SANTEE RIVER BASIN PLAN 2025 DRAFT

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Name and Organization

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** RBC member who participated during the process but was not an active member at the time this Plan was prepared*.

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The Santee RBC

Acronyms

°F	Fahrenheit
7Q10	lowest 7-day average streamflow that occurs, on average, once every 10 years
ACE	Ashepoo-Combahee-Edisto
ACP	Atlantic Coastal Plain
AMI	advanced metering infrastructure
AMR	automated meter reading
ASR	aquifer storage and recovery
AWWA	American Water Works Association
BEA	Bureau of Economic Analysis
BMP	best management practice
cfs	cubic feet per second
CHEOPS	Computer Hydro-Electric Operations and Planning Software
CMOR	Condition Monitoring Observer Report
COG	Council of Government
CPW	Commission of Public Works
CUA	Capacity Use Area
CWS	Charleston Water System
CWWMG	Catawba-Wateree Water Management Group
DMA	Drought Management Area
DRC	Drought Response Committee
EDA	Economic Development Administration
EF	Enhanced Fujita
EIA	U.S. Energy Information Agency
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ft	feet
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FSA	Farm Service Agency
GDP	gross domestic product
gpf	gallons per flush
gpm	gallons per minute
HMGP	Hazard Mitigation Grant Program
HUC	hydrologic unit code
in.	inches
IN	industrial water user
IR	agricultural (irrigation) water user
IWNP	intelligent water and nutrient placement
IRA	Inflation Reduction Act

JGS	Jeffries Generating Station
LDC	Load Duration Curve
LEED	Leadership in Energy and Environmental Design
LEPA	low elevation precision application
LESA	low elevation spray application
LIDCP	Low Inflow and Drought Contingency Plan
LIP	Low Inflow Protocol
MESA	mid-elevation spray application
mg/L	milligrams per liter
MGD	million gallons per day
MGM	million gallons per month
MI	mining water user
MIF	minimum instream flow
mph	miles per hour
MRLC	Multi-Resolution Land Characteristics Consortium
NA	not available/applicable
NASS	National Agricultural Statistics Service
NCEI	National Centers for Environmental Information
NDMC	National Drought Mitigation Center
NLCD	National Land Cover Database
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
PFAS	per- and polyfluoroalkyl substances
PPAC	Planning Process Advisory Committee
P&R	permitted and registered
RBC	River Basin Council
RMA	Risk Management Agency
SCAWWA	South Carolina Water Works Association
SCDA	South Carolina Department of Agriculture
SCDES	South Carolina Department of Environmental Services
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SCE&G	South Carolina Electric & Gas Company
SCFC	South Carolina Forestry Commission
SC ORFA	South Carolina Office of Revenue and Fiscal Affairs
SCO	State Climatology Office
SCRWA	South Carolina Rural Water Association
SEPA	Southeastern Power Administration
SJWC	St. Johns Water Company
SMS	soil moisture sensor
SPI	Standard Precipitation Index

sq mi	square mile
SWAM	Simplified Water Allocation Model
SWB	Soil-Water Balance
TDS	total dissolved solids
TMDL	Total maximum daily load
UNESCO	United Nations Educational, Scientific and Cultural Organization
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WBIC	Weather-based irrigation controller
WS	water supply water user
WTP	water treatment plant
WWQA	Watershed Water Quality Assessment

Chapter 1 Introduction

1.1 Background

The South Carolina Water Resources Planning and Coordination Act mandates that the South Carolina Department of Natural Resources (SCDNR) develop a comprehensive water resources policy for the state of South Carolina. SCDNR developed the first state water plan—the *South Carolina Water Plan*—in 1998. In 2004, the plan was updated following what is recognized as one of the worst multi-year droughts on record, which ended in 2002. One of the recommendations from the *South Carolina Water Plan, Second Edition* was forming advisory committees to develop comprehensive water resource plans for each of the state's four major river basins: Ashepoo-Combahee-Edisto (ACE), Pee Dee, Santee, and Savannah. In 2014, when the development of surface water quantity models to support the planning process began, SCDNR and the South Carolina Department of Health and Environmental Control (SCDHEC) decided to further subdivide the basins based on SCDHEC's delineations used for the Water Quality Assessments. The eight planning basins were the Broad, Catawba, Edisto, Pee Dee, Salkehatchie, Saluda, Santee, and Savannah. In 2022, SCDNR made two adjustments to the planning basins. In the Saluda basin, the drainage area just below the confluence of the Broad and Saluda Rivers, which is generally below the Fall Line, was added to the Santee basin. The Savannah basin was subdivided into two planning basins and the portion below Lake Thurmond was combined with the Salkehatchie basin to form the Lower Savannah-Salkehatchie basin, as shown in Figure 1-1.

Each of these water resource plans is called a River Basin Plan, which is defined in the *South Carolina State Water Planning Framework* (SCDNR 2019a; referred to hereafter as the Planning Framework) as "a collection of water management strategies supported by a summary of data and analyses designed to ensure the surface water and groundwater resources of a river basin will be available for all uses for years to come, even under drought conditions." The 2025 update to the State Water Plan will build on the analyses and recommendations developed in the River Basin Plans.

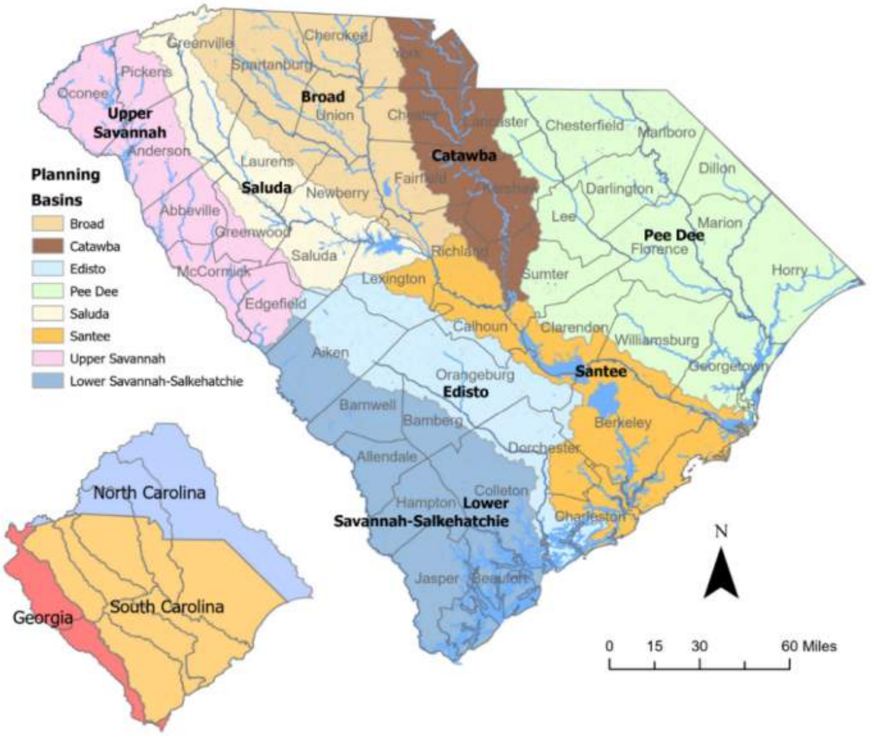


Figure 1-1. Planning basins of South Carolina.

River basins are seen as a natural planning unit for water resources since surface water in each basin is relatively isolated from water in other basins by natural boundaries. Each River Basin Plan will include data, analysis, and water management strategies to guide water resource development in the basin for a planning horizon of 50 years. Specifically, a River Basin Plan answers four questions:

1. What is the basin's current available water supply and demand?
2. What are the current permitted and registered water uses within the basin?
3. What will be the water demand in the basin throughout the planning horizon, and will the available water supply be adequate to meet that demand?
4. What water management strategies will be employed in the basin to ensure the available supply meets or exceeds the projected demand throughout the planning horizon?

In each river basin, a River Basin Council (RBC) is established and tasked with developing a plan that fairly and adequately addresses the needs and concerns of all water users following a cooperative, consensus-driven approach. The Santee River basin is the seventh river basin to begin and complete the process that culminated in developing this plan. River basin planning is expected to be an ongoing, long-term process, and this plan will be updated in subsequent years.

1.2 Planning Process

The river basin planning process in South Carolina formally began with the development of the eight surface water quantity models starting in 2014 and the update of the Coastal Plain Groundwater Model in 2016. In March 2018, SCDNR convened the Planning Process Advisory Committee (PPAC). Over the next year and a half, SCDNR and the PPAC collaboratively developed the Planning Framework, which defines river basin planning as the collective effort of the numerous organizations and agencies performing various essential responsibilities, as described in the bullets that follow. A more complete description of the duties of each entity are provided in Chapter 3 of the Planning Framework.

- RBC: A group of no more than 25 members representing diverse stakeholder interests in the basin. Each RBC includes at least one representative from each of the eight broadly defined stakeholder interest categories shown in Figure 1-2. The RBC is responsible for developing and implementing the River Basin Plan; communicating with stakeholders; and identifying recommendations for policy, legislative, regulatory, or process changes.
- PPAC and WaterSC: The PPAC was a diverse group of water resource experts established to develop and help implement the Planning Framework for state and river basin water planning. The PPAC was dissolved in 2024 and the WaterSC Water Resources Working Group (WaterSC) was established by Executive Order 2024-22 to advise the South Carolina Department of Environmental Services (SCDES) on developing the

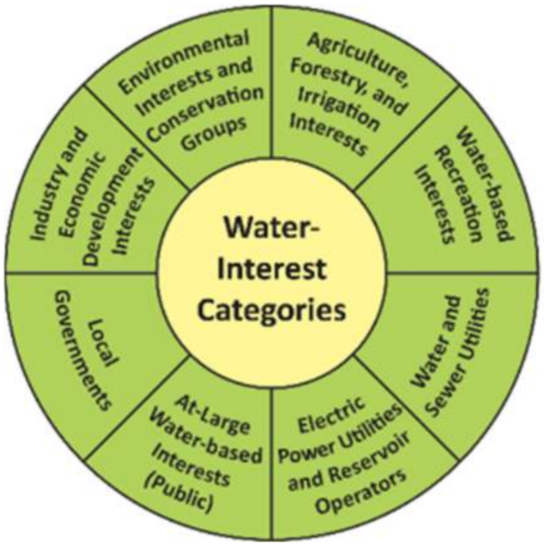


Figure 1-2. RBC water-interest categories.

new State Water Plan and facilitate additional collaboration with ongoing water planning efforts and existing initiatives.

- State and Federal Agencies:
    - SCDNR was the primary oversight agency for the river basin planning processes until July 1, 2024 when the Water Division of SCDNR moved to the newly formed SCDES. Key duties of SCDNR, which now fall to SCDES, include appointing members to the RBCs; educating RBC members on critical background information; providing RBCs and contractors with data, surface water models, and groundwater models; hiring contractors; and reviewing and approving the final River Basin Plans.
    - SCDES (formerly SCDHEC) is the regulatory agency that administers laws regarding water quality and use within the state and now oversees water planning activities. Key duties of SCDES include ensuring recommendations are consistent with existing laws and regulations, serving as an advisor for recommended changes to existing laws and regulations, directing the river basin planning effort, and developing the State Water Plan.
    - Other State Agencies: Representatives from other state agencies, such as the Department of Agriculture, Department of Commerce, Forestry Commission, Rural Infrastructure Authority, and the Energy Office, may be asked to attend RBC meetings in an advisory role.
    - Federal Agencies: Representatives from federal agencies, such as the U.S. Geological Survey (USGS), U.S. Army Corps of Engineers (USACE), and Southeastern Power Administration (SEPA), may be asked to attend RBC meetings as formal advisors. Representatives from other federal agencies may be asked to attend RBC meetings in an advisory role.
- Contractors: SCDES hired contractors to perform administrative, facilitative, technical, authorship, and public outreach functions. Specific roles included:
    - Coordinator: Performs administrative functions. Coordination of Santee RBC meetings and other activities have been performed by representatives from CDM Smith with assistance from SCDES (collectively, the Planning Team). The Planning Team met at least monthly in between RBC meetings.
    - Facilitator and Author: Guides RBC meetings in a neutral manner to encourage participation and provides River Basin Plan authorship services. CDM Smith served in these roles for the Santee RBC.
    - Public Outreach Coordinator: Engages stakeholders and the public in the planning process. Staff from SCDES served in this role for the Santee RBC.
- Groundwater and Surface Water Technical Advisory Committees: SCDES-appointed groups with specific technical expertise intended to enhance the scientific and engineering aspects of the planning process.
- Subcommittees and Ad Hoc Groups: The Santee RBC elected not to form any subcommittees during the initial, 1-year process of developing this plan.
- The Public and Stakeholders: The public was invited to attend and provide comments at RBC meetings and designated public meetings. Additional detail on public participation is described in Chapter 1.4.

The creation of the Santee RBC began with two public meetings organized by SCDNR on October 7 and 10, 2024, in West Columbia and North Charleston, respectively. The goal of these meetings was to describe the need and process for river basin planning to stakeholders and solicit applications to join the Santee RBC. SCDNR selected RBC appointees in November 2024, based on their credentials, knowledge of their interest category, and their connection to the basin (i.e., RBC members must live, work, or represent a significant interest in the water resources of the basin). The diverse membership of the RBC is intended to allow for a variety of perspectives during development of the River Basin Plan. Table 1-1 lists the Santee RBC members and their affiliations, appointment dates, and term lengths. Term lengths are staggered to ensure continuity in the planning process. After serving an initial term, RBC members may be reappointed to serve additional terms subject to SCDES approval, not to exceed three consecutive terms total.

Table 1-1. Santee RBC members and affiliations.

Name	Organization	Position	Interest Category	Appointment Date and Term Length (Years)
Todd Biegger	Crowfield Golf Club	Golf Course Superintendent	Agriculture, Forestry, and Irrigation	December 2024 (4)
Allan Clum	Mount Pleasant Waterworks	General Manager	Water and Sewer Authorities	December 2024 (3)
Hixon Copp	Williamsburg County	Director of Economic Development	Industry and Economic Development	December 2024 (3)
Riley Egger*	Coastal Conservation League	Program Director	Environmental	December 2024 (2)
John Grego	Friends of Congaree Swamp	President	Environmental	December 2024 (2)
W.E. Mickey Johnson, Jr.*	Four J Family Farms	Owner	Agriculture, Forestry, and Irrigation	December 2024 (4)
Michael Melchers	Santee Cooper	FERC Administrator	Electric Power Utilities	December 2024 (2)
Jeff Ruble*	Richland County	Director of Economic Development	Industry and Economic Development	December 2024 (3)
Brandon Stutts	Dominion Energy	Environmental Consultant	Electric Power Utilities	December 2024 (4)
Jason Thompson	Charleston Water System	Source Water Manager	Water and Sewer Authorities	December 2024 (4)
David Wielicki	South Carolina Waterfowl Association	CEO	Environmental	December 2024 (2)
Sarah Wiggins	State Farm	Sales – Business Insurance	Agriculture, Forestry, and Irrigation	December 2024 (3)
Alicia Wilson	Summerville CPW	Deputy GM - Operations	Water and Sewer Authorities	December 2024 (2)
Mike Wooten	Bolton and Menk, Inc.	Principal Engineer	At-Large	December 2024 (3)

** Member was not active at the time this River Basin Plan was prepared.*

The Santee RBC began meeting in December 2024, and continued meeting monthly using a hybrid format that allowed for virtual participation when needed. Meetings were held in and around Moncks Corner.

The planning process was completed in four phases, as specified in the Planning Framework. During the mostly informational phase (Phase 1), RBC members heard presentations from subject matter experts representing SCDNR, SCDES, USGS, Clemson University, and CDM Smith. Presentation topics included water legislation and permitting; hydrology, monitoring, and low-flow characteristics and statistics;

climatology; the South Carolina Drought Response Act; and freshwater aquatic and marine resource management.

Phase 2 of the planning process focused on assessing past, current, and future surface water availability. The RBC reviewed historical and current water use, and 50-year planning scenario results from the surface water quantity model (referred to as the Simplified Water Allocation Model or SWAM). Potential water shortages and issues were identified and discussed.

During Phase 3, water management strategies to address water availability issues were identified, evaluated, selected, and prioritized by the RBC based on their effectiveness, as determined by modeling and feasibility criteria such as cost, environmental impact, and socioeconomic impact.

Legislative, policy, technical, and planning process recommendations were considered during Phase 4 of the planning process, which culminated in developing this River Basin Plan.

Santee RBC members participated in one field trip to better understand the water resources of the basin, how water is withdrawn and used to support hydroelectric supply needs, and its importance in energy production. In March 2025, the RBC visited Jefferies Hydroelectric Facility to learn about the Santee Cooper project history and its operations. Photos from the field trip are shown in Figure 1-3.

Figure 1-3. March 2025 field trip to Jefferies Hydroelectric Facility

1.3 Vision and Goals

During Phase 1 of the planning process, the Santee RBC developed a vision statement establishing the desired outcome of the planning process, and actionable goals supporting their vision for the Santee River basin. The vision statement and goals are listed in Table 1-2.

Table 1-2. Santee RBC Vision Statement and Goals.

Vision Statement	
A resilient and sustainably managed Santee River Basin that balances human and ecological needs now and in the future.	
Goals	
1	**Understand and evaluate existing history, hydrology, policies, and management of the basin.**
2	**Identify information and management gaps and develop new policy and water management strategy recommendations, as may be required, to ensure that water resources are maintained to support stakeholders' and ecological needs.**
3	**Evaluate current surface water and groundwater demands and project future water demands and needs.**
4	**Coordinate efforts and collaborate with the upstream and other impacted basins.**
5	**Enhance the stakeholders' understanding of regional water issues and the need for support of policies and behaviors to protect resources through public education and promotion.**

1.4 Public Participation

Public participation is a vital component of the river basin planning process. All RBC meetings are open to the public. To promote visibility and encourage participation, meeting notices are posted on the SCDES Water Planning web page and are distributed to an email list. Meeting agendas, minutes, summaries, presentations, and recordings are posted on the SCDES website and are available to the public.

In addition to the RBC meetings, dedicated public meetings were also held to distribute information and solicit feedback.

The first two public meetings were held on October 7 and 10, 2024, in West Columbia and North Charleston, respectively. At these meetings, the public was informed of the basin planning process and the plan for public participation. RBC membership applications were solicited at this meeting.

The third public meeting was held on November 18, 2025, in Moncks Corner. A summary of the plan was provided to attendees and a public comment period was opened, which included a verbal comment period at the meeting followed by a 30-day written comment period. Written comments received from the public and the RBC's responses to those comments are included in Appendix C.

