shoals boat ramp in Lake Oconee.
USGS 02223000 Oconee R. at Milledgeville GA	Runnable for nonmotorized boating	# days with gage levels below 11 feet (equal to 5000-5500 cfs), March - October. Applies from Oconee River Greenway and Central State Hospital.
USGS 02223500 Oconee R. at Dublin, GA	Passable for jonboats	# days with gage height above 2 feet. Applies from Dublin to the Ocmulgee R.
Note: Metrics are measured in cubic feet per second (cfs) or height in feet. Background and details are provided in Appendix B.		

3.2.3 Groundwater Availability

The Groundwater Availability Resource Assessment evaluates the amount of water that can be withdrawn from modeled areas of a prioritized aquifer without reaching specific thresholds of local or regional impacts. Indicators of impacts included declines in groundwater levels that may affect neighboring wells (drawdown) and reductions in the amount of groundwater that seeps into streams and thereby contributes to streamflows. The assessment estimates a range of yield that

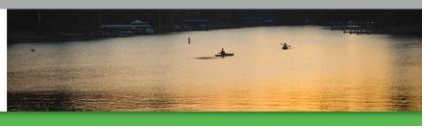
can be withdrawn from an aquifer before specific thresholds are met. The results reflect modeled aquifer responses to specific baseline conditions and specific pumping scenarios. GAEPD prioritized the aquifers based on their characteristics, and evidence of existing impacts, as well as potential future impacts. The Region includes three prioritized aquifer systems: the Crystalline rock aquifer, the Cretaceous aquifer system, and the Floridan aquifer. The Crystalline rock aquifer system lies within the upper portion of the Oconee River watershed; the Cretaceous and Floridan aquifer systems lie within the Ocmulgee, Oconee, and Altamaha River watersheds in the Region. GAEPD developed a regional numerical groundwater model to estimate sustainable yield in the Floridan aquifer of south-central Georgia and the eastern Coastal Plain of Georgia and the Cretaceous aquifer system; a water budget approach developed for the basin within the Crystalline rock aquifer system was used to estimate sustainable yield in this part of the Region.

In the Upper Oconee region, the Cretaceous and Floridan aquifer systems serve Washington, Wilkinson, and Laurens Counties, as well as areas outside the Region. Table 3-7 shows current use in the region from these aquifers, the current aquifer-wide use, and the estimated range of sustainable yield from each aquifer system. Results indicate that supplies from the Cretaceous and Floridan aquifers are generally sufficient in meeting the forecasted groundwater demand from areas with access to these aquifers. It should be noted that the groundwater yield estimates are based on the capacity of the entire aquifer system and local or regional groundwater yields may vary.

Table 3-7 Groundwater Availability Assessment Results: Cretaceous Aquifer and Floridan Aquifer in South-Central and Eastern Coastal Plain

	Cretaceous Aquifer	Floridan Aquifer in South-Central and Eastern Coastal Plain
Upper Oconee Region Demand: 2020 Use (mgd)	27	11
Aquifer-Wide Demand: 2020 Use (mgd)	177	579
Sustainable Yield Range (mgd): Low End	347	868
Sustainable Yield Range (mgd): High End	445	982
Source: GAEPD modeling data, 2023.		

Although most wells produce less than 200 gallons per minute (gpm) in the Crystalline rock aquifers, in local geologically unique settings, several wells exist with production rates between 200 and 500 gpm (Georgia Geologic Survey, 2006). Although there are potential sustainable yield limitations in the Crystalline rock aquifer systems that locally serve portions of Athens-Clarke, Jackson, Barrow, and Oconee Counties, data analysis indicates that there is a limited amount of additional groundwater available above its current use, assuming that conditions are similar to those in the Piedmont Study basin (GAEPD, 2010a).



Typical water quality issues known to be associated with the Crystalline rock aquifer systems include elevated iron/manganese levels and local concentration of radionuclides. Groundwater within the Floridan aquifer is generally hard (calcium bicarbonate-rich) with few surface or groundwater quality problems in the area. Dominant cations include calcium, magnesium, sodium, and potassium; dominant anions include bicarbonate, chlorine and sulfate. Water from the Cretaceous aquifer system is reported to be generally of good chemical quality, although lower values of pH have been reported locally (Clarke et al., 1985; Johnson and Bush, 1988).

3.3 Ecosystem Conditions and In-Stream Use

This section includes information on stream classifications, impaired waters, priority watersheds, conservation areas, and fisheries resources.

3.3.1 Water Use Classifications (Designated Uses)

In accordance with the Clean Water Act, GAEPD classifies each of its surface waters according to six designated uses: (1) drinking water supply; (2) recreation; (3) fishing—propagation of fish, shellfish, game and other aquatic life; (4) wild river; (5) scenic river; and (6) coastal fishing. Each designated use has numeric and narrative water quality criteria developed to protect the use. At a minimum, all waters are classified as fishable. Table 3-8 lists the water bodies in the Region that are classified by the State for uses other than fishing, such as drinking water or recreation. These waters should also support designated uses for fishing and any other use requiring water of a lesser quality. Additionally, the Oconee River from Georgia Highway 16 to the Sinclair Dam (i.e., including Lake Sinclair) is designated for recreational activities, such as water skiing, boating, and swimming, or for any other use requiring water of a lesser quality, such as recreational fishing.

Table 3-8 Special Stream or Reservoir Classification

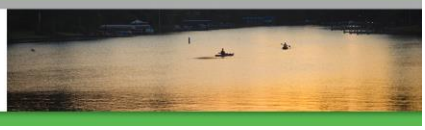
Stream/ Reservoir	Reach	Counties	Classification[1]
Alcovy River	Maple Creek to Cornish Creek (including John T. Briscoe Reservoir)	Walton	Drinking Water
Apalachee River	Shoal Creek to Freeman Creek	Walton, Oconee, Morgan	Drinking Water
Barber Creek	Headwaters to Parker Branch	Barrow, Oconee	Drinking Water
Bear Creek	Headwaters to confluence with Middle Oconee River (including Bear Creek Reservoir)	Barrow, Jackson, Athens-Clarke	Drinking Water
Beaverdam Creek	Headwaters to confluence with Alcovy River	Walton	Drinking Water
Big Haynes Creek	Georgia Highway 78 to confluence with Yellow River	Walton	Drinking Water
Cornish Creek	Headwaters to confluence with Alcovy River (including Lake Varner)	Walton	Drinking Water
Curry Creek	Headwaters to confluence with Little Curry Creek	Jackson	Drinking Water
Fort Creek	Headwaters to confluence with Sikes Creek upstream of Lake Sinclair	Hancock	Drinking Water

Stream/ Reservoir	Reach	Counties	Classification[1]
Hard Labor Creek	Headwaters to Lake Brantley Dam	Morgan, Walton	Drinking Water
Hard Labor Creek	Lake Rutledge, Hard Labor Creek State Park Beaches	Morgan	Recreation
Hard Labor Creek	Lake Rutledge Dam to Mile Branch	Morgan	Drinking Water
Jacks Creek	Headwaters to Grubby Creek	Walton	Drinking Water
Lake Oconee	Lake Oconee to Lake Oconee Dam (Wallace Dam)	Greene, Hancock, Morgan, Putnam	Recreation and Drinking Water
Lake Sinclair	Lake Oconee Dam downstream to Sinclair Dam	Baldwin, Hancock, Putnam	Recreation and Drinking Water
Little River	Big Indian Creek to Glady Creek	Putnam	Drinking Water
Marbury Creek	Fort Yargo Lake, Fort Yargo State Park Beaches	Barrow	Recreation
Middle Oconee River	Beech Creek to McNutt Creek	Athens-Clarke, Jackson	Drinking Water
Mulberry River	Little Mulberry Creek to Barbers Creek	Gwinnett, Barrow	Drinking Water
North Oconee River	Cedar Creek to Gravelly Creek	Hall, Jackson	Drinking Water
North Oconee River	Shankles Creek to Trail Creek	Athens-Clarke	Drinking Water
Oconee River	Sinclair Dam to Fishing Creek	Baldwin	Drinking Water
Oconee River	Oochee Creek to Long Branch	Laurens, Washington, Wilkinson	Drinking Water
Oconee River	Flat Creek to Long Branch	Laurens	Drinking Water
Parks Creek	Headwaters to confluence with North Oconee River	Jackson	Drinking Water
Sherrills Creek	Headwaters to confluence with South Fork Little River (including Sherrills Reservoir)	Greene	Drinking Water

Source: GAEPD Rule 391-3-6-.03 Designated Use and Water Quality Standards (2022).

Notes:

[1] Streams and stream reaches not included in Table 3-8 are classified as having designated use - Fishing.



3.3.2 Monitored and Impaired Waters

GAEPD publishes a list of streams that do not meet the water quality standards associated with each designated use category. GAEPD monitors streams throughout the State and publishes an integrated list, known as the 305(b)/303(d) list, every 2 years. In 2022 GAEPD evaluated 1,736 stream miles in the Region; of these, 61 percent were not supporting their designated use. Most of these waters were rated impaired based on biological data (i.e., fish or macroinvertebrates data indicated reduced organism number or diversity) or bacteria data (i.e., fecal coliform). Fecal coliform bacteria, including *E. coli*, are an indicator of the presence of human or animal waste, and high levels indicate potential health risks in waters used for swimming and other recreational purposes. GAEPD has begun shifting from more general fecal coliform standards to standards that are specific for *E. coli*, which is a more precise indicator of potential health risks. The agency is now implementing a strategy to change their monitoring and assessment of waters for bacteria.

Figure 3-10 shows the locations of the impaired stream segments within the Region based on the 2022 listings, the most recent year for which mapping data were available at the time of plan development. Lakes are also monitored as part of the 305(b)/303(d) process and are listed as "not supporting" if sample results indicate they do not meet State water quality standards. For the Region, 3 of the 10 lakes evaluated were impaired (33,673 acres).

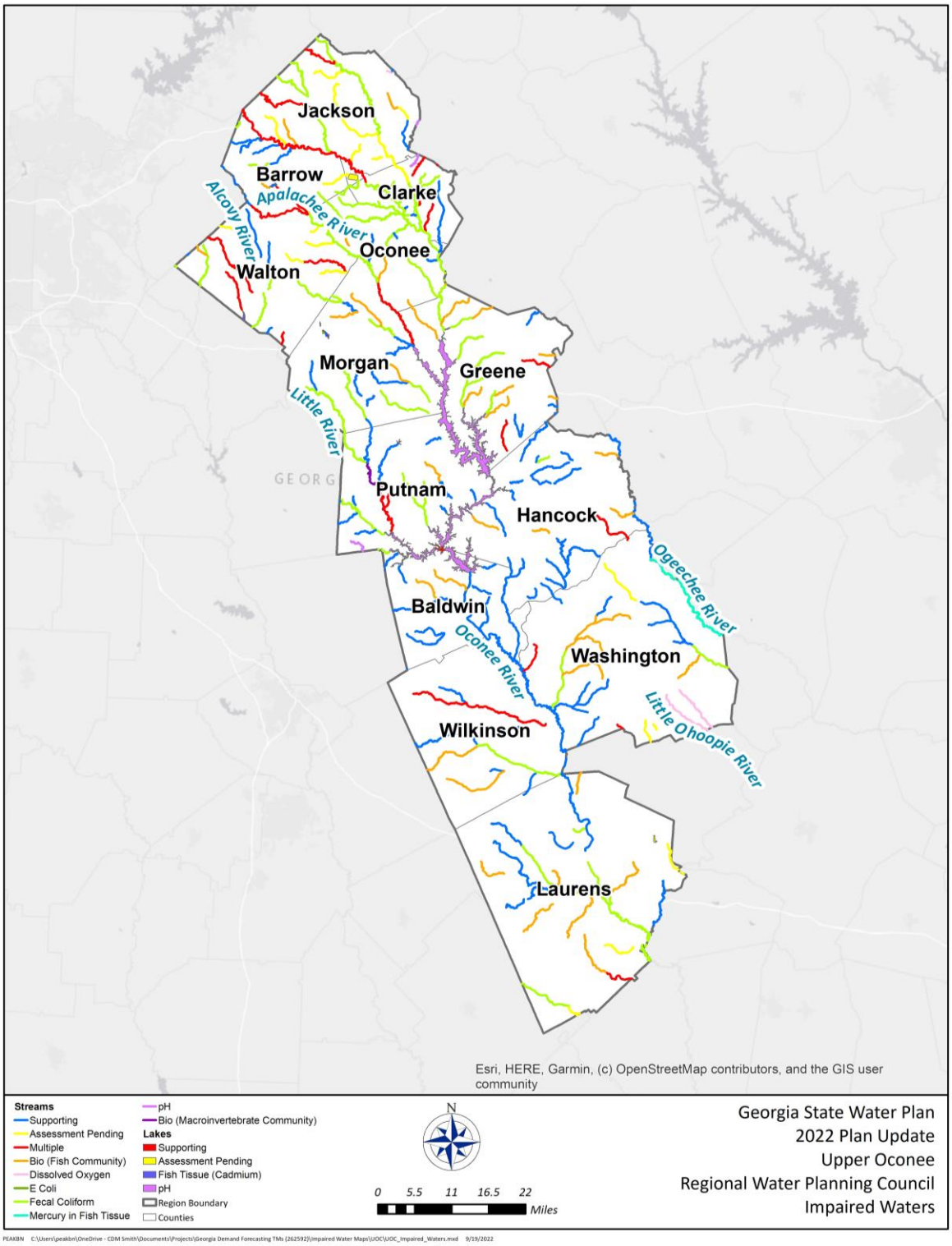
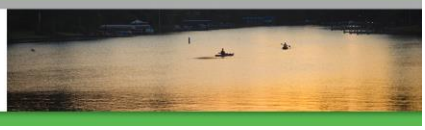


Figure 3-10 Upper Oconee Region Impaired Waters



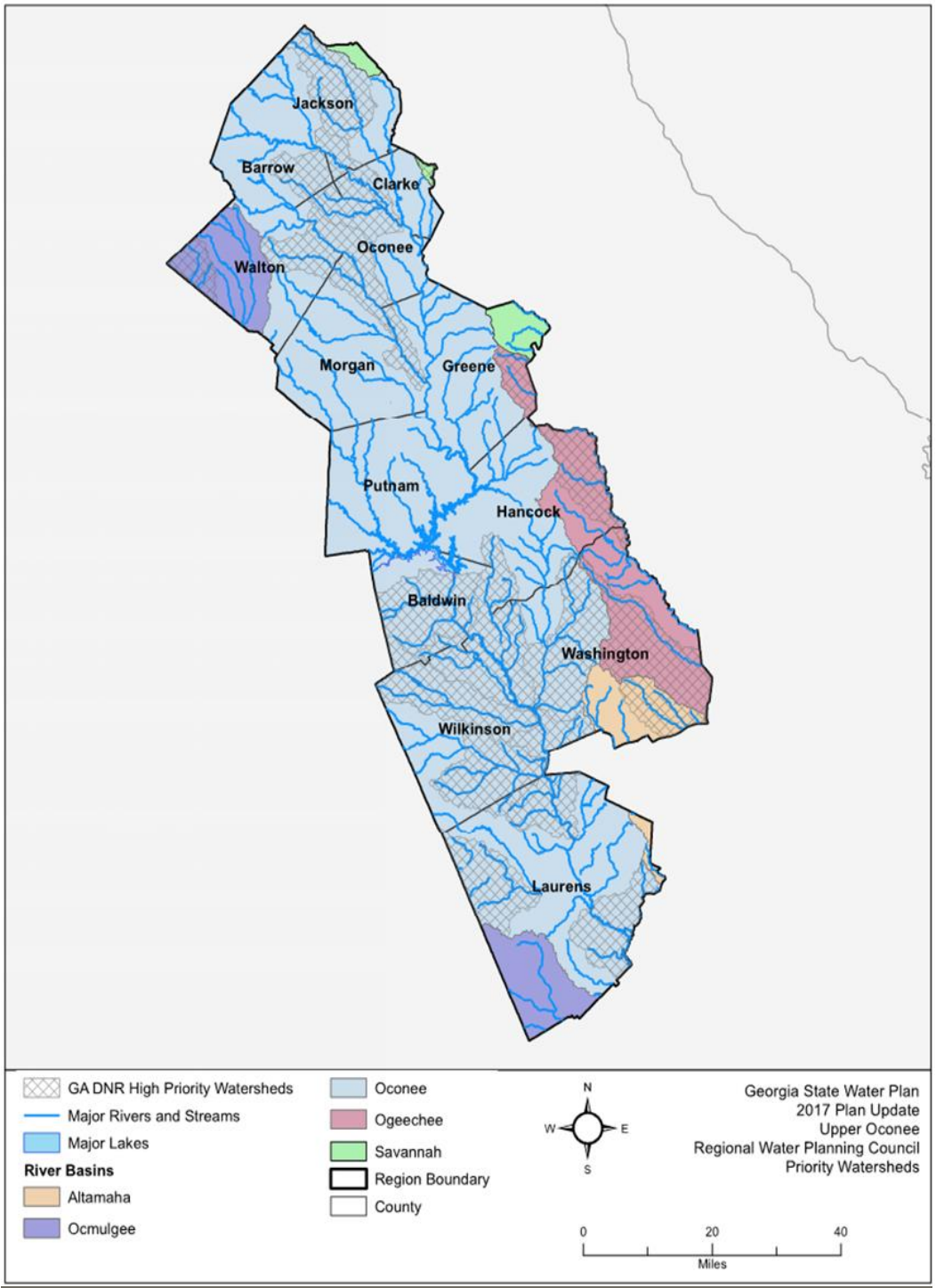
3.3.3 Conservation Areas

The Georgia Department of Natural Resources (GADNR) Wildlife Resources Division (WRD) produced the current State Wildlife Action Plan in 2015. The plan identifies waters and watersheds it believes should be given high conservation priority to protect important populations of high priority species and to protect or restore representative aquatic systems throughout Georgia (GADNR, 2015). The high priority waters in the Region are listed in Table 3-9. The streams included on the final priority list are those that are a high priority for restoration, preservation, or other conservation activity; streams that were too degraded were not included in the final list. The streams on the list contain anadromous fish (fish that return to the river where they were born to breed), include rare habitats, or represent the least disturbed aquatic systems within the Region. Figure 3-11 presents the priority watersheds in the Upper Oconee Region, listed due to critical habitat or a recent occurrence of a listed species, migratory corridor, or ecological drainage units that were poorly represented in the dataset.

Table 3-9 High Priority Waters in the Upper Oconee Region

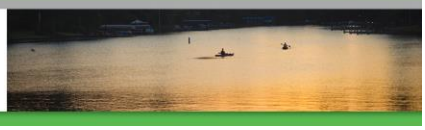
Classification	Waters
High Priority Aquatic Community Stream	Alligator Creek, Copeland Creek
High Priority Species Stream	Alcovy River, Little River
High Priority Species and Aquatic Community Streams	Apalachee River, Jacks Creek, Little River, Murder Creek, North Fork Wolf Creek, North Oconee River, Oconee River, Ogeechee River, Shoal Creek, Williamson Swamp Creek

Source: GADNR, 2015.



Source: GADNR, 2015.

Figure 3-11 High Priority Watersheds



The Georgia Conservation Lands Database, a product of the Georgia Gap Analysis Program, was compiled to aid a state-wide evaluation of how the distribution of lands managed for protection of biodiversity compares with potential vertebrate habitat. Within the Region, there are over 131,000 acres of protected land managed for conservation purposes, representing 4 percent of the Region's total area. The largest portion of these conservation lands is located in the Oconee National Forest; the B.F. Grant Memorial Forest and the Ogeechee Wildlife Management Area also contain significant conservation acreage.

WRD's Biodiversity Portal[6] provides information on the species of greatest conservation needs identified in the State Wildlife Action Plan. In the Upper Oconee region, 47 animal and 40 plant species are identified as species of greatest conservation need. Approximately half of these are aquatic or water-dependent species, including two fish and two mussel species that are listed by Georgia (but not the Federal government) as threatened or endangered. One fish species—Altamaha Shiner (*Cyprinella xaenura*)—and two invertebrates—Altamaha Arcmussel (*Alasmidonta arcula*) and Oconee Burrowing Crayfish (*Cambarus truncates*) are State-listed as threatened. The fish species Robust Redhorse (*Moxostoma robustum*) is State-listed as endangered. The latter is an important conservation species re-discovered in 1991 in the Oconee River below Sinclair Dam after being presumed extinct for more than 100 years. The Robust Redhorse Conservation Committee was organized soon after the re-discovery with the intention of reestablishing the species in other rivers within the species' former range and to avoid a listing in the future under the Federal Endangered Species Act. The Oconee River contains a remnant gene pool that is considered indispensable to the recovery of this rare species.

3.3.4 Fisheries Resources

The WRD manages the fisheries resources of the Region's two major sport fishing reservoirs, Oconee and Sinclair. Both lakes are routinely stocked with striped bass, and Lake Oconee is also stocked with hybrid striped bass. Largemouth bass, striped bass, hybrid bass, white bass, crappie, sunfish, and catfish are very popular with anglers at Lake Oconee, as are largemouth bass, crappie, catfish, sunfish, and striped bass at Lake Sinclair (GADNR, 2015). The WRD also manages the fisheries of Lake Rutledge in Morgan County, Bear Creek Reservoir in Jackson County, and the Hugh M. Gillis Public Fishing Area in Laurens County.

[6] Georgia Wildlife Resources Division, https://georgiabiodiversity.org/portal/, last accessed May 25, 2023.

SECTION 4

Forecasting Future Water Resource Needs

Section 4 Forecasting Future Water Resource Needs

Summary

Total water demands are expected to increase from 146 MGD in 2020 to 191 MGD in 2060. Wastewater flows are likewise anticipated to increase from 93 MGD in 2020 to 132 MGD in 2060.

Industrial water demands are expected to remain relatively constant, while agriculture, municipal, and thermoelectric generation water demands are projected to increase by 21, 51, and 60 percent respectively from 2020 to 2060.

Water demand and wastewater flow forecasts and the Resource Assessments described in Section 3 form the foundation for water planning in the Region and serve as the basis for the selection of the MPs discussed in Sections 6 and 7.

This Section presents the regional water demand and wastewater flow forecasts from 2020 through 2060 for the four water use sectors: municipal, industrial, agriculture, and thermoelectric generation. Detailed descriptions of the methodology and data used to generate the forecasts can be found in — *Upper Oconee Water and Wastewater Forecasting Technical Memorandum,* available on the Council website.[7]

4.1 Municipal Forecasts

Municipal water demand and wastewater flow forecasts include water supplied to residences, commercial businesses, small industries, institutions, and military bases. Water use by high water-using industries are forecasted separately and are discussed in Section 4.2. The municipal forecasts are based on county population projections developed by the Governor's Office of Planning and Budget, which is responsible for preparing, maintaining, and furnishing official demographic data for the State in accordance with State law (O.C.G.A. 45-12-171). The population projections by county for the planning period are shown in Table 4-1.

The Region's population is projected to increase from 617,291 in 2020 to 1,024,663 in 2060, a 66 percent growth increase over this 40-year period. Since the completion of the updated population projections in 2019, a very robust rebound in development has occurred within the more-populated portion of the Council's Region. The Council notes that in some areas, the future population projections are probably understated.

4.1.1 Municipal Water Demand Forecasts

Regional municipal water demand forecasts were calculated by multiplying the baseline per capita water use for each county by its population. Per capita water use rates differ for public water systems and self-supplied water use; therefore, the demands are calculated separately and then summed together for each county.

[7] https://waterplanning.georgia.gov/water-planning-regions/upper-oconee-water-planning-region

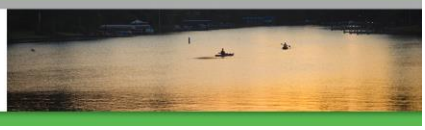


Table 4-1 Population Projections by County

County	2020	2030	2040	2050	2060	Difference (2020 to 2060)	% Increase (2020 – 2060)
Baldwin	44,428	43,637	41,221	38,125	35,806	-8,622	-19%
Barrow	86,383	116,916	149,706	189,385	239,941	153,558	178%
Clarke	129,779	146,104	158,840	168,872	181,071	51,292	40%
Greene	18,717	22,546	24,505	27,014	30,982	12,265	66%
Hancock	8,193	7,637	7,004	6,557	6,482	-1,711	-21%
Jackson	74,700	95,493	115,088	136,627	160,808	86,108	115%
Laurens	47,296	47,405	46,964	45,989	45,193	-2,103	-4%
Morgan	19,138	20,757	22,438	24,206	26,328	7,190	38%
Oconee	41,737	52,926	63,566	75,060	87,460	45,723	110%
Putnam	21,885	22,308	22,341	22,478	23,209	1,324	6%
Walton	95,814	109,179	124,621	141,993	162,652	66,838	70%
Washington	20,302	20,009	19,452	18,595	18,066	-2,236	-11%
Wilkinson	8,919	8,361	7,791	7,095	6,665	-2,254	-25%
TOTAL	**617,291**	**713,278**	**803,537**	**901,996**	**1,024,663**	**407,372**	**66%**

Source: Georgia Governor's Office of Planning and Budget, 2019.