1.5 Previous Water Planning Efforts

1.5.1 Drought Planning

The South Carolina State Climatology Office (SCO) is responsible for drought planning in the state. The South Carolina Drought Response Act and supporting regulations establish the South Carolina Drought Response Committee (DRC) as the drought decision-making entity in the state. The DRC is composed of state agencies and local members representing various stakeholder interests. To help prevent overly broad response to drought, SCDNR split the state into four drought management areas (DMAs). The Santee River basin is split between the Central (Santee Basin) DMA and the Southern (ACE Basin) DMA. The DRC monitors drought indicators, issues drought status updates, determines nonessential water use, and issues declarations for water curtailment as needed. In addition to establishing the DRC, the South Carolina Drought Response Act also requires all public water suppliers to develop and implement their own drought plans and ordinances. Drought management plans developed by the public water suppliers in the Santee River basin are further discussed in Chapter 8.

In the Santee River basin, Santee Cooper also has responsibility for drought planning and response. Santee Cooper operates the Santee Cooper Project, which consists of Lake Marion and Lake Moultrie in the Lowcountry of South Caroina. The Project's Santee Dam is on the Santee River, and it controls Lake Marion water levels and releases downstream. The Santee Dam diverts water from Lake Marion through the Diversion Canal into Lake Moultrie and the southern portion of the Santee River Basin. Water management during droughts has been a major issue, with recent droughts occurring in 1950–1958, 1998–2002, 2007–2009, and 2015–2016. Additional short-term low inflow periods, or "flash droughts," occurred in portions of the Santee River basin in early 1981, spring 1985, summer 1986, summer 1990, winter 1993-1994, fall 2010 through fall 2011, summer 2015, and late fall 2021. The Santee Cooper Project's Low Inflow and Drought Contingency Plan (LIDCP) is required under the terms and conditions of Article 406 of the Project's Federal Energy Regulatory Commission (FERC) licesnse (Santee Cooper 2024).

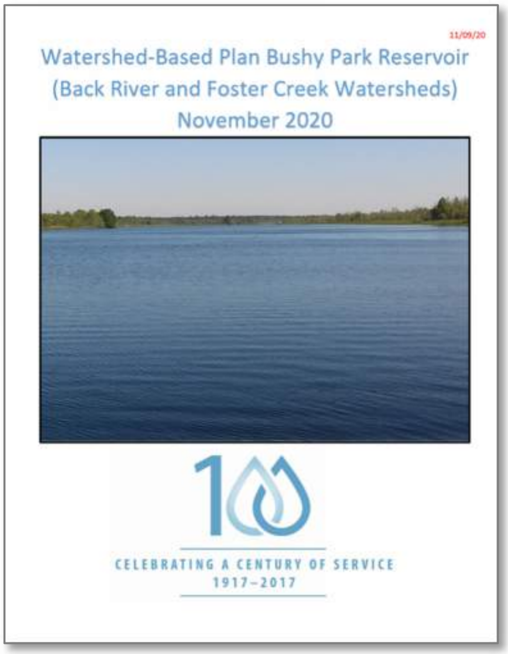
1.5.2 Watershed-Based Plans

Watershed-based plans have been developed for various watersheds throughout South Carolina to document sources of pollution and present a course of action to protect and improve water quality within a watershed. While this first iteration of the Santee River Basin Plan focuses on water quantity issues, previous planning efforts that addressed water quality are worth noting. Water quality considerations may be more fully developed in future updates to this River Basin Plan.

In 1992, SCDHEC initiated its Watershed Water Quality Management program to better coordinate river basin planning and water quality management. Watershed-based management allows SCDES to address congressional and legislative mandates and improve communication with stakeholders on existing and future water quality issues. Watershed Water Quality Assessments (WWQAs) were completed in 1996, 1999, 2005, and 2013 for the portion of the Santee River planning basin downstream of the confluence of the Congaree and Wateree Rivers (downstream of the Congaree subbasin). In addition, the Congaree subbasin was included in the past Saluda River Basin WWQAs, which were published in 1995, 1998, 2004, and 2011 The WWQAs describe, at the watershed level, water-quality-related activities that may potentially have an adverse impact on water quality. As of 2016, the WWQAs have been replaced by the SC Watershed Atlas, which allows users to view watershed information and even add data, create layers from selected features, and export data for use outside of the application. Chapter 3 presents more information on current water quality impairments in the basins.

Bushy Park Reservoir Watershed Plan

In 2018, the Charleston Water System (CWS) applied for a 319 grant to develop a watershed-based plan for the Back River and Foster Creek Watersheds encompassing the Bushy Park Reservoir (CWS 2020). The primary goal of the Bushy Park Reservoir Watershed Plan was to safeguard the long-term water quality of the Bushy Park Reservoir from urbanization and development, due to its status as the primary drinking water source for the area. The plan includes an implementation plan of 12 best management practices (BMPs) that were evaluated on their effectiveness for reducing nutrient, bacteria, and sediment loading. The BMPs that were recommended include pet waste collection sites, stormwater retention systems for older or industrial areas, septic system assessment/replacement program, porous/pervious pavements, and rain barrels/cisterns. The plan recommends implementation of at least one BMP each year from 2021 through 2026. Best education practices are also included to engage stakeholders to assist with the structural measures to provide the desired long-term water quality benefits. The plan also outlines a monitoring strategy and evaluation criteria to determine if the implementation of the BMPs and the educational outreach have led to improvements of water quality.



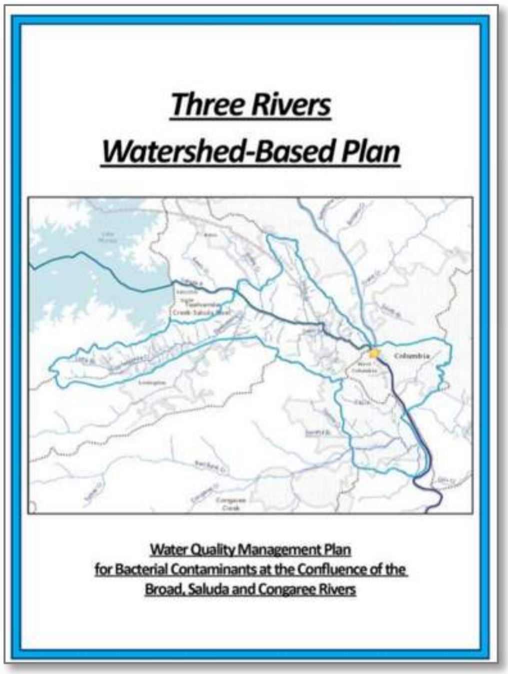
11/09/20

Watershed-Based Plan Bushy Park Reservoir
(Back River and Foster Creek Watersheds)
November 2020

CELEBRATING A CENTURY OF SERVICE
1917–2017

Three Rivers Watershed Plan

In 2022, a watershed-based plan was developed for the watershed which drains to the confluence of the Lower Saluda, Broad, and Congaree Rivers (McCormick Taylor Inc., KCI, and Three Oaks Engineering 2022), *i.e.*, the Three Rivers Watershed. This plan focused on sources of bacterial pollution in the 11 subwatersheds that drain to the Three Rivers Watershed. The watershed covers 55.6 square miles (sq mi) in the Columbia metropolitan area, with a total population of 94,480 at the time of the assessment. Source water protection and climate change considerations were evaluated, for both current and future conditions. Specifically for the Congaree River, this assessment showed that 7 percent of *E. coli* samples exceeded the allowable loading, and would require a 63 percent reduction of the loading to comply with water quality standards. BMPs, including bioretention cells, filter BMPs, constructed stormwater wetlands, conventional wet ponds, and infiltration practices, were proposed to be implemented from 2022 through 2050 with methods for evaluating the success of the watershed plan. Lastly, a community engagement plan was suggested, to include both coordination strategies for stakeholders and broader plans for outreach.



Three Rivers
Watershed-Based Plan

Water Quality Management Plan
for Bacterial Contaminants at the Confluence of the
Broad, Saluda and Congaree Rivers

1.5.3 Groundwater Management Plans

The Groundwater Use and Reporting Act (S.C. Code Ann. §49-5-10 *et seq.*) establishes conditions for the designation of Capacity Use Areas (CUAs). These are areas where excessive groundwater withdrawal may have adverse effects on natural resources; may pose a threat to public health, safety, or economic welfare; or may pose a threat to the long-term integrity of the groundwater source. Once a capacity use area is designated, a Groundwater Management Plan must be developed to study the area's groundwater availability and demand, and offer strategies to promote the sustainability of the resource. The plan must balance the competing needs and interests of the area, including those of future generations. Additionally, all users within the capacity use area withdrawing more than 3 million gallons of groundwater in any month must obtain a groundwater permit. The Santee River basin lies primarily within the Trident CUA but also covers parts of the Western, Santee-Lynches, Pee Dee, and Waccamaw CUAs as shown in Figure 1-4. Additional discussion of the CUAs is included in Section 3.3.4.

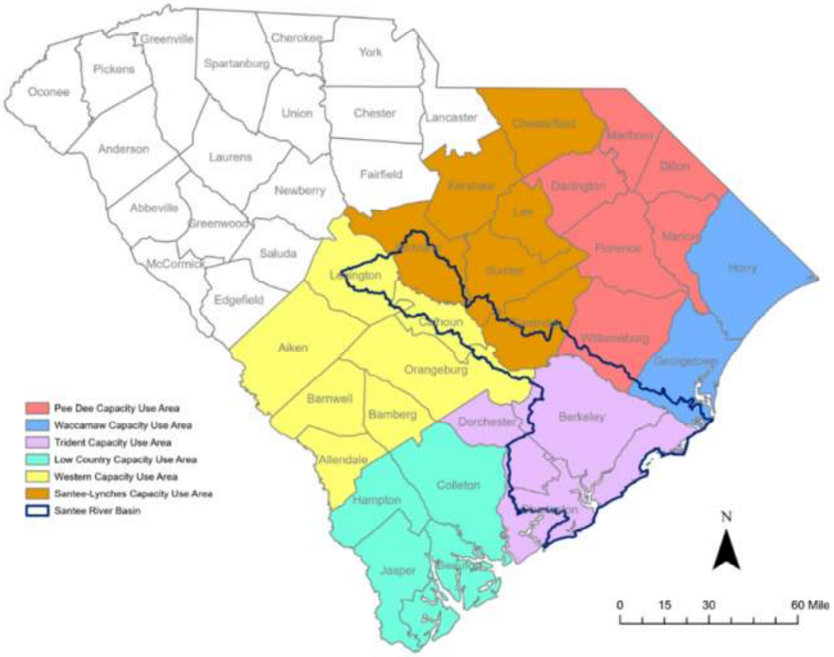


Figure 1-4. Capacity Use Areas.

1.6 Organization of this Plan

The Planning Framework outlines a standard format that all river basin plans are intended to follow, providing consistency in the organization and content. Consistency between river basin plans will facilitate the eventual update of the State Water Plan. Following the format outlined in the Planning Framework, the Santee River Basin Plan is divided into 10 chapters, described as follows:

Chapter 1: Introduction – Chapter 1 provides an overview of the river basin planning purpose and process. Background on the basin-specific history and vision for the future is presented. The planning process is described, including the appointment of RBC members and the roles of the RBC, technical advisory committees, subcommittees, ad hoc groups, state and federal agencies, and contractors.

Chapter 2: Description of the Basin – Chapter 2 presents a physical and socioeconomic description of the basin. The physical description includes a discussion of the basin's land cover, geography, geology, climate, natural resources, and agricultural resources. The socioeconomic section describes the basin's population, demographics, land use, and economic activity, as these factors influence the use and development of water resources in the basin.

Chapter 3: Water Resources of the Basin – Chapter 3 describes the surface and groundwater resources of the basin and the modeling tools used to evaluate their availability. Monitoring programs, current projects, issues of concern, and trends are noted.

Chapter 4: Current and Projected Water Demand – Chapter 4 summarizes the current and projected water demands within the basin. Demands for public water supply, thermoelectric power, industry, agriculture, and other uses are presented along with their permitted and registered withdrawals. The chapter outlines the methodology used to develop demand projections and the results of those projections.

Chapter 5: Comparison of Water Resource Availability – Chapter 5 describes the methodology and results of the basin's surface water availability analysis. This chapter presents planning scenarios that were developed, and the performance measures used to evaluate them. Any water shortages or reaches of interest identified through this analysis are described. The projected water shortages identified in this chapter serve as the basis for the water management strategies presented in Chapter 6.

Chapter 6: Water Management Strategies – Chapter 6 presents the water management strategies developed to address potential water shortages, increase water availability, extend the water supply, and build resilience. For each water management strategy considered, Chapter 6 includes a description of the measure, results from a technical evaluation (as simulated in the surface water quantity model, if applicable), feasibility for implementation, and a cost-benefit analysis.

Chapter 7: Water Management Strategy Recommendations – Chapter 7 presents the final recommendations for water management strategies based on the analysis and results presented in Chapter 6. The chapter discusses the selection, prioritization, and justification for each of the recommended strategies. Any remaining shortages or concerns are also discussed in this chapter.

Chapter 8: Drought Response –The first part of the chapter discusses existing drought management plans, ordinances, and drought management advisory groups. The second part presents drought response initiatives and recommendations developed by the RBC.

Chapter 9: Policy, Legislative, Regulatory, Technical, and Planning Process Recommendations – Chapter 9 presents overall recommendations intended to improve the planning process and/or the results of the planning process. Recommendations to address data gaps encountered during the planning process are presented along with recommendations for revisions to the state's water resources policies, legislation, and agency structure.

Chapter 10: River Basin Plan Implementation – Chapter 10 presents a 5-year implementation plan and long-term planning objectives. The 5-year plan includes specific objectives, action items to reach those objectives, detailed budgets, and funding sources. The long-term planning objectives include other recommendations from the RBC that are less urgent than those in the implementation plan. There will be a chapter in future iterations of this plan that details progress made on planning objectives outlined in previous plan iterations.

Chapter 2
Description of the Basin

2.1 Physical Environment

2.1.1 Geography

The Santee River basin covers approximately 3,704 square miles (sq mi) in South Carolina. It is wholly contained within South Carolina, making up 12 percent of the state's total area. The basin consists of the Congaree River, Santee River, and Cooper River as well as numerous smaller tributaries such as Goose Creek, Gills Creek, Wateree River, and Cedar Creek (Figure 2-1). The Santee River basin extends approximately 110 miles from the confluence of the Saluda and Broad Rivers to the Atlantic Ocean. The upper half of the basin spans around 15 to 30 miles wide while the lower half widens to nearly 60 miles. Parts of Berkeley, Calhoun, Charleston, Clarendon, Dorchester, Georgetown, Lexington, Orangeburg, Richland, Sumter, and Williamsburg Counties are contained within the Santee River basin (Table 2-1).

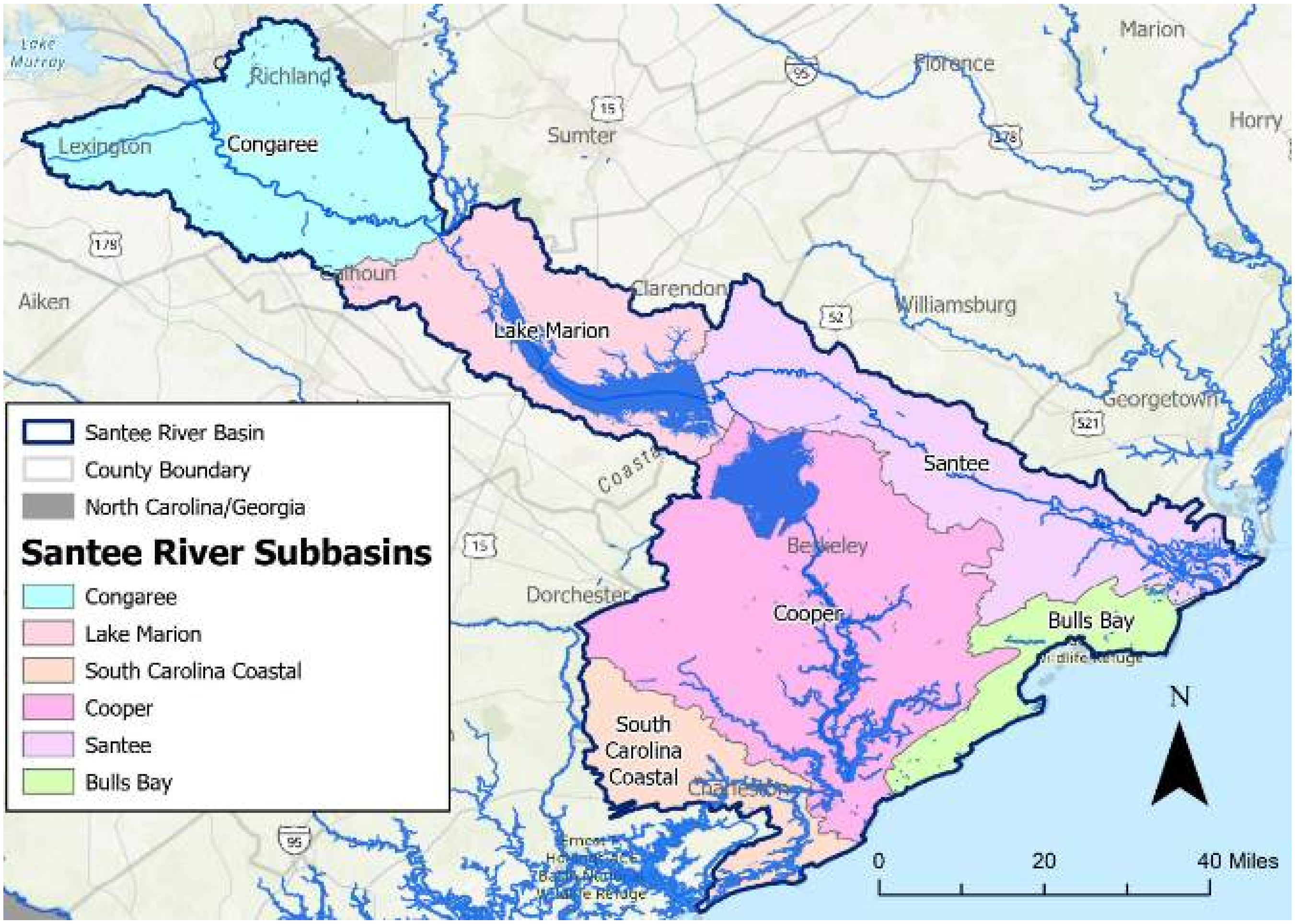


Figure 2-1. The Santee River basin and surrounding counties.

Table 2-1. Counties of the Santee River basin.

County	Percentage of Santee River Basin in County	Percentage of County in Santee River Basin
Berkeley	31%	94%
Calhoun	7%	68%
Charleston	21%	73%
Clarendon	9%	46%
Dorchester	6%	40%
Georgetown	4%	16%
Lexington	5%	26%
Orangeburg	2%	7%
Richland	9%	45%
Sumter	2%	9%
Williamsburg	4%	15%

The Santee River basin consists of six major subbasins: Congaree, Lake Marion, Santee, Cooper, Bulls Bay, and South Carolina Coastal. The basin begins at the confluence of the Saluda and Broad Rivers, which form the Congaree River. For planning purposes, the extent of the Santee River basin includes the Congaree River subbasin, which is typically considered to be part of the Saluda major river basin.

The Congaree River is characterized by a wide, meandering stream bed with extensive floodplains (USACE 1977a). The Congaree is formed by the confluence of the Broad River and the Saluda River just west of Columbia and subsequently flows approximately 50 miles to where it combines with the Wateree River to form the Santee River. The Santee River then flows to Lake Marion. Lake Marion is a manmade lake first constructed in 1941 to provide hydroelectric power to the surrounding area. From Lake Marion, the Santee River flows through the Coastal Plain and into the Atlantic Ocean. Downstream of Lake Marion, the Santee is generally considered to be narrow and meandering until it reaches the coast, where the river widens and straightens. Most tributaries to the Santee below Lake Marion form wide swamplands (SCDES 2025c). At Lake Marion, most of the outflow is diverted to Lake Moultrie via a Diversion Canal. Lake Moultrie was constructed concurrently with Lake Marion to provide additional storage and adequate water depth for generation of hydroelectric power at the Jefferies Hydroelectric Generating Station, which is located just north of Moncks Corner. Together the two lakes, spanning over 250 sq mi, govern much of the basin's hydrology.

Before the construction of Lake Moultrie, the Cooper River's headwaters formed in the same area. Prior to construction of the Santee Cooper Project, the Cooper River was a small coastal estuary with an average discharge of approximately 75 cubic feet per second. Today, the Cooper River forms at the outfall of Lake Moultrie's Tailrace Canal. The Bushy Park Reservoir was created soon after, and enabled by, the Santee Cooper Diversion Project and is located off the West Branch of the Cooper River (SC Act 355 of 1953, USACE Harbor 45 Report). The Cooper River continues past the Bushy Park Reservoir and slowly flows toward Charleston, merging with the East Branch of the Cooper River and later the Wando River before discharging into Charleston Harbor. The Goose Creek Reservoir discharges to the Cooper River before the confluence of the Cooper and Wando Rivers. A large portion of the Cooper River is marshy and tidally-influenced. In the 1980s, a Rediversion Canal was constructed to direct most of outflow from Lake Moultrie back into the Santee River. Today, a weekly average of approximately 4,500 cubic feet per second (cfs) flows from Lake Moultrie to the Cooper River, with the remaining available water (which averages approximately 13,000 cfs under typical inflow conditions) flowing from Lake Marion and the Rediversion Canal to the Santee River (Santee Cooper 2025). The Rediversion Canal was built by the United States Army Corps of Engineers in the early 1980s. The project included the construction of another hydroelectric power station (St. Stephen) and a fish lift to allow for inland migration of anadromous shad, herring and striped bass from the Santee River into Lake Moultrie.

2.1.2 Land Cover

Land cover in the Santee River basin primarily consists of wetlands and forested areas, but there is also a significant amount of developed land (Figure 2-2) (Multi-Resolution Land Characteristics Consortium [MRLC] 2024a). Most of the population in the basin is clustered near the upper and lower extents of the basin. At the top of the basin, urban areas include the lower half of Columbia, West Columbia, and Cayce. Charleston and the surrounding municipalities of North Charleston, Summerville, Mount Pleasant, James Island, Folly Beach, and Isle of Palms are all found near the end of the Cooper River at Charleston Harbor. Other towns include Santee, Moncks Corner, and St. Stephen, but, overall, the majority of the Santee Basin is more rural in nature. The basin contains large tracts of protected land, such as the Francis Marion National Forest, which cumulatively spans 420,000 acres. More information on this land can be found in Section 2.3.3.

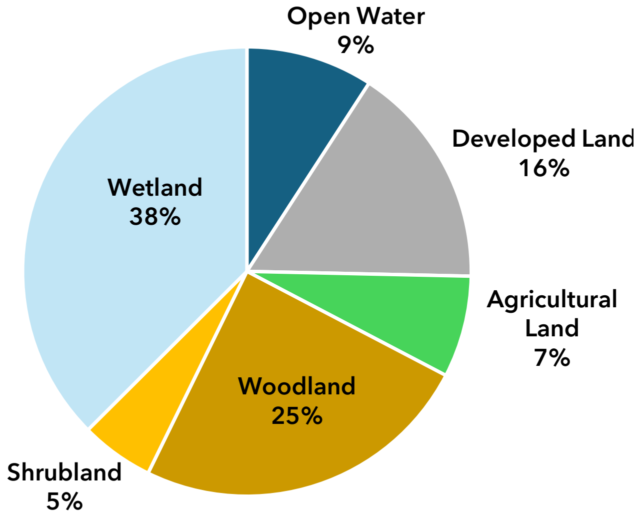


Figure 2-2. 2023 Santee River basin land cover (MRLC 2024a).

Table 2-2, derived from MRLC's National Land Cover Database (NLCD), provides a more detailed summary of land cover types in the basin, and it includes changes in land cover area from 2001 to 2023 (MRLC 2024a, 2024b). In that time, developed land has increased by approximately 161 sq mi, while agricultural land (composed of hay/pasture, cultivated crops, and barren land) decreased by 30 sq mi and woodland (deciduous, evergreen, and mixed forest) decreased by 107 sq mi. The composition of woodland has also changed significantly with over 70 percent of the deciduous forest and 50 percent of the mixed forest being removed compared to only a 5 percent decrease in evergreen forest. Wetlands (woody wetlands and emergent herbaceous wetlands) decreased by 26 sq mi. Open water and shrub land cover types have remained somewhat consistent between 2001 and 2023. Minor differences in open water are likely the product of the water level in the existing reservoirs at the time of the survey.

Table 2-2. Santee River basin land cover and trends (MRLC 2024a, 2024b).

NLCD Land Cover Class	2001 Area (sq mi)	2023 Area (sq mi)	Change from 2001 to 2023 (sq mi)	Change from 2001 to 2023	Percentage of Total Land (2023)
Open Water	343.0	339.3	-3.7	-1%	9%
Developed, Open Space	196.3	229.3	33.0	17%	6%
Developed, Low Intensity	155.4	229.3	73.9	48%	6%
Developed, Medium Intensity	59.8	104.7	44.8	75%	3%
Developed, High Intensity	26.3	35.7	9.3	35%	1%
Barren Land	13.2	23.4	10.2	78%	1%
Deciduous Forest	53.1	14.7	-38.4	-72%	0%
Evergreen Forest	924.8	877.7	-47.1	-5%	24%
Mixed Forest	41.3	19.4	-21.8	-53%	1%
Shrub/Scrub	111.8	109.4	-2.4	-2%	3%
Herbaceous	77.5	86.1	8.6	11%	2%
Hay/Pasture	81.5	46.9	-34.6	-42%	1%
Cultivated Crops	206.1	200.8	-5.2	-3%	5%
Woody Wetlands	1,156.4	1,136.0	-20.4	-2%	31%
Emergent Herbaceous Wetlands	257.7	251.9	-5.8	-2%	7%
Total Land Area	**3,704**	**3,704**	**0.0**	**-**	**100.0%**

2.1.3 Geology

South Carolina is divided into three major physiographic provinces based on geologic characteristics: the Blue Ridge, the Piedmont, and the Coastal Plain. The Santee River basin lies completely within the Coastal Plain (SCDNR 2009). The Coastal Plain contains six major aquifers composed of layers of clay, sand, and limestone. Approximately 4,000 feet (ft) thick near the coast, the Coastal Plain thins as it extends inward and crops out at the Fall Line, which divides the Coastal Plain and the Piedmont provinces. The Santee River basin starts just below the Fall Line and flows through the upper, middle, and lower Coastal Plain subregions to the coast of South Carolina. Each subregion is successively lower, less dissected (i.e., less cut by erosion into hills and valleys), and younger toward the coast. The upper Coastal Plain extends from the Fall Line to the Orangeburg Scarp and has high relief and high drainage density compared to the lower regions. The middle Coastal Plain is a gently rolling to flat terrain that starts at the Orangeburg Scarp and continues to Surry Scarp. The lower Coastal Plain is the area to the east of the Surry Scarp extending to the shoreline (SCDNR 2009). Figure 2-3 depicts a generalized geologic map of the Santee River basin.

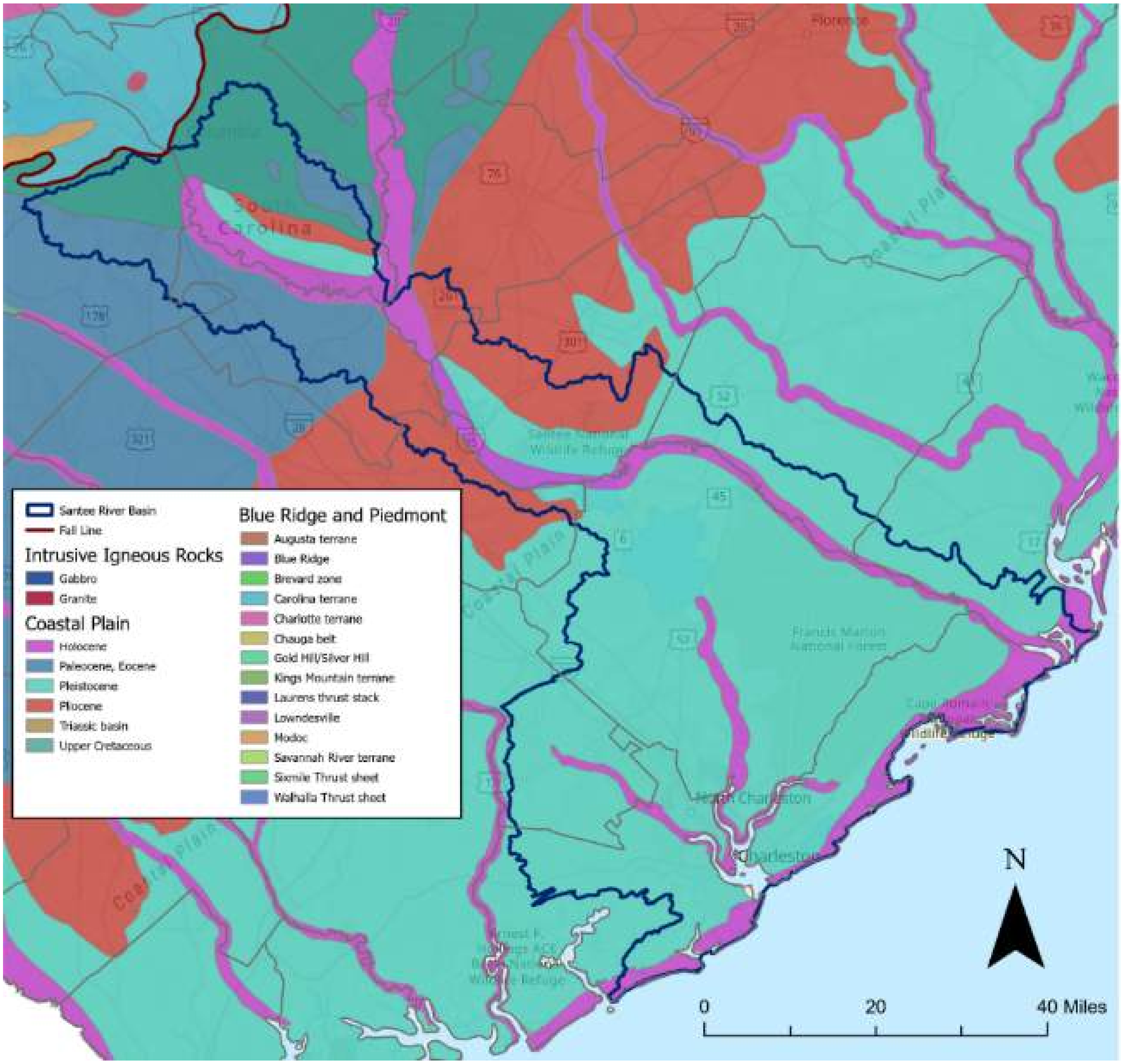


Figure 2-3. Generalized geological map of the Santee River basin (SCDNR 2023a).

2.2 Climate

2.2.1 General Climate

Much like the rest of the Carolinas, the Santee River basin's climate is characterized as humid subtropical, featuring hot summers and mild winters. Figure 2-4 illustrates the annual average temperature and average annual precipitation for the Santee River basin, based on current climate normals (1991 to 2020). The current climate normals maps for all of South Carolina, covering temperature (average, maximum, and minimum) and precipitation, are available at annual, seasonal, and monthly time steps on the South Carolina SCO's "Climate" webpage (SCDNR SCO 2021).

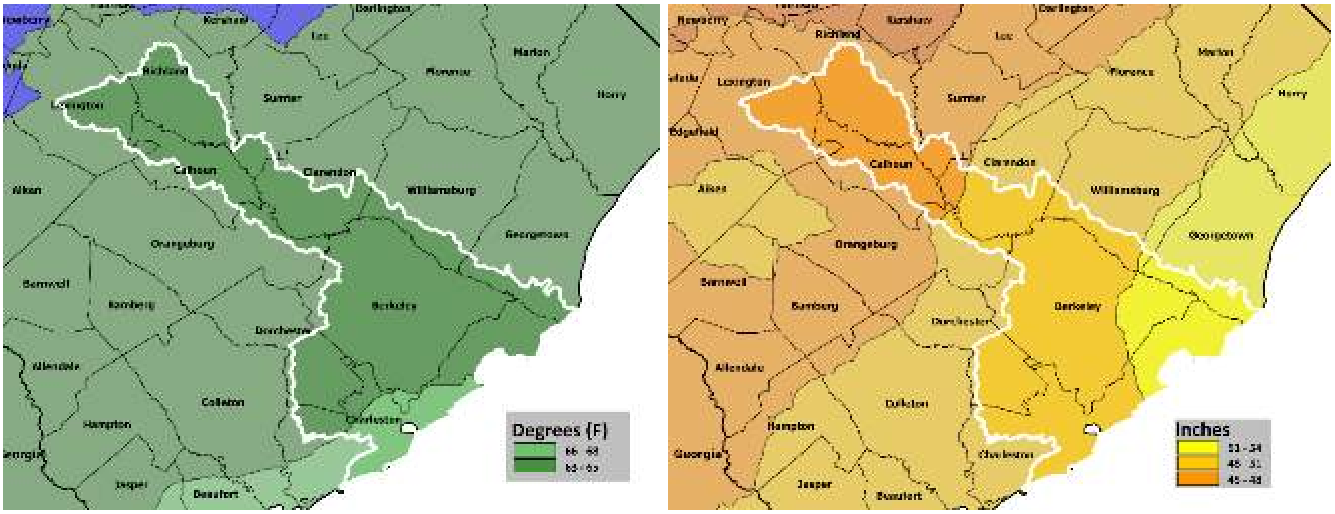


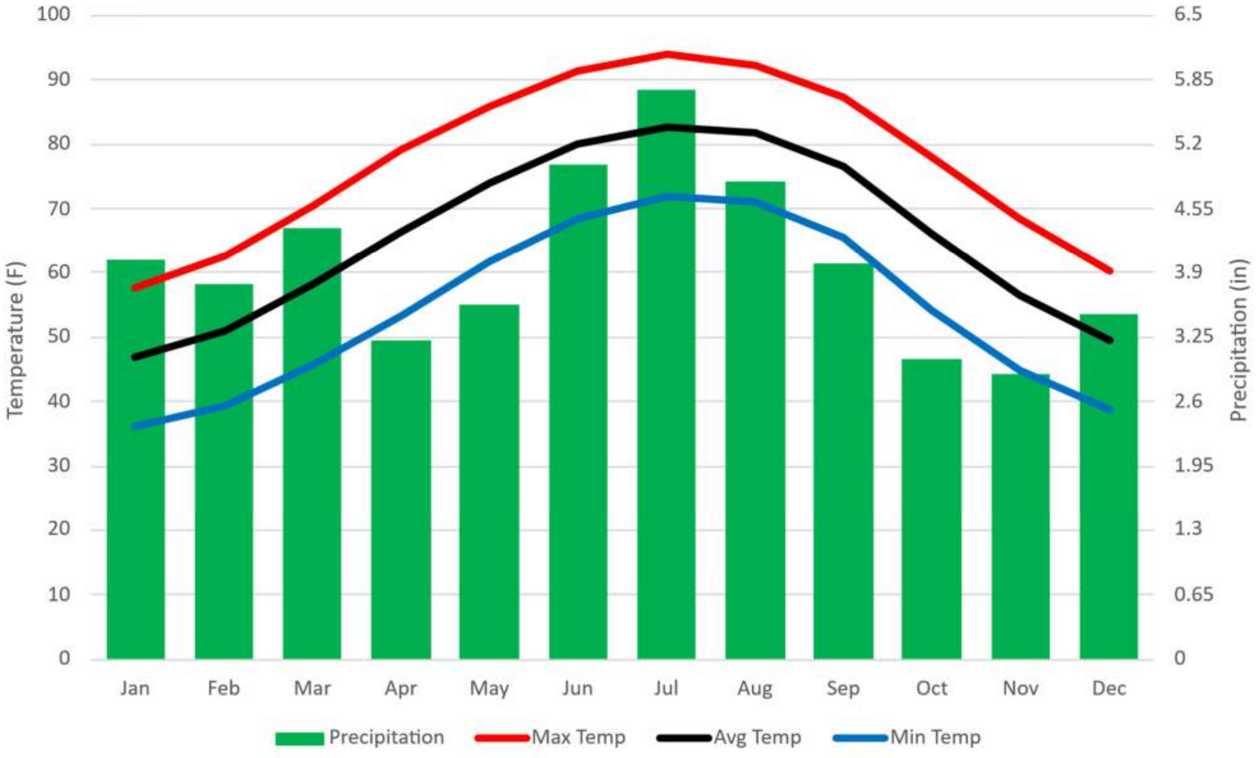
Figure 2-4. Normal annual average temperatures and precipitation (1991 through 2020) for the Santee River basin.

The average annual temperature in the Santee River basin ranges from 63 to 68 degrees Fahrenheit (°F), with increasing temperatures from the upper basin to the lower basin. The annual average precipitation for the entire basin ranges from 42 to 54 inches (in.), with precipitation totals increasing from the upper basin to the lower basin. The part of the basin with the highest annual average rainfall is in the northern coastal section of the basin, which encompasses parts of north Charleston County and southern Georgetown County.

Temperature and precipitation values are not constant throughout the basin or for a given location throughout the year. Figures 2-5 and 2-6 show the monthly variation in temperature and precipitation at the meteorological stations "Columbia-USC in Richland County" and "Charleston International Airport" in Charleston County. The two stations were selected for their long-term records (Columbia-USC reports from 1954 to the present, and Charleston International Airport reports from 1937 to the present). The Charleston International Airport station had no missing data in its period of record for temperature and precipitation. The station at Columbia-USC was selected despite missing 10 years of temperature and precipitation data, to provide a more comprehensive geographic representation of climatological differences across the basin (SCDNR SCO 2025a). The missing annual values result from one or more months of missing data during each of those years, which affects the annual average for that specific year. The annual average values of temperature and precipitation for each station (Figures 2-7 through 2-10) may not align with their locations on the basin climatology images in Figure 2-4 because of differences in the periods of record for the data. The long-term station data used in Figures 2-7 through 2-10 span the entire time frame that the meterological stations have been active, while the data used for Figure 2-4 is based on the current climate normals (1991 to 2020).