Per capita water use rates were initially developed using withdrawal data for 2005 reported by GAEPD and USGS (Fanning and Trent, 2009). With feedback from water providers, adjustments were made to subtract wholesale and industrial water uses where necessary. Self-supplied water users were assumed to use a standard 75 gallons per capita per day, unless stakeholder feedback indicated otherwise. To support this Plan update, EPD reviewed water loss audit data and the estimated population served reported by permitted municipal water systems from the years 2015 through 2018. A weighted average was then calculated for each county using those data for the public-supplied municipal demand. The self-supplied per capita values remained unchanged.

The forecasting methodology may result in discrepancies between local planning documents and the forecasts in this regional water plan. Forecasts will be updated in advance of the next plan revision and specific input received from water and wastewater service providers will be incorporated at that time.

Adjustments were also made to the municipal water use rates to account for changes in plumbing codes and to reflect water savings over time from the transition to ultra-low flow and high efficiency toilets (maximum 1.6 and 1.28 gallons per flush [gpf], respectively), required by Federal and State laws. As new homes are constructed and less efficient toilets are replaced within existing housing stock, the average indoor water use rate is reduced over time.

Although the assumed plumbing improvements lower future per capita water use rates, the total municipal water demand for the region increases significantly from 2020 to 2060 (69.2 MGD to

104.4 MGD) as a result of population growth. Table 4-2 summarizes the municipal water demand forecasts by county for the Upper Oconee Region over the planning period.

Table 4-2 Municipal Water Demand Forecasts by County (AAD-MGD)[1]

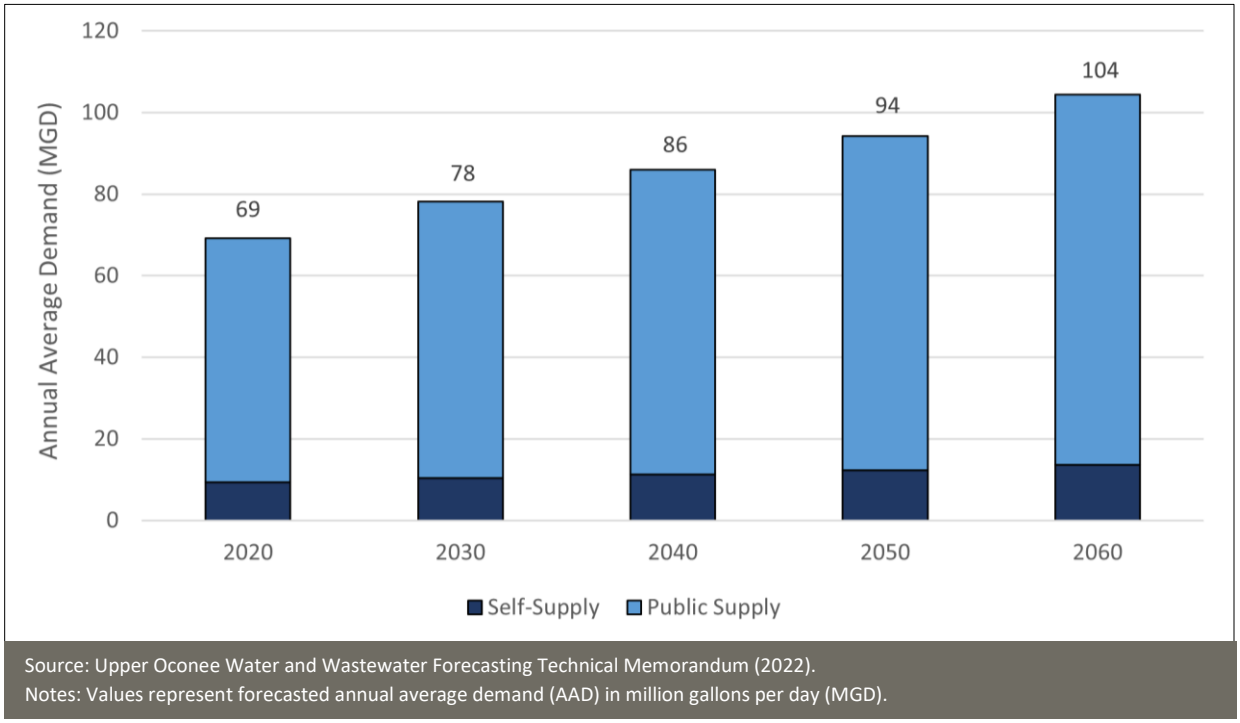
County	2020	2030	2040	2050	2060
Baldwin	6.41	6.19	5.74	5.21	4.81
Barrow	8.68	11.60	14.57	18.04	22.34
Athens-Clarke[2]	11.59	12.86	13.83	14.42	15.05
Greene	2.69	3.20	3.42	3.72	4.20
Hancock	1.53	1.40	1.27	1.17	1.14
Jackson	9.12	11.47	13.61	15.91	18.42
Laurens	5.84	5.73	5.56	5.32	5.11
Morgan	2.69	2.87	3.06	3.24	3.47
Oconee	4.63	5.78	6.82	7.91	9.06
Putnam	2.08	2.08	2.04	2.01	2.03
Walton	9.66	10.82	12.14	13.59	15.28
Washington	3.28	3.18	3.04	2.85	2.72
Wilkinson	1.01	0.95	0.90	0.83	0.79
TOTAL	**69.22**	**78.14**	**85.99**	**94.23**	**104.42**

Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (2022).
Notes:
[1] Municipal water demand forecasts include publicly supplied and self-supplied demands from surface water and groundwater sources. Values represent forecasted annual average demand (AAD) in million gallons per day (MGD).
[2] Athens-Clarke County adopted a revised Service Delivery Plan in 2020 that projects 2060 water demand and wastewater flows higher than shown here (2060 water demand = 30-35 MGD). The Council recommends that EPD evaluate the higher numbers using the resource assessment models.

Additional details regarding development of the municipal water demand forecasts, including the per capita rate and plumbing code adjustment for each county, are provided in the supplemental document *Upper Oconee Water and Wastewater Forecasting Technical Memorandum*, which is available on the Council website.[8]

Based on existing uses, it is forecast that approximately 75 percent of the municipal water demand in the future will be obtained from surface water sources and 25 percent from groundwater sources; the latter includes private wells (self-supply). Figure 4-1 shows the municipal water demand forecasts for the Region.

[8] https://waterplanning.georgia.gov/water-planning-regions/upper-oconee-water-planning-region



Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (2022).
Notes: Values represent forecasted annual average demand (AAD) in million gallons per day (MGD).

Figure 4-1 Municipal Water Demand Forecast (in AAD-MGD)

4.1.2 Municipal Wastewater Flow Forecasts

Municipal wastewater flow forecasts were developed to determine the amount of treated wastewater generated and returned to the watershed. Municipal wastewater may be treated by centralized treatment plants or onsite sanitary sewage (septic) systems. Wastewater effluent flow from centralized treatment facilities is either discharged as a point source to a receiving water body or delivered to a land application system (LAS). EPD permit data as well as feedback from municipal suppliers were used to determine volume of discharge from centralized treatment and the ratio of point discharge to land application system for each county.

U.S. Census data on the percent of households with septic systems were obtained by county. For planning purposes, it was assumed that households with septic systems use 75 gallons per capita per day and that 80 percent of this water use is disposed of via septic system (U.S.Geological Survey 2019; Black and Veatch 2020). The estimated septic flow was based on the county population from the updated (2019) OPB population projections for each planning year (2020, 2030, 2040, 2050, and 2060).

Reported centralized wastewater flows from 2019 EPD permits, including point discharges and LAS, were adjusted over time by the change in county population projections. As noted above, the forecasting methodology may result in discrepancies between local planning documents and the forecasts in this regional water plan. Forecasts will be updated before the next plan revision

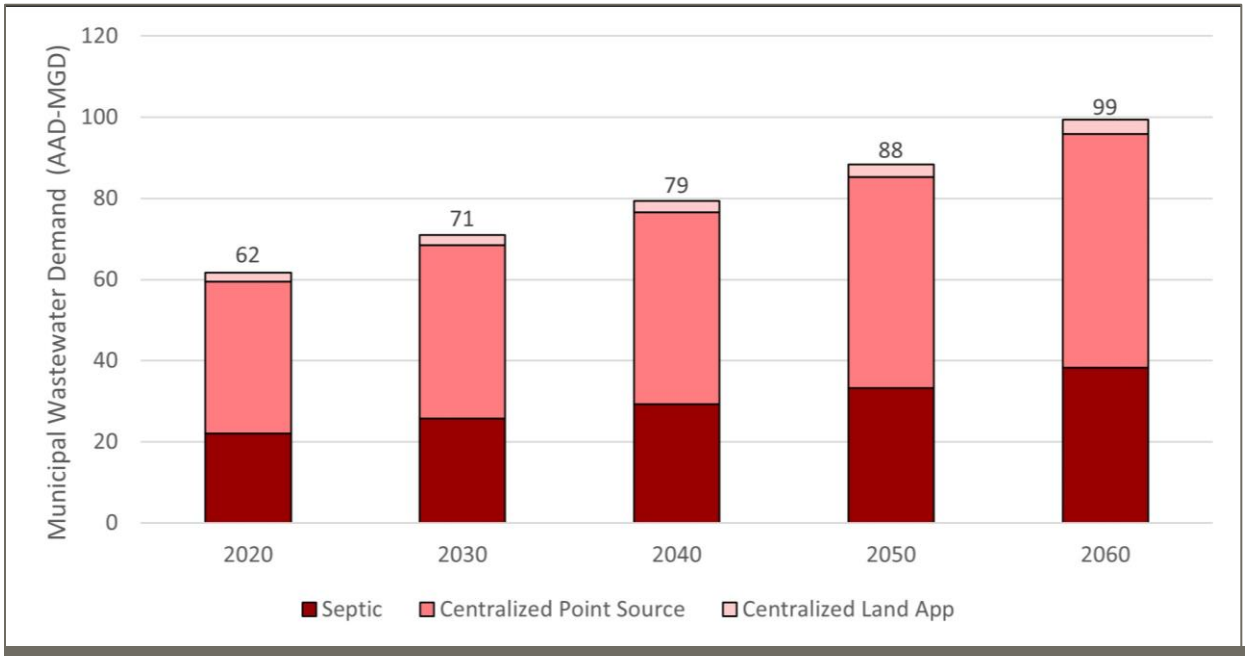
and specific input received from water and wastewater service providers will be incorporated at that time.

Table 4-3 summarizes municipal wastewater flow forecasts for the Region over the planning period. Figure 4-2 shows the municipal wastewater flow forecasts by disposal type. In summary, municipal wastewater demand in the Upper Oconee Region is forecasted to increase from 62 MGD in 2020 to 99 MGD in 2060. Of this amount, 4 percent will be treated and discharged to LAS, 59 percent by systems with point source discharges and 37 percent by septic systems. The percentage of municipal wastewater treated by septic systems has declined since the previous update as a result of additional areas being served by centralized sewer (point discharge) but remains relatively steady in counties with lower population density.

Table 4-3 Municipal Wastewater Flow Forecasts by County (AAD-MGD)[1]

County	2020	2030	2040	2050	2060
Baldwin	4.95	4.86	4.59	4.25	3.99
Barrow	6.06	8.20	10.49	13.28	16.82
Athens-Clarke[2]	16.77	18.96	20.70	22.13	23.81
Greene	1.42	1.71	1.86	2.05	2.35
Hancock	0.87	0.81	0.74	0.70	0.69
Jackson	9.15	11.69	14.09	16.73	19.69
Laurens	5.36	5.38	5.33	5.22	5.13
Morgan	1.39	1.51	1.63	1.76	1.91
Oconee	4.16	5.27	6.33	7.47	8.71
Putnam	1.45	1.47	1.48	1.49	1.53
Walton	7.29	8.30	9.48	10.80	12.37
Washington	2.29	2.25	2.19	2.09	2.03
Wilkinson	0.54	0.50	0.47	0.43	0.40
TOTAL	**61.67**	**70.92**	**79.38**	**88.38**	**99.43**

Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (2022).
Notes:
[1] Values represent forecasted annual average demand (AAD) in million gallons per day (MGD).
[2] Athens-Clarke County adopted a revised Service Delivery Plan in 2020 that projects 2060 water demand and wastewater flows higher than shown here (2060 wastewater flow = 26-30 MGD). The Council recommends that EPD evaluate the higher numbers using the resource assessment models.



Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (2022).
Note: Values represent forecasted annual average demand (AAD) in million gallons per day (MGD).

Figure 4-2 Municipal Wastewater Demand Forecast (in AAD-MGD)

4.2 Industrial Forecasts

Industrial water demand and wastewater flow forecasts anticipate the future needs of industries that are expected to be the major water users including food processing, manufacturing, paper and forestry products, and mining. Industries use water for production processes, sanitation, cooling and other purposes. Industrial forecasts were previously based on either the employment growth rate or production growth, depending on the available information. The current industrial water need was determined through permit information and representative input from each industrial sub-sector (paper and forestry products, food processing, manufacturing, and mining). The forecast industrial demands include major industrial water users and wastewater generators, many of which supply their own water and/or treat their own wastewater.

4.2.1 Advisory Group Review Process

EPD identified experts throughout the State of Georgia to form an industrial stakeholder advisory group representing the state's thirteen largest industrial sectors. Through the advisory group's review of the previous methodology, it was determined that employment projections were no longer a valid basis for estimating future industrial water requirements as increased automation has reduced the number of employees per unit of production. The advisory group subsequently formed sub-sector advisory groups to review water trends and investigate a variety of considerations for paper and forestry products, food processing, manufacturing, and mining industries. Both common and sector-specific conclusions were determined.

4.2.2 Industrial Water Demand Forecasts

In addition to sub-sector advisory group feedback, confidential trade association surveys were collected for additional input. This information was used in conjunction with municipal water purchases and facility withdrawal permit information to develop the water withdrawals forecast by county and sub-sector. The average water withdrawal from 2010 to 2019 for the majority of industrial facilities was used as the basis for projected water use. Water withdrawals are assumed to remain constant over time for all sub-sectors except for an expected increase in water demand for food processing.

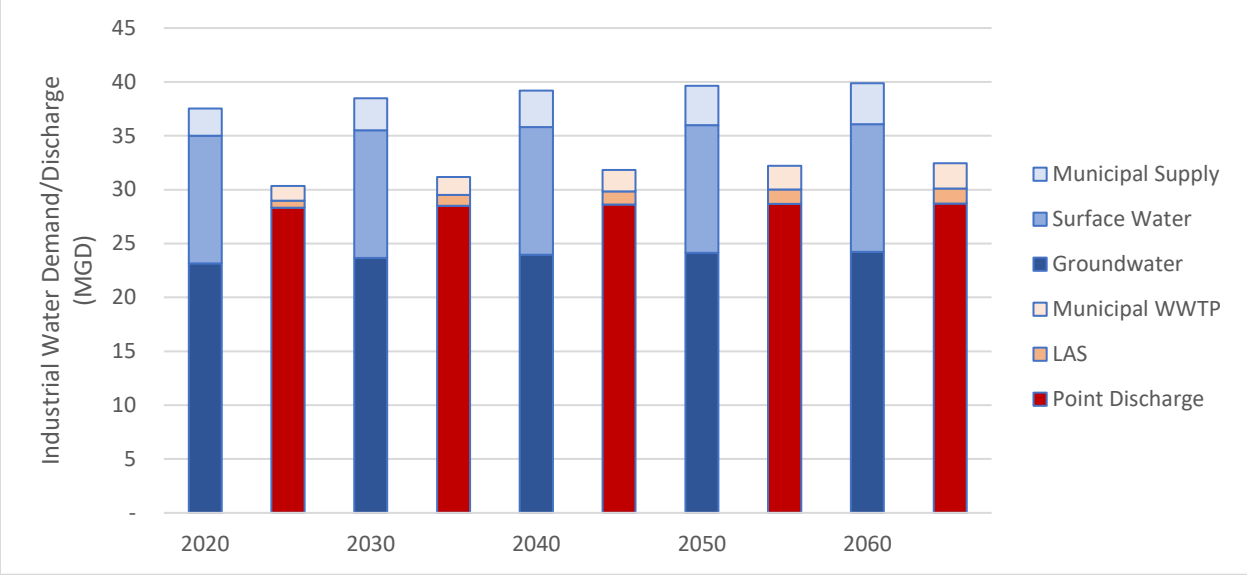
The mining (kaolin) and paper industries are expected to continue to be the most significant water-using industries in the Region. While the mining industry obtains its water supply primarily from groundwater, the paper industry relies heavily on surface water. Both industries tend to have their own permits for withdrawals. Industrial demand for water in the Region is forecast to increase from 37.5 MGD in 2020 to 39.9 MGD in 2060. Based on current proportions, approximately 31

percent of industrial demand in the future will be met by surface water, 7 percent by municipal sources and 62 percent by groundwater sources. Figure 4-3 shows the industrial water and wastewater forecast over the planning period. As shown in Figure 4-3, 2.5 MGD of the 2020 industrial water demand, increasing to 3.5 MGD in 2060, is supplied by municipal systems and is included in the municipal water demand forecast presented in Section 4.1.1.

4.2.3 Industrial Wastewater Flow Forecasts

Similar to the industrial water forecast, the industrial wastewater forecast is estimated using facility discharge permit information from 2015 to 2019. Trade association surveys also reported industrial discharges, however, the information was limited to 2019 data in some cases. It should be noted that permitted stormwater discharges are excluded because the resource assessment accounts for stormwater flows using precipitation data. During wet periods, some mining operations may use stormwater for process water resulting in a decrease in water withdrawal. Discharges are assumed to remain constant over time for all sub-sectors except for an expected increase for food processing.

Once the industrial wastewater flows were estimated, flows were separated between point discharges and land application based on EPD permit data. This allows accounting for flows discharging to surface water bodies in each planning region. The industrial wastewater forecasts are presented in Figure 4-3 by the anticipated disposal system type: industrial wastewater treatment (with point discharge or LAS) or municipal wastewater treatment. Based on current proportions, the vast majority of forecasted industrial wastewater flow is assumed to be treated by systems with point source discharges.



Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (2022).
Notes: Values represent forecasted annual average Demand (AAD) in million gallons per day (MGD).

Figure 4-3 Total Industrial Water and Wastewater Flow Forecast (in AAD-MGD)

4.3 Agricultural Forecasts

The agricultural water use forecast includes irrigation for both crop production and non-crop uses (i.e., livestock, nurseries, and golf courses). Golf courses with withdrawal permits are included with crop water use although the acreage is small. Golf courses without permits may be included with nurseries. The forecasts for 2020 through 2060 were developed by the Georgia Water Planning & Policy Center at Albany State University (GWPPC), with support from the University of Georgia's (UGA) College of Agricultural and Environmental Sciences. The crop water demand is based on the acres irrigated for each crop and provide values for irrigation water use as expected for dry, average, and wet years.

Current non-crop (including non-permitted) agricultural water demands have been compiled by respective industry associations; however, water forecasts for future non-crop agricultural use were not developed due to lack of available data. Current water demands were held constant throughout the planning period for these water use sectors.

Table 4-4 summarizes agricultural water demands for the Upper Oconee Region with a drier-than-normal year crop irrigation forecast for each county. A 21% increase in agricultural water demand is projected by 2060. The largest forecasted demands occur in Laurens and Washington Counties.

Table 4-4 Agricultural Water Demand Forecasts by County (AAD-MGD)

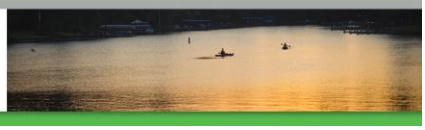
County	2020	2030	2040	2050	2060	% Increase (2020 to 2060)
Baldwin	0.18	0.18	0.18	0.18	0.18	0%
Barrow	0.18	0.18	0.18	0.18	0.18	0%
Athens-Clarke	0.68	0.68	0.68	0.72	0.68	0%
Greene	0.57	0.57	0.57	0.58	0.57	0%
Hancock	0.19	0.19	0.19	0.19	0.19	1%
Jackson	1.02	1.02	1.02	1.02	1.02	0%
Laurens	12.60	12.91	13.41	14.22	14.61	16%
Morgan	3.06	3.10	3.16	3.23	3.31	8%
Oconee	2.89	2.89	2.89	2.90	2.89	0%
Putnam	2.01	2.01	2.02	2.04	2.05	2%
Walton	2.17	2.17	2.17	2.16	2.17	0%
Washington	15.40	16.42	17.91	19.82	21.71	41%
Wilkinson	0.24	0.25	0.25	0.26	0.27	12%
Total	**41.2**	**42.6**	**44.6**	**47.5**	**49.8**	**21%**

Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (2022).
Notes: Crop demands represent dry year conditions, in which 75% of years had more rainfall and 25% of years had less.
Agricultural withdrawals (crop and non-crop) are supplied by groundwater and surface water.
Values represent forecasted annual average demand (AAD) in million gallons per day (MGD).

4.4 Water for Thermoelectric Power Forecasts

Thermoelectric water withdrawal and consumption demands were developed for the State of Georgia based on forecasted power generation needs and assumptions regarding future energy generation processes. The ad-hoc Energy Advisory group helped identify the mix of future fuel sources and potential water needs from various energy generation processes. Thermoelectric facilities (powered by fossil fuels or nuclear energy) are the primary types of power plants that utilize water for cooling.

Thermoelectric facilities use a significant amount of water, but their water consumption varies depending on the type of cooling used for power generation. The two major types are once-through cooling and closed-loop cooling. Once-through cooling systems use water to condense steam. River or lake water is passed through a heat exchanger to condense steam, the condensed steam is pumped back through the steam cycle, and the cooling water is returned to its source. Although the consumptive water use is minimal at the power plant, the amount of water withdrawn from the river or lake is significant. However, the once-through cooling water is immediately returned to the source. Closed-loop cooling systems were designed to minimize the amount of water withdrawn and/or to minimize the heat rejected to the receiving river or lake. Closed-loop systems also use water for cooling to condense the steam, but the heat is rejected through evaporation in a cooling tower. The cooling water is pumped in a closed loop between the cooling tower and the condenser heat exchanger; makeup water is required to replace the water that evaporates. Closed-loop systems consume much more water than once-through



systems, which return most of the withdrawal with minimal consumption. However, closed-loop systems withdraw less water because less water is needed to make up the evaporated portion. Note that all generating facilities in Georgia with once-through cooling have been retired.

There are six energy facilities in this Region, in Jackson, Walton, and Washington Counties. The forecast analysis covers both water withdrawal requirements and water consumption associated with energy generation. Information related to water withdrawals is an important consideration in planning for the water needed for energy production. However, water consumption is an important element when assessing future resources because the volume of water not consumed is typically returned to the environment following the energy production process. The Region's total water withdrawal need for the energy sector and the respective consumptive water need is provided in Table 4-5.

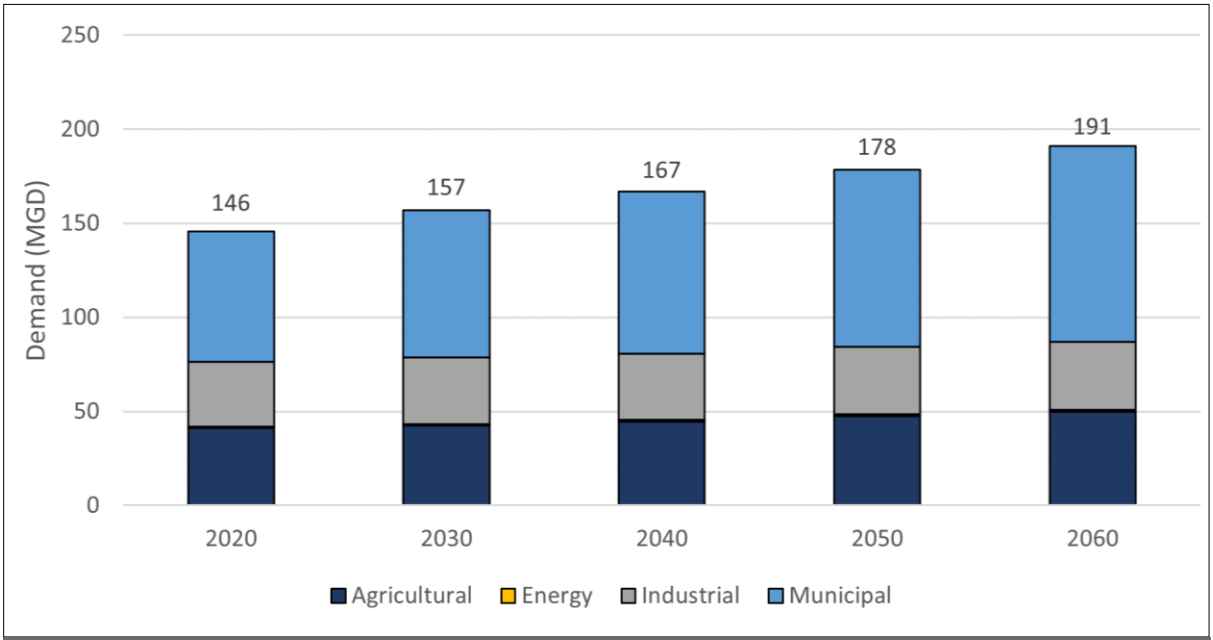
Table 4-5 Energy Sector Water Demand Forecast (AAD-MGD)

Demand Type	2020	2030	2040	2050	2060
Withdrawals	0.72	0.72	0.94	1.05	1.15
Consumption	0.63	0.63	0.83	0.92	1.01

Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (2022).
Notes: Values represent forecasted annual average demand (AAD) in million gallons per day (MGD).