At both Columbia-USC and Charleston International Airport, temperatures oscillate throughout the year, with July generally being the warmest month for both stations (average monthly temperature of 82.8°F and 81.6°F, respectively) and January being the coldest month (average monthly temperature of 46.9°F and 48.9°F, respectively). When comparing the climographs for Columbia-USC and Charleston International Airport, the average monthly temperatures at Charleston International Airport tend to be slightly cooler during the summer months than those at Columbia-USC, but slightly warmer during the winter months.

Precipitation also varies annually for Columbia-USC and the Charleston International Airport. The wettest climatological month for both stations is July (5.76 and 7.08 in., respectively), though the monthly normal rainfall total for August at Charleston International Airport is 7.06 in. Columbia-USC typically receives more rainfall in winter (December through February) and spring (March through May) (11.29 and 11.14 in.) than Charleston International Airport (9.59 and 10.42 in.), while summer (June through August) and fall (September through November) totals at Charleston International Airport (20.22 and 11.43 in.) are higher than those at Columbia-USC (15.59 and 9.89 in.). Each station's driest month is November, with an average monthly precipitation of 2.42 in. at Charleston International Airport and 2.87 in. at Columbia-USC (SCDNR SCO 2025a).



Note: The Columbia-USC station's period of record began in 1954; however, because of missing data, the analysis shown is based on data starting in 1955.

Figure 2-5. Columbia-USC monthly climate averages from 1955 through 2024 (SCDNR SCO 2025a).

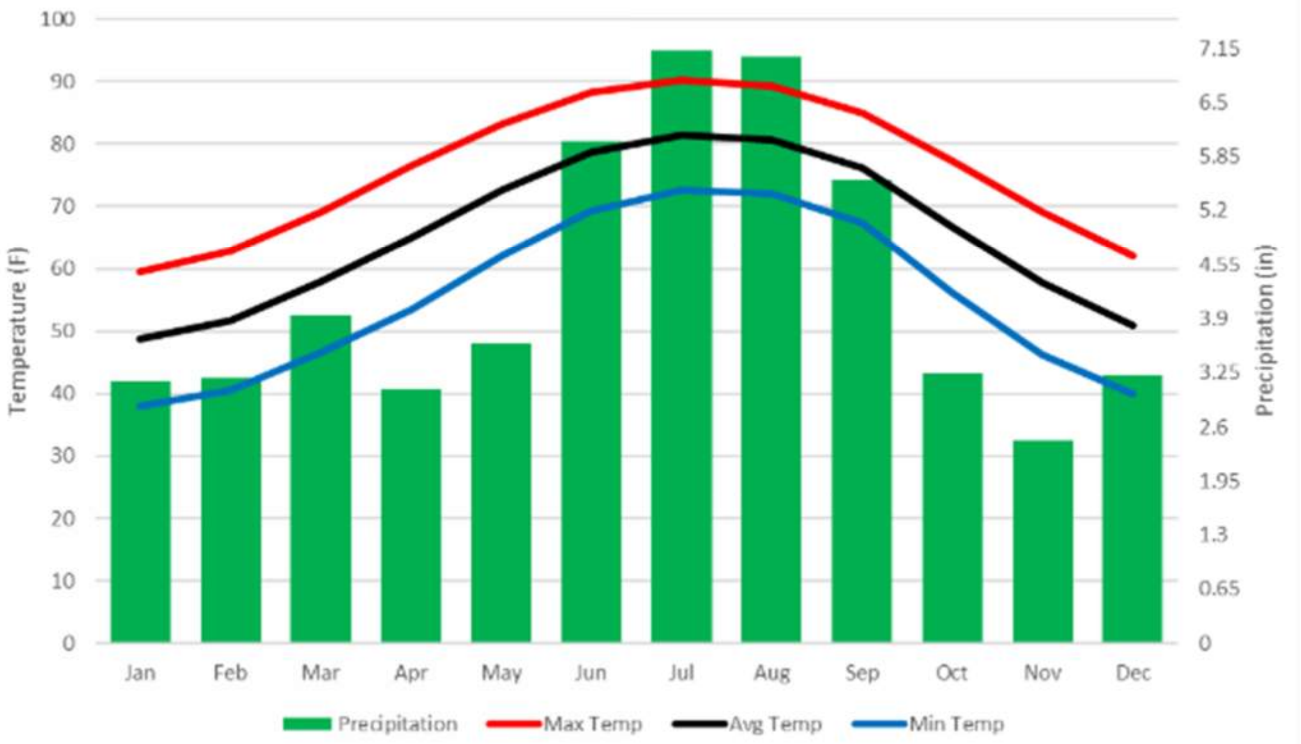
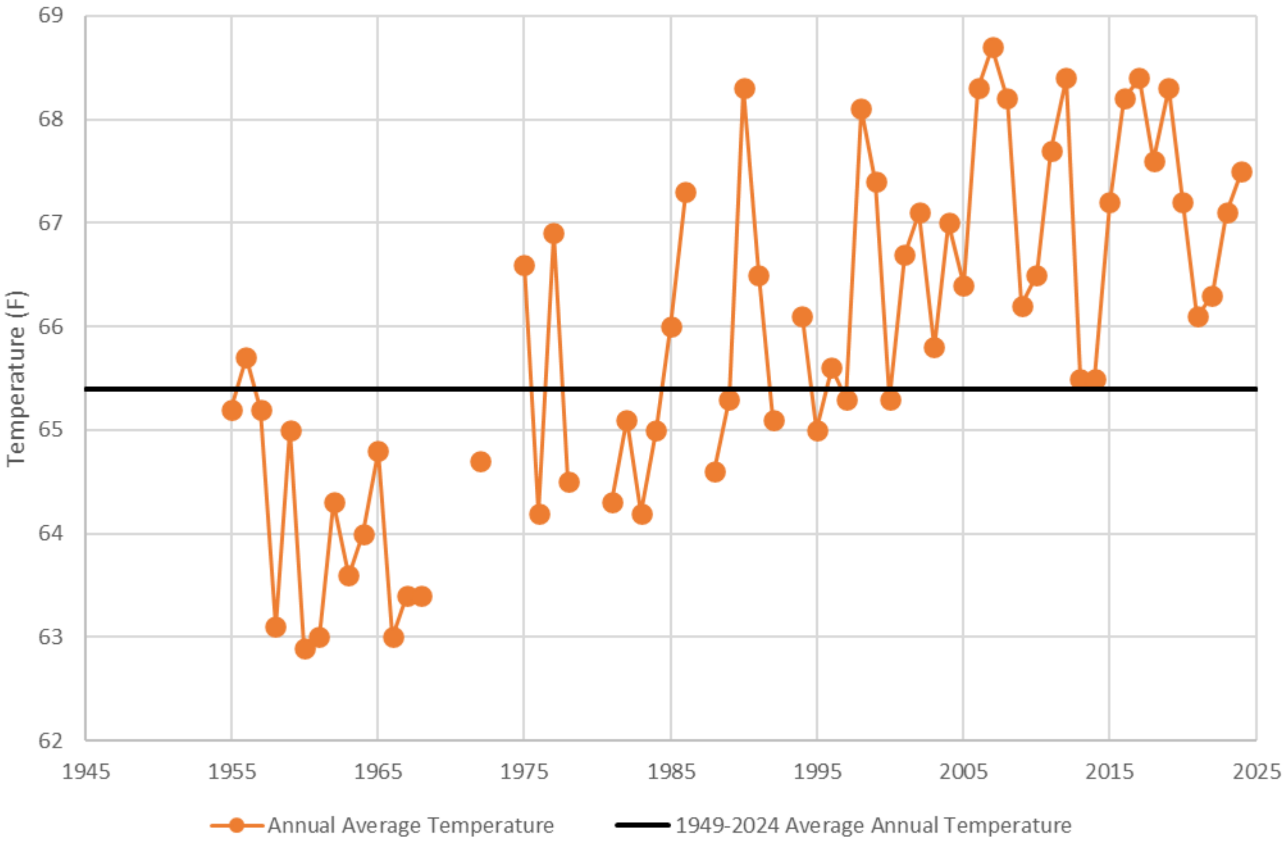


Figure 2-6. Charleston International Airport's monthly climate averages from 1937 through 2024 (SCDNR SCO 2025a).

Figure 2-7 shows the annual average temperature time series for Columbia-USC, and Figure 2-8 shows the data for Charleston International Airport. Figures 2-7 and 2-8 show years with annual average temperatures above and below the 1954 through 2024 average for Columbia-USC and the1949 through 2024 average for Charleston International Airport, respectively. Throughout this period, Columbia-USC has had a long-term annual average temperature of 65.4°F (Figure 2-7), and Charleston International Airport has had a long-term annual average temperature of 65.7°F (Figure 2-8). Table 2-3 shows the warmest and coldest 5 years for both stations. The two stations have 1990 and 2017 as two of their top five warmest years and 1958, 1960, 1966, and 1968 as four of their top five coldest years. These two stations' warmest years occurred after 1990, and the top five coldest years occurred before 1990.



Note: The Columbia-USC station's period of record began in 1954; however, because of missing data, the analysis shown is based on data starting in 1955.

Figure 2-7. Annual average temperature for Columbia-USC, 1955 through 2024 (SCDNR SCO 2025a).

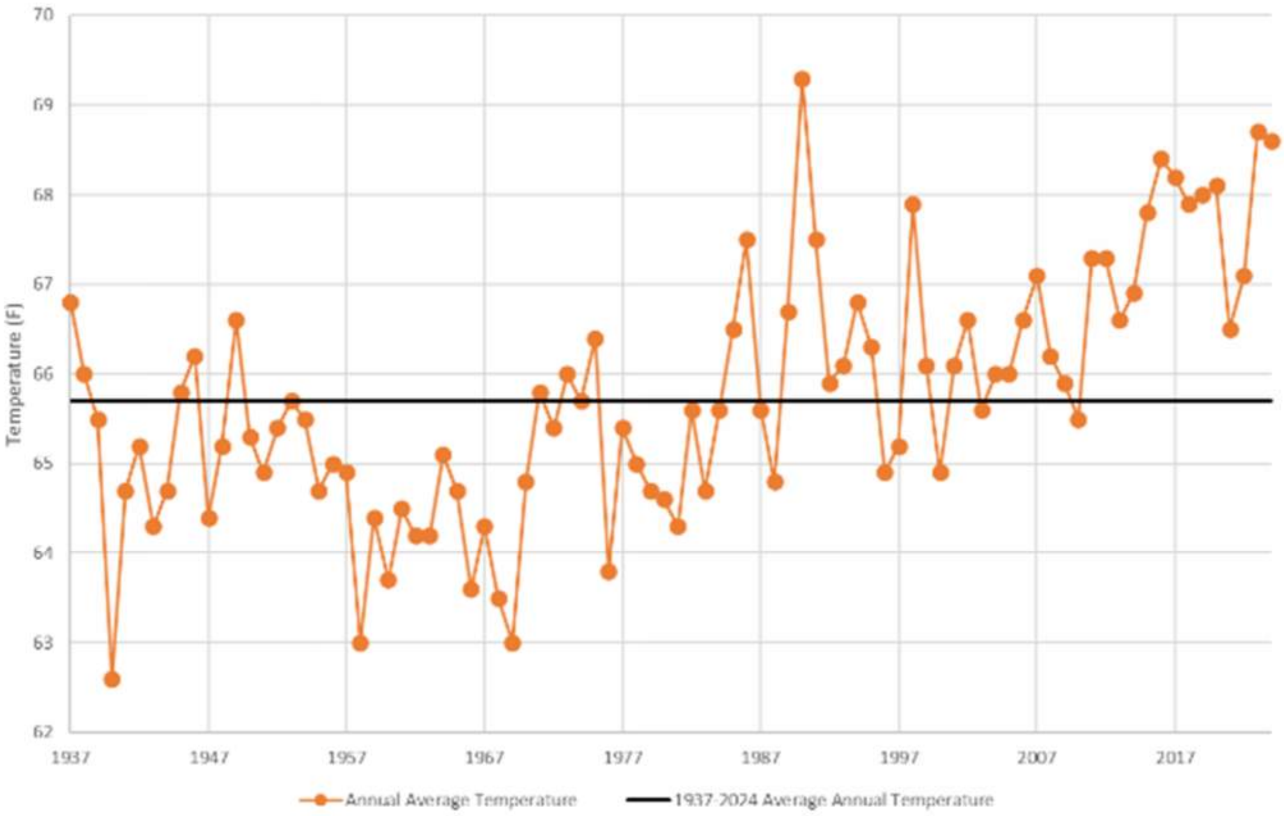


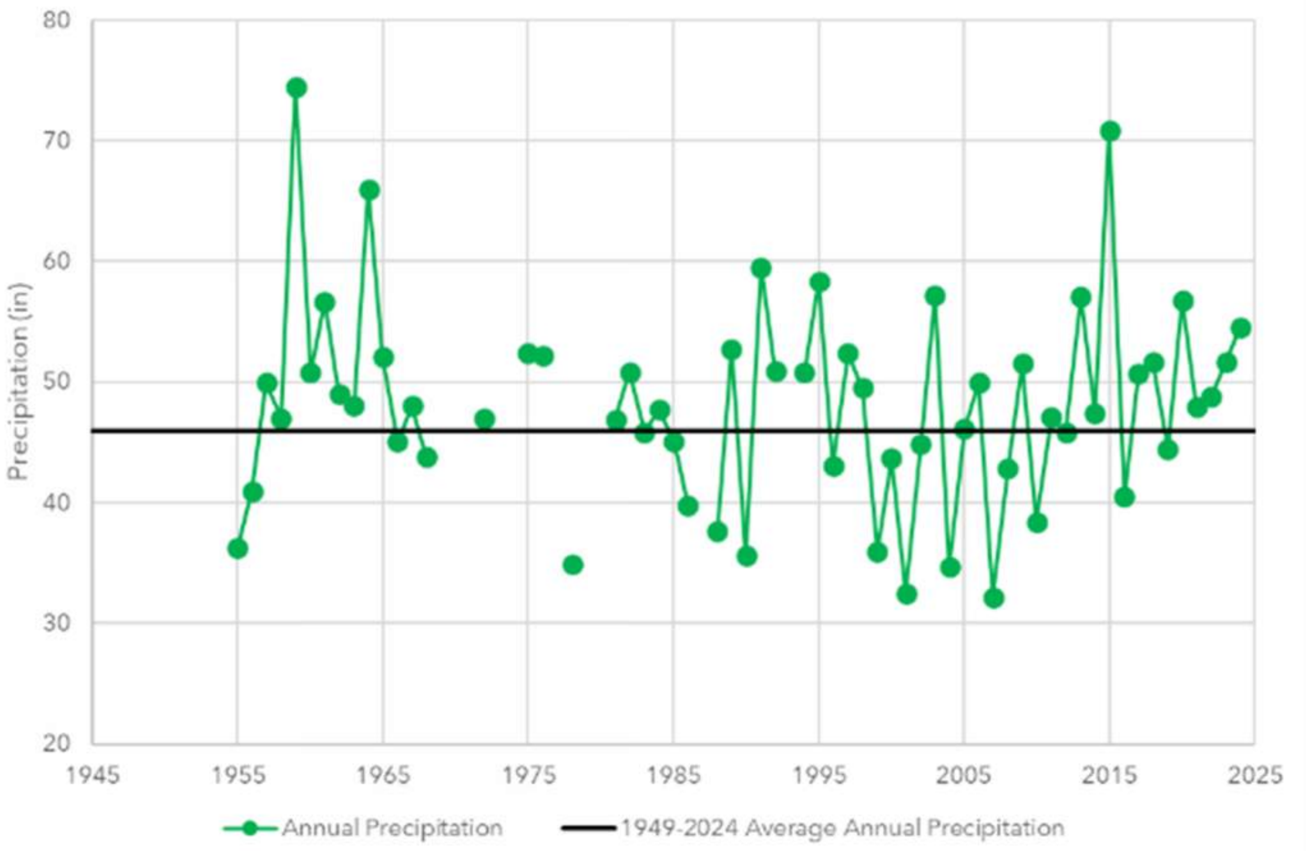
Figure 2-8. Annual average temperature for Charleston International Airport, 1937 through 2024 (SCDNR SCO 2025a).

Table 2-3. Five warmest and coldest years for Columbia-USC and Charleston International Airport for the period of record available at each station (SCDNR SCO 2025a).

Year Rank	Warmest		Coldest	
	Columbia-USC	Charleston International Airport	Columbia-USC	Charleston International Airport
1	2007 (68.7˚F)	1990 (69.3˚F)	1960 (62.9˚F)	1958, 1969 (63.0˚F)
2	2012, 2017 (68.4˚F)	2023 (68.7˚F)	1961, 1966 (63.0˚F)	
3		2024 (68.6˚F)		1968 (63.5˚F)
4	2019, 2006, 1990 (68.3˚F)	2016 (68.4˚F)	1958 (63.1˚F)	1966 (63.6˚F)
5		2017 (68.2˚F)	1967, 1968 (63.4˚F)	1960 (63.7˚F)

Figure 2-9 shows the annual precipitation time series for Columbia-USC, and Figure 2-10 shows the same for Charleston International Airport. Figures 2-9 and 2-10 show years with annual precipitation above and below the average for the period of record at each station. During this period, Columbia-USC experienced an average annual precipitation of 45.95 in. (Figure 2-9), while Charleston International Airport recorded an average annual precipitation of 51.08 in. (Figure 2-10).

Table 2-4 shows the driest and wettest 5 years for both stations. Columbia-USC and Charleston International Airport only have 1 year in common (2004) in their respective top five driest years. However, both locations have experienced notable droughts in South Carolina, including those of the 1950s and early 2000s. Both 2015 (the fourth wettest year statewide) and 1964 (the wettest year on record statewide) are in the top five wettest years on record for both Columbia-USC and Charleston International Airport.



Note: The Columbia-USC station's period of record began in 1954; however, because of missing data, the analysis shown is based on data starting in 1955.

Figure 2-9. Annual precipitation for Columbia-USC, 1955 through 2024 (SCDNR SCO 2025a).

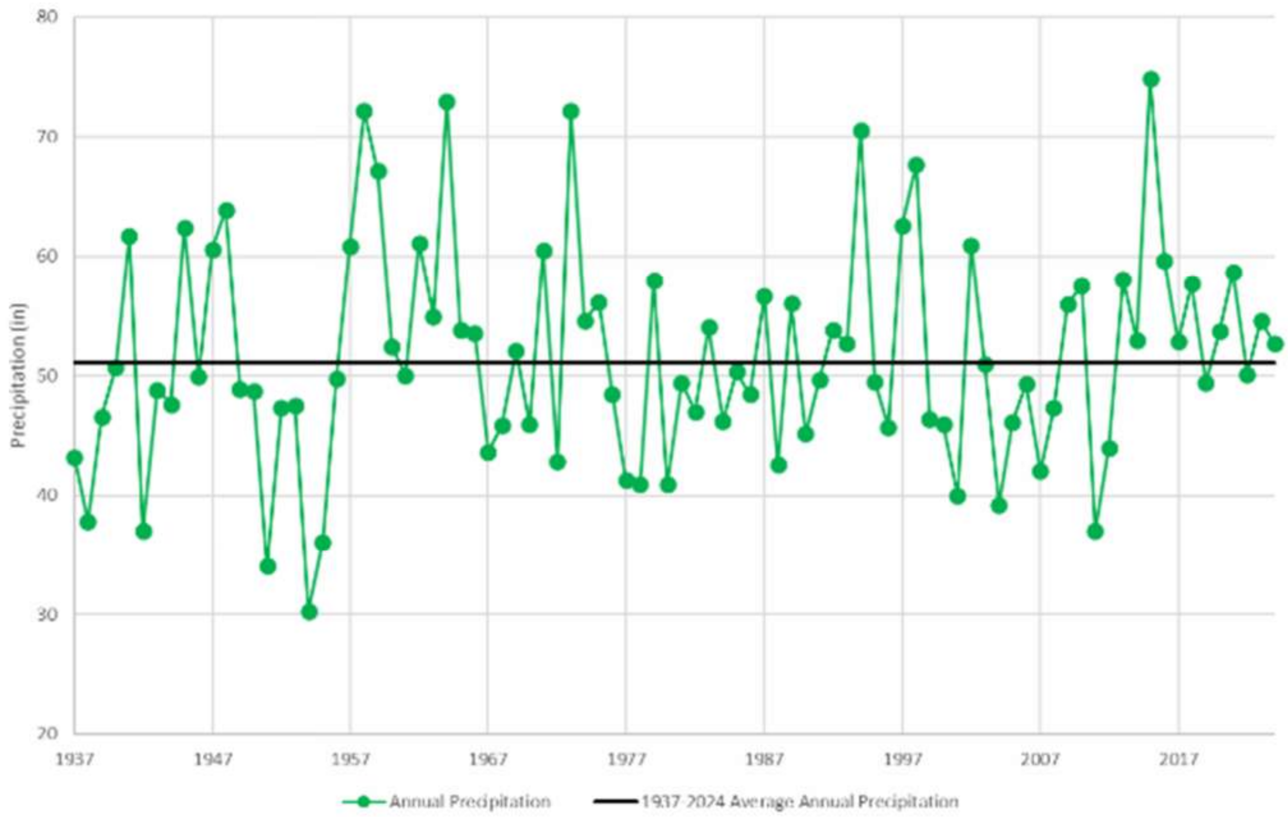


Figure 2-10. Annual precipitation for Charleston International Airport, 1937 through 2024 (SCDNR SCO 2025a).

Table 2-4. Five wettest and driest years at Columbia-USC and Charleston International Airport for the period of record available at each station (SCDNR SCO 2025a).

Year Rank	Driest		Wettest	
	Columbia-USC	Charleston International Airport	Columbia-USC	Charleston International Airport
1	2007 (32.19 in.)	1954 (30.31 in.)	1959 (74.49 in.)	2015 (74.89 in.)
2	2001 (32.47 in.)	1951 (34.06 in.)	2015 (70.85 in.)	1964 (72.99 in.)
3	2004 (34.68 in.)	1955 (36.11 in.)	1964 (66.03 in.)	1973 (72.17 in.)
4	1978 (34.89 in.)	2011 (37.01 in.)	1991 (59.52 in.)	1958 (72.17 in.)
5	1990 (35.62 in.)	2004 (39.23 in.)	1995 (58.40 in.)	1994 (70.54 in.)

2.2.2 Severe Weather

Severe weather, including thunderstorms, tornadoes, and tropical cyclones, can impact all portions of the Santee River basin.

2.2.2.1 Severe Thunderstorms and Tornadoes

There are between 54 to 72 thunderstorm days annually across the Santee River basin, with typically more thunderstorm days occurring in the lower sections of the basin than in the middle section (National Oceanic and Atmospheric Administration [NOAA] 2023b). While thunderstorms occur throughout the year, severe thunderstorms are more common during climatological spring (March, April, May) and summer (June, July, and August). For a thunderstorm to be considered severe, it must produce wind gusts of at least 58 miles per hour (mph), hailstones of 1 in. in diameter or larger, or a tornado.

Most of South Carolina's tornadoes are short-lived and rated on the Enhanced Fujita (EF) Scale as EF-0 and EF-1 tornadoes, the lowest strengths, with winds between 65 and 110 mph. However, even a tornado with the lowest intensity rating is dangerous and poses a significant risk to lives and property. Table 2-5 shows the number of tornadoes by intensity ranking, confirmed within the basin between 1950 and 2024. The counts are based on tornadoes that formed within one of the counties in the basin or the first county in the basin that the tornado crossed into if it touched down outside the basin. This is to not "double count" tornadoes that may have passed through multiple counties (NOAA 2025a).

Table 2-5. Count of tornadoes in the Santee River basin by intensity ranking 1950 through 2024 (NOAA 2025a).

EF Scale	Wind Speed	Count
EF-0	65–85 mph	76
EF-1	86–110 mph	68
EF-2	111–135 mph	17
EF-3	136–165 mph	6
EF-4	166–200 mph	0
EF-5	Over 200 mph	0
Total Number of Tornadoes in the Basin		167

Since 1950, the basin has experienced 167 tornadoes, with 23 of them being of significant strength (EF-2 or higher). The strongest tornadoes to affect the basin were six EF-3 tornadoes, three of which were recorded in Lexington County (two from Tropical Storm Beryl in 1994 and one in November 1995), one in Berkeley County (April 2020), one in Sumter County (April 2007), and one in Charleston County (associated with Hurricane Donna in 1960, which impacted downtown Charleston). In South Carolina, there is no record of an EF-5 tornado since records and ratings started in 1950.

The South Carolina SCO collected the tornado figures from NOAA National Centers for Environmental Information (NCEI) Storm Events Database (NOAA 2025a), the National Weather Service (NWS) Greenville-Spartanburg's Historic Tornadoes in the Carolina and Northeast Georgia Database (NWS 2024), and the tornado database maintained by NOAA's Storm Prediction Center (NOAA 2025b).

2.2.2.2 Tropical Cyclones

South Carolina has an 86 percent chance of being impacted by a tropical cyclone (including tropical depressions, tropical storms, or hurricanes) yearly. Tropical cyclones are warm-core, nonfrontal, synoptic-scale cyclones that originate over tropical or subtropical waters, characterized by organized deep convection and a closed surface wind circulation centered around a well-defined center (NOAA 2024). Tropical cyclones can cause storm surges, damaging winds, precipitation-induced flooding (including flash flooding and riverine flooding), and tornadoes. These impacts can occur near and far from the storm's center, as tropical cyclones have an average diameter of approximately 300 miles.

For example, in 2017, the combined effect of high tide combined with the storm surge from Hurricane Irma, which made landfall near and tracked through southwest Georgia and into Alabama, produced maximum inundation levels of 3 to 5 ft above ground level along much of the South Carolina coast (Figure 2-11) (NOAA 2021).

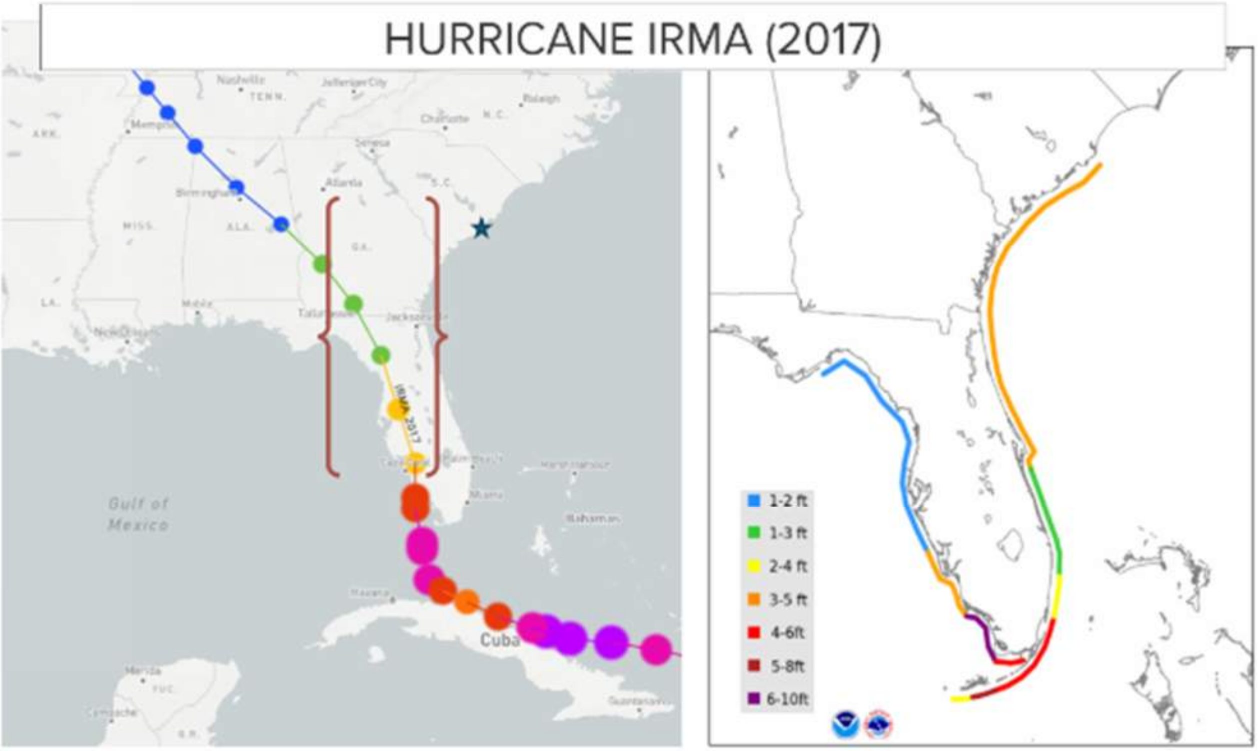


Figure 2-11. Hurricane track map of Hurricane Irma from 2017 (NOAA 2025c) and observed storm surge inundation ranges (NOAA 2021).

The NOAA National Ocean Service (NOS) gauge at Charleston Harbor recorded a peak tide level of 9.92 ft (Figure 2-12), the third-highest crest at the gauge since 1922. Although the storm surge produced by Hurricane Irma was less than that produced by Hurricane Matthew in 2016 along the coast of South Carolina, it occurred closer to the timing of high tides and caused water levels at the Charleston NOS gauge to exceed the values observed during Hurricane Matthew.

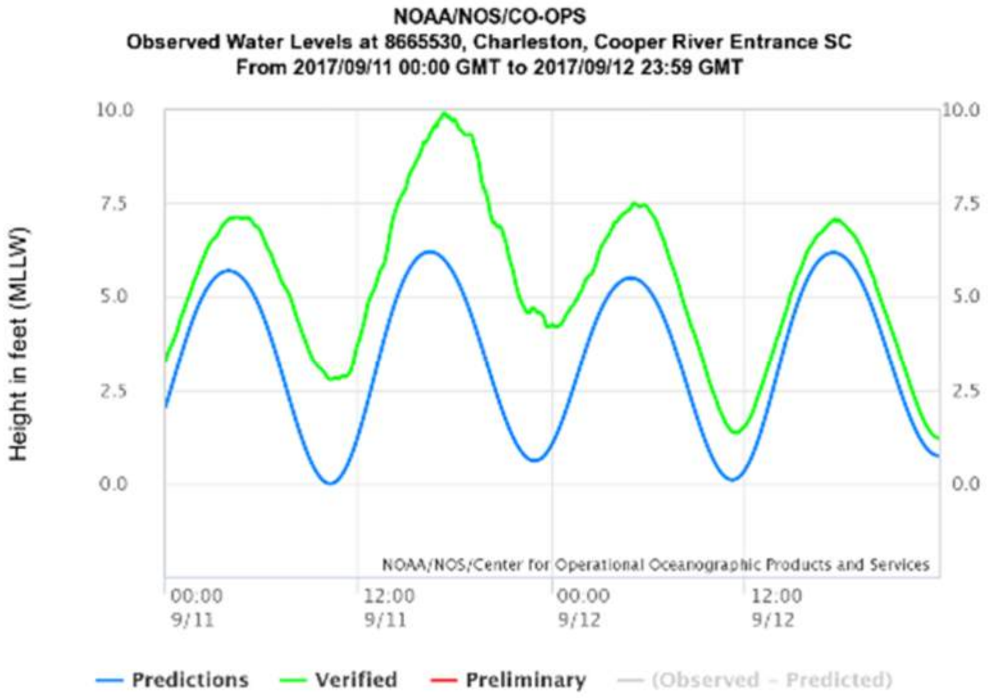


Figure 2-12. Observed and predicted water levels from the Charleston Harbor/Cooper River Entrance tidal gauge during Hurricane Irma in 2017 (NOAA 2025d).

Hurricane Matthew made landfall near the Cape Romain National Wildlife Refuge, close to McClellanville, on October 8, 2016 as a Category 1 hurricane. The highest measured wind gust in South Carolina reached 87 mph at Hilton Head, with gusts estimated at 109 mph affecting other areas of Beaufort County. The hurricane caused significant rainfall and historic flooding as it moved slowly along the coast. Between 8 and 16 in. of rain fell over the Coastal Plain, with the peak rainfall reaching 16.08 in. at Edisto Island. Additionally, 3 to 6 in. of rain were recorded over parts of the Interstate 77 corridor and the southern Central Savannah River Area. Major river flooding persisted for days after Hurricane Matthew passed. The storm surge led to severe flooding along the South Carolina coast, with the peak water level at the Charleston Harbor gauge reaching 9.29 ft, the fifth highest level on record.

Hurricane Hugo made landfall near Sullivan's Island as a Category 4 hurricane on the night of September 21 to 22, 1989, and weakened into a Category 1 hurricane as it exited the state later that morning. The hurricane caused catastrophic wind damage across much of the Lowcountry, Pee Dee, and eastern Midlands, and it also inflicted significant wind damage in York and Cherokee Counties. Power outages lasted for weeks in some areas. Rainfall amounts reached up to 10 in. in the Lowcountry, with most of the state receiving 2 to 5 in. The highest recorded rainfall was 10.28 in. at Edisto Island. The storm surge was devastating, peaking at nearly 20 ft at Bulls Bay. Hurricane Hugo's storm surge remains the record holder for the highest water levels recorded at the Charleston and Springmaid Pier tide gauges (SCDNR SCO 2023a).

Since 1851, 89 tropical cyclones have tracked through the Santee River basin, meaning the storm's center crossed through part of the basin. Of these 89 cyclones, 15 were of tropical depression strength (maximum wind of 38 mph), 38 were of tropical storm strength (maximum wind of 39 to 73 mph), and 22 were of hurricane strength (maximum wind of 74 mph or greater); the remaining 14 were either extratropical or subtropical systems. Because of the spatial extent of tropical cyclones, multiple storms of various strengths have affected the Santee River basin that did not track through the basin boundary (SCDNR SCO 2023a).

For more information about tropical cyclones that have affected South Carolina, please visit the South Carolina SCO Hurricane and Tropical Storms Database (SCDNR SCO 2023a).

2.2.2.3 Winter Storms

Despite the rare occurrence of winter weather in the Southeast, the Santee River basin has been affected by multiple winter weather events, including winter precipitation (snow, sleet, ice accumulation, and freezing rain) and extreme cold. The basin has a mean annual snow accumulation of less than 1 in.; however, it has experienced several snow events since data records began in the 1890s. The largest snowfall recorded in the Santee River basin is 24 in. at Rimini in Clarendon County, which occurred on February 9 to 10, 1973 (SCDNR SCO 2023b). This snowfall total also holds the record for the highest 24-hour snowfall in the state. The station at Summerville recorded 15 in. of snow, while over 1 ft of snow was reported at the Columbia-USC location during this event. A more recent snow event occurred in January 2018, when locations along and south of Lake Marion recorded totals ranging from 3 in. at Summerton 8.4 SE (Clarendon County) to 8 in. of snow at Daniel Island 1.0 SW (Berkeley County), while areas of the basin's headwaters received no snow from the event.

Winter weather events are typically high-impact situations in South Carolina because of their infrequent subseasonal, seasonal, and annual occurrence. Winter precipitation primarily affects travel and transportation; however, snow and ice accumulations have also impacted trees, power lines, and built structures. Since 1990, several freezing rain and ice events have caused property damage and impacted the basin. The effect of these events is primarily due to ice accumulations of over 0.5 in. The most common impacts were damage to power lines, resulting in power outages, and damage to roofs and trees. However, during some of these events, ice accumulation on roads led to car accidents and fatalities. Table 2-6 lists the major ice storms in South Carolina since 1990 (SCDNR SCO 2023b).

Table 2-6. Winter storms that have caused significant ice accumulation and damage in South Carolina since 1990.

Event Date	Estimated Damage in Dollars*
December 27–28, 1992	$500,000 to $5 million $500,000 to $5 million (crop)
March 13, 1993	$45 million $38 million (crop)
January 2–3, 1999	$1.45 million
December 4–5, 2002	$100 million
January 25 –27, 2004	$54 million
January 29–30, 2010	$180,000
January 9–11, 2011	$716,000
February 12–13, 2014	$360 million (timber damage)

*Damages in dollars refer to property damage unless otherwise stated and have not been adjusted to 2025 dollars.

Since 1958, multiple cold or extended freeze events have affected the state, with some impacting at least part of the Santee River basin. Generally, these events impact water lines, particularly those close to or above ground level, making them more susceptible to freezing in cold temperatures. Water lines that freeze typically burst, resulting in water loss and potential flooding within structures. While these types of events have occurred on a more localized scale regularly throughout the period of record, their impacts have been on a large scale in the Santee River basin during cold events in January 1986, December 1989, January 2005, January 2018, and December 2022, and most recently January 2025. During each of these events, minimum temperatures across the basin dropped below 10°F, with multiple stations in the upper part of the basin experiencing minimum temperatures in the single digits (not accounting for wind chill). The December 23 to 26, 2022 cold weather event caused many water lines to freeze and burst as minimum temperatures in the basin ranged from 10°F to 22°F. This was a significant issue in homes and businesses that were vacant because of holiday travel. Beyond the internal water damage to homes and buildings, the amount of line breaks caused some water systems to experience a significant drop in water supplies. The extreme cold also caused significant issues with electrical generation at several generating stations in the state, resulting in rolling blackouts for a brief period of time on Christmas Day 2022. This extreme cold event highlights how other natural hazards, besides drought, can cause water supply, infrastructure, and delivery issues (SCDNR SCO 2023b).