4.5 Total Water Demand and Wastewater Flow Forecasts

Total water demand forecasts for the years 2020-2060 for the Upper Oconee Region are summarized in Figure 4-4. This figure presents the forecasts for municipal, industrial, agricultural, and thermoelectric power. Overall, the water demands in the region are expected to grow by 31% (45 MGD) from 2020 through 2060. Municipal water demand is currently the largest demand, followed by agricultural water demand and then industrial water demand. Energy demand in the region is minimal.

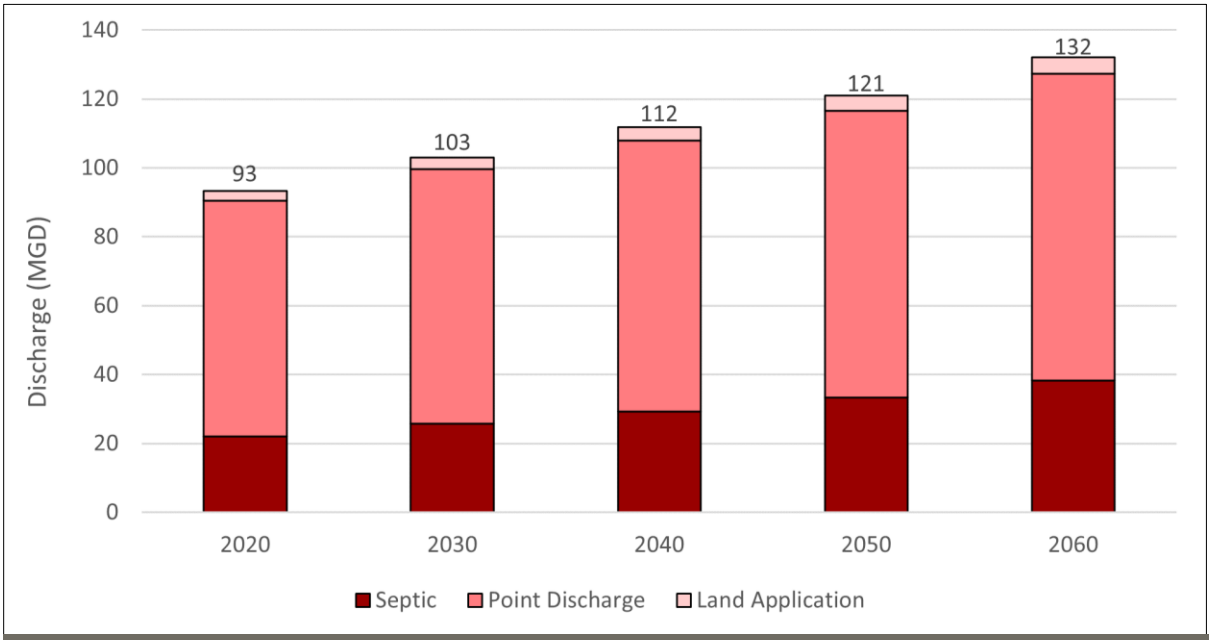


Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (2022).
Notes: Values represent forecasted annual average demand (AAD) in million gallons per day (MGD).

Figure 4-4 Water Demand Forecast by Sector

Figure 4-5 summarizes total wastewater forecasts from 2020 through 2060 for the Upper Oconee Region. This figure presents the forecasts by the anticipated disposal system type: point discharge, LAS, or discharge into a septic system. Overall, wastewater flows in the region are expected to grow by 42% (39.9 MGD) from 2020 through 2060.

The increase in wastewater quantity is particularly significant in fast-growing counties such as Barrow, Jackson, Oconee, and Walton. Strategic wastewater management will be essential to protecting the Region's surface water quality.



Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (2022).
Notes: Values represent forecasted annual average Demand (AAD) in million gallons per day (MGD).

Figure 4-5 Total Wastewater Flow Forecast (AAD-MGD)

SECTION 5

Comparison of Available Resource Capacity and Future Needs

Section 5 Comparison of Available Resource Capacity and Future Needs

Summary

For groundwater availability, no resource challenges are expected to occur over the planning horizon.

Increased demand in the region may add to potential challenges with surface water availability at a few water withdrawal and wastewater discharge facilities.

Potential needs for infrastructure capacity include water supply capacity in Hancock County and wastewater infrastructure Greene, Jackson, and Oconee counties.

Results indicate potential nutrient issues in Lake Oconee and Lake Sinclair without implementation of Management Practices to reduce nutrient loadings.

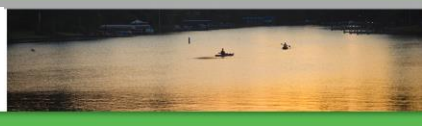
This Section compares the water demand and wastewater flow forecasts (Section 4) with the Resource Assessments, (Section 3), providing the basis for selecting the water management practices discussed in Sections 6 and 7. As described in Section 3, a potential "challenge" is defined as a condition where the modeled future conditions exceed the Resource Assessment metric. By contrast, a potential "need" is defined as a condition where the current permitted capacity of water or wastewater treatment facilities is less than the future forecast demands (i.e., there may be a need for new or upgraded infrastructure; see Section 5.4).

Areas where future demands exceed the estimated capacity of the resource for groundwater availability, surface water availability, and surface water quality (the assimilative capacity of the waterway) will be addressed through the management practices described in Section 6.2. Similarly, areas where future demand exceed the current permitted water supply or wastewater treatment capacity may have needs that should be addressed through the management practices. This section summarizes these potential challenges and needs, also referred to as water resource management issues, for the Upper Oconee Region.

5.1 Groundwater Availability Comparisons

There are three priority aquifers within the Upper Oconee Region. North of the Fall Line, in the Piedmont Physiographic Province, the Crystalline rock aquifer system is located beneath Barrow, Jackson, Walton, Oconee, Morgan, Greene, Putnam, Baldwin, and Hancock Counties. South of the Fall Line, the Cretaceous aquifer system is located beneath Wilkinson, Washington, and Laurens Counties in Georgia's Coastal Plain. The Floridan aquifer is located south of the portions of the Region within the Eastern Coastal Plain. Only a small portion of the Region includes the Floridan aquifer.

The results from the *Groundwater Availability Assessment* estimated the potential range of sustainable yield for each of the three priority aquifers in the Region based on the models developed for the respective aquifers. The sustainable yields were then compared to the projected 2060 groundwater demands across Water Planning Regions. The assessment concluded that supplies from the Crystalline-Rock, Cretaceous, and Floridan aquifers are generally sufficient in meeting the forecasted groundwater demand from areas with access to these aquifers.



Crystalline-Rock Aquifer – Many communities in the upper portion of the Region use groundwater from the Crystalline-Rock aquifer to meet local needs or supplement their surface water supply sources. In addition, groundwater is drawn from this aquifer for self-supply wells in the region. A small portion of the Crystalline-Rock aquifer within the Upper Oconee Region was modeled as part of the *Groundwater Availability Assessment* giving a low range normalized sustainable yield of 0.01 MGD per square mile of area. Using this conservative value for planning would give an estimated sustainable yield for the Upper Oconee area overlaying the Crystalline-Rock aquifer of about 30 MGD on an annual average basis. Total estimated demands in this same area are 1.1 MGD in 2020 increasing to 2.2 MGD in 2060. Current aquifer-wide demands are estimated at 17.4 MGD, increasing to 18.1 MGD in 2060.

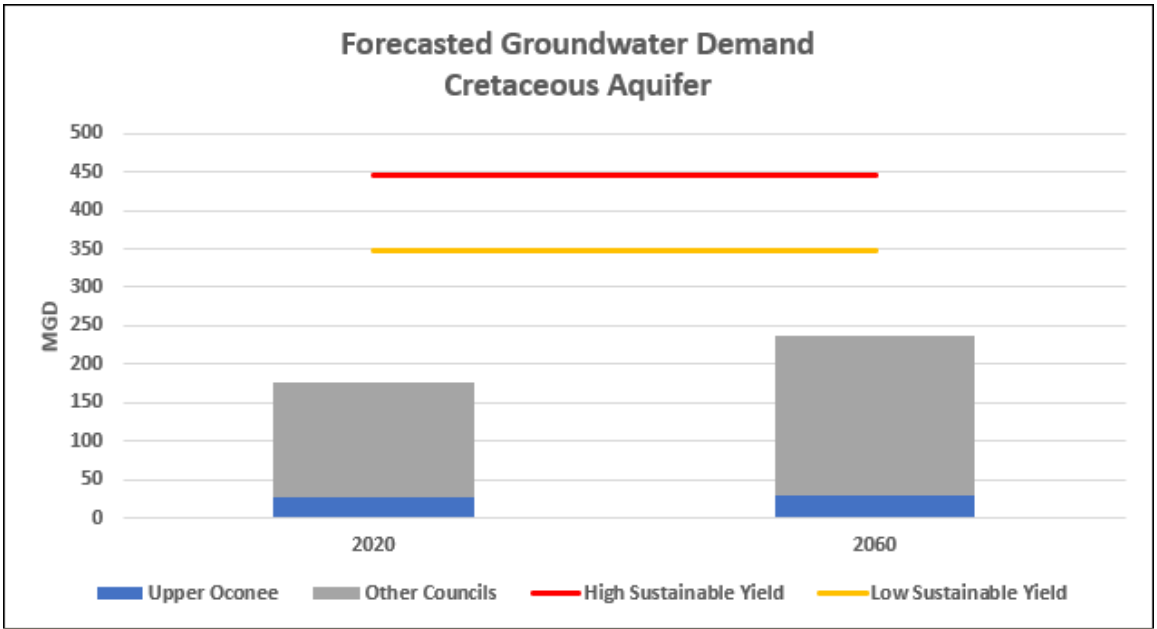
Cretaceous Aquifer – The Cretaceous aquifer is a significant water source in the Upper Oconee Region and in other water planning regions in Georgia (Table 5-1). The sustainable yield for the prioritized aquifer units modeled is estimated to range from 347 to 445 MGD. Projections for water use from the multiple regions with access to this aquifer show that future demand within the modeled area is not projected to exceed the sustainable yield in future years (Figure 5-1). The demand estimates include 75th percentile agricultural demands representing dry year conditions. Because the Resource Assessment modeling is not specific to individual planning regions, site-specific studies would likely be required to determine the sustainable yield of this aquifer in any particular local area.

Floridan Aquifer – The total estimated range of sustainable yield for the Floridan aquifer in the South-Central Georgia and Eastern Coastal Plain modeled portions of the aquifer is higher than forecasted 2060 groundwater demands from regions with access to this aquifer (Table 5-1). The projected water supply need from this aquifer for the Upper Oconee Region is approximately 15 MGD in 2060 from the southern portion of the region (Laurens, Washington, and Wilkinson counties utilize this aquifer). The modeling results indicate that significant additional resources are available from the Floridan aquifer.

Table 5-1 Groundwater Availability Assessment Results: Cretaceous Aquifer and Floridan Aquifer in South-Central and Eastern Coastal Plain

	Cretaceous Aquifer	Floridan Aquifer in South-Central and Eastern Coastal Plain
Upper Oconee Region Demand: 2060 Use (mgd)	29	15
Aquifer-Wide Demand: 2060 Use (mgd)	237	684
Sustainable Yield Range (mgd): Low End	347	868
Sustainable Yield Range (mgd): High End	445	982

Source: GAEPD modeling data, 2023.



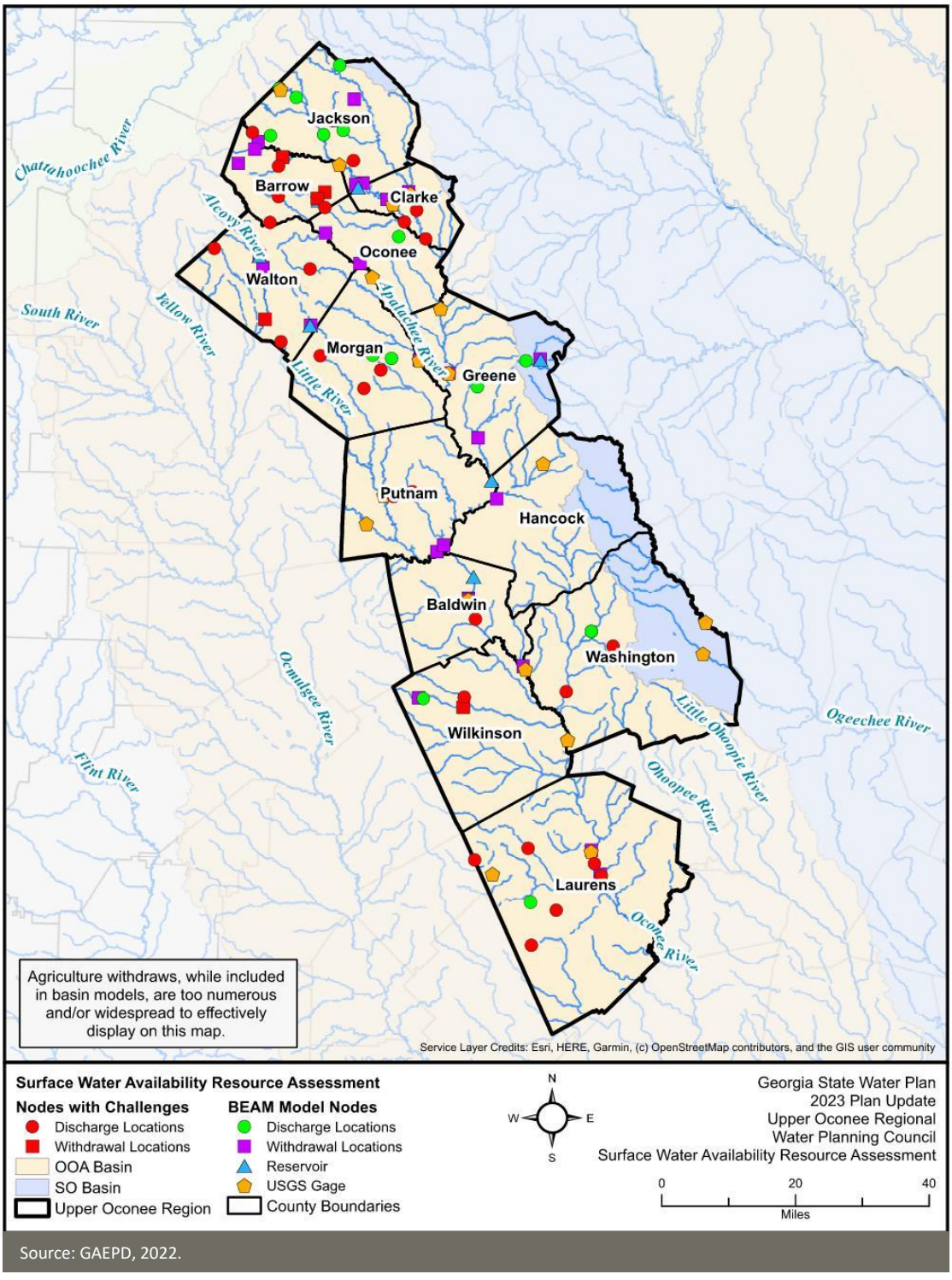
Sources: Supplemental Modeling conducted for the Cretaceous and Claiborne Aquifers, 2011. Upper Oconee Updated Demand Forecast Technical Memorandum, 2017.

Figure 5-1 Demand in Cretaceous Aquifer Between Macon and Augusta vs. Estimated Yield

5.2 Surface Water Availability Comparisons

The evaluation of surface water availability is based on projected surface water demands for 2060 and modeled results of their impact on streamflows at permitted water withdrawal and wastewater discharge facilities. The new BEAM model allowed evaluation of surface water availability at a much high level of resolution (Figure 5-2). The nodes in Figure 5-2 include all of the permitted water withdrawal and wastewater discharge facilities, which are among the locations where the BEAM model can apply projected surface water demands and identify potential water availability challenges. GAEPD's modeling located facilities with water availability challenges. Metrics indicated when and by how much surface water was not available to meet forecasted water withdrawals, based on instream flow protection thresholds in withdrawal permits, or to assimilate forecasted wastewater discharges, based on the availability of water to meet the discharge flow requirements (i.e., 7Q10 flow).[9]

[9] 7Q10 is a commonly applied metric for assessing low flow conditions. It is the lowest 7-day average flow that occurs on average once every 10 years. Additional information about low flow metrics is available from the Environmental Protection Agency at https://www.epa.gov/ceam/definition-and-characteristics-low-flows



Source: GAEPD, 2022.

Figure 5-2 Surface Water Availability Assessment Nodes With Potential Challenges

Table 5-2 summarizes the surface water availability challenges seen in modeled results with 2060 projected demands. Potential water supply challenges were seen in modeled results for four out of 30 water withdrawal facilities analyzed. Potential challenges with wastewater assimilation are seen in 27 of the 44 wastewater discharge facilities analyzed.

Table 5-2 Summary of Current Water Supply and Wastewater Assessment Results: Projected Future Demand

	Facility Type	# of permitted facilities analyzed	# of permitted facilities with challenge indicated
Water Withdrawals	Municipal	22	3
	Industrial	6	1
	Energy	2	0
Wastewater Discharge Assimilation	Municipal	34	26
	Industrial	8	1
	Energy	2	0

Source: GAEPD
Note: Permitted direct discharges of wastewater are included in the evaluation but land application systems are not.

Table 5-3 provides detailed results for the first set of metrics for surface water availability, which compare streamflows to the instream flow protection threshold at a water withdrawal facility and indicate availability for water supply. Potential challenges were seen at one industrial facility in Wilkinson County; the remainder of facilities with potential challenges are municipal withdrawal facilities in the upper portion of the basin. This is consistent with the future surface water demand projections by county discussed in Section 4, which show that most future demands are projected to occur in the upper portion of the basin (i.e., Jackson, Barrow, Athens-Clarke, Oconee, and Walton Counties). The largest shortage is associated with a permit held by the City of Statham for a reservoir on Barber Creek which, at least partially, resulted from a lack of data on that reservoir's storage capacity.

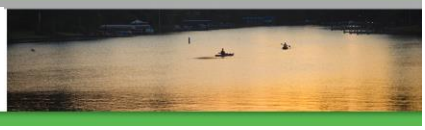


Table 5-3 Water Supply Challenges Indicated in Assessment Results: Projected Future Demand

Facility (permit number)	Amount of time in model period		Total volume of shortage (million gallons)		
	Days with shortage	% of model period[1]	In model period	In 2007-08 drought	In 2011-12 drought
City of Social Circle (147-0410-01)	2479	8.48	226.4	22.09	19.31
City of Statham (007-0304-07)	27169	92.98	2965.73	103.82	93.98
City of Statham (007-0304-04)	331	1.13	17.57	7.5	9.47
BASF Catalysts LLC (158-0314-03)	4576	15.66	1980.21	133.99	183.72

Notes:
[1] % time is calculated as a proportion of the full model period (1939-2018). Shortage is total volume for full model period or for the drought period indicated. Each drought period includes the full two years listed.

Table 5-4 shows detailed results for the second set of metrics used to indicate potential surface water availability challenges: shortages in the amount of water needed to assimilate treated wastewater. The table provides details on facilities for which modeled flows fell below the 7Q10, indicating a shortage. No shortage was seen in modeled flows at 8 municipal facilities; 7 industrial facilities; and 1 thermoelectric power facility: Maysville WPCP (GA0032905); Jefferson (Central City WPCP; GA0023132); Jackson County Water & Sewer Authority (Middle Oconee WPCP; GA0002712); Hoschton WPCP (GA0035980); Oconee County (Calls Creek WPCP; GA0050211); City of Madison (Northside WPCP; GA0023159); City of Greensboro (South WPCP; GA0021351-1); Dexter WPCP (GA0048682); KEMRON Environmental Services, Inc. (GA0050277-1; GA0050277-2); Wayne Farms (GA0039390); Georgia Pacific (GA0047988); Imerys Clays Inc. Sandersville (GA0002135-1; GA0002135-2); BASF Corporation (Gordon; GA0003271); and Georgia Power Co - Plant Branch (117-0390-01).

For the facilities with a shortage, a substantial increase in the percent of time with a shortage, when compared to the baseline presented in Section 3, would indicate an increased risk of violations of ambient water quality standards. However, that is not the case for the wastewater discharge facilities in this Region. Only 8 facilities in Table 5-4 show an increase in percent time with shortages and none of the increases are larger than one percentage point. In fact, many of the facilities show a lower percent time with shortages compared to the baseline, largely due to projected increases in return flows from upstream wastewater discharges. These results do not indicate substantial concerns about availability of surface water for assimilation of treated wastewater at this time. GAEPD will use this information to guide communications about future capacity and permit requirements with the water pollution control plant (WPCP) facilities with the highest percent of time with a shortage. Those facilities include the Eatonton - Putnam Water & Sewer Authority's Eastside WPCP, the Gordon WPCP, and the City of Dudley WPCP.

Table 5-4 Wastewater Assimilation Challenges Indicated in Assessment Results: Projected Future Demand

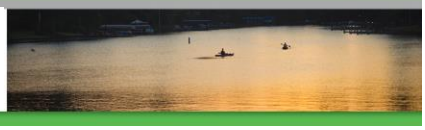
Facility	Permit #	7Q10 Flow[1]	Days of shortage over model period	% of time[2]	Change in % of time compared to current conditions[3]
Loganville (Loganville WPCP)	GA0020788	0.14	67	0.23	0
Athens-Clarke County (North Oconee WRF)	GA0021725	34.7	579	1.98	-0.25
Braselton (Braselton WRF)	GA0038857	4.27	43	0.15	0.07
Winder (Cedar Creek WPCP)	GA0038776	1.22	420	1.44	0
Arcade (Arcade WRF)	GA0039110	41.1	8	0.03	-0.81
Barrow County BOC (Barber Creek WRF)	GA0038733	0.15	600	2.05	-0.84
Oconee County BOC (Rocky Branch WRF)	GA0038806	3.03	675	2.31	-0.53
Athens-Clarke Co. (Middle Oconee WPCP)	GA0021733	47.43	135	0.46	-0.64
Athens-Clarke Co. (Cedar Creek WPCP)	GA0034584	91.82	49	0.17	-0.78
Winder (Marburg Creek WPCP)	GA0023191	1.29	634	2.17	0
Barrow County BOC (Tanners Bridge WPCP)	GA0039314	6.69	631	2.16	0
Monroe (Jack's Creek WPCP)	GA0047171	2.74	1066	3.65	0
Madison (Southside WPCP)	GA0023141	0.23	2152	7.36	0
Eatonton - Putnam Water & Sewer Authority (Eastside WPCP)	GA0032271	0.76	6076	20.79	0.35
Madison (Indian Creek WRF)	GA0038741	1.38	1537	5.26	0.08
Rutledge (Rutledge WPCP)	GA0025895	0.07	288	0.99	0.34
Social Circle (Little River WPCP)	GA0026107	0.02	37	0.13	0
Eatonton - Putnam Water & Sewer Authority (Westside WPCP)	GA0032263	0.08	1279	4.38	0
Cadwell (Cadwell WPCP)	GA0025887	0.18	1011	3.46	1.00
Milledgeville (Milledgeville WPCP)	GA0030775	285.89	1179	4.03	-0.77
Sandersville (Sandersville WPCP)	GA0032051	0.36	348	1.19	0
Tennille (City of Tennille WWTP)	GA0039357	15.1	321	1.1	0
Dublin (Dublin WPCP)	GA0025569	574.45	1746	5.98	-0.45
Westrock Southeast, LLC	GA0032620	575.84	1792	6.13	-0.45
Gordon (Gordon WPCP)	GA0020397	6.97	9692	33.17	0.61
Dudley (Dudley WPCP)	GA0023957	14.68	5880	20.12	0.04
Rentz (Rentz WPCP)	GA0037630	2.52	316	1.08	0.29

Notes:

[1] 7Q10, commonly used as a metric to assess low flow conditions, is the lowest 7-day average flow that occurs on average once every 10 years.