For more information about winter weather events that have affected South Carolina, visit the South Carolina SCO Winter Weather Database (SCDNR SCO 2023b).

2.2.2.4 Flooding

The general definition of a flood is the temporary condition of a partial or complete inundation of typically dry land. There are three common types of flooding: fluvial, pluvial, and coastal. Fluvial flooding, or riverine flooding, is the flooding of typically dry areas caused by an increase in the water level of an established lake, river, or stream when the water overflows its banks. The damage from fluvial flooding can be widespread, extending miles away from the original body of water. This type of flooding is caused by excessive freshwater from a severe or prolonged rain event. Pluvial flooding occurs when rainfall events cause flooding in an area independent of an overflowing body of water. This can occur when drainage systems are overwhelmed, or as flash floods caused by heavy rainfall or from a sudden release of water upstream or uphill. Coastal flooding occurs when seawater inundates land; this can be caused by wind-driven storm surges, tsunamis, or extreme tidal events. The discussion below focuses on pluvial flooding.

Tropical Storm Debby strengthened over the eastern Gulf of Mexico on August 5, 2024, becoming a Category 1 hurricane before making landfall near Steinhatchee, Florida. It moved through Florida and Georgia, slowing down off the Georgia coast on August 6, then made a second landfall near Bulls Bay, South Carolina on August 8. Debby’s slow drift through South Carolina resulted in historic heavy rainfall and flooding over parts of the state. Rainfall totals were comparable to those of other recent extreme rainfall events, including Hurricane Matthew in 2016 and Hurricane Florence in 2018, as well as the flood event in early October 2015. Debby produced heavy rainfall, particularly in the Coastal Plain and Pee Dee regions. Totals exceeding 5 in. were measured primarily east of the Interstate 20 corridor, and some locations east of Interstate 95 reported rainfall totals exceeding 15 in. (Figure 2-13). A community observer in Moncks Corner reported 22.02 in. of rain from August 5 to the morning of August 9; this total currently ranks as the third-highest rainfall associated with a tropical cyclone in South Carolina since 1956 (SCDNR SCO 2023c).

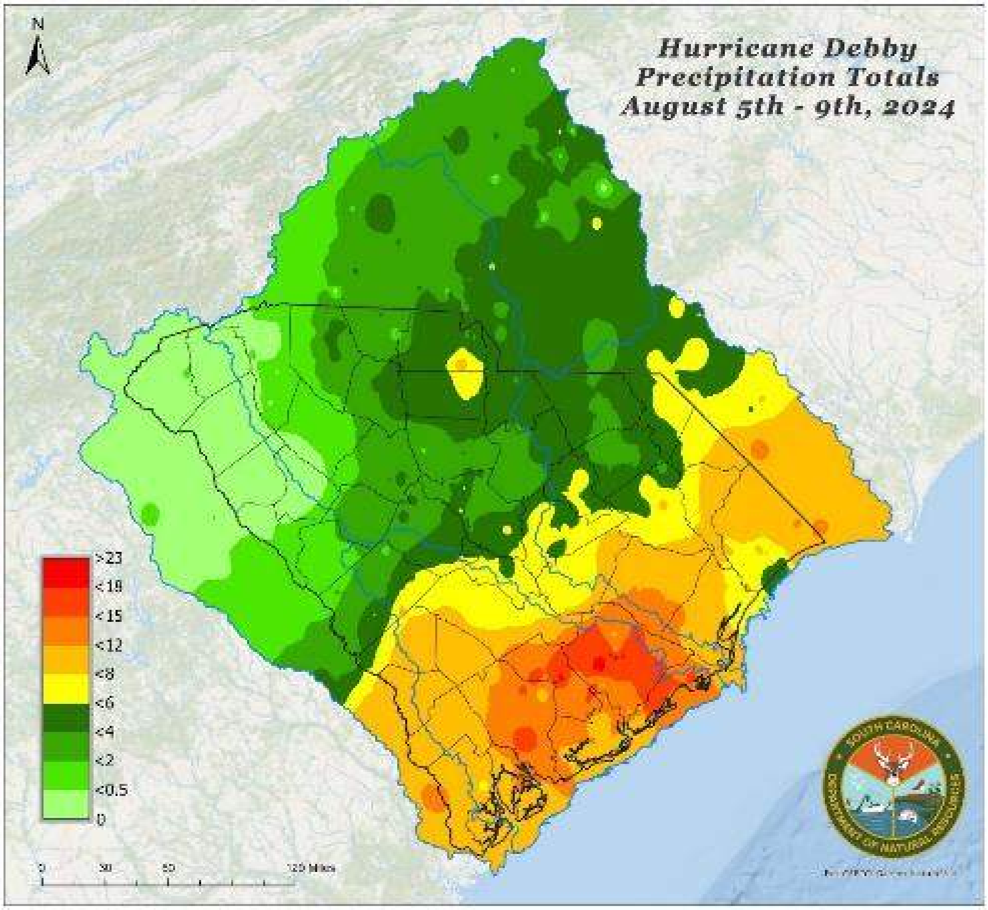
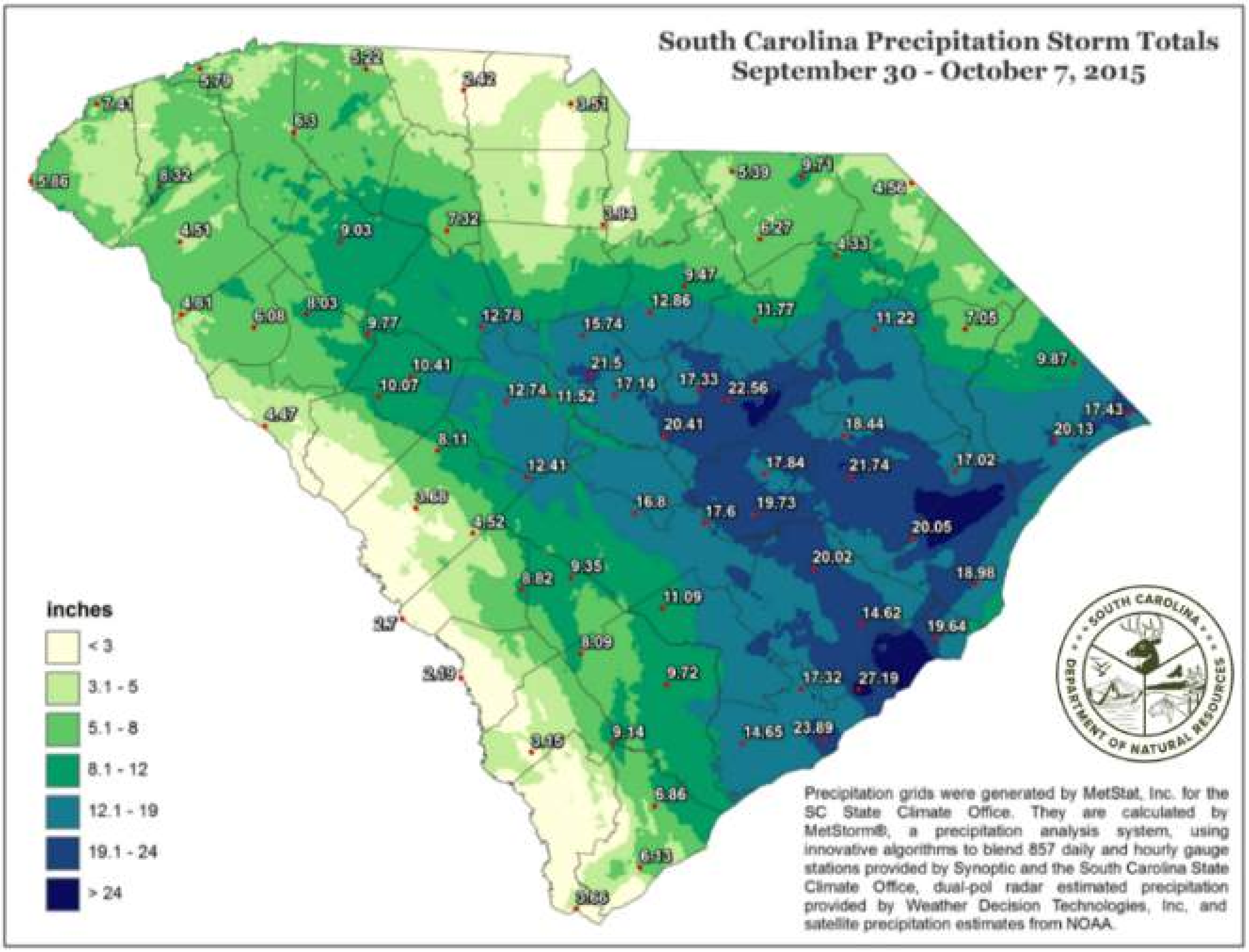


Figure 2-13. Observed precipitation totals over August 5 to 9, 2024, across South Carolina's watersheds from Hurricane Debby (SCDNR SCO 2023c).

Another record-setting and historic rainfall event occurred October 1 to 5, 2015, producing widespread and significant flooding across much of South Carolina. The event's heavy rainfall, which followed a wet period at the end of the previous month, resulted in catastrophic flooding in some portions of the state. On October 1, a cold front swept across the state and stalled offshore for the next 5 days. This boundary tapped into deep tropical moisture over the Gulf of Mexico as it sat offshore of the Lowcountry. At the same time, Hurricane Joaquin rapidly strengthened over the Bahamas and interacted with the stalled coastal front, providing additional moisture in the region. All–time precipitation records were shattered, with rainfall totals ranging from 10 to over 26 in. from the Midlands to the coast (Figure 2-14). Streams and creeks overflowed their banks. The USGS gage along the Congaree River at Columbia recorded a peak stage of 31.81 ft and a peak flow of 185,000 cfs on October 4, 2015. (Figure 2-15). Despite being regulated by the storage available in Lake Marion upstream, the USGS gage on the Santee River at Jamestown recorded one of its top five peak stage heights (22.13 ft) and peak flow values (96,000 cfs) on October 10, 2015 (SCDNR SCO 2023c). Statewide, 51 regulated dams either breached or failed (SCDES 2025g), with the majority occuring in the Coastal Plain, including the Santee River basin.



South Carolina Precipitation Storm Totals
September 30 - October 7, 2015

Precipitation grids were generated by MetStat, Inc. for the SC State Climate Office. They are calculated by MetStorm®, a precipitation analysis system, using innovative algorithms to blend 857 daily and hourly gauge stations provided by Synoptic and the South Carolina State Climate Office, dual-pol radar estimated precipitation provided by Weather Decision Technologies, Inc, and satellite precipitation estimates from NOAA.

Figure 2-14. Observed precipitation totals September 30 to October 7, 2015, across South Carolina (SCDNR SCO 2023c).

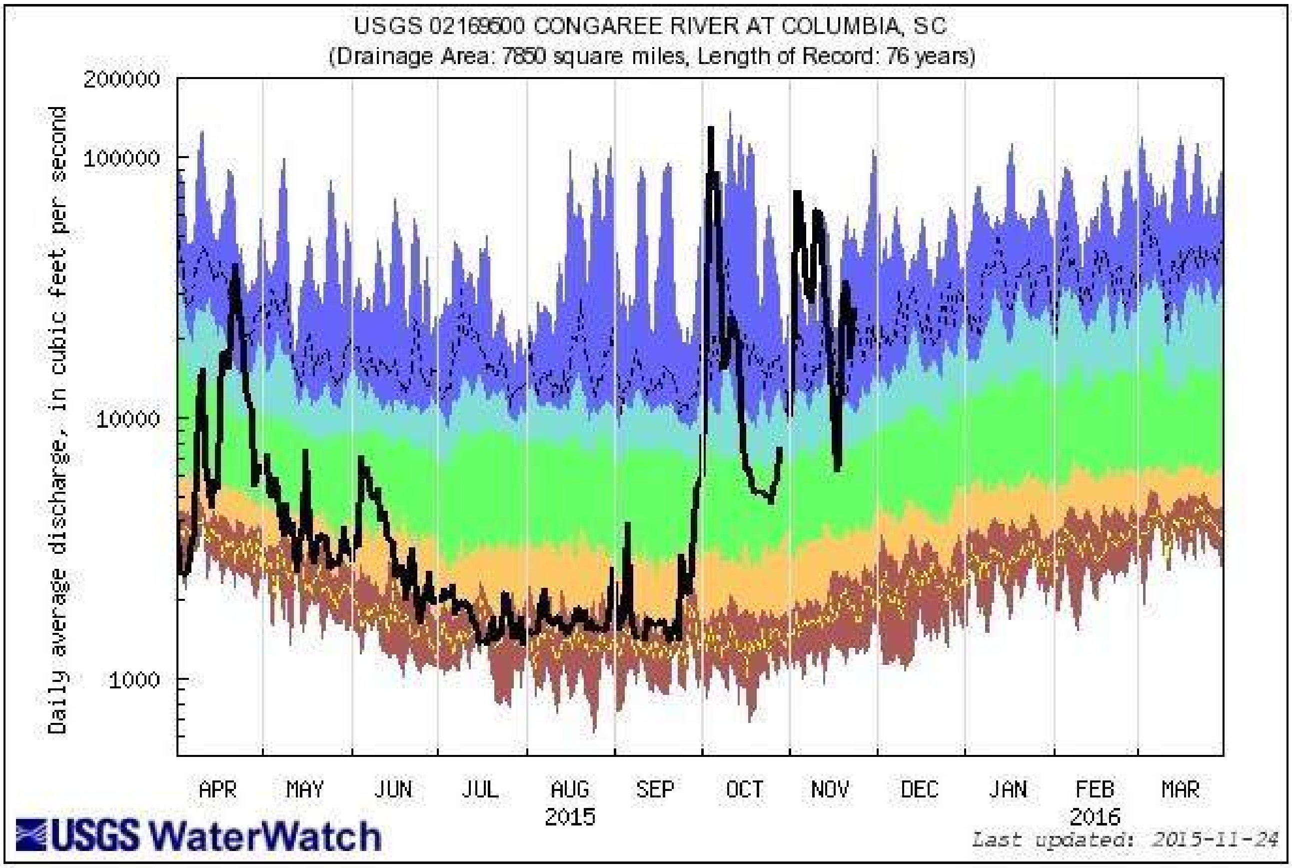


Figure 2-15. Observed daily average discharge from the USGS gage on the Congaree River at Columbia from April 2015 through March 2016 (SCDNR SCO 2023d).

To learn more about historical riverine flooding events across the state, refer to the SCO's *Keystone Flooding Events* publication (SCDNR SCO 2023c).

2.2.3 Drought

Drought is a normal part of climate variability that occurs in every climate. Drought results from a prolonged period of insufficient precipitation, often leading to a water shortage for specific activities, sectors, or the environment. In contrast to other environmental hazards, droughts develop slowly over weeks, months, or years. The three main categories that physically define drought are meteorological, agricultural, and hydrological. These categories help determine the economic, ecological, and societal impacts of droughts in communities.

Figures 2-16 and 2-17 display the annual Standard Precipitation Index (SPI) values for the Columbia-USC and Charleston International Airport stations over their reporting periods through 2023 (the latest SPI data available for these stations). The SPI is a drought index that compares accumulated rainfall over a given period (here, 12 months) to the historical average, where the index values are standard deviations from the mean. Any index equal to or less than -1.0 is considered a drought. The lower the index value, the more severe the drought. The lowest SPI values were -2.32 for Columbia-USC and -2.73 for Charleston International Airport in 2007 and 1954, respectively. Since 2000, both stations have had a mix of dry and wet years.

Annual SPI values do not reflect short-term conditions, such as those experienced on a monthly or seasonal basis. During a year with a negative annual SPI value, there can be months or seasons with positive SPI values, and vice versa. While the annual SPI time series is provided here for reference, it is not the only method for looking at wet and dry periods over time. Furthermore, the SPI only accounts for precipitation accumulation and does not consider wetness or dryness in terms of evapotranspiration, soil moisture, streamflow, or groundwater.

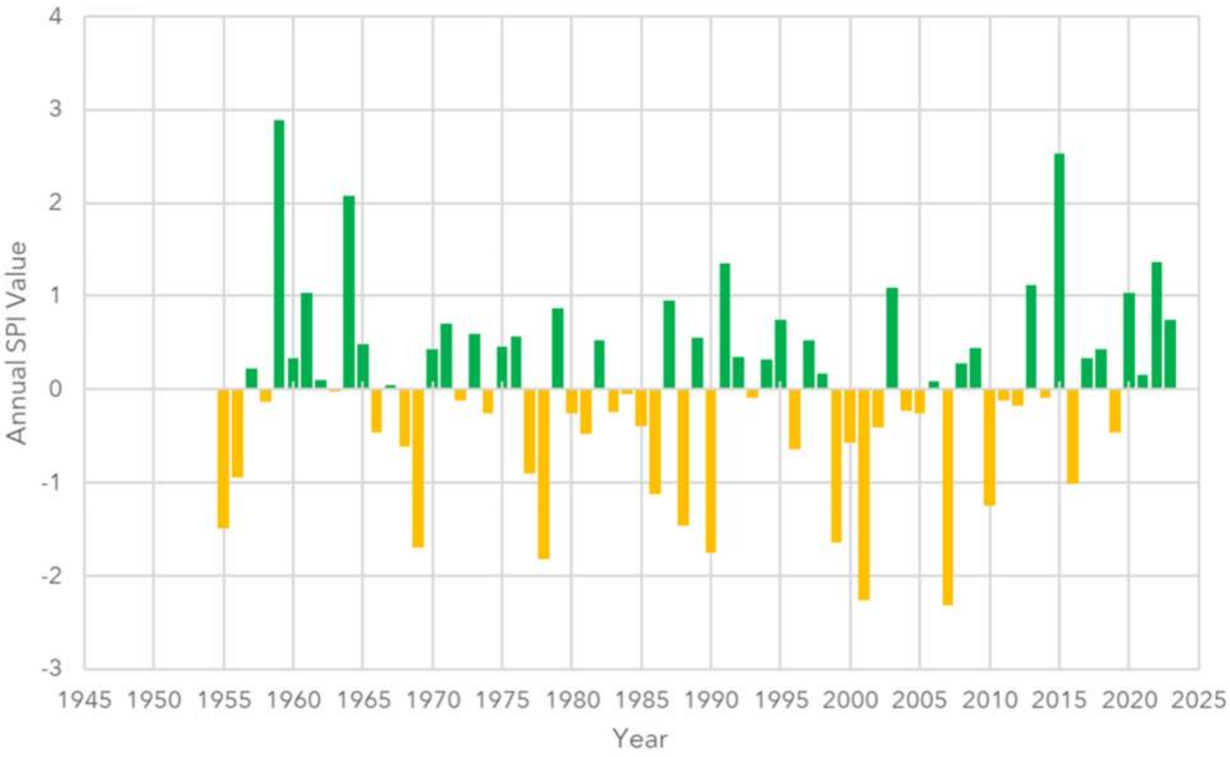


Figure 2-16. Annual SPI values for Columbia-USC, 1954 through 2023 (SCDNR SCO 2025b).