[2] The model period is 1939-2018; % time is the proportion of the model period when average daily flow is below the 7Q10 (i.e., shortage occurs).

[3] Negative numbers mean that the time with shortages is less than that seen under current conditions. See Table 3-5 for % of time with shortage under current conditions.



In general, surface water availability challenges are driven by both net consumption (withdrawal minus returns) and year to year variations in river flows. In wet years, the region is likely to not experience any potential challenges in meeting off-stream uses and instream needs. In dry years, the potential challenges are likely to be more severe. A variety of management practices can address future challenges in dry years. Examples include the following:

- Interconnections between neighboring water providers;
- Drought management measures implemented by GAEPD and users in the Region;
- Development of alternate water supply sources like the quarry projects undertaken by Athens-Clarke County and the cities of Auburn and Winder; and
- Development of new water supply storage.

In addition to the surface water availability assessment modeling, the existing permitted water withdrawals (surface water and groundwater) and future demands were compared to identify potential needs in available facilities or infrastructure (Table 5-5). With one exception, all future needs across the Region can be met through current permitted water withdrawal capacity. For Hancock County, the projected water demand is slightly higher than the current permitted capacity. Estimates were calculated by comparing the permitted monthly average withdrawal limit with the forecast annual average demands. Therefore, these estimates are only an indicator of potential future needs in permitted capacity and indicate areas where continued localized facility planning will be needed, but are useful for regional planning.

Table 5-5 Permitted Municipal Water Withdrawal Limits vs. 2060 Forecasted Demands (MGD)[1,2]

County	Current Permitted Water Withdrawals[3]	Projected 2020 Water Demand[3]	Projected 2060 Water Demand[3]	2060 Permitted Capacity Need[4]
Baldwin	12.9	6.1	4.6	-
Barrow	14.4	7.7	19.7	*
Athens-Clarke	34.6	11.5	14.9	*
Greene	5.5	2.4	3.8	-
Hancock	1.08	1.47	1.0	0.02
Jackson*	111.7	8.1	16.4	*
Laurens	7.4	4.1	3.7	-
Morgan	2.9	1.9	2.5	-
Oconee	2.8	3.6	7.1	*
Putnam	7.0	1.9	1.9	-
Walton*	112.3	7.6	12.1	*
Washington	4.4	2.7	2.3	-
Wilkinson	0.9	0.8	0.7	-

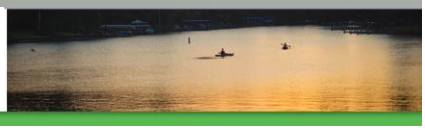
Source: GAEPD Permit Data.
Notes:
[1] Permitted municipal water withdrawals and projected water demands include publicly supplied surface water and groundwater. It also includes industrial facilities that purchase their water from municipal sources.
[2] It does not include self-supply.
[3] All units shown are MGD Average Annual Demand (AAD).
[4] Analysis does not account for demands in one county that may be met by permits from another county.
* Bear Creek reservoir withdrawals in Jackson County also supply Barrow, Clarke, and Oconee counties. Hard Labor Creek reservoir withdrawals in Walton County also supply Oconee County.

5.3 Surface Water Quality Comparisons (Assimilative Capacity)

This section summarizes the results of the *Assimilative Capacity Resource Assessment,* (GAEPD, 2017a) and the water quality challenges that the Upper Oconee Region may face, based on projected 2060 wastewater flows and assumptions.

5.3.1 Assimilative Capacity Assessments

The Assimilative Capacity Resource Assessment drew upon water quality modeling tools to estimate the ability of streams and estuaries to assimilate pollutants under current and future conditions. As described in Section 3, pollutant loads come from permitted discharges of treated wastewater and nonpoint sources carried in stormwater runoff. Assimilation of pollutants occurs through physical, chemical, and biological processes. Modeling focused on instream dissolved oxygen (DO) and incorporated all municipal and industrial wastewater facilities operating at their full permitted discharge levels (flow and effluent discharge limits as of 2019).



The results of the DO modeling at current permitted conditions are presented in Figure 5-3 and Table 5-6 for the Upper Oconee Region, which includes portions of the Altamaha, Ocmulgee, Oconee, Ogeechee, and Savannah River basins. The results show the modeled effects of oxygen-demanding compounds in wastewater and other factors on instream DO levels. Stream segments denoted as red lines in Figure 5-3 have estimated instream DO levels below the DO water quality criteria, indicating that their assimilative capacity has been exceeded. It is important to note that an exceedance of DO assimilative capacity on a stream segment could be the result of a point source discharge, non-point source loading, or a naturally low instream DO condition. Reaches within the Upper Oconee Region that have exceeded their full assimilative capacity under the current conditions assessment include:

- Little Cedar Creek in the Altamaha Basin
- Fulsom Creek tributary in the Ogeechee Basin; and
- Little River, an unnamed tributary to Big Indian Creek, and portions of the mainstem of the Oconee River downstream of the confluence of Turkey Creek in Laurens County in the Oconee Basin.

Table 5-6 Permitted Assimilative Capacity for DO in Upper Oconee Planning Council: Current Conditions

Basin	Available Assimilative Capacity (Total Mileage)							Total River Miles Modeled in the Region
	Very Good (≥1.0 mg/L)	Good (0.5 to <1.0 mg/L)	Moderate (0.2 to < 0.5 mg/L)	Limited (>0.0 to <0.2 mg/L)	At Assimilative Capacity (0.0 mg/L)	Exceeded (<0.0 mg/L)	Un-modeled	
Altamaha	0	3	11	6	8	2	0	30
Ocmulgee	39	4	4	9	0	0	0	55
Oconee	407	176	31	20	1	14	0	649
Ogeechee	21	58	27	2	0	1	4	113
Savannah	1	0	0	0	0	0	0	1

Source: GAEPD, 2019.

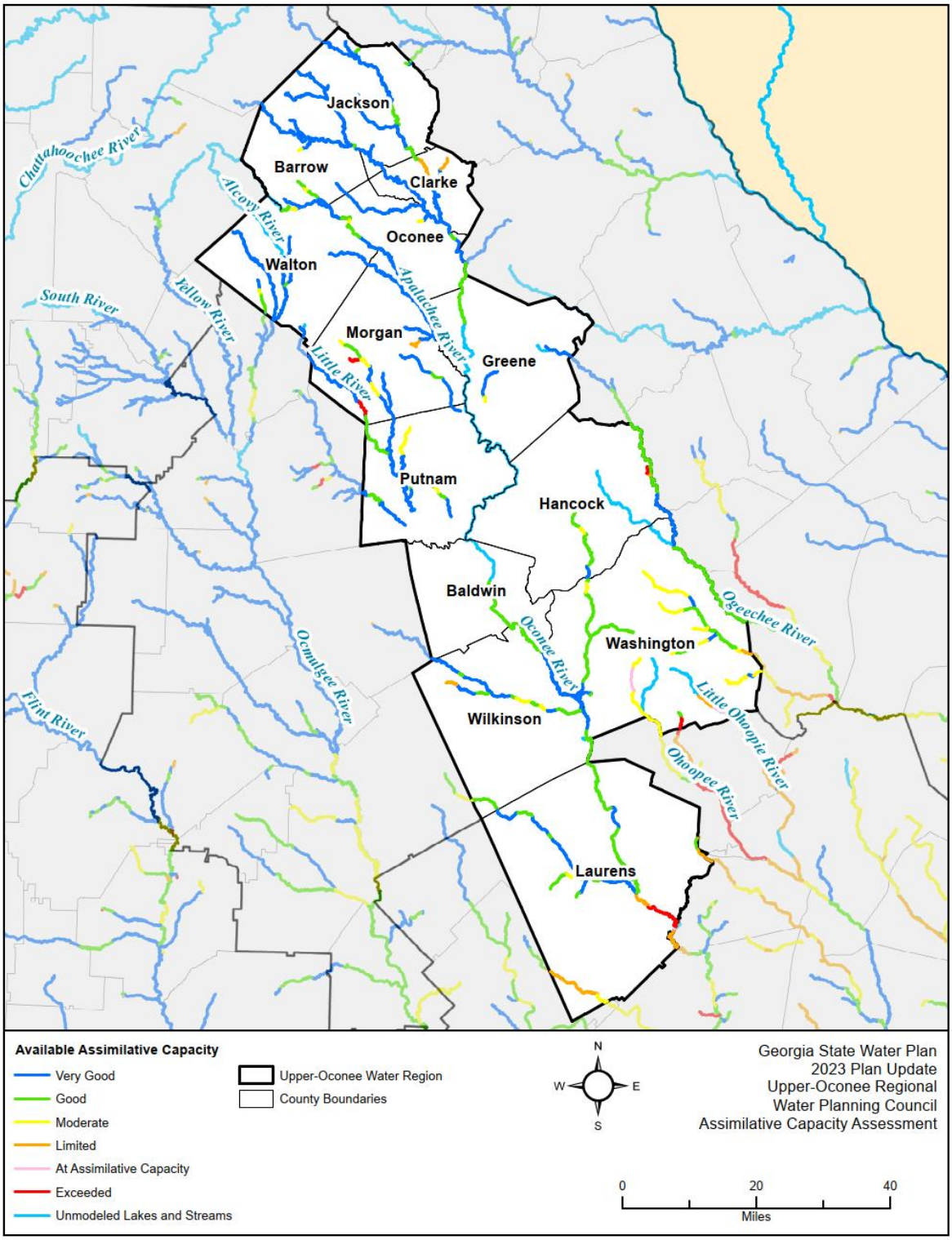
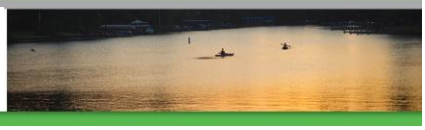


Figure 5-3 Results of Assimilative Capacity Assessment – DO at Current Permitted Conditions



Based on the results shown in Figure 5-3, GAEPD also conducted modeling under future conditions. In order to address areas of limited or no assimilative capacity for DO, GAEPD incorporated some assumptions regarding future (2060) permitted flows and modifications to permit effluent limits. Since GAEPD cannot issue permits that will violate water quality standards, GAEPD will continue to evaluate and modify future permit requests and adjust permit limits to avoid potential DO violations. Figure 5-4 shows the assimilative capacity at assumed future (2060) permitted flows and effluent limits. More information regarding the type of assumptions made under future conditions modeling is provided in the *Assimilative Capacity Resource Assessment* on the Georgia water planning website (https://waterplanning.georgia.gov).

5.3.2 Nutrient Loadings

For the previous plan, watershed-based modeling to evaluate nutrient loadings under 2050 conditions was completed for watersheds contributing to the areas upstream of Lakes Oconee and Sinclair. That modeling supported adoption of new chlorophyll *a* water quality standards for Lakes Oconee and Sinclair. In Georgia, there are now eight lakes that have lake standards: West Point, Walter F. George, Jackson, Lanier, Allatoona, Carters, Oconee, and Sinclair.

Lake Oconee chlorophyll *a* standards include "shall not exceed" criteria for three different locations. At the following locations, monthly samples in the months of April – October cannot exceed the specified average concentrations more than once in a five-year period: 26 micrograms per liter (µg/L) at Oconee Arm at Highway 44; 15 µg/L at Richland Creek Arm; and 18 µg/L upstream from the Wallace Dam Forebay. The new Lake Sinclair chlorophyll *a* standards include criteria that shall not be exceeded more than once in a five year period criteria at three locations: Oconee River Arm Midlake cannot exceed average of 14 µg/L, Little River and Murder Creek Arm upstream from Highway 441 cannot exceed 14 µg/L, and upstream from the Sinclair Dam Forebay cannot exceed 10 µg/L.

Modeling assumptions included no changes to the total phosphorus (P) limits or concentrations for all facilities that have permit limits. For facilities with discharges greater than 1 MGD that currently don't have Total P limits, a Total P concentration of 1 mg/L for both current and future model runs was assumed. For facilities with discharges less than 1 MGD, the current discharge had a Total P concentration of 4 mg/L and all future discharges had a concentration of 8.34 mg/L above a flow of 0.02 MGD. Below this flow, the Total P concentration would be 5 mg/L.

Modeling results are shown in Figure 5-5 for Lake Oconee and Figure 5-6 for Lake Sinclair. The years on the x-axis indicate the climatic and hydrologic conditions used in the model. Results are shown for current conditions and projected 2050 conditions. For each of those time periods, the figures show the total modeled chlorophyll *a* level (blue in Figure 5-5 and purple in Figure 5-6). The figures also include orange lines that show the amount of the total from nonpoint sources in the watershed.

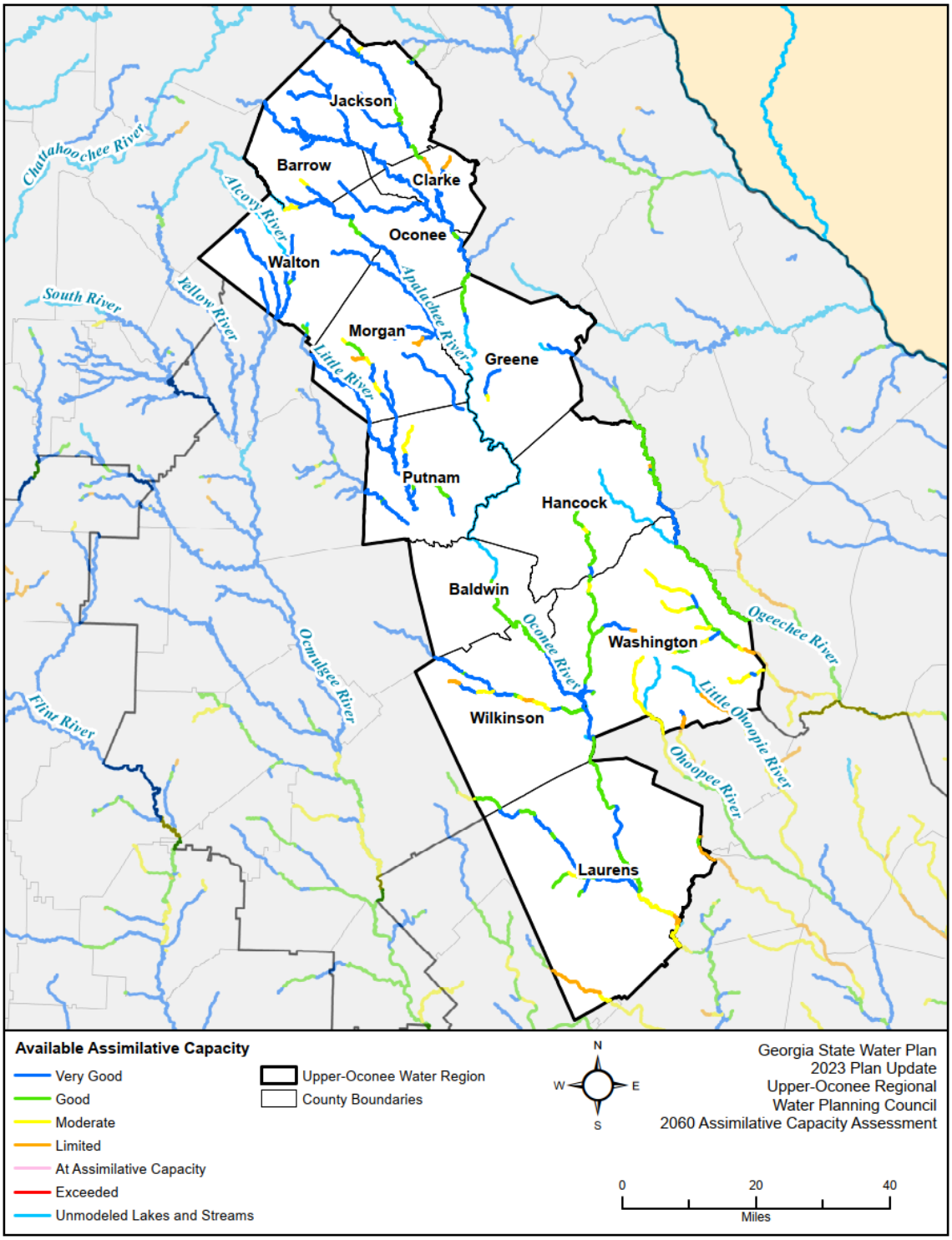
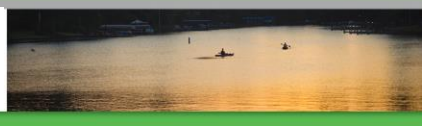


Figure 5-4 Results of Assimilative Capacity Assessment – DO at Assumed Future (2060) Permitted Conditions



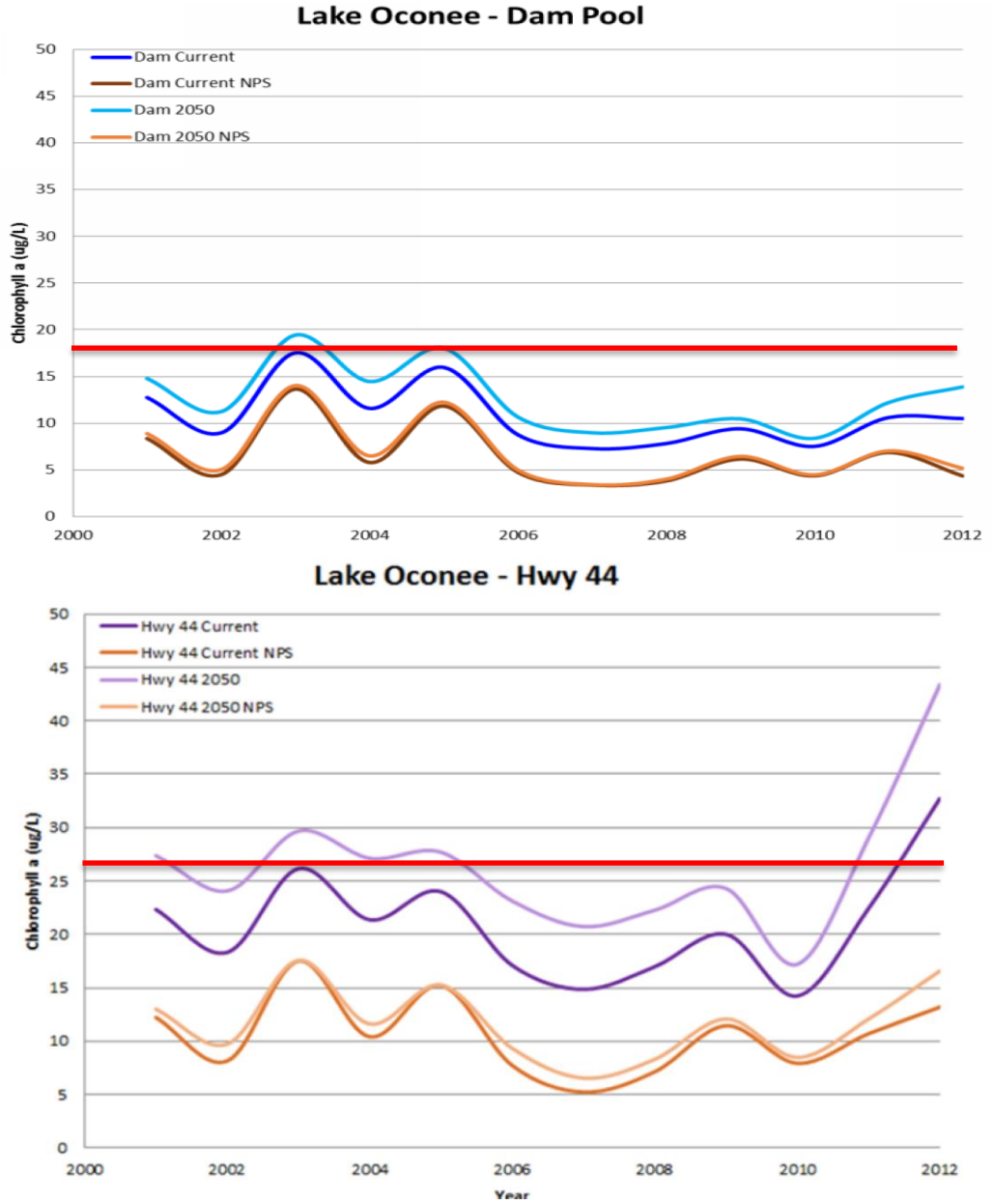


Figure 5-5 Growing Season Median Chlorophyll-a Concentration – Lake Oconee

Figure 5-5 indicates that, when current and 2050 conditions are compared at the Lake Oconee Dam Pool, chlorophyll levels increase slightly due to land use changes and quite a bit due to increase in the loads from major point sources. Results are similar but more dramatic for the portion of the Lake near Hwy 44.

Modeling completed for Lake Sinclair (Figure 5-6) indicates that the chlorophyll *a* levels also are projected to increase between current and 2050 conditions. As discussed in Section 3, recent

chlorophyll *a* measurements in Lake Oconee and Lake Sinclair exceeded the chlorophyll *a* criteria. Management practices for nutrient reductions from both point and nonpoint sources will be needed in order for waters to meet the new standards and to maintain conditions in Lakes Oconee and Sinclair.

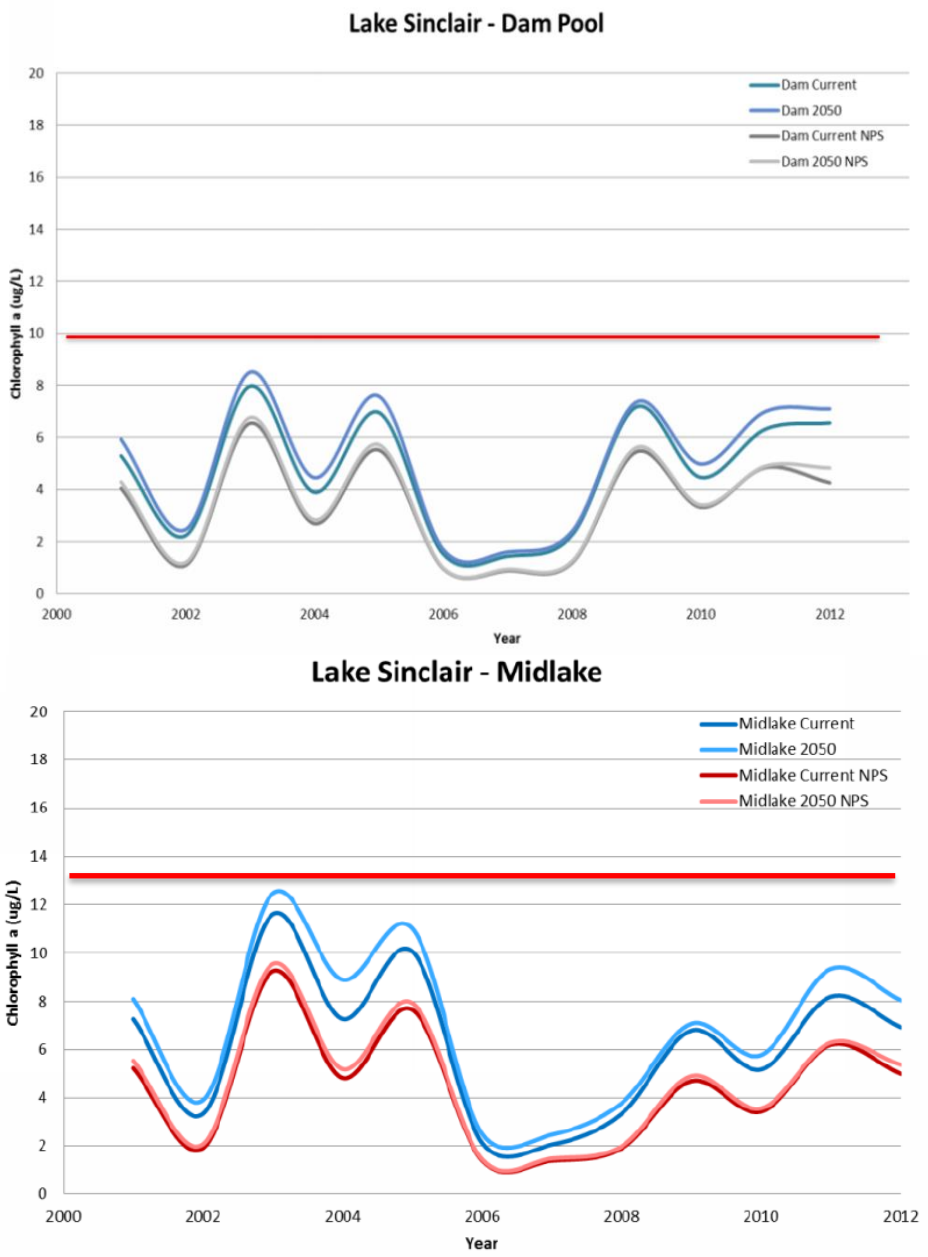
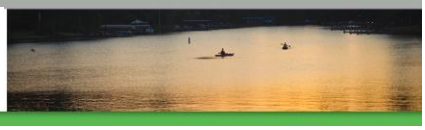


Figure 5-6 Growing Season Median Chlorophyll-a Concentration – Lake Sinclair



5.4 Future Treatment Capacity Comparison

Comparison of the forecasted wastewater demand with existing permitted capacity indicates that future demands for municipal wastewater management can largely be met with existing permitted facilities (Table 5-7). Availability of existing permitted wastewater capacity in the Region suggests that future management practices described in Sections 6 and 7 will need to focus on the specific counties where capacity shortages are likely to occur. This currently includes just Greene, Jackson, and Oconee counties. The permitted quantities are based on existing municipal facilities permitted under the National Pollutant Discharge Elimination System (NPDES) or State land application systems (LAS) permits. It should be noted that the comparison in Table 5-7 was completed at the county level and additional localized shortages in treatment capacity may exist.

Table 5-7 Permitted Municipal Wastewater Discharge Limits vs. 2060 Forecasted Municipal Wastewater Flows (MGD)[1]

County	Point Source (PS)			Land Application Systems (LAS)		
	2060 Forecast[1]	Permitted Capacity	2060 Surplus or Need (-)	2060 Forecast[2]	Permitted Capacity	2060 Surplus or Need (-)
Baldwin	2.60	10.50	7.90	0	0	0
Barrow	5.72	11.10	5.38	1.34	1.41	0.08
Athens- Clarke	21.35	28.04	6.69	0.01	0.01	0.00
Greene	0.45	1.45	1.00	0.71	0.65	- 0.06
Hancock	0.04	0.06	0.02	0.33	0.80	0.47
Jackson	12.08	4.17	- 7.91	0.46	0.92	0.46
Laurens	3.47	6.37	2.90	0.21	0.75	0.54
Morgan	0.83	1.71	0.88	0.02	0.10	0.08
Oconee	4.02	2.50	- 1.52	0.12	0.42	0.30
Putnam	0.40	1.10	0.70	0.13	0.57	0.44
Walton	5.40	5.80	0.40	0.02	0.35	0.33
Washington	1.23	2.23	1.00	0.16	0.30	0.14
Wilkinson	0.10	0.79	0.69	0	0	0

Notes:

[1] The forecasted municipal wastewater flows presented are annual average values (MGD), and the permitted capacity values are based upon the monthly average discharge limits (MGD) for wastewater facilities in the County.

[2] Includes industrial wastewater expected to be treated at municipal facilities.

5.5 Summary of Potential Water Resource Challenges and Needs

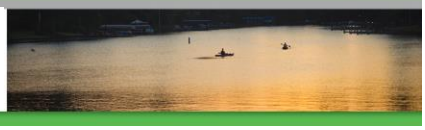
Table 5-8 summarizes the counties occurring upstream of planning nodes with potential water resource challenges or infrastructure needs from the previous subsections to help guide the appropriate selection and application of management practices in Sections 6 and 7. The basis, or source, for each potential challenge or need is noted so the reader can return to that portion of the plan for further explanation. In addition to measured results for chlorophyll *a* in lakes Oconee and Sinclair and the nutrient loading contributed from the lakes' watersheds (Section 3.2.1), the

water quality – impaired waters column also integrates the widespread listings of impaired streams in the Region that were noted in Section 3.3.2.

Table 5-8 Summary of Potential Water Resource Challenges and Infrastructure Needs by County

County	Ground-water Availability	Surface Water Availability	Municipal Water Permitted Capacity	Municipal Permitted Wastewater Capacity	Water Quality – Dissolved Oxygen Assimilative Capacity	Water Quality – Impaired Waters
For more details see:	*Section 5.1*	*Table 5-3*	*Table 5-5*	*Table 5-7*	*Figure 5-4*	*Sections 3.2.1 and 3.3.2*
Baldwin						Yes
Barrow		Yes				Yes
Athens-Clarke						Yes
Greene				Yes		Yes
Hancock			Yes			Yes
Jackson				Yes		Yes
Laurens					Yes	Yes
Morgan					Yes	Yes
Oconee				Yes		Yes
Putnam						Yes
Walton		Yes				Yes
Washington					Yes	Yes
Wilkinson		Yes				Yes
Total Counties	**0**	**3**	**1**	**3**	**3**	**13**

Notes: "Yes" indicates that there is a potential challenge or infrastructure need at a facility or a water quality issue in the indicated county. "Challenge" is defined as a condition where, under current or projected demands, modeled conditions do not meet a Resource Assessment metric. "Need" is indicated in counties where the current permitted water or wastewater capacity is lower than the project demand. For Water Quality – Impaired Waters, "Yes" indicates that exceedances of water quality criteria or violations of water quality standards were observed in some waters in the county.



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SECTION 6

Addressing Water Needs and Regional Goals

Section 6 Addressing Water Needs and Regional Goals

Summary

A prioritization and ranking process resulted in the Council selecting 10 Water Conservation, 7 Water Supply, 8 Wastewater, and 10 Water Quality Management Practices. In 2023, while recognizing that these management practices are still robust and generally applicable, revisions were limited to updates of outdated information due to the number of vacant seats on the Council.

This Section presents the Council's management practices, selected to address the water resource challenges or infrastructure needs identified and described in Section 5 and/or to meet the Council's vision and goals described in Section 1.3. The management practices described here were fully revised in 2017. The Council recognizes that the management practices are generally robust and still applicable. However, due to the number of vacant seats during this round of revision, the Council was concerned that representation and knowledge of the region would not be sufficient to fully revise the management practices. Therefore, 2023 revisions of this section were limited to updates of outdated information.

6.1 Identifying Water Management Practices

The State Water Plan defines management practices as reasonable methods, considering available technology and economic factors, for managing water demand, water supply, return of water to water sources, and prevention and control of pollution to waters of the state. The plan builds upon Georgia's current statutory framework to create a more integrated water management policy, with management practice selection as part of an adaptive four-step water planning process. This process is consistent with current state laws and policies. Figure 6-1 illustrates how it interacts with State-wide water policy.

Identification of potential management practices appropriate for the Region started with a review of existing local and regional plans, which helped update the Council about practices already in place. Section 5 compares the Resource Assessments described in Section 3 with the forecasted future needs described in Section 4. Section 5 also summarizes the Region's existing or likely future water resource or infrastructure issues and demonstrates the need for County- and resource-specific management practices. In areas with no water resource challenges or infrastructure needs, the management practices have been selected to meet needs specified by the Council (i.e., facility needs and practices, programmatic practices, etc.) that are aligned with the Region's vision and goals.

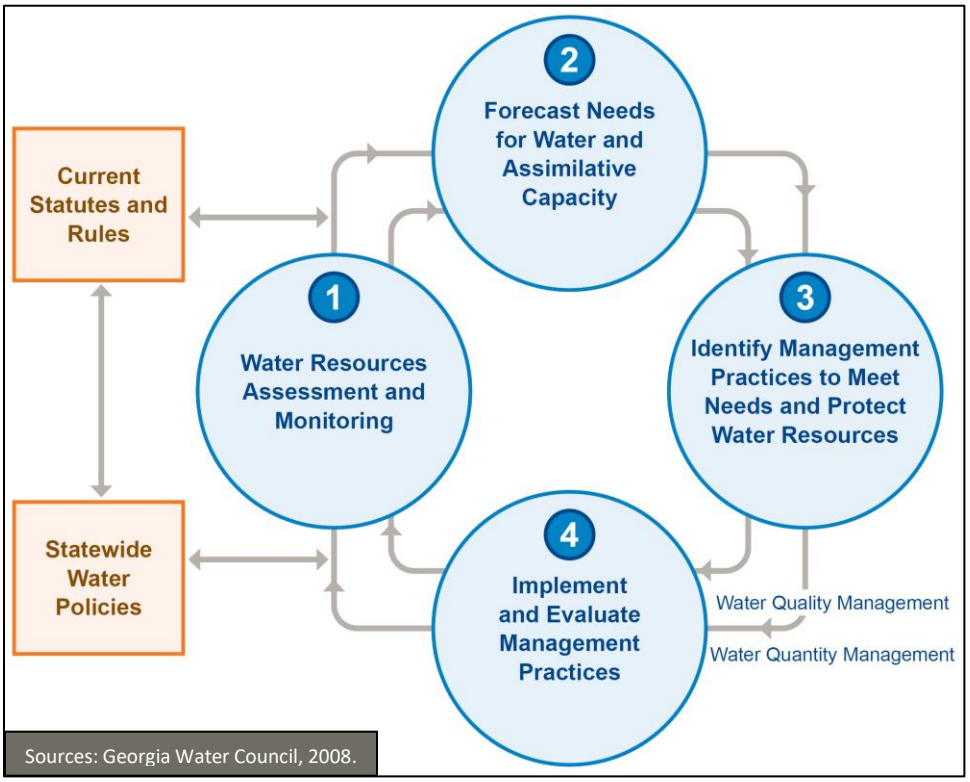


Figure 6-1 Relationship of Management Practices to Georgia Rules and Statutes

6.1.1 Review of Existing Plans and Practices

The Council conducted a comprehensive review of existing local and regional Water Management Plans and relevant related documents to frame the selection of management practices. The types of plans/studies that were reviewed to support identification and selection of the management practices for the Upper Oconee Region consisted of the following:

- Best Management Practices (forestry, agriculture, and stormwater management)
- Comprehensive Work Plans (local and regional scale)
- EPD databases (permitted withdrawals, planned projects, and proposed reservoirs)
- Regional infrastructure and permitting plans
- State-wide guidance documents (conservation, cost, and water planning)
- TMDL evaluations
- Water quality studies, including watershed protection plans (basin, watershed, and local scale)

6.2 Selected Water Management Practices for the Upper Oconee Region

This Section presents the management practices selected by the Council to address the water resource challenges and needs identified in Section 5 and to meet the Council's vision and goals. Each subsection groups management practices by the primary water resource area addressed, such as Water Quality or Water Conservation, and then generally lists the practices in order of the total benefit ranking assigned by the Council. Management practices may not be applicable to all sub-geographies or local governments based on existing conditions or future resource challenges or infrastructure needs. The Council assumes that the list of management practices would be considered for implementation based on local needs. Section 7 provides a summary of the recommendations for implementation responsibilities.

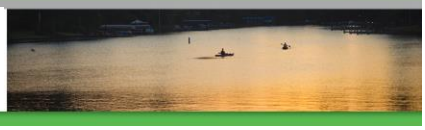
During the 2017 plan update, the Council formed a subcommittee to review and update their original 2011 Regional Water Plan management practices. The subcommittee reviewed the types of management practices already being implemented, local needs, and the feasibility of local implementation of management practices to address potential resource challenges or infrastructure needs. As noted above, 2023 revisions were limited to updates of outdated information. Table 6-1 through Table 6-4 identify the management practices adopted by the Council for implementation.

6.2.1 Water Conservation Management Practices

Georgia will need to practice water conservation in order to meet its long-term water needs. Conservation also helps ensure responsible use of a public resource and may reduce the need for, or delay, implementation of potentially costly water supply management practices. As laid out in this Section, this Regional Water Plan's approach to water conservation will be accomplished by setting water conservation goals and requiring water withdrawal permittees to demonstrate progress toward those goals, while providing for due consideration of technical feasibility, cost-effectiveness, conservation measures in place prior to the adoption of this plan, and water use required by other regulatory programs for human health and sanitation.

Water conservation is a priority management practice in Section 7, Policy 3 of the State Water Plan and the State Water Conservation Implementation Plan (WCIP). The latter, released in March 2010, identifies water conservation goals, benchmarks, and best management practices for the State's diverse water users. The WCIP framed the following conservation tiers for each Council to use during management practice selection:

- Tier 1: Basic water conservation activities and practices that are currently required by statute or will soon be required in GAEPD's upcoming amended rules.
- Tier 2: Basic water conservation activities and practices that will be addressed in upcoming amended rules, but are not required of all permit applicants.
- Tier 3: Basic water conservation practices (for all water use sectors) that will not be addressed in current or upcoming amended rules.



- Tier 4: "Beyond basic" water conservation practices to be considered if a gap exists between current or future water supplies and demands for the Region.

Figure 6-2 illustrates the process used to consider these tiered practices during selection of the Water Conservation Management Practices listed in Table 6-1 (GAEPD, 2010b). Three of the Council's goals specifically address conservation or water infrastructure optimization:

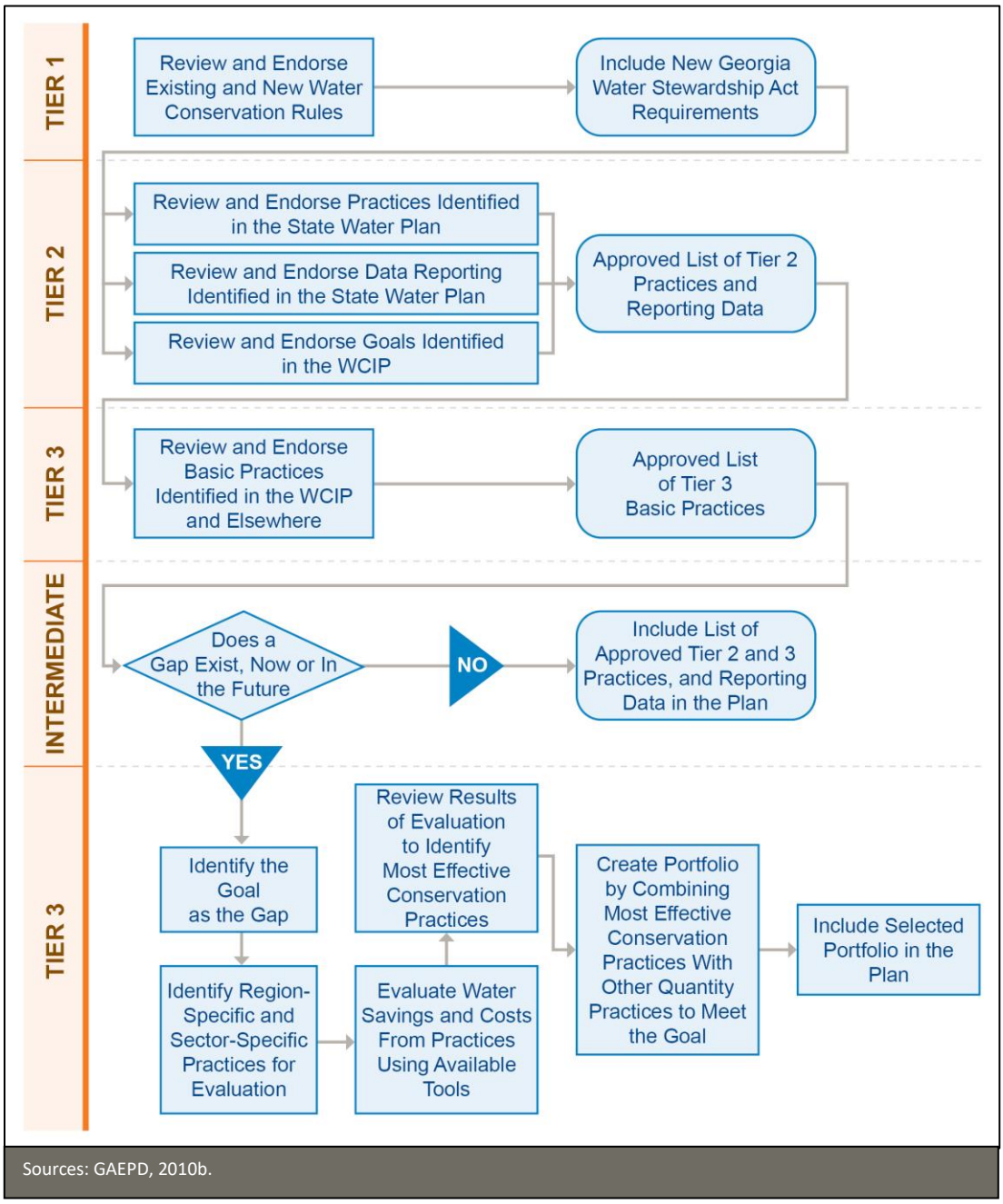


Figure 6-2 Water Conservation Guidance Process Flow Chart

Goal # 1: Promote alternatives and technologies that conserve, reuse, return, and recycle water within the Upper Oconee Region.

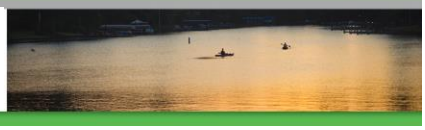
Goal # 3: Educate stakeholders in the Region on the importance of water quality and managing water as a resource including practices such as water conservation and increased water efficiency.

Goal # 6: Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency.

The 10 final Water Conservation management practices listed in Table 6-1 meet the goals noted above and address potential water availability challenges as discussed in Section 5 and summarized in Table 5-8. Additionally, the management practices promote increased efficiency by agricultural users to decrease water demand from the groundwater aquifers. Many of the management practices involving public education address multiple sectors, such as both water conservation and nonpoint source/water quality issues.

Table 6-1 Water Conservation Management Practices Selected for the Region

Action Needed (Management Practice)[1]	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WC-1. Encourage conservation pricing	Encourage conservation pricing to provide economic incentive for people to use water more efficiently within the entire Region. Specific measures for implementation are to: ▪ Perform a rate and revenue analysis, and ▪ Review and update pricing on a regular basis.	**Vision:** Manage water as a critical resource. Supports WS, RS, ES, and CR goals.[1]
WC-2. Develop water conservation goals	Identify achievable, measurable goals to help local governments evaluate long-term water supply needs and to provide benchmarks for determining progress in reducing water supply challenges through conservation. Goals should be both regional and local regardless of where water supply challenges exist in the Resource Assessments.	**Vision:** Manage water as a critical resource. Supports WS, CR, ES, and BP goals.[1]
WC-3. Encourage education and public awareness programs	Encourage local jurisdictions to develop an education and public awareness program focused on water conservation and water quality improvement awareness needs.	**Vision:** Develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and CR goals.[1]
WC-4. Encourage variable rate agricultural irrigation systems	Promote variable rate irrigation systems, which allow for different irrigation rates depending on site-specific water needs.	**Vision:** Manage water as a critical resource Supports WS, WQ, BP and CR goals.[1]



Action Needed (Management Practice)[1]	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WC-5. Encourage non-potable reuse	When and where feasible: ▪ Identify areas with potential for reuse application to offset existing or future withdrawals; ▪ Promote irrigation with high quality treated effluent in unrestricted areas, such as golf courses and parks. ▪ Encourage industries to use reclaimed water for processes such as cooling when feasible.	**Vision:** Manage water as a critical resource. Supports WS and CR goals.[1]
WC-6. Encourage retrofitting of rain sensor shut-off switches on irrigation systems	Encourage retrofitting on residential and commercial systems (excluding golf courses and agriculture irrigation) to utilize irrigation systems that automatically shut off during rain events or moist soil conditions. Investigate the potential for legislation or local government ordinances to require installation in new facilities where shortages are anticipated. Develop educational materials for residents and businesses to encourage retrofitting of rain sensors, the use of cisterns for irrigation systems, as well as the proper use and operation of rain sensors.	**Vision:** Manage water as a critical resource. Supports WS, BP, and CR goals.[1]
WC-7. Encourage new car washes to recycle water	Encourage all new car wash establishments, regardless of size and scale, to recycle wash water to minimize the amount of potable water used during their processes and to capture and treat stormwater properly. Programs can either be mandated for new establishments or voluntary through local ordinances. For voluntary programs, incentives, such as a certification that can be displayed and/or advertised, can be offered.	**Vision:** Manage water as a critical resource. Supports WS, WQ, and CR goals.[1]
WC-8. Encourage residential water audits	Develop a regional residential water audit program. Distribute water audit guidelines. Encourage voluntary audits.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, ES, and CR goals.[1]
WC-9. Encourage certification of irrigation specialists	Trained irrigation specialists understand the design, installation and maintenance of irrigation application timing and levels of water needed by vegetation as well as the technologies and installations that will increase water use efficiency of irrigation systems in the Region.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ and CR goals.[1]

Action Needed (Management Practice)[1]	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WC-10. Encourage commercial water audits	Identify an agency to conduct commercial audits and train personnel to conduct them throughout the Region. Advertise and promote the commercial water audit program. Conduct commercial audits with interested commercial partners. Report results to commercial partners and encourage use of the results in future decisions related to water use efficiency and conservation.	**Vision:** Develop an educated and engaged citizenry that embraces sound water management. Supports WS, BP and CR goals.[1]

Note:

[1] Management practices were selected in 2011 and revised in 2017. In 2023, while recognizing that these management practices are still robust and generally applicable, revisions were limited to updates of outdated information due to the number of vacant seats on the Council. The following acronyms identify the goals that each management practice supports:

CR: Conservation and Reuse – Promote alternatives and technologies that conserve, reuse, return, and recycle water within the Region

BP: Balance Priorities – Ensure that Management Practices balance economic development, recreation, and environmental interests

ES: Educate Stakeholders – Educate stakeholders in the Region on the importance of water quality and managing water as a resource, including practices such as water conservation and increased water efficiency

DA: Data Management – Encourage the development and provision of easily accessible data and information to guide management decisions

WQ: Water Quality – Identify programs, projects, and educational messages to reduce nonpoint source pollution to protect water quality in lakes and streams

RS: Revenue Strategies – Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency

WS: Water Supply – Identify and plan measures to ensure sustainable, adequate water supply to meet current and predicted long-term population, environmental, and economic needs

WW: Wastewater

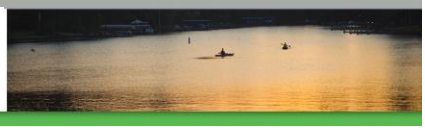
WC: Water Conservation

6.2.2 Water Supply Management Practices

Management practices that supplement water supply play an important role in addressing the Region's potential water resource challenges that are summarized in Table 5-8. Of the 13 counties in the Region, potential surface water availability challenges were seen in three counties and potential infrastructure needs were indicated in one county, as described in Section 5. Potential groundwater availability challenges do not affect any counties in the region, although groundwater yields may vary locally. Table 6-2 outlines the 7 Water Supply Management Practices targeted for implementation in the Region to address water resources issues and regional goals by decreasing water demand, increasing surface and groundwater supplies, and returning more water to streams to make more water available for downstream users.

Two of the Council's goals specifically address water supplies or water infrastructure optimization:

Goal #6: Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency.



Goal # 7: Identify and plan measures to ensure sustainable, adequate water supply to meet current and predicted long-term population, environmental, and economic needs.

Table 6-2 Water Supply Management Practices Selected for the Region

Action Needed (MP)[1]	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WS-1. Expand existing reservoirs	Evaluate yield and potential expansion of existing facilities. Evaluate potential for Natural Resources Conservation Service (NRCS) impoundments to serve as water supply sources; estimate yield; identify any potential water quality and environmental issues.	**Vision:** Manage water as a critical resource and build trusting partnerships with neighboring regions. Supports WS, WQ, BP, and CR goals.[1]
WS-2. Construct new water supply reservoirs	Water Management Councils and GAEPD to identify the yield of current sources. Identify when potential shortages between available supply and demand will occur. Require a financial feasibility study as a part of new water supply reservoir assessment. Encourage local governments to coordinate with each other to develop regional water supply projects. Local governments should begin permitting processes early for new water supplies.	**Vision:** Manage water as a critical resource and build trusting partnerships with neighboring regions. Supports WS, BP, and CR goals.[1]
WS-3. Develop new groundwater wells	Evaluate potential for groundwater supplies (likely as supplemental source). Permit wells as needed and practicable.	**Vision:** Manage water as a critical resource and build trusting partnerships with neighboring regions. Supports WS, RS and BP goals.[1]
WS-4. Encourage development of water master plans with periodic update	Create and utilize a local water master plan with a 30-year planning horizon. Update local water master plans. Develop or update local emergency water plans. Update a minimum of every 5 years.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, RS, and ES goals.[1]
WS-5. Encourage indirect potable reuse	Return highly treated wastewater to water supply reservoirs and streams.	**Vision:** Manage water as a critical resource. Supports WS, BP and CR goals.[1]
WS-6. Expand existing withdrawals from available reservoirs	Negotiate with Georgia Power on potential expansion of existing withdrawals.	**Vision:** Manage water as a critical resource and build trusting partnerships between neighboring regions. Supports WS, RS, and BP goals.[1]

Action Needed (MP)[1]	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WS-7. Encourage water system asset management	Map water system assets. Develop a water system asset management program. Develop targeted asset replacement/rehabilitation program to prevent catastrophic failures. Coordinate asset management and leak detection programs.	**Vision:** Manage water as a critical resource. Supports WS, BP, ES, and CR goals.[1]

Note:
[1] See endnotes in Table 6-1.