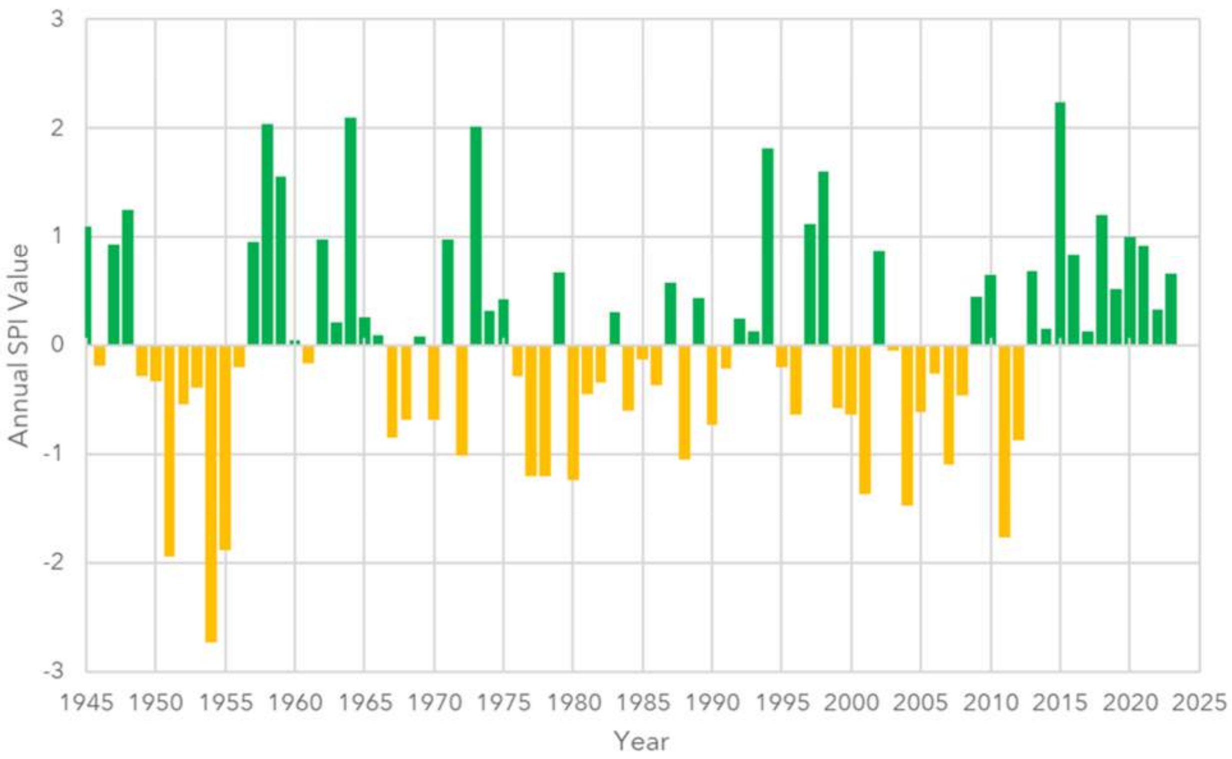


Figure 2-17. Annual SPI values for Charleston International Airport, 1945 through 2023 (SCDNR SCO 2025b).

The impact of drought on streamflow in the basin was analyzed using three USGS streamflow gaging stations at different locations. The gage on the Congaree River at Columbia is located along the mainstem. While this is downstream of the controlled releases from Lake Murray, this gage is also upstream of the Catawba-Wateree inflow and upstream of the Santee Cooper regulated reservoir system. The gages on Gills Creek and Turkey Creek are located on tributary streams, which may exhibit more "naturalized" flow than the gages on the controlled mainstem, though the Gills Creek gage flow is affected by urbanization within its watershed. These gages were selected for their long-term, continuous data records. Table 2-7 shows the lowest monthly average flow and the year in which that low flow occurred for these streamflow gages, as well as the average monthly average flow for each calendar month. Table 2-7 also shows the year with the lowest average annual flow, the long-term average annual flow for that calendar year, and the average annual flow (based on complete calendar years). The lowest monthly minimum flows on the Congaree River generally occurred during drought periods (mid-1950s, 2001 to 2002, and 2007 to 2008). On Gills Creek, the monthly average low flows generally occurred in the mid-1980s, 2001 to 2002, and in 2007. Turkey Creek recorded the lowest flows of the three gages, with a minimum monthly average flow of zero for most months; minimum monthly average flows occurred most often in 2011 to 2012. The two tributary streams both experienced their annual average low flows in 2012, while the Congaree River at Columbia experienced the lowest annual average low flow in 2008.

Table 2-7. Year of lowest monthly and lowest annual average flow, compared to average monthly flow and average annual flow, for the Congaree River at Columbia, Gills Creek at Columbia, and Turkey Creek above Huger streamflow gages.

Congaree River at Columbia (USGS 02169500)
(Based on October 1939 through September 2024)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Year of Minimum Flow	1956	2001	2017	2012	2001	2008	2008	2007	2007	2007	2007	2007	2008
Minimum Average Flow (cfs)	2,967	3,211	3,361	3,848	2,283	1,427	1,109	1,342	1,328	1,085	1,191	1,804	3,234
Monthly (or Annual) Average Flow (cfs)	11,659	12,252	13,308	10,874	7,781	6,559	6,051	6,350	5,795	6,532	6,993	9,094	8,577

Gills Creek at Columbia (USGS 02169570)
(Based on October 1966 through September 2024)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Year of Minimum Flow	2003	1986	1985	1986	1986	1986	2002	1983	2007	2001	2001	2001	2012
Minimum Average Flow (cfs)	38	38	23	13	6	13	11	4	2	7	11	18	37
Monthly (or Annual) Average Flow (cfs)	108	100	98	72	53	58	62	59	57	46	57	79	70

Turkey Creek above Huger (USGS 02172035)
(Based on October 2005 through August 2024)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Year of Minimum Flow	2012	2012	2017	2012	2012, 2016	2011	2011, 2012	2007	2011	2011, 2012, 2013	2011, 2012, 2021	2011, 2012	2012
Minimum Average Flow (cfs)	0	0.06	0.667	0.151	0	0	0	0.015	0.018	0	0	0	1.32
Monthly (or Annual) Average Flow (cfs)	20	32	20	16	6	14	9	27	28	43	10	26	20

Although South Carolina typically receives adequate precipitation, droughts can occur at any time of the year and last for several months to several years. While precipitation is the primary driver of water availability in the Santee River basin, multiple factors, including temperature, evapotranspiration, and water demands, must be considered when evaluating how drought periods impact stream and river flows. Severe drought conditions can lead to compromised water and air quality, heightened public health and safety risks, and a decline in quality of life and social well-being. Because drought causes a lack of expected water across multiple sectors at different time frames, it is essential to plan for drought so water demands can be adequately met and managed before and during a severe drought period.

The 1998 to 2002 drought was a statewide event that had severe impacts across multiple sectors, including agriculture, recreation, forestry, and public water supply. Agricultural impacts included reduced crop yields or yield loss, the cost of digging new wells for irrigation, ponds drying up, and a decrease in pastures' ability to feed livestock adequately (SCDNR SCO 2002). Forestry dealt with the cascading impact as the potential for fire increased, leading to outdoor burn bans, while reduced water availability stressed trees. This stress increased susceptibility to the southern pine beetle, resulting in billions of dollars in losses to the timber industry. Some mandatory conservation efforts were enforced, and streamflows reached record lows. Low flows exposed boats to hazards and negatively affected businesses that rely on river recreation for income. Groundwater levels and reservoir storage were significantly depleted, and coastal areas, such as Charleston, experienced the effects of saltwater intrusion on their surface water supplies.

The drought from 2007 to 2009 was a statewide event in South Carolina, with the most severe conditions observed north of the Fall Line, in basins that flow into the Santee River basin. With low upstream flows from the Broad and Saluda basins, the effects were felt across various sectors in the Santee basin, including agriculture, recreation, forestry, public water supplies, and hydroelectric generation. In agriculture, there was a notable reduction in corn and soybean yields, but hay production suffered the most significant losses. This decline hindered farmers' ability to feed their livestock adequately. The recreation industry was also affected as low water flows and resulting low water levels created hazards for boaters and harmed businesses that depended on river-related activities for income. The combination of low soil moisture and tree stress caused by reduced water availability led to increased wildfire risks. In July and August 2007, wildfire occurrences exceeded normal levels, with 518 fires burning a total of 2,730 acres. By April 2008, the number of fires had risen to 2,800, damaging 17,000 acres (SCDNR SCO 2008a). By September 2008, the state saw a 66 percent increase in the number of acres burned compared to the 5-year average (SCDNR SCO 2008b). It was not until April 2009 that the risk of wildfires began to decrease as conditions improved.

Public water supplies were also severely impacted by the intensity and duration of the 2007 to 2009 drought. Between the summer and fall of 2007, the number of water systems implementing water restrictions increased significantly. By January 2008, a total of 191 water systems statewide had implemented some level of water conservation measures; of these, 146 systems had voluntary restrictions, and 45 systems had imposed mandatory restrictions (SCDNR SCO 2008c). Water levels in Lake Marion dropped more than 6 ft between July 2007 and November 2007, also impacting the availability of hydroelectric generating facilites located on the Santee Cooper Project.

In July 2008, the Governor and SCDNR issued a statement encouraging the conservation of water, particularly in counties experiencing severe and extreme drought conditions. This message aimed to promote water-saving practices for all residents throughout the state (SCDNR SCO 2008d). The Governor had rarely needed to exercise his executive authority to promote water conservation in South Carolina, underscoring the severity of the drought situation. It was not until June 2009 that conditions returned to normal.

Like the 2007 to 2009 drought, the 2010 to 2013 drought was also a statewide event. While the driest conditions affected the Upper Savannah and Saluda River basins, impacts were felt in the Santee River basin. Dry conditions affected the entire state in the summer of 2010, with all 46 counties placed into incipient drought status. However, conditions worsened during the summer of 2011, when most areas south of the Fall Line were placed in moderate drought status. By November 2011, the basin had entered a severe drought caused by continual dry conditions since the summer, which had caused hydrologic conditions to decline (streamflows, reservoir levels, and groundwater). There was some relief from drought conditions reported in the late summer and early fall of 2012; however, drought conditions reemerged by the beginning of 2013 following a dry winter. Charleston International Airport recorded its driest January on record in 2013, with only 0.35 in. of rainfall (3.02 in. below the monthly normal). The continued long-term dryness raised concerns for the spring 2013 fire season. Throughout the remainder of 2013, conditions across the basin fluctuated between dry and above-normal rainfall, with the entire basin removed from any drought status in April 2014 (SCDNR SCO 2023e).

Since 2014, the Santee basin has been affected by several shorter-term droughts (SCDNR SCO 2025b). More information on historical drought events across the state, some of which have affected the Santee River basin, can be found in the SCDNR SCO's *Keystone Drought Events in South Carolina* publication (SCDNR SCO 2023e).

2.3 Natural Resources

2.3.1 Soils, Minerals, and Vegetation

The Natural Resources Conservation Service (NRCS) divides South Carolina into six land resource areas based on soil conditions, climate, and land use, as shown in Figure 2-18. These areas generally follow the boundaries of the state physiographic provinces (see Section 2.1.3) but are defined based on soil characteristics and their supported land-use types. Moving from its landward to seaward extents, the Santee River basin encompasses parts of the Carolina-Georgia Sandhills, Southern Coastal Plain, Atlantic Coast Flatwoods, and Tidewater land resource areas. The land resource area descriptions below were originally presented in the South Carolina State Water Assessment (SCDNR 2009).

- The Carolina-Georgia Sandhills land resource area consists of strongly sloping, sandy soils underlain by sandy and loamy sediments. With well-drained to excessively drained soils, the region supports cotton, corn, and soybean growth. Approximately two-thirds of the region is covered by forest types dominated by mixed pine and scrub oaks.

- The Southern Coastal Plain land resource area is characterized by gently sloping terrain with increased dissection. The region is well suited for farming because of its loamy and clayey soils. The soils are mostly poorly drained except for the sandy slopes and ridges, which are excessively drained.

- The Atlantic Coast Flatwoods and Tidewater land resource areas are characterized as nearly level Coastal Plain with meandering streams in broad valleys. The region is two-thirds forested and supports truck crops (e.g., tomatoes, lettuce, melons, beets, broccoli, celery, radishes, onions, cabbage, and strawberries) and corn and soybean production. There are four general soil groups in the area:

    1. The wet lowlands consist of loamy and clayey soils underlain by clayey sediment and soft limestone.
    2. Broad ridges found in strips near the coast have wet, sandy soils.
    3. Floodplains of rivers have well-mixed soils underlain by clayey and loamy sediments.
    4. On the coast, salt marshes have clayey sediments and beaches have sandy sediments.

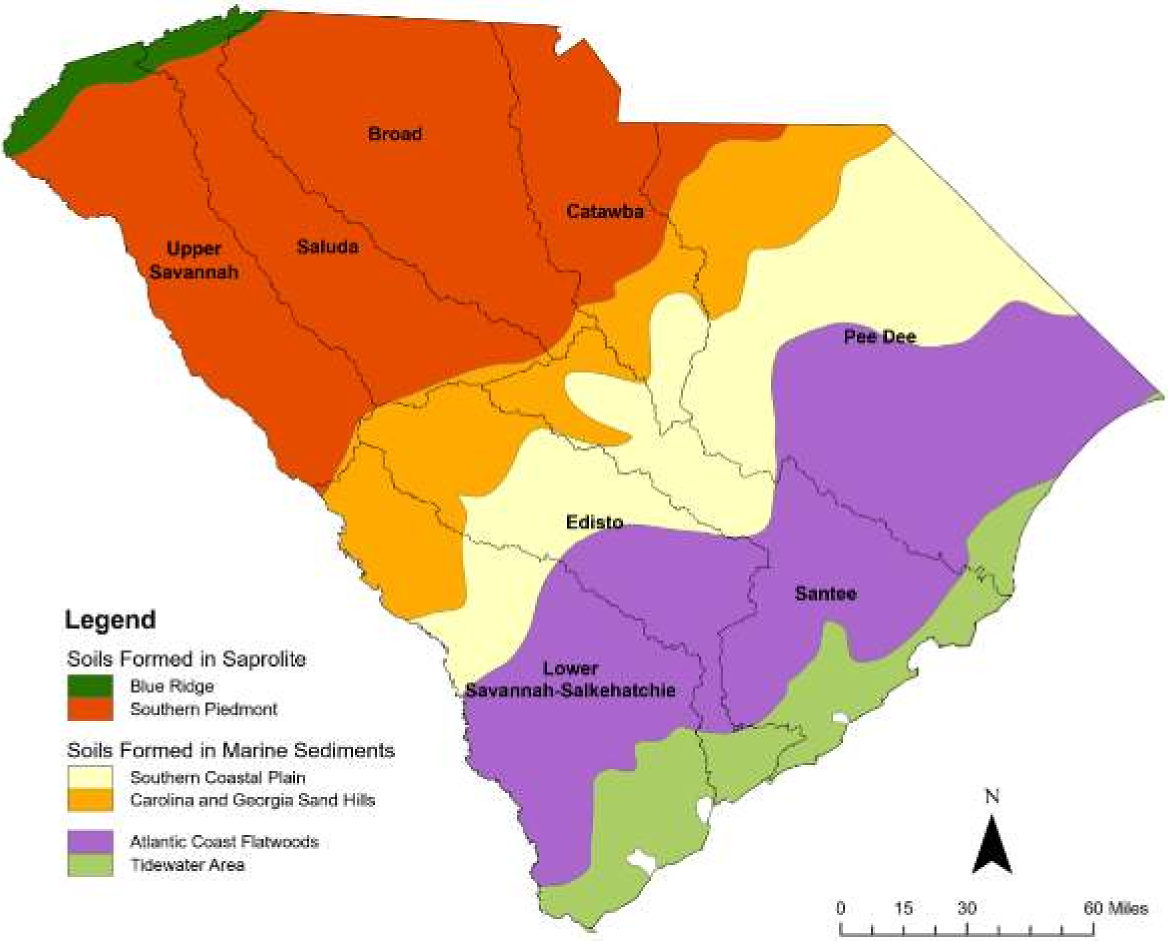


Figure 2-18. Generalized land resource and soils map of South Carolina.

There are currently 69 active mines within the Santee River basin, most of which are in Charleston (23), Lexington (15), and Berkeley (14) Counties (SCDES 2025e). Many of these mines produce multiple materials such as sand, clay, and topsoil. Sand is the most common mined material (56), though many mines also produce clay and/or topsoil in addition to sand (SCDES 2025e). According to the most recently published USGS Minerals Yearbook, South Carolina produced $1.15 billion in nonfuel minerals in 2019 (USGS 2022a). Because 69 of the state's 488 active mines, or approximately 14.1 percent, are in the Santee basin, a rough percentage-based estimate of the annual value of minerals produced from the basin is $162.2 million (SCDES2025e). Principal commodities in South Carolina include cement (masonry and Portland), clay (kaolin), sand and gravel (construction), and stone (crushed) (USGS 2022a).

2.3.2 Fish and Wildlife

The Santee River basin encompasses a diverse array of aquatic habitats from freshwater rivers to coastal estuaries and supports a rich variety of fish and wildlife. In the basin, there are 91 native and 9 introduced species of fish (SCDNR 2025c). Popular sportfish include striped bass, largemouth bass, redbreast sunfish, bluegill, and crappie. The Dennis Wildlife Center located on Lake Moultrie was a pioneer in developing striped bass hatchery techniques now used across the country. The basin's most well-known sportfish are catfish, which attract fishermen across the southeast because of how large they can grow in the basin's reservoirs.

Additionally, the basin's rivers are an important habitat for diadromous fish, or those that migrate from freshwater to saltwater (catadromous) and from saltwater to freshwater (anadromous) for spawning. Anadromous fish found in the basin include American shad, Atlantic and shortnose sturgeon, striped bass, and blueback herring. Catadromous fish include American eel. Estuarine fish (those that live in the Santee River and Cooper River deltas) include red drum, southern flounder, spot, and multiple coastal sharks (SCDNR 2025d). The basin is home to an ongoing reintroduction program for robust redhorse. Once thought to be extinct, this fish species was rediscovered in Georgia in the 1980s. After years of restocking, recent evidence of wild reproduction indicates that robust redhorse may have successfully established themselves in the basin (SCDNR 2025c). Figure 2-19 displays a panel of some representative species within the Santee River basin.