6.2.3 Wastewater Management Practices

The *Surface Water Quality Resource Assessments* described in Section 5.3 were performed to measure the assimilative capacity, or the ability of surface waters to absorb pollutants from treated wastewater and stormwater without unacceptable degradation of water quality. The Water Resource Assessments and measured chlorophyll *a* levels also highlight the need for nutrient load reductions to Lakes Oconee and Sinclair to address water quality issues. Table 5-8 summarizes the results of these Resource Assessments and potential wastewater infrastructure shortages. Three of the 13 counties in the Region have potential wastewater infrastructure needs that added emphasis on implementation of the eight Wastewater Management Practices listed in Table 6-3.

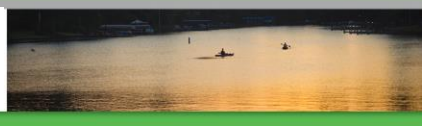
Two of the Council's goals specifically address wastewater infrastructure:

Goal # 1: Promote alternatives and technologies that conserve, reuse, return, and recycle water within the Upper Oconee Region.

Goal # 6: Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency.

Table 6-3 Wastewater Management Practices Selected for the Region

Action Needed (MP)[1]	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WW-1. Encourage implementation of centralized sewer in developing areas where density warrants	Identify areas that would benefit from being served by a centralized sewer versus septic systems. Work with developers to ensure they understand the program.	**Vision:** Manage water as a critical resource and build trusting partnerships with neighboring regions. Supports WS, RS, WQ and, BP goals.[1]



Action Needed (MP)[1]	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WW-2. Encourage development of local wastewater master plans / Evaluate wastewater treatment and disposal options to meet future demands	Evaluate future wastewater capacity needs. Identify and evaluate options to treat and dispose of wastewater, including reuse. Focus on existing public utilities. Update a minimum of every 5 years.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, RS, WQ, and BP goals.[1]
WW-3. Develop recommendations for decentralized sewer systems	Evaluate potential for designing decentralized systems so they can potentially connect to a centralized sewer system in the future when available. Identify implementation issues. Develop design standards for smaller, clustered systems. Implement design standards. Work with developers to ensure they understand the program. Establish policies for future connections to centralized sewer. Coordinate with local governments on the development of private wastewater system ordinance(s).	**Vision:** Manage water as a critical resource. Supports WQ, WS, and BP goals.[1]
WW-4. Develop septic system planning and management policies and guidance	Determine future septic system areas and local requirements. Develop near- and long-term policies for transitioning unsewered areas to sewered areas where financially feasible. Identify grant funds or other sources to develop and implement education program. Identify and manage septic systems in environmentally sensitive areas. Implement a septic system homeowner education program. Create a septic system map. Require septic tank certification program as part of the homebuyer closing process.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, WS, and BP goals.[1]
WW-5. Develop and implement sewer system capacity, management, operation, and maintenance (CMOM) program	Create a sewer system map. Implement sewer inspection and maintenance programs. Conduct inspection and maintenance training. Implement sewer system rehabilitation programs. Develop sewer system overflow emergency programs. Develop sewer system asset management programs.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, and BP goals.[1]

Action Needed (MP)[1]	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WW-6. Provide local government with acceptable parameters for septage disposal at facilities	Develop a plan and acceptable parameters for septage disposal. Collect septage manifests and provide to County Boards of Health. Consider septage disposal needs when upgrading or designing new wastewater treatment facilities.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that supports sound water management. Supports WQ, WS, and ES goals.[1]
WW-7. Implement grease management program	Develop procedures for grease control and enforcement. Implement fats, oils, and grease (FOG) education efforts.	**Vision:** Manage water as a critical resource and develop an engaged citizenry that embraces sound water management. Supports WQ and ES goals.[1]
WW-8. Implement "Do Not Flush" management program	Implement educational materials and informational campaign illustrating materials that should not and cannot be flushed if SSOs are to be prevented. Develop guidance / requirements for capture and removal of foreign materials that may be flushable, but non-biodegradable, before they reach the sewer system.	**Vision:** Manage water as a critical resource and develop an engaged citizenry that embraces sound water management. Supports WQ and ES goals.[1]

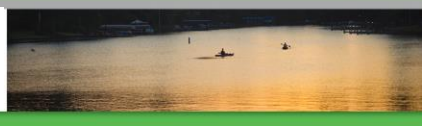
Note:
[1] See endnotes in Table 6-1.

6.2.4 Water Quality Management Practices

Significant progress has been made in Georgia in managing pollution from point sources; however, the State's future growth will continue to bring land cover conversion, more intensive land uses, and increases in the volume of pollutants discharged to waters from both point and non-point sources. Table 5-8 illustrates that the entire Region needs to focus on the implementation of Water Quality Management Practices to address the 303(d) listings of impaired waters in each County and achieve nutrient load reductions in watersheds contributing to Lakes Sinclair and Oconee. Implementation of the 10 Water Quality Management Practices described in Table 6-4 would build on the existing TMDL and stormwater management activities already being performed by the MS4 or NPDES permittees within the Region. Some management practices—such as WQ-10, which calls for monitoring of long-term ambient trends—will facilitate the tracking of long-term point and nonpoint source pollutant loads. This will be useful in addressing water quality issues throughout the Region and will help inform future Regional Water Plan updates.

Two of the Council's goals specifically address water quality:

Goal #3: Educate stakeholders in the region on the importance of water quality and managing water as a resource including practices such as water conservation and increased water efficiency.

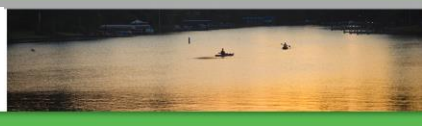


Goal #5: Identify programs, projects, and educational messages to reduce non-point source pollution to protect water quality in lakes and streams.

Table 6-4 Water Quality Management Practices Selected for the Region

Action Needed (MP)[1]	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WQ-1. Encourage comprehensive land use planning	Use land use planning to encourage development in certain areas and discourage development in environmentally sensitive areas. Protect open space along riparian corridors, wetlands, and groundwater recharges areas to help protect water resources. Monitor compliance with Part V (environmental criteria).	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, BP, and CR goals.[1]
WQ-2. Encourage local government participation in construction erosion and sediment control	Develop a training program for citizens and contractors who implement erosion and sediment control programs. Consider implementation of the Better Back Roads Manual recommendations for dirt road maintenance, drainage improvements, stabilization and erosion control (GA RC&D, 2009).	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and BP goals.[1]
WQ-3. Encourage implementation of agricultural nutrient management programs	Utilize existing standards and practices to develop plans for the application of nutrients (including animal waste), typically row crops and hay, at rates that are used by plants to avoid excessive nutrient runoff. Utilize educational materials from the Georgia Department of Agriculture, University of Georgia College of Agriculture and Environmental Sciences, and the Georgia Farm Bureau to encourage agricultural nutrient management.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WQ goal.[1]
WQ-4. Encourage forestry management practices	Continue to implement the measures and practices outlined in the Georgia Forestry Commission BMP manual.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and BP goals.[1]
WQ-5. Encourage stream buffer protection	Continue to implement the measures and practices outlined through current legislation and local jurisdictions.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and BP goals.[1]

Action Needed (MP)[1]	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WQ-6. Encourage floodplain management / flood damage prevention	Implement site plan review practices to minimize development in the floodplain.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and BP goals.[1]
WQ-7. Encourage general stormwater practices	Implement practices such as: ▪ Measures to minimize stormwater runoff through site planning (conservation subdivisions and other practices) and land use planning. ▪ Stormwater system inventory and maintenance. ▪ Preventing pollutants from reaching stormwater systems through good housekeeping or illicit discharge detection programs. ▪ Public education. ▪ Capital programs to develop Management Practices, regional ponds, and other watershed practices. Implement post-development stormwater controls to decrease runoff velocity and promote infiltration, such as stormwater retention ponds, constructed wetlands, grassed swales, and other low-impact development methods, for new development and redevelopment areas to address hydrology and water quality.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, and ES goals.[1]
WQ-8. Support total maximum daily load (TMDL) implementation	Evaluate existing impaired waters, investigate potential pollutant sources, and participate in the TMDL development and implementation planning processes. Comply with TMDLs.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, and ES goals.[1]
WQ-9. Encourage agricultural cropland management practices	Encourage the use of agricultural crop practices as outlined in the Soil and Water Conservation Commission BMP for Georgia Agricultural Manual. Examples of such include the following: conservation tillage, cover crops, field buffers, riparian forested buffers, land conversion (crop to forest), and strip cropping.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, and BP goals.[1]



Action Needed (MP)[1]	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WQ-10. Monitor long-term ambient trends	Include long-term water quality, habitat, and biological monitoring. Use long-term monitoring to help stakeholders evaluate the extent which watershed practices are working. Implement consistent, equitable monitoring across the Region.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, BP, WQ, DA, and ES goals.[1]

Note:
[1] See endnotes in Table 6-1.

SECTION 7

Implementing Water Management Practices

Section 7 Implementing Water Management Practices

This Section presents the Council's roadmap for implementing the water management practices identified in Section 6. The implementation steps described here were fully revised in 2017. As noted in Section 6, the Council recognizes the management practices as generally robust and still applicable. However, due to the number of vacant seats during the 2023 revision, the Council was concerned that representation and knowledge of the region would not be sufficient to fully revise the management practices. Therefore, 2023 revisions of this section were limited to updates of outdated information.

Once adopted, this Regional Water Plan will be primarily implemented by the various water users in the Region along with the other responsible parties described below, as specified in the State Water Plan. The Plan will be used to guide permitting decisions by GAEPD and guide the awarding of State grants and loans from the Georgia Environmental Finance Authority (GEFA) for water-related projects. And this plan can help inform and guide other GAEPD programs such as the awarding of Section 319(h) Nonpoint Source Implementation Grant funds.

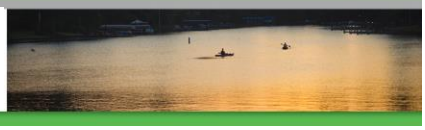
Summary

The Council has developed a roadmap for implementing the Management Practices identified in Section 6. In 2023, the Council recognized the practices as still robust and generally applicable, but revisions were limited to updates of outdated information due to the number of vacant seats on the Council.

The implementation roadmap specifies the short-term (next five years) and long-term (beyond the next five years) actions needed to implement the Management Practices for the corresponding responsible parties. Responsibility for most of the implementation actions falls to local governments and utilities and their respective Regional Commissions; however, extensive support will be needed from various State entities for initial activities, in particular.

7.1 Implementation Schedule and Roles of Responsible Parties

Tables 7-1 through Table 7-4 identify the short- and long-term actions needed to implement the Management Practices detailed in Table 6-1 through Table 6-4 and the corresponding responsible parties for each series of actions. Actions for implementation are framed as initial activities expected to occur as short- or long-term actions. The Council has defined short-term as occurring within the next five years and long-term as beyond the next five years. It is assumed that all long-term activities would occur after the 5-year Regional Water Plan update, allowing for the Council to revisit these actions using an adaptive management approach.



While the bulk of implementation actions noted in Table 7-1 through Table 7-4 fall to local governments and utilities and their respective Regional Commissions, extensive support for short term activities, in particular, will be needed from State entities, such as GAEPD, DCA, Georgia Department of Community Health (DCH), Division of Public Health, Environmental Health Section, and GEFA. This Regional Water Plan also assumes continuing support from the Council in some capacity. Support from other organizations, such as the Association of County Commissioners of Georgia (ACCG), Georgia Green Industry Association (GGIA), Georgia Municipal Association (GMA), Georgia Rural Water Association (GRWA), and Georgia Association of Water Professionals (GAWP), will also be needed to implement the management practices in an efficient, cost-effective manner.

Table 7-1 Water Conservation Management Practice Implementation Schedule

Management Practice[1]	Permittee Category of Responsible Parties[1]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[2]
WC-1. Encourage conservation pricing	MU	Implement Conservation Pricing, if needed.	Revise Rate Study and Rates, if needed.	Local governments and utilities.
WC-2. Develop water conservation goals	MU	▪ Identify achievable, measurable goals (and benchmarks) to help local governments evaluate progress and success in reducing water supply challenges through conservation. ▪ Develop ways to track progress in meeting conservation goals and reporting of progress.	▪ Administer Survey to gauge progress toward meeting water conservation goals during the short term. ▪ Revise program during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	GAEPD and Regional Councils working with the RCs noted in Section 2.3 with support from organizations such as the ACCG, GMA, GRWA, and GAWP.
WC-3. Encourage education and public awareness programs	MU and MS4	Implement the Education and Public Awareness program.	▪ Administer Survey to gauge effectiveness of program during the short term. ▪ Revise Education and Public Awareness program during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	**Short-term Actions:** Local governments noted in Section 2.1.1. **Long-term Actions:** GAEPD and Regional Councils working with the RC.
WC-4. Encourage variable rate agricultural irrigation systems	AG	▪ Identify incentives to encourage the installation and use of variable rate irrigation systems. ▪ Implement with the support of the GSWCC. ▪ Integrate message regarding cost-effectiveness of variable rate irrigation into the Public Education and Awareness Program (see WC-3).	▪ Evaluate requiring variable rate irrigation systems in water-limited areas. ▪ Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	**Short-term Actions:** GAEPD and GSWCC. **Long-term Actions:** GAEPD, Regional Councils and GSWCC

Management Practice[1]	Permittee Category of Responsible Parties[1]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[2]
WC-5. Encourage non-potable reuse	MU and MUWW	Develop implementation costs and assess feasibility of serving non-potable reuse water.	Encourage industries to use reclaimed water for processes, such as cooling, when technically and economically feasible.	GEFA, Industry, local governments, and utilities.
WC-6. Encourage retrofitting of rain sensor shut-off switches on irrigation systems	MU	▪ Develop regional guidelines / educational materials for local implementation. ▪ Require installation or retrofitting to utilize irrigation systems that automatically shut off during rain events or moist soil conditions. ▪ Integrate message regarding cost-effectiveness of variable rate irrigation into the Public Education and Awareness Program (see WC-3).	▪ Require switches in water-limited areas and revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness. ▪ Develop maintenance program to ensure long-term effectiveness of sensors.	**Short-term Actions:** Local governments and utilities. **Long-term Actions:** GAEPD and Regional Councils working with the RCs.
WC-7. Encourage new car washes to recycle water	MU and MS4	▪ Develop regional guidelines / program materials or templates requiring all new car wash establishments to recycle wash water. Integrate with GAEPD's existing Carwash BMP program ▪ Implement with the support of the local government business licensing process. ▪ Integrate message into the Public Education and Awareness Program (see WC-3).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	**Short-term Actions:** Local governments and utilities. **Long-term Actions:** GAEPD and Regional Councils working with the RCs.
WC-8. Encourage residential water audits	MU	Implement regional program via Public Education and Awareness (see WC-3) to encourage voluntary audits and educate the public about water audit guidelines.	▪ Administer Survey to gauge progress toward meeting water conservation goals during the short term. ▪ Revise program during 5-year Regional Water Plan update, if necessary, to improve effectiveness. ▪ Identify/create incentive program	**Short-term Actions:** Local governments and utilities. **Long-term Actions:** GAEPD and Regional Councils working with the RCs.

Management Practice[1]	Permittee Category of Responsible Parties[1]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[2]
WC-9. Encourage certification of irrigation specialists	AG and MU	▪ Consider creating a certification requirement and process for irrigation specialists. ▪ Develop regional educational materials regarding the value of using a trained, certified residential/commercial irrigation specialist to increase water use efficiency within the agricultural and green industry. ▪ Encourage certification of irrigation specialists via Public Education and Awareness Program (see WC-3).	Evaluate whether requirement for certified irrigation specialists should be considered in plan update.	**Short-term Actions:** GAEPD Agriculture Water Permitting Unit and Regional Councils working with the GSWCC Agriculture Meter Program, GGIA, and GSWCC.
WC-10. Encourage commercial water audits	MU	▪ Implement regional program via Public Education and Awareness Program (see WC-3). ▪ Advertise and promote the water audit program. ▪ Conduct audits with interested commercial partners.	▪ Administer Survey to gauge Results during the short term. ▪ Report results to commercial partners and revise program during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	**Short-term Actions:** Local governments and utilities. **Long-term Actions:** GAEPD and Regional Councils working with the RCs and GADNR Sustainability Division.

Note:

[1] The implementation roadmap was developed in 2011 and revised in 2017. In 2023, while recognizing that these management practices are still robust and generally applicable, revisions were limited to updates of outdated information due to the number of vacant seats on the Council. Permittee Categories of Responsible Parties have the following acronyms and refer to the entities who may have permits of various types through GAEPD:

[2] Assumes continued support from the Council in some capacity beyond their 3-year appointment.

AG: Agricultural Water Withdrawal
CST: Construction Stormwater
GC: Golf Course Water Withdrawal
IND: Industrial Water Withdrawal
INDST: Industrial Stormwater
INDWW: Industrial Wastewater
MU: Municipal Water Withdrawal
MS4: Municipal Stormwater
MUWW: Municipal Wastewater
SD: Safe Dams Program

Table 7-2 Water Supply Management Practice Implementation Schedule

Management Practice[1]	Permittee Category of Responsible Parties[1]	Short-term Actions (Next 5 Years)	Long-term Actions: (5 Years and Beyond)	Responsible Parties[2]
WS-1. Expand existing reservoirs	MU and SD	▪ Evaluate potential expansion of existing reservoirs. ▪ Identify and evaluate potential for retrofitting NRCS impoundments for water supply use. ▪ Begin process of expanding existing reservoirs.	Revise local Water Master Plan(s) based on 5-year Regional Water Plan update, if necessary. Continue to maximize existing reservoir capacities.	Local governments and utilities with support from GAEPD and NRCS.
WS-2. Construct new water supply reservoirs	MU	▪ Identify site-specific needs for new water supply reservoirs over the next 30 years via the local Water Master Planning Process and Regional Water Plan. ▪ Identify opportunities to create regional reservoirs for cost sharing and efficiency. ▪ Begin permitting process for new water supplies.	▪ Continue permitting process for new water supplies and construct as needed and as funding allows. ▪ Revise local Water Master Plan based on 5-year Regional Water Plan update, if necessary.	Local governments and utilities with support from GAEPD.
WS-3. Develop new groundwater wells	IND and MU	▪ Identify site-specific needs for new groundwater wells over the next 30 years via the local Water Master Planning Process. ▪ Begin permitting process for new wells and construct as needed and as funding allows.	▪ Continue permitting process for new wells and construct as needed and as funding allows. ▪ Revise local Water Master Plan based on 5-year Regional Water Plan update, if necessary.	Industry, local governments, and utilities with support from GAEPD.

Management Practice[1]	Permittee Category of Responsible Parties[1]	Short-term Actions (Next 5 Years)	Long-term Actions: (5 Years and Beyond)	Responsible Parties[2]
WS-4. Encourage development of water master plans with periodic updates	MU	Consider developing (or revising) a local Water Master Plan to: ▪ Include a 30-year planning horizon. ▪ Include an emergency water plan. Reflect implementation of Regional Water Plan water Management Practices. Implement local water master plan. (See WW-2)	Revise local Water Master Plan(s) periodically based on 5-year Regional Water Plan update.	Local governments and utilities with support from GAEPD.
WS-5 Encourage indirect potable reuse	MU and MUWW	▪ Identify opportunities to augment water supplies with highly treated wastewater via the local Water Master Planning Process. ▪ Identify incentives to encourage potable reuse. ▪ Implement via local water master plan. (See WS-4).	Revise local Water Master Plan based on 5-year Regional Water Plan update, if necessary.	Local governments and utilities with support from GAEPD and GEFA.
WS-6. Expand existing withdrawals from available reservoirs	MU	▪ Coordinate with current reservoir owners / operators to establish a clear process for local governments and utilities to follow when future water supply needs arise. ▪ Identify need for expansion of future water withdrawals from existing reservoirs via local Water Master Planning process.	▪ Revise local Water Master Plan based on 5-year Regional Water Plan update, if necessary, to include this water MP. ▪ Coordinate with current reservoir owners / operators and FERC, as needed, to meet future water supply needs.	**Short-term Actions:** GAEPD, Regional Councils, local governments and utilities working with Georgia Power and FERC Local governments and utilities. **Long-term Actions:** Local governments and utilities, GAEPD, and Regional Councils working with Georgia Power and FERC.

Management Practice[1]	Permittee Category of Responsible Parties[1]	Short-term Actions (Next 5 Years)	Long-term Actions: (5 Years and Beyond)	Responsible Parties[2]
WS-7. Encourage water system asset management	MU	▪ Develop a water system asset management program, if one does not already exist ▪ Develop targeted asset replacement/rehabilitation program to prevent catastrophic failures. ▪ Begin or continue mapping of water system assets. ▪ Coordinate asset management and leak detection programs.	▪ Continue asset management and leak detection programs. ▪ Revise program based on 5-year Regional Water Plan update, if necessary.	Local governments and utilities with support from GAEPD.

Notes:
[1] See endnotes on Table 7-1.
[2] Assumes continued support from the Council in some capacity beyond their 3-year appointment.

Table 7-3 Wastewater Management Practice Implementation Schedule

Management Practice[1]	Permittee Category of Responsible Parties[1]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[2]
WW-1. Encourage implementation of centralized sewer in developing areas where density warrants	MUWW	Implement local Wastewater Master Plan (See WW-2), working with developers to secure their participation.	Revise local Wastewater Master Plan based on 5-year Regional Water Plan update, if necessary.	Local governments and utilities with support from GAEPD.
WW-2. Encourage development of local wastewater master plans / Evaluate wastewater treatment and disposal options to meet future demands	MUWW	Develop and implement local Wastewater Master Plan.	Revise local Wastewater Master Plan based on 5-year Regional Water Plan update.	Local governments and utilities with support from GAEPD.

Management Practice[1]	Permittee Category of Responsible Parties[1]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[2]
WW-3. Develop recommendations for decentralized sewer systems	MUWW	▪ Local governments to consider adoption of model ordinance for decentralized and clustered sewer systems. ▪ Local Public Health Departments to implement revised minimum design standards.	Revise guidelines during 5-year Regional Water Plan update, if necessary.	**Short-term Actions:** Local governments and local Public Health Departments. **Long-term Actions:** GAEPD and Regional Councils working with State and local Public Health Department representatives.
WW-4. Develop septic system planning and management policies and guidance	MUWW	As part of local planning efforts: ▪ Develop near- and long-term policies for transitioning to sewer in areas where feasible. ▪ Identify grant funds or other sources to develop and implement Septic System Homeowner Education program. ▪ Develop template materials for Septic System Homeowner Education efforts. Develop septic tank certification program as part of the homebuyer closing process. ▪ Integrate Septic System Homeowner Education and septic certification program components into the Public Education and Awareness Program (see WC-3).	Track implementation and revise Regional Water Plan, if necessary.	**Short-term Actions:** Local governments and utilities. **Long-term Actions:** GAEPD and Regional Councils working with State and local Public Health Department representatives
WW-5. Develop and implement sewer system capacity, management, operation, and maintenance (CMOM) program	MUWW	▪ Develop regional CMOM guidelines or templates for local government and utility implementation. ▪ Implement local CMOM programs. ▪ Integrate CMOM topics into the Public Education and Awareness Program (see WC-3).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	**Short-term Actions:** Local governments and utilities. **Long-term Actions:** GAEPD and Regional Councils with support from GAWP.

Management Practice[1]	Permittee Category of Responsible Parties[1]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[2]
WW-6. Provide local government with acceptable parameters for septage disposal at facilities	MUWW	▪ Propose legislative changes, if needed, to allow for consistent, minimum parameters for local governments to utilize in determining whether septage is acceptable for disposal at their facilities. ▪ Local governments and utilities to implement minimum septage disposal standards and regularly convey manifests to local Public Health officials.	Revise guidelines during 5-year Regional Water Plan update, if necessary.	**Short-term Actions:** Georgia State legislature, local governments and utilities working with local Public Health Department representatives. **Long-term Actions:** GAEPD and Regional Councils working with Georgia Division of Public Health and local Public Health Department representatives.
WW-7. Implement grease management program	MUWW	▪ Develop regional Grease Management Program guidelines or templates for local government and utility implementation. ▪ Implement local Grease Management Program. ▪ Integrate FOG reduction message into the Public Education and Awareness Program (see WC-3).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	**Short-term Actions:** GAEPD and Regional Councils working with the RCs; Local governments and utilities. **Long-term Actions:** GAEPD and Regional Councils working with the RCs.
WW-8. Implement "Do Not Flush" management program	MUWW	▪ Develop "Do Not Flush" Management Program guidelines or templates for local government and utility implementation. ▪ Implement local "Do Not Flush" Management Program. ▪ Integrate "Do Not Flush" message into the Public Education and Awareness Program (see WC-3).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	**Short-term Actions:** Local governments and utilities working with the RCs. **Long-term Actions:** Local governments and utilities working with the RCs.

Notes:
[1] See endnotes in Table 7-1.
[2] Assumes continued support from the Council in some capacity beyond their 3-year appointment.

Table 7-4 Water Quality Management Practice Implementation Schedule

Management Practice[1]	Permittee Category of Responsible Parties[1]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[2]
WQ-1. Encourage comprehensive land use planning		Integrate any needed revisions into local comprehensive plans during the next, regular 10-year update or 5-year updates to the Short-Term Work Program portion of the Community Agenda from the comprehensive plan.	▪ Implement comprehensive plan. ▪ Coordinate with DCA regarding potential revisions to Chapter 110-12-1, Standards and Procedures for Local Comprehensive Planning, and the Part V Environmental Planning Criteria to facilitate implementation of the State Water Plan water Management Practices.	**Short-term Actions:** Regional Councils, local governments and utilities. **Long-term Actions:** GAEPD and Regional Councils working with DCA and the RCs as well as local governments and utilities.
WQ-2. Encourage local government participation in construction erosion and sediment control	CST	Integrate construction erosion and sedimentation component into the Public Education and Awareness Program (see WC-34). Consider implementation of Better Back Roads program.	Revisit Resource Assessment results during the 5-year Regional Water Plan update to evaluate whether recommendations for changes to the existing Construction NPDES Program are needed.	**Short-term Actions:** Regional Councils, local governments and GSWCC supervisors **Long-term Actions**: GAEPD and Regional Councils
WQ-3. Encourage Implementation of agricultural nutrient management programs	AG	▪ Identify incentives to encourage local implementation of Nutrient Management guidelines. ▪ Implement with the support of the GSWCC. ▪ Integrate message into the Public Education and Awareness Program (see WC-3).	Revisit Resource Assessment results during the 5-year Regional Water Plan update to evaluate whether changes to guidelines are needed.	**Short-term Actions:** Agricultural Water Users, GSWCC, Regional Council, and NRCS. **Long-term Actions:** GAEPD, Regional Councils, GSWCC, and NRCS.
WQ-4. Encourage forestry management practices		Expand education and enforcement of the measures and practices outlined in the Georgia Forestry Commission BMP manual.	Revisit Resource Assessment results during the 5-year Regional Water Plan update to evaluate whether recommendations for changes to the Georgia Forestry Commission BMP manual are needed.	**Short-term Actions:** Private foresters and the Georgia Forestry Commission **Long-term Actions:** the Georgia Forestry Commission

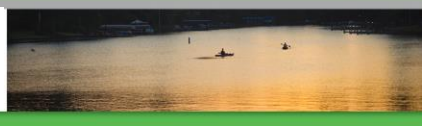
Management Practice[1]	Permittee Category of Responsible Parties[1]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[2]
WQ-5. Encourage stream buffer protection		▪ Consider adoption of model stream buffer protection ordinance. ▪ Revise development review process, if needed. ▪ Integrate message into the Public Education and Awareness Program (see WC-4).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	**Short-term Actions:** Regional Councils, local governments and utilities. **Long-term Actions:** GAEPD and Regional Councils working with the Regional Commissions.
WQ-6. Encourage floodplain management/ flood damage prevention		▪ Develop regional recommendations and a model flood damage prevention ordinance. ▪ Develop educational materials emphasizing the importance of preventing flood damage. ▪ Identify incentives and potential funding sources to encourage local implementation.	▪ Integrate message into the Public Education and Awareness Program (see WC-3). ▪ Consider adoption of flood damage prevention ordinance. ▪ Revise development review process, if needed. ▪ Begin mapping location of future floodplains. ▪ Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	**Short-term Actions:** Regional Councils, GAEPD and GEMA. **Long-term Actions:** GAEPD and Regional Councils working with local governments and utilities.
WQ-8. Encourage general stormwater practices	MS4	▪ Consider implementation of regional guidelines for general stormwater management in non-MS4 communities. ▪ Implement regional guidelines for general stormwater management in MS4 communities. ▪ Integrate general stormwater management message into the Public Education and Awareness Program (see WC-4).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	**Short-term Actions:** Regional Councils, MS4 and Non-MS4 local governments and utilities. **Long-term Actions:** GAEPD and Regional Councils working with the RCs.

Management Practice[1]	Permittee Category of Responsible Parties[1]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[2]
WQ-9. Support total maximum daily load (TMDL) implementation	MUWW and MUST	Continue to follow TMDL implementation plans and to participate in GAEPD updates.	Update TMDL implementation plans, as needed, based on water quality and biological monitoring data as well as Resource Assessment results.	**Short-term Actions:** GAEPD, industry, local governments and utilities. **Long-term Actions:** GAEPD and Regional Councils working with the RCs.
WQ-9. Encourage agricultural cropland management practices	AG	▪ Implement with the support of the GSWCC. Integrate message into the Public Education and Awareness Program (see WC-3).	Revisit Resource Assessment results during the 5-year Regional Water Plan update to evaluate whether changes to guidelines are needed.	**Short-term Actions:** Agricultural Water Users, GSWCC, Regional Councils, and NRCS. **Long-term Actions:** GAEPD, Regional Councils, GSWCC, and NRCS
WQ-10. Monitor long-term ambient trends	MUWW, INDWW, MS4, and INDST	▪ Implement regional long-term ambient trend monitoring network for the Region. ▪ Utilize GAEPD's online data management system to maximize use of and access to these data.	Utilize results of regional long-term ambient trend monitoring network to help guide the 5-year Regional Water Plan update and revise monitoring program, if needed.	**Short-term Actions:** GAEPD with support from industry, local governments and utilities. **Long-term Actions**: GAEPD

Notes:

[1] See endnotes on Table 7-1.

[2] Assumes continued support from the Council in some capacity beyond their 3-year appointment.



7.1.1 Implementation of Water Conservation Management Practices

Table 7-1 lists implementation details for the 10 Water Conservation Management Practices selected by the Council and detailed in Table 6-1. The list includes a wide variety of practices, such as practices that benefit all communities (e.g., WC-3, Implement education and public awareness program) and practices that may be appropriate for some communities, but not for others (e.g., WC-5, Encourage non-potable reuse). Each community will need to evaluate all the practices to determine which are appropriate for it to implement. Communities with potential water resource challenges or infrastructure needs are strongly encouraged to implement these Water Conservation practices to address these issues. All communities will need to track and report on their implementation activities as described in Section 8 to help monitor progress in meeting the benchmarks.

7.1.2 Implementation of Water Supply Management Practices

Table 7-2 lists implementation details for the 7 Water Supply Management Practices selected by the Council and as indicated in Table 6-2. The list includes a wide variety of practices, such as practices that benefit all communities (e.g., WS-4, Encourage development of water master plans with periodic updates), and practices that may be appropriate for some communities, but not for others (e.g., WS-2 Construct new water supply reservoirs). Each community will need to evaluate all the practices to determine which are appropriate for it to implement. Communities with Resource Assessment challenges or infrastructure needs are strongly encouraged to implement these Management Practices to address their water resource issues. All communities will need to track and report on their implementation activities as described in Section 8 to help monitor progress in meeting the benchmarks.

7.1.3 Implementation of Wastewater Management Practices

Table 7-3 lists implementation details for the 8 Wastewater Management Practices selected by the Council and as described in Table 6-3. The list includes a wide variety of practices, such as practices that benefit all communities (e.g., WW-2, Encourage development of local wastewater master plans/Evaluate wastewater treatment and disposal options to meet future demands) and practices that may be appropriate for some communities, but not for others (e.g., WW-3, Develop recommendations for decentralized sewer systems). Each community will need to evaluate all the practices to determine which are appropriate for it to implement. Communities with Resource Assessment challenges or infrastructure needs are strongly encouraged to implement these Management Practices to address their water resource issues. All communities will need to track and report on their implementation activities as described in Section 8 to help monitor progress in meeting the benchmarks.

7.1.4 Implementation of Water Quality Management Practices

Table 7-4 lists implementation details for the 10 Water Quality Management Practices selected by the Council and as described in Table 6-4. The list includes a wide variety of practices, such as practices required by state law (e.g., WQ-2. Encourage local government participation in construction erosion and sediment control), practices that benefit all communities (e.g., WQ-4,

Encourage forestry management practices), and practices that may be appropriate for some communities. Each community will need to evaluate all the practices to determine which are appropriate for it to implement. Communities with water resource challenges or infrastructure needs are strongly encouraged to implement these Management Practices to address the issues. All communities will need to track and report on their implementation activities as described in Section 8 to help monitor progress in meeting the benchmarks.

7.2 Fiscal Implications of Selected Water Management Practices

When this Regional Plan was first developed, the Council used GAEPD's *Supplemental Guidance for Planning Contractors: Water Management Practice Cost Comparison* (2011) to outline general planning level costs for implementation of the management practices selected by the Council and potential funding sources and options. The guidance documents and sources used to inform the planning-level cost information have not been updated since then. However, in recent years, infrastructure-related costs have escalated dramatically, and costs continue to be variable and dependent on a number of local, national, and international factors. Accordingly, specific cost estimates were removed in the 2023 Plan revision.

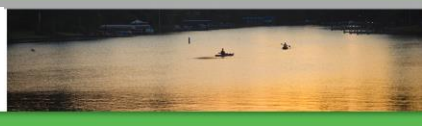
7.3 Alignment with Other Plans

As discussed in Section 6, a review of regional and local plans served as the basis for the development of the Region's selected management practices. As a result, this update of the Regional Water Plan is generally aligned and consistent with these efforts; however, the following sections describe ongoing efforts and/or differences that are worth noting and revisiting during future Regional Water Plan updates.

7.3.1 Metro Water District Plan

The Metro Water District was created by the Georgia General Assembly in 2001 to establish policy, create plans, and promote intergovernmental coordination within the 15 County Metro Atlanta region, which includes more than 90 cities. The Metro Water District is therefore governed by a separate authorizing legislation than the Region, though the two are similar in some respects. For example, the Metro Water District is funded by State appropriations and per capita local government dues; it is governed by an elected/appointed Governing Board, which sets policy and direction. Metro Water District staffing is provided by the Atlanta Regional Commission Environmental Planning Division, while plans and policies are guided by the Board Executive and Finance Committees, the Technical Coordinating Committee, and the Basin Advisory Councils (Metro Water District, 2011).

Local governments and utilities are responsible for implementing the Regional Water Plans at the local level. This Regional Water Plan will guide GAEPD's future permitting decisions for facilities in the Upper Oconee Region. However, all local governments lying partially or wholly in the Metro Water District must be in compliance with the Metro Water District's plans to obtain a permit for an increased water withdrawal or a new or increased discharge, or to obtain an MS4 permit (unless they have an approved request to opt-out of the Metro Water District). GAEPD is



responsible for auditing local governments lying within the Metro Water District to determine compliance with the plans, including audit checklists and site visits.

In May 2009, the Metro Water District adopted comprehensive updates to the plans the District first adopted in 2003; these long-term water management plans address water supply and water conservation, wastewater management, and watershed management. In 2017, the three long-term water management plans were updated and integrated into one plan, which was again updated in 2022.

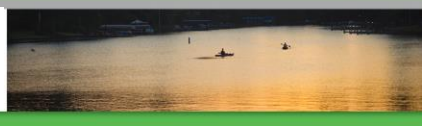
7.4 Recommendations to the State

This subsection describes the Council's recommendations to the State of Georgia for actions that will support the implementation of this Regional Water Plan. Table 7-5 summarizes these recommendations by type and reflects the role the Council envisions the State taking in support of the activities described in Section 7.1.

Table 7-5 Recommendations to the State

	Recommendation
Funding	Identify long-term funding mechanism, beyond grants, to assist responsible parties with implementation.
	Work with existing organizations such as the GSWCC to identify incentives to encourage the installation and use of variable rate irrigation systems by a certified irrigation professional.
	Identify funding assistance (grants or loans) for small community water systems that have had to shut down their groundwater supply wells and move onto surface water withdrawal and treatment systems based upon radionuclides levels of concern in groundwater. These systems fall within an area of the Upper Oconee Region that is known to have such levels of concern based on geologic conditions. Funding assistance may include grant or loan programs administered by DCA or GEFA, and may also include federal funding sources from USEPA or USDA.
Coordination	Coordinate with DCA and the RCs to serve as the clearing house and coordinator for ongoing Regional Water Plan planning activities.
	To provide continuity between Regional Water Plan updates, a minimum of six to nine members of the current Council should be re-appointed when terms expire. Vacancies should be filled by timely appointments of new members.
	The Council should meet a minimum of once a year (as directed by the Chairperson) to track implementation and address potential issues or questions regarding implementation or plan amendments. A Planning Contractor should be available to the Council to assist with coordination as well as implementation tracking or plan amendments. Invite regional utility directors to the annual Council Meetings.
	Work with existing organizations, such as ACCG, GMA and GAWP to develop templates and materials that each Regional Council, with the assistance of DCA or the RCs noted in Section 2.3, can adapt for regional / local implementation. Topic areas from Table 7-1 could include: public education program, water conservation goals, regional residential and commercial water audit program materials, golf course water management, grease management, CMOM, general stormwater management and stream buffer protection.

	Recommendation
	Work with existing organizations such as the GSWCC, United States Department of Agriculture (USDA), and the State's University System to develop regional watering, nutrient management, cropland management guidelines for the major crops grown in the Region.
	Coordinate with State and local Public Health Departments to: ▪ Develop consistent, minimum design standards that anticipate future centralized sewer connections where appropriate. ▪ Develop example policies for connections to public sewer. ▪ Develop regional recommendations and a model ordinance for decentralized sewer systems.
	Coordinate with GEMA on development of a model flood damage prevention ordinance.
Policy / Programmatic	Consider modifying (limiting) the extent of exemptions found in O.C.G.A. § 12-7-17 regarding the Erosion and Sedimentation Control Act. Increase enforcement capabilities for GSWCC as well as local erosion and sedimentation control acts.
	Continue to implement the rule and listing methodology that recognizes naturally-low DO in some streams in South Georgia and in the Region.
	Build on existing GAEPD monitoring program to develop a regional long-term ambient trend monitoring network for the Region.
	Evaluate methodologies to shorten the timing for the permitting process on new reservoir systems.
Next 5-Year Update	Refine Groundwater Resource Assessment model to allow presentation of results at a finer resolution, as done for the Surface Water Resource Assessment model for the 2023 Plan revision.
	Collect and monitor withdrawal and discharge data from industries to refine the water balance and wastewater return ratio assumptions.
	Support the evaluation of the current in-stream flow policy to determine whether revisions are needed to protect aquatic resources.



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SECTION 8

Monitoring and Reporting Progress

Section 8 Monitoring and Reporting Progress

Summary

Monitoring of the progress toward implementation of the recommendations will be based on key benchmarks for water conservation, water supply, wastewater, and water quality management practices.

Progress will be evaluated annually, biennially, or at each of the 5-year plan updates, depending on the management practice.

The selected management practices identified in Section 6 will be primarily implemented (as described in Section 7) by the various water users in the Region, including local governments and others with the capacity to develop water infrastructure and apply for the required permits, grants and loans.

The benchmarks prepared by the Council and listed in Table 8-1 will be used to assess the effectiveness of implementation and to identify changes that need to be addressed during the next 5-year Regional Water Plan update. As detailed below, the Council selected both qualitative and quantitative benchmarks that will be used to assess the extent to which the management practices are addressing water resource challenges and infrastructure needs over time and allowing the Region to meet its vision and goals.

8.1 Benchmarks

The State Water Plan guided the Council's selection of benchmarks that are specific, measurable, achievable, realistic, and time-phased. Table 8-1 outlines the benchmarks for implementing this Regional Water Plan; the short-term actions outlined in Table 7-1 will serve as overall benchmarks to be measured via an annual survey. While details on administration of the annual survey are pending Regional Water Plan adoption, it is assumed that GAEPD and DCA will coordinate this online measurement tool with the support of the RCs. GAEPD and DCA will track the results of these surveys for needed adaptation and Regional Water Plan adjustments during the 5-year update.

Table 8-1 also provides resource-specific benchmarks that allow a mechanism for tracking realistic and measurable progress in the long-term in addressing the water resource challenges and infrastructure needs described in Section 5. For example, due to the time it takes to develop or expand water and wastewater infrastructure, it is appropriate to measure overall progress during the 5-year Regional Water Plan update cycle by revisiting the infrastructure shortages by County summarized in the tables in Section 5. The resource benchmarks also build on existing measurement tools, such as the biennial update of the Clean Water Act 305(b)/303(d) list of waters not meeting their designated uses.

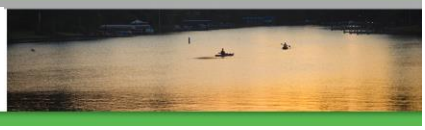


Table 8-1 Benchmarks for Water Management Plans

Category of Benchmark	Benchmark	Measurement Tools	Time Period
All Practices	Implementation of initial and short term actions	Annual Survey	Annual
Water Conservation (WC)			
Water Conservation (WC)	Maintenance or reduction of residential per capita water use	Update of Regional Water Plan per capita Water Use Estimates	Every 5 years
	Implementation of recommended Water Conservation Management Practices	Survey via Annual Water Conservation Plan Progress Report	Annual
Water Supply Practices (WS)			
Water Supply Practices (WS)	Improvement in challenges indicated by the surface water resource assessment and maintenance of flow regime.	Resource Assessments	Every 5 years
	Reduction in number of counties where current permitted withdrawal capacity (surface and groundwater) is lower than future demands.	Update of Regional Water Plan Forecasts	Every 5 years
Wastewater Practices (WW)			
Wastewater Practices (WW)	Availability of permitted assimilative capacity in the major tributaries of the Region.	Resource Assessments	Every 5 years
	Reduction in the number of counties where current permitted wastewater treatment capacity is less than future demands through expansions or development of new facilities.	Update of Regional Water Plan Forecasts	Every 5 years
Water Quality Practices (WQ)			
Water Quality Practices (WQ)	Support of designated use	305(b)/303(d) List of Waters	Biennial
	Reduction in pollutant loads observed in the watershed modeling.	Resource Assessments	Every 5 years
	Observed improvements in water quality monitoring results.	GAEPD Online Water Quality Database.[1]	Annual

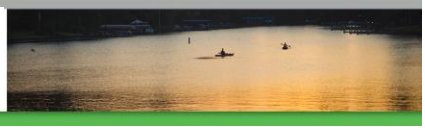
Note:
[1] http://www.gaepd.org/Documents/EPDOnlineWaterQualityData.html

8.2 Plan Updates

Meeting current and future water needs will require periodic review and revision of Regional Water Plans. The State Water Plan and associated rules provide that each Regional Water Plan will be subject to review by the appropriate Regional Water Planning Council every 5 years and in accordance with guidance provided by the Director, unless otherwise required by the Director for earlier review. These reviews and updates will allow an opportunity for the Regional Water Plan to be adapted based on changed circumstances and new information that becomes available in the 5 years after GAEPD's adoption of these plans. These benchmarks will guide GAEPD during Regional Water Plan review.

8.3 Plan Amendments

This Regional Water Plan will be amended on a 5-year basis, as required, unless additional changes (triggering events) are identified in the interim period. Triggering events may include major droughts or significant water quality problems. Council Members may request a full meeting of the Council to address potential Regional Water Plan amendments in the interim period between Regional Water Plan updates by contacting the current Council Chair and/or Vice Chair.



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SECTION 9

Bibliography

Section 9 Bibliography

Black and Veatch on behalf of Georgia EPD. 2020. Municipal Water and Wastewater Flow Forecasting Methods Report. Prepared for the Regional Water Planning Councils on behalf of EPD. Available at https://waterplanning.georgia.gov/forecasting/municipal-water-use

CDM. 2017. *Upper Oconee Water and Wastewater Forecasting Technical Memorandum*.

Clark, F. 1999. "Map of Sherman's March through Georgia," in *War Approaches the Heart of South Carolina*. http://sciway3.net/clark/civilwar/marchingthruGA.html (accessed January 2017).

Clarke, J.S., R. Brooks, and R.E. Faye. 1985. *Hydrogeology of the Dublin and Midville Aquifer Systems of East-Central Georgia*. Georgia Geologic Survey Information Circular 74.

Fanning, J.L. and V.P. Trent. 2009. *Water Use in Georgia by County for 2005; and Water-Use Trends, 1980-2005*. USGS Scientific Investigations Report 2009-5002.

Georgia Department of Natural Resources (GADNR). 2015. "High Priority Waters," in *Georgia Rare Species and Natural Community Information*. http://www.georgiawildlife.com/node/1377 (accessed January 2017).

GADNR. 2010. "2010 Reservoir Fishing Prospects," in *Georgia Reservoir Fishing Information*. http://www.georgiawildlife.com/node/242?cat=fishing (accessed November 2009).

Georgia Environmental Protection Division (GAEPD). May 2023. Development of Basin Environmental Assessment Models (BEAMs) for Georgia Surface Water Basins

GAEPD. May 2023. Dissolved Oxygen Assimilative Capacity Resource Assessment Report.

GAEPD. May 2017a. Synopsis Report *Groundwater Availability Assessment Updates*. Report completed in cooperation with CDM Smith.

GAEPD. May 2017b. Synopsis Report *Water Quality (Assimilative Capacity) Resource Assessment*. Report completed in cooperation with TetraTech.

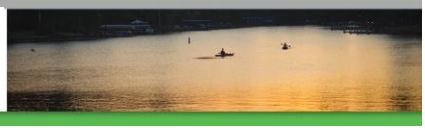
GAEPD. March 2011. *Supplemental Modeling conducted for the Cretaceous and Claiborne Aquifers.*

GAEPD. 2011. *Supplemental Guidance for Planning Contractors: Water Management Practice Cost Comparison, Revised April 2011.* Last accessed March 2023 at https://waterplanning.georgia.gov/document/publication/cost-guidance/download

GAEPD. 2010a. *Synopsis of Groundwater Availability Assessment.*

GAEPD. September 2010b. *Detailed Guidance for Evaluating Practices to Manage Demand*.

GAEPD. 2009. *Georgia's State Water Plan. Regional Planning Guidance.*



GAEPD. 1998. *Oconee River Basin Management Plan*.

Georgia Geologic Survey. 2006. *Digital Environmental Atlas of Georgia, 2006*. CD1.

Georgia Governor's Office of Planning and Budget. 2015. *Georgia 2050 Population Projections*.

Georgia Resource Conservation and Development Council (GA RC&D) and Watershed Services, Inc. May 2009. *Georgia Better Back Roads Field Manual*.

Georgia Water Council. 2008. *Georgia Comprehensive State-wide Water Management Plan*. http://www.georgiawatercouncil.org/Files_PDF/water_plan_20080109.pdf (accessed January 2017).

Gordon, S. 2009. (March 3). "Flannery O'Connor," in *New Georgia Encyclopedia*. Georgia Humanities Council and the University of Georgia Press. http://www.georgiaencyclopedia.org/nge/Article.jsp?path=/Literature/Fiction/Authors&id=h-498 (accessed January 2017).

Jackson, E.L. 1988. "The Story of Georgia's Capitols and Capital Cities," in *GeorgiaInfo,* part of the *Digital Library of Georgia*. GALILEO and the University of Georgia Libraries. http://georgiainfo.galileo.usg.edu/capital.htm (accessed January 2017).

Johnson, R.H. and P.W. Bush. 1988. *Summary of the Hydrology of the Floridan Aquifer System in Florida and in Parts of Georgia, South Carolina, and Alabama*. U.S. Geological Survey Professional Paper 1403-A.

Metropolitan North Georgia Water Planning District. (Metro Water District). 2011. *About Us*. http://www.northgeorgiawater.org/html/aboutus.htm (accessed January 2017).

National Park Service. *Ocmulgee Mounds National Historical Park: History and Culture.* https://www.nps.gov/ocmu/learn/historyculture/index.htm Last updated February 25, 2022.

University of Georgia. (UGA). 2010 (August 20). *A Brief History of the University of Georgia*. http://www.uga.edu/profile/history (accessed January 2017).

University of Georgia. (UGA). 2008a. "General Sherman's Campaign War Map," in *Historical Maps*. University of Georgia Libraries. Hargrett Rare Book & Manuscript Library. http://www.libs.uga.edu/darchive/hargrett/maps/1864g4.jpg (accessed January 2017).

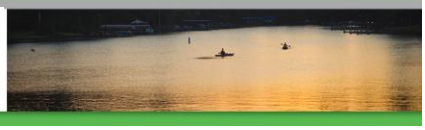
University of Georgia. (UGA). 2008b. Georgia Land Use Trends. Natural Resources Spatial Analysis Laboratory. College of Agricultural and Environmental Sciences. http://gis.caes.uga.edu/GLUT/ (accessed January 2017).

U.S. Bureau of Labor Statistics. (BLS). 2016. Local Area Unemployment Statistics. https://www.bls.gov/lau/#cntyaa (accessed January 2017).

U.S. Environmental Protection Agency. (USEPA). 2001. *Preliminary Data Analysis Using Responses from the Detailed Industry Questionnaire: Phase II Cooling Water Intake Structures*.

U. S. Geological Survey (USGS). 2016. *Water Use in Georgia by County for 2010 and Water-Use Trends, 1985–2010*. https://pubs.er.usgs.gov/publication/ofr20151230 (accessed January 2017).

U.S. Geological Survey. 2019. Estimated Water Use in Georgia for 2015 and Water-Use Trends for 1985-2015. Open-File Report 2019-1086.



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APPENDIX A

Appendix A Summary of Edits and Updates 2022-2023 Review and Revisions

Section	Location	Change	Description
ES	Section Introduction	Text Modifications	▪ The text was revised to add the 2023 update. ▪ The text was revised to remove duplicate sentences.
ES	Section Water and Wastewater Demands	Updated	▪ The text was updated to reflect the 2020 water and wastewater demand forecasts.
ES	Figure ES-2	Updated	▪ The text was updated to reflect the 2020 water and wastewater demand forecasts.
ES	Figure ES-3	Updated	▪ The text was updated to reflect the 2020 water and wastewater demand forecasts.
ES	Section Major Findings	Updated	▪ The text was updated to reflect current resource assessment methods, terminology, and results
ES	Table ES-2	Updated	▪ The table was updated to reflect results of the current analyses, as described in Section 5.
ES	Recommended Management Practices	Text Modifications	▪ Text revised to reflect current terminology. ▪ Text revised to reflect the 2023 revisions, which were limited to updates of outdated information.
ES	Table ES-3	Text Modifications	▪ Text revised to reflect current terminology and updates.
1	Introduction and Section 1.2 and 1.3	Updated	▪ Text added to reference the 2023 plan revision ▪ Text added to reference Appendix A that identifies the portions of the plan that have been updated.
1	Figure 1-1	Removed	▪ This figure was removed in the plan update.
1	Figure 1-2	Updated	▪ This figure was updated in the plan update.
1	Figure 1-3	Added	▪ This figure was added to reflect the goals for the Upper Oconee Region. ▪ Text describing the goals for the Upper Oconee Region was removed.
2	Introduction	Updated	▪ Population updated to 620,422 in 2020 from 577,039 in 2015
2	Section 2.1	Text Additions	▪ Text was added to provide additional information on the history of the Oconee and Apalachee Rivers.
2	Section 2.1.3	Updated	▪ The text was updated to reflect the percent of groundwater from the Floridan aquifer used in the Upper Oconee region.
2	Section 2.2.1	Updated	▪ Population numbers for referenced counties updated to reflect the 2020 Census numbers.
2	Section 2.2.2	Updated	▪ Total employment in the Region updated to 271,345 in 2019 from 253,582 in 2015. ▪ The unemployment rate in the Region was updated to 3.4 percent in 2019 from 5.8 percent in 2015
2	Section 2.2.3 and Figure 2-3	Updated	▪ Text and Figure 2-3 updated to reflect more recent land use information.
2	Section 2.3	Text Additions	▪ Text added regarding the enabling statute for Georgia's Regional Commissions

Section	Location	Change	Description
3	Introduction	Text Additions	▪ Text describing chlorophyll a standards and nutrient loading to Lake Oconee and Sinclair added to the Summary box
3	Section 3.1 including Figures 3-1 through 3-4	Updated	▪ Updated water use information to the most recent information compiled by USGS (2019 USGS Publication). ▪ The figures were updated to reflect updated values from 2019 USGS Publication (USGS Water Use in Georgia 2015). ▪ Text modified to add information on Plant Branch retirement
3	Section 3.2	Text Additions	▪ Text added to clarify approach to each resource assessment
3	Section 3.2.1	Modified text	▪ The text explaining the Surface Water Quality (Assimilative Capacity) Assessment was modified for clarity. ▪ The text was updated to reflect the adoption of chlorophyll *a* standards for Lake Oconee and Lake Sinclair. ▪ Text added to describe EPD action to manage point source loadings to Lake Oconee.
3	Table 3-1	Updated	▪ This table was updated to reflect the most recent results of the assimilative capacity assessment.
3	Figure 3-5	Updated	▪ This figure was updated to reflect the most recent results of the assimilative capacity assessment for the entire council region.
3	Figure 3-6	Updated	▪ This figure was updated to reflect the most recent results of the assimilative capacity assessment by basin.
3	Figure 3-7 and 3-8	Added	▪ Figures were added to show measured chlorophyll *a* in Lake Oconee and Lake Sinclair.
3	Section 3.2.2	Text Additions	▪ Text modified to describe updated methodology new metrics for determining surface water availability, and results from the Basin Environmental Assessment Model (BEAM). ▪ Text and former Figure 3-6, which described results from the earlier model, were removed.
3	Figure 3-9	Updated	▪ This figure was updated to show the surface water availability assessment and evaluation nodes in the in the new model for Upper Oconee region.
3	Table 3-2	Added	▪ This table was added to describe the metrics reported from the BEAM model.
3	Table 3-3	Added	▪ This table was added to summarize permitted water withdrawal facilities and wastewater discharge facilities with potential water supply availability challenges. ▪ Text was added explaining the results shown in Table 3-3.
3	Table 3-4	Added	▪ This table was added to provide additional detail on facilities where the model shows potential water supply challenges. ▪ Text describing the results shown in Table 3-4 was added.
3	Table 3-5	Added	▪ This table was added to provide additional detail on the facilities where the model shows potential water assimilation challenges. ▪ Text describing the results shown in Table 3-5 was added.

Section	Location	Change	Description
3	Table 3-6	Added	▪ This table and associated text were added to provide information from a Regional Water Planning Implementation seed grant, including example flow metrics for recreation and aquatic species and habitat in the Oconee River.
3	Table 3-7	Added	▪ This table was added to provide information on the groundwater availability assessment results for the Cretaceous Aquifer and Floridian Aquifer in South-Central and Eastern Coastal Plain. ▪ Text describing the results shown in Table 3-7 was added.
3	Table 3-8	Text Update	▪ Table entries were updated with 2022 designated uses in the Region.
3	Section 3.3.2	Text Updates and Modifications	▪ The text was updated to reference the latest 305(b)/303(d) list published by GAEPD. ▪ The text was revised to reflect GAEPD's shift in bacteria standards, moving from fecal coliform standards to *E. coli* standards.
3	Figure 3-10	Updated	▪ This figure was updated to reflect the impaired waters in the Upper Oconee region.
3	Section 3.3.3	Modified Text	▪ The text describing the DNR State Wildlife Action Plan was clarified and enhanced with information from the Georgia Biodiversity Portal.
4	Section 4	Text Updated	▪ The text was revised to reflect updated projected values for the regional water demand and wastewater flow forecasts from 2020 through 2060. ▪ Text referencing the 2010 USGS data was removed. ▪ The text was updated to replace energy with thermoelectric generation.
4	Section 4.1	Updated	▪ Text additions describe the updated methodology for determining municipal water demand and wastewater flow forecasts. ▪ Population projections were updated based on the most recent statewide population projections from the Governor's Office of Planning and Budget.
4	Table 4-1	Updated	▪ This table was updated to reflect the Governor's Office Planning and Budget's latest population projections by county.
4	Section 4.1.1	Text Updated	▪ The text was updated to describe the updated methodology for determining per capita water use rates and the total municipal water demand for the Upper Oconee region. ▪ The text was modified to remove reference to the forecasted municipal water demand in the region from 2015 to 2050.
4	Table 4-2	Updated	▪ This table was updated to reflect the latest municipal water demand forecasts by county. ▪ Surrounding text was updated to reflect the revised municipal water forecasts. ▪ A note was added to the table explaining how to interpret the values. The values represent forecasted annual average demand (AAD) in million gallons per day (MGD).
4	Figure 4-1	Updated	▪ This figure was updated to reflect the latest municipal water demand forecast. ▪ A note was added to the figure explaining how to interpret the values. The values represent forecasted annual average demand (AAD) in million gallons per day (MGD).

Section	Location	Change	Description
4	Section 4.1.2	Updated	▪ Text additions describe the municipal wastewater flow forecasts and add a reference for assumptions regarding septic systems. ▪ Text describing the previously used methodology for determining wastewater flow forecasts was removed. ▪ Text additions describe the usage of Census data to determine wastewater flows.
4	Table 4-3	Updated	▪ This table was updated to reflect the latest municipal wastewater flow forecasts by county. ▪ A note was added to the table explaining how to interpret the values. The values represent forecasted annual average demand (AAD) in million gallons per day (MGD).
4	Figure 4-2	Updated	▪ This figure was updated to reflect the latest municipal water use forecast. ▪ A note was added to the figure explaining how to interpret the values. The values represent forecasted annual average demand (AAD) in million gallons per day (MGD).
4	Section 4.2	Updated	▪ The text was updated to reflect the updated methodology used to determine industrial water demand and wastewater flow forecasts
4	Section 4.2.1	Added	▪ This section was added to provide information on the formation of EPD's advisory group and the review process for estimating future industrial water requirements.
4	Section 4.2.2	Updated	▪ The text was updated to reflect the updated methodology for determining industrial water demand forecasts. ▪ Text describing the previously used methodology for determining industrial water demand forecasts was removed. ▪ The text was updated to reflect the updated values for industrial water demand in the region.
4	Former Figure 4-3	Removed	▪ This figure was removed in the Plan update.
4	Section 4.2.3	Updated	▪ The text was updated to reflect the updated methodology for determining industrial wastewater flow forecasts in the Region. ▪ Text describing the previously used methodology for determining industrial wastewater flow forecasts was removed.
4	Figure 4-3	Updated	▪ This figure was updated to reflect the latest total industrial water and wastewater flow forecast. ▪ The title of the figure was updated. ▪ A note was added to the figure explaining how to interpret the values. The values represent forecasted annual average demand (AAD) in million gallons per day (MGD).
4	Section 4.3	Updated	▪ The text was updated to reflect the methodology used to determine agricultural water use forecasts in the Region.

Section	Location	Change	Description
4	Table 4-4	Updated	▪ This table was updated to reflect the latest agricultural water demand forecasts by county. ▪ Text describing the values shown in Table 4-4 was updated. ▪ A note was added to the table explaining how to interpret the values. The crop demands represent dry year conditions, in which 75% of years had more rainfall and 25% of years had less. ▪ A note was added to the table explaining how to interpret the values. The source of agricultural withdrawals are supplied by groundwater and surface water ▪ A note was added to the figure explaining how to interpret the values. The values represent forecasted annual average demand (AAD) in million gallons per day (MGD).
4	Section 4.4	Updated	▪ The text was updated to reflect the updated methodology for determining thermoelectric water withdrawal and consumption demands. ▪ Text describing the previously used methodology for determining thermoelectric water withdrawal and consumption demands was removed. ▪ The text describing once-through and closed-loop cooling systems was revised to reflect differences in water use by the two types of systems and to reflect the closure of all of Georgia's thermoelectric facilities with once-through cooling.
4	Table 4-5	Updated	▪ This table was updated to reflect the latest energy sector water demand forecast. ▪ Surrounding text was updated based on the revised energy sector water demand forecast. ▪ A note was added to the figure explaining how to interpret the values. The values represent forecasted annual average demand (AAD) in million gallons per day (MGD). ▪ A note referencing the decommissioning of Plant Branch was removed.
4	Section 4.5	Updated	▪ The text was updated to reflect the updated total water demand forecasts for the years 2020-2060 for the Upper Oconee Region.
4	Figure 4-4	Updated	▪ This figure was updated to reflect the latest water demand forecast by sector.
4	Former Figure 4-6	Removed	▪ This figure was removed in the Plan update.
4	Figure 4-5	Updated	▪ This figure was updated to reflect the latest total wastewater flow forecast. ▪ Surrounding text was updated based on revised total wastewater flow forecast.
5	Introduction	Text Additions	▪ Text added to clarify the difference between potential water resource challenges and potential infrastructure needs.
5	Section 5.1	Text Updates	▪ The text was updated to reflect the total estimated regional and aquifer-wide water demands for Crystalline-Rock Aquifer in 2020 and 2060. ▪ The text was updated to reflect the updated projected water supply need from the Floridian Aquifer for the Upper Oconee Region in 2060.
5	Table 5-1	Added	▪ This table was added to provide information on groundwater availability results for the Cretaceous Aquifer and Floridian Aquifer in South-Central and Eastern Coastal Plain.

Section	Location	Change	Description
5	Figure 5-1	Updated	▪ This figure was updated to reflect the updated forecasted groundwater demand in the Cretaceous Aquifer between Macon and Augusta in 2020 and 2060.
5	Section 5.2	Text Additions	▪ Text added to describe the updated methodology, new metrics for evaluating surface water availability, and results from the BEAM model. ▪ Text added to define the 7Q10 metric and provide a link to EPA's webpage containing additional information about low flow metrics. ▪ Text added to include quarries in the list of options that can be implemented to address surface water availability challenges.
5	Figure 5-2	Updated	▪ This figure was updated to show the updated surface water availability assessment nodes with potential challenges with surface water availability.
5	Table 5-2	Added	▪ This table was added to summarize the current water supply and wastewater assessment results. ▪ Text additions explain the information summarized in Table 5-2.
5	Table 5-3	Added	▪ This table was added to provide detailed results on water supply challenges indicated in assessment results. ▪ Text additions explain the information summarized in Table 5-3.
5	Table 5-4	Added and Text Modifications	▪ This table was added to provide detailed results on wastewater assimilation challenges indicated in assessment results. ▪ Text was added to Section 5.2 to explain the information summarized in Table 5-4.
5	Former Table 5-1	Removed	▪ This table was removed in the Plan update.
5	Former Table 5-2	Removed	▪ This table was removed in the Plan update.
5	Former Table 5-3	Removed	▪ This table was removed in the Plan update.
5	Former Table 5-4	Removed	▪ This table was removed in the Plan update.
5	Table 5-5	Updated	▪ This table was updated with current information on permitted municipal water withdrawal limits vs. 2060 forecasted demands and specify the counties served by withdrawals from Bear Creek reservoir and Hard Labor Creek reservoir. ▪ Text additions were added to explain the information summarized in Table 5-5.
5	Section 5.3.1	Text Updates	▪ The text was updated to provide information on the relationship between DO levels, pollutant loading, and assimilative capacity shown in Figure 5-3. ▪ The text was updated to reflect the updated list of stream segments within the Upper Oconee Region that have exceeded their full assimilative capacity under the current conditions assessment and tp clarify the meaning of that result. ▪ The text was updated to include the link to the *Assimilative Capacity Resource Assessment* on the state water planning website.
5	Table 5-6	Updated	▪ This table was updated to reflect the updated assimilative capacity results for DO under current permitted conditions.

Section	Location	Change	Description
5	Figure 5-3	Updated	▪ This figure was updated to reflect the latest assimilative capacity results for DO under current permitted conditions.
5	Figure 5-4	Updated	▪ This figure was updated to reflect the latest assimilative capacity results for DO under assumed future (2060) permitted conditions.
5	Section 5.3.2	Text Updates and Additions	▪ The text was updated with the number and names of lakes that have lake standards. ▪ The text was updated to discuss the chlorophyll *a* standards for Lake Oconee and Lake Sinclair. ▪ The text was updated to remove discussion of chlorophyll *a* standards for Lake Jackson. ▪ The text was updated to remove mention of GAEPD's development of nutrient (i.e., chlorophyll *a*) standards. ▪ References to major and minor facilities were deleted for clarity. ▪ Text was added to explain graphs shown in Figures 5-5 and 5-6.
5	Section 5.4	Text Updates	▪ The text was updated to better explain the relationship between forecasted wastewater demand and existing permitted capacity. ▪ The text was updated to reflect the updated names of counties where infrastructure capacity may be needed.
5	Table 5-7	Updated	▪ This table was updated to reflect the latest permitted discharge flow values and the updated wastewater flow forecasts.
5	Section 5.5	Text Updates	▪ The text was updated to reference the correct table.
5	Table 5-8	Updated	▪ The table was updated to reflect the updated summary of potential challenges and needs by county. ▪ Text was added to clarify interpretation of the table.
6	Introduction	Text Additions	▪ Text revised for consistency in terms (challenges and infrastructure needs) ▪ Text added explaining that, while management practices are still robust and generally applicable, the 2023 revisions were limited to updates of outdated information due to the number of vacant seats on the Council.
6	Section 6.2	Text Modifications	▪ Text revised for consistency in use of terms (challenges and infrastructure needs) ▪ Text added to explain that 2023 revisions were limited to updates of outdated information.
6	Section 6.2.1	Text Modifications	▪ Text revised for consistency in use of terms (challenges and infrastructure needs)
6	Table 6-1	Text Additions	▪ Text added to clarify that management practices were selected in 2011 and revised in 2017. In 2023, while management practices are still robust and generally applicable, revisions were limited to updates of out-of-date information due to the number of vacancies on the Council.
6	Section 6.2.2	Text Modifications	▪ Text revised to reflect results of resource assessments completed for the 2023 plan revision.
6	Section 6.2.3	Text Modifications	▪ Text revised to reflect results of resource assessments completed for the 2023 plan revision.

Section	Location	Change	Description
7	Introduction	Text Additions	▪ Text added explaining that, while management practices are still robust and generally applicable, the 2023 revisions were limited to updates of outdated information due to the number of vacant seats on the Council.
7	Table 7-1	Text Additions	▪ Text added to clarify that the implementation roadmap was selected in 2011 and revised in 2017. While management practices are still robust and generally applicable, the 2023 revisions were limited to updates of outdated information due to the number of vacant seats on the Council.
7	Section 7.1.1	Text Modifications	▪ Text revised for consistency in use of terms (challenges and infrastructure needs)
7	Section 7.2	Text Modifications	▪ Text revised to explain rationale for removal of specific cost estimates (former Table 7-5) from the 2023 revised plan.
7	7.3.1	Text Modifications	▪ Text revised to clarify that Metro Water District requirements apply to localities lying wholly or partially in the District and to recognize the 2017 and 2022 updates of the Metro District Water Plans.
7	Table 7-5	Text Modifications	▪ Text revised to update the coordination recommendation concerning appointments to the Upper Oconee Regional Water Council. ▪ Text revised to update in the policy/programmatic recommendation on naturally-low DO streams to recognize the EPD rule and methodology for listing these streams as impaired. ▪ Text revised to update the recommendation for the next 5-year update that concerns the resource assessments, recognizing the recent improvements in the surface water assessment model.
8	Table 8-1	Text Modifications	▪ Text of benchmarks for water supply and wastewater practices revised for consistency in use of terms (challenges and infrastructure needs)
8	Section 8.3	Text Additions	▪ Text added to reference the current Council Chair and Vice Chair.
9	Bibliography	Text Updates	▪ References were updated to add new technical reports from GAEPD and US Geological Survey.
General updates completed throughout the plan		Replaced word	▪ The word ‘gap’ was replaced with the word ‘challenge’ throughout the document (with one exception when the word ‘gap’ was used in the original source).
		Removed word	▪ The word ‘shortage’ was primarily applied in the surface water resource assessment results. It was removed from descriptions of resource assessment results in other sections of the document.

APPENDIX B

Appendix B Flow Metrics for Recreation and Aquatic Species/Habitat in the Oconee River Basin

Measurement Location	Use or Benefit	Indicator	Example Metrics
USGS 02217475 Middle Oconee River near Arcade,GA	Recreation	Passable for canoeing/kayaking	# days with flows above 250 cubic feet per second (cfs), March - October
		Runnable for canoeing/kayaking	# days with flows from 500-3000 cfs, March - October. Applies from Hwy 82 to Hwy 330.
		Runnable for canoeing/kayaking	# days with flows between 300-2400 cfs, March - October. Applies from Tallassee Shoals to Ben Burton Park.
Tallassee Dam on Middle Oconee River	Aquatic species and habitats	Dam releases to maintain downstream habitat	138 cfs in May and 70 cfs in all other months
USGS 02217500 Middle Oconee River near Athens, GA	Aquatic species and habitats	Loss of species in extreme drought	# days with flow <100 cfs, June-October
		Loss of deep, swift habitat in dry season	# days with flow <265 cfs, June-October
		Fish reproduction	# of years with the 10-day maximum flow >1200 cfs, March-May
		Fish reproduction	# days with flow <500 cfs, March-May
	Recreation	Runnable for canoeing/kayaking	# days with gage heights between 1.3 and 4 feet. Applies from Ben Burton Park to Macon Hwy.
		Runnable for canoeing/kayaking	# days with gage heights greater between 1.5 and 4 feet, March - October. Applies from Macon Highway to Barnett Shoals Road.
USGS 02217615 North Oconee River near Commerce, GA	Recreation	Runnable for canoeing/kayaking	# of days with gage height above 2 feet or flow above 60 cfs, March - October. Applies from Deadwyler Road to Dudley Park.
USGS 02217770 North Oconee River at College St., Athens, GA	Aquatic species and habitats	Connection to floodplain habitat	# flow events greater than 800 cubic feet per second (cfs) in winter, spring and summer of each year
	Recreation	Runnable for canoeing/kayaking	# days with gage height between 4.2 feet and 8 feet, March - October. Applies from Dudley Park to Whitehall Road.
		Passable for canoeing/kayaking	# of days with gage height above 2 feet or flow above 60 cubic feet per second (cfs), March - October
USGS 02218300 Oconee River near Penfield, GA	Recreation	Passable for motorized boating	# days with gage height greater than 5 feet, March - October. Applies from Barnett Shoals Dam and Lake Oconee

Measurement Location	Use or Benefit	Indicator	Example Metrics
USGS 02219000 Apalachee River near Bostwick, GA	Recreation	Runnable for canoeing/kayaking	# days with flows above 350 cubic feet per second (cfs), March - October. Applies from North High Shoals to Price Mill Road.
		Runnable for canoeing/kayaking	# days with flow above 100 cubic feet per second (cfs), March - October. Applies from Price Mill Road to Hwy 441
		Runnable for canoeing/kayaking	# days with flow above 175 cubic feet per second (cfs), March - October. Applies from Hwy 441 to Pot Leaf Shoals.
Georgia Power boat ramps on Lake Oconee	Recreation	Developed boat access	
Lawrence Shoals Boat Ramp			# of days with lake level above 428.4 feet.
Long Shoals Ramp			# of days with lake level above 429.2 feet.
Old Salem Ramp			# of days with lake level above 428.7 feet.
Armour Bridge Boat Ramp			# of days with lake level above 429.0 feet.
Sugar Creek Ramp			# of days with lake level above 428.7 feet.
Parks Ferry Boat Ramp			# of days with lake level above 429.3 feet.
Georgia Power boat ramps on or just below Lake Sinclair	Recreation	Developed boat access	
Rocky Creek Ramp			# of days with lake level above 335.6 feet.
Cosbys Landing Ramp			# of days with lake level above 333.8 feet.
Dennis Station Boat Ramp			# of days with lake level above 337.5 feet.
Highway 16 Boat Ramp			# of days with lake level above 333.4 feet.
Sinclair Dam on the Oconee River	Aquatic species and habitats	Dam releases to maintain downstream habitat	Low flow releases vary by month, with higher minimum releases in the spring; moderate flows in the summer and early fall; and lower minimum releases in the winter.
USGS 02223000 Oconee River at Milledgeville GA	Aquatic species and habitats	Channel maintenance	# years with flows > 12,000 cubic feet per second (cfs).
	Recreation	Runnable for canoeing/kayaking	# days with gage height between 8 feet and 10 feet (about equal to flows between 1000 and 3700 cubic feet per second), March - October. Applies from Sinclair Dam to Oconee River Greenway.
		Runnable for canoeing/kayaking	# days with gage levels below 11 feet (equal to flows of 5000-5500 cubic feet per second), March - October. Applies from Oconee River Greenway to Central State Hospital.

Measurement Location	Use or Benefit	Indicator	Example Metrics
USGS 02223056 Oconee River at Avant Mine near Oconee, GA	Aquatic species and habitats	Aquatic habitat in dry season	# days June-October with flow above 500 cubic feet per second (cfs)
		Fish passage in dry season	# days with flow above 750 cubic feet per second (cfs)
		Fish reproduction	# of consecutive days with flow between 1000-2000 cubic feet per second (cfs), May
		Fish reproduction in oxbows	# days with flow above 3,000 cubic feet per second (cfs), March-May
		Connection to floodplain habitat	# days with flow above 5,000 cubic feet per second (cfs), November-March
		Connection to floodplain habitat	# of days with flow above 10,000 cubic feet per second (cfs), November to March
USGS 02223500 Oconee River at Dublin, GA	Aquatic species and habitats	Connection to floodplain habitat	# of days with flow above 15,000 cubic feet per second (cfs), November to March
Oconee River between Georgia Highway 540 and the Central of Georgia railroad bridge near Oconee, GA	Recreation	Passable for paddling	# days with flows above 570 cubic feet per second (cfs), March - October. Applies from Georgia Highway 540 and the Central of Georgia railroad bridge near Oconee, GA
		Passable for jonboats	# days with gage height above 2 feet. Applies from Dublin to the confluence with the Ocmulgee.

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