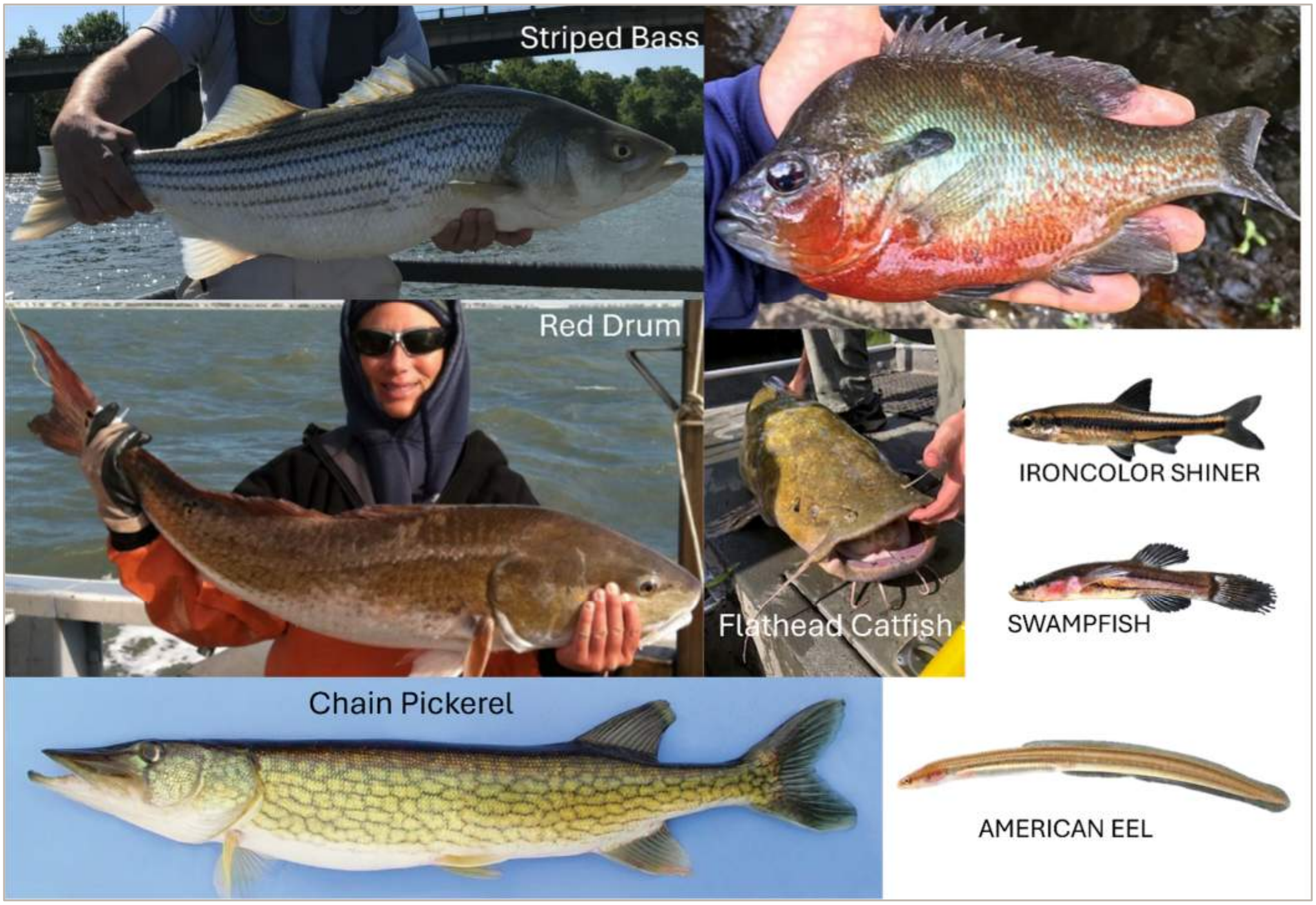


Figure 2-19. Representative fish species within the Santee River basin. (SCDNR 2025c, 2025d).

Oysters, a valuable commercial and recreational resource, can be found along coastal habitats in the basin. Data collected by the South Carolina Estuarine and Coastal Assessment Program indicates that several water quality parameters in the basin are in good condition. Perhaps owing to these conditions, oysters in the Santee basin have a lower mortality rate than other basins in the state (SCDNR 2025d).

The Santee River basin provides habitat for numerous rare, threatened, and endangered species. Within the 11 counties that make up the basin, 10 federally endangered and 11 federally threatened species are present, along with 14 state-listed endangered and 12 state-listed threatened species. The bald eagle, protected by the Bald and Golden Eagle Protection Act, has also been noted in all 11 of these counties. The tricolored bat, which has been placed on the proposed federally endangered list, is also found in all counties. A list of the threatened and endangered species is provided in Table 2-8 (SCDNR 2025b).

Table 2-8. Federal- and state-listed endangered and threatened species in Santee River basin counties (SCDNR 2025b).

Federally Endangered	Federally Threatened	State Endangered	State Threatened
Atlantic Sturgeon	Black Rail	Bachman's Warbler	Bald Eagle
Canby's Cowbane	Florida Manatee	Carolina Gopher Frog	Broad-striped Dwarf Siren
Chaffseed	Frosted Flatwoods Salamander	Eskimo Curlew	Broadtail Madtom
Golden Sedge	Green Sea Turtle	Florida Manatee	Carolina Pygmy Sunfish
Kemp's Ridley Sea Turtle	Loggerhead Sea Turtle	Frosted Flatwoods Salamander	Common Ground Dove
Leatherback Sea Turtle	Piping Plover	Gopher Tortoise	Green Sea Turtle
Northern Long-eared Bat	Red Knot	Kemp's Ridley Sea Turtle	Least Tern
Pocosin Loosestrife, ‘Roughleaf Loosestrife’	Red-cockaded Woodpecker	Leatherback Sea Turtle	Loggerhead Sea Turtle
Shortnose Sturgeon	Seabeach Amaranth, Dwarf Amaranth	Piping Plover	Pine Barrens Treefrog
Southern Spicebush, Pondberry	Smooth Purple Coneflower	Rafinesque's Big-eared Bat	Southern Hog-nosed Snake
	Wood Stork	Red-cockaded Woodpecker	Spotted Turtle
		Shortnose Sturgeon	Wilson's Plover
		Swallow-tailed Kite	
		Wood Stork	

Of particular environmental concern in the Santee River basin are freshwater mussels. Freshwater mussels serve as natural water filters and provide a food source, linking microorganisms at the bottom of the food chain to higher level predators. Freshwater mussels have the highest percentage of federally endangered species in North America. There are 11 freshwater mussel species found in the Santee River basin that have made the 2025 State Wildlife Action Plan list for greatest conservation need (SCDNR 2025c) as listed below:

- Tidewater Mucket
- Carolina Slabshell
- Atlantic Spike
- Roanoke Slabshell
- Yellow Lampmussel
- Eastern Lampmussel
- Eastern Pondmussel
- Savannah Lilliput
- Barrel Floater
- Alewife Floater
- Southern Rainbow

2.3.3 Natural and Cultural Preserves

The Santee River basin has a plethora of natural and cultural resources. The basin is home to the Congaree National Park, the largest intact expanse of old growth bottomland hardwood forest remaining in the United States. Spanning 26,900 acres, the park's biodiversity is recognized as a United Nations Educational, Scientific and Cultural Organization (UNESCO) International Biosphere Reserve and an Important Bird Area by the Audubon Society. It is home to 56 species of fish (SCDNR 2025c). The park experiences an average of 10 major flooding events per year, which result in flooding of 90 percent of the park and create a unique riverine habitat. Figure 2-20 shows one type of environment typically found in the national park, though the floodplain is a mosaic of riverine environments (SCDNR 2025c).

Figure 2-20. Example of floodplain within Congaree National Park (SCDNR 2025c, courtesy of Carrie McIntosh).

There are two national wildlife refuges in the basin: Cape Romain National Wildlife Refuge and Santee National Wildlife Refuge. The 15,000-acre Santee National Wildlife Refuge is located on the north shore of Lake Marion and was established to benefit migratory waterfowl, other birds, and terrestrial and aquatic wildlife found within the ecosystem of the lake. Cape Romain National Wildlife Refuge extends

22 miles along the coast in Charleston County and consists of barrier islands with forest and ponds, salt marshes, and intricate waterways. The refuge is one of the few locations in the United States where red wolves can be found due to an ongoing reintroduction program. Just inland of the Cape Romain National Wildlife Refuge is the Francis Marion National Forest, which is managed by the U.S. Forest Service (USFWS 2025).

On a state level, there are multiple sites of interest identified by the South Carolina Heritage Trust. The South Carolina Heritage Trust program was founded in 1974 to protect critical natural habitats that monitored species depend on, along with significant cultural sites. There are 12 natural and cultural preserves designated by the South Carolina Heritage Trust program within the Santee River basin (SCDNR 2019b):

- Congaree Creek Heritage Preserve – The Congaree Creek Heritage Preserve covers 1,300 acres in Lexington County with the Congaree River defining its eastern border and the city of Cayce surrounding the rest of the preserve. The site is known for its pre-European contact cultural sites that date to 12,000 years ago. Archaeologists have discovered stone tools, projectile points, pottery sherds, and other artifacts.
- Crab Bank Seabird Sanctuary – The Crab Bank Seabird Sanctuary, at the mouth of Shem Creek in Charleston Harbor in Charleston County, was established to protect a significant nesting habitat of sea and shorebirds. The Sanctuary is on an artificial island that was formed with the placement of dredged materials. It received significant soil enrichment in 2022 and is once again a nesting habitat for black skimmers, gull-billed terns, and American oystercatchers.
- Childsbury Towne Heritage Preserve – The Childsbury Towne Heritage Preserve, located on a 90-acre parcel in Berkeley County, South Carolina, was acquired by the SCDNR Heritage Trust Program in 2002 to protect the site of a colonial town from 1707. The town, designed by James Child, featured open squares, a market area, a schoolhouse, and a chapel, and thrived until it became a plantation in the 1750s. The only remaining structure is Strawberry Chapel.
- Buzzard’s Island Heritage Preserve – Buzzard’s Island Heritage Preserve consists of a 1-acre plot off the coast of Mount Pleasant, South Carolina, and protects a precontact shell mound created by Indigenous people. The site features a shell ring about 50 meters wide and 1 meter high. It is one of over 20 known shell mounds in the area, some dating back 4,300 years. Ecologically, the shell ring supports a unique coastal fringe shell woodland ecosystem, with vegetation thriving on the calcium-rich soil. This includes the rare small-flowered buckthorn, which is only associated with these cultural sites.
- Capers Island Heritage Preserve – The Capers Island Heritage Preserve encompasses 2,000 acres of maritime uplands, salt marsh, and brackish water impoundments in Charleston County. The island contains diverse habitats supporting abundant wildlife. One may observe alligators, white-tailed deer, raccoons, and loggerhead sea turtles. The creeks and marshes adjacent to Capers are alive with oysters, shrimp, hard clams, crabs, and many species of fish such as sea trout, red drum, flounder, black drum, king whiting, spot, pompano, and croaker.
- Bennett’s Bay Heritage Preserve – Bennett’s Bay Heritage Preserve is an example of the Carolina Bay phenomenon found in Clarendon County. Bennett’s Bay is one of the few large, intact bays remaining in South Carolina. The preserve features major plant communities like pocosin and pond-

pine woodland bay forest, which are indicative of thick peat deposits. Dominant canopy species include pond pine and loblolly bay, with oaks and hickories in the transition zone.

- Tom Yawkey Wildlife Center Heritage Preserve – The Tom Yawkey Wildlife Center covers 24,000 acres across three coastal islands at the mouth of Winyah Bay in Georgetown County. It was bequeathed to the SCDNR by Tom Yawkey in 1976. The center includes diverse habitats, such as marshes, managed wetlands, forests, and beaches, and serves as a wildlife preserve, research area, and waterfowl refuge. It is considered one of the most generous gifts to wildlife conservation in North America.
- Fort Lamar Heritage Preserve – The Fort Lamar Heritage Preserve is located on a 14-acre property in James Island (Charleston County). The site hosts a fort where one of the most significant battles of the American Civil War in South Carolina was fought. On June 16, 1862, although outnumbered three to one, the Confederate forces repelled the assaulting Union troops who then withdrew from the battle and the peninsula. Historians often speculate that the Union's loss here and their inability to take Charleston lengthened the American Civil War by an additional 2 years.
- Dungannon Plantation Heritage Preserve – The Dungannon Plantation Heritage Preserve in Charleston County was acquired by the SCDNR to protect a key nesting colony of the endangered wood stork. The preserve also supports other birds like osprey, anhinga, great egrets, and great blue herons. It features bald cypress-tupelo gum swamps and mixed upland forests.
- Congaree Bluffs Heritage Preserve – The Congaree Bluffs Heritage Preserve in Calhoun County spans 201 acres and features steep bluffs along the Congaree River. Unique to the Coastal Plain of South Carolina, the preserve and nearby private lands host a diverse array of trees, shrubs, and woody vines, with over 100 species documented. It contains significant stands of American beech, oak hickory, and bottomland hardwood forests, with upland areas consisting of longleaf pine.
- Peachtree Rock Heritage Preserve – Peachtree Rock Heritage Preserve comprises over 400 acres in Lexington County. The preserve is geologically significant for its unusual sandstone formations and abundant fossils from the middle Eocene Epoch, about 60 million years ago. It also contains the only waterfall in the Coastal Plain, a swamp tupelo-evergreen shrub bog, and a longleaf pine ecosystem.
- Shealy's Pond Heritage Preserve – Shealy's Pond Heritage Preserve covers 62 acres in Lexington County and is centered around an old mill pond and associated wetlands on spring-fed Scouter Creek. The preserve also includes approximately 6 acres of sandhills on the west side, which is forested primarily in longleaf pine and turkey oak. The remainder of the tract is an Atlantic white cedar bog surrounding the mill pond that supports several rare plant species.

There are five state parks within the Santee River basin: Charles Towne Landing State Historic Site, Colonial Dorchester State Historic Site, Hampton Plantation State Historic Site, Santee State Park, and Sesquicentennial State Park (South Carolina State Parks 2025).

Approximately 32 percent, or 1,196 sq mi, of the Santee River basin is conserved land. A third of all conserved land in the basin is privately owned. The U.S. Forest Service, who maintains the Francis Marion National Forest, is the single largest owner of conserved land, owning 412 sq mi of land (USDA Forest Service 2023). Figure 2-21 shows conserved land within the Santee River basin.

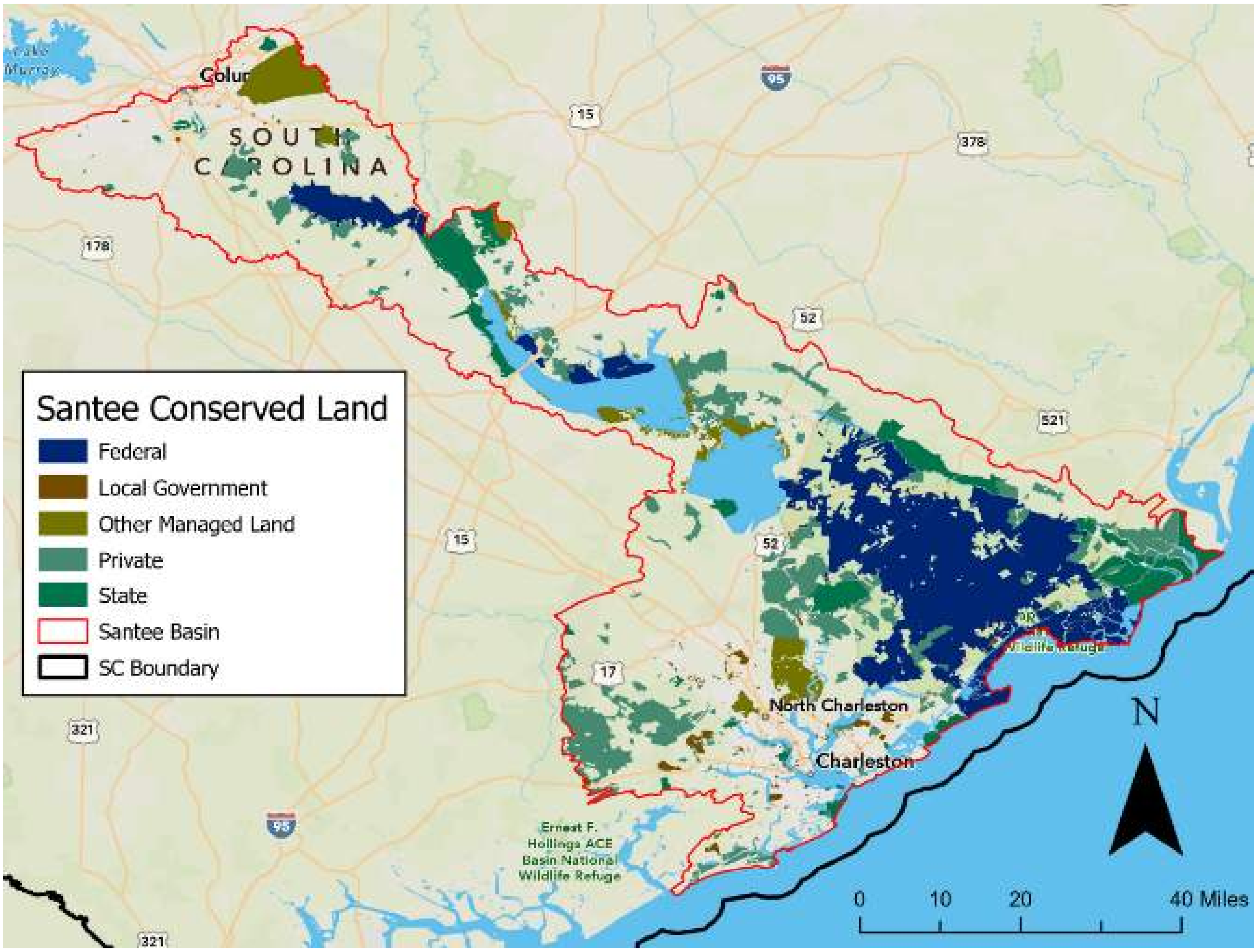


Figure 2-21. Conserved land within the Santee River basin.

2.4 Agricultural Resources

2.4.1 Agriculture and Livestock

In the Santee River basin, most agricultural production, both crops and livestock, can be found upstream of Lake Marion. Crop and pasturelands constitute approximately 7 percent of the basin's total footprint. Between 2001 and 2023, the total percentage of farmland in these land cover types have decreased by 1 percent (MRLC 2024a, 2024b).

Total crop and livestock sales for the entirety of the 11 counties overlapping the basin totaled $815 million according to the U.S. Department of Agriculture (USDA) Agricultural Census (USDA National Agricultural Statistics Service [NASS] 2022). The USDA NRCS, which inventories land that can be used to produce the nation's food supply, has categorized 22 percent of the Santee River basins as prime farmland and 30 percent of the Santee River basin as farmland of statewide importance, as shown in Table 2-9 (USDA NRCS 2017). Prime farmland is defined as land containing the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, and a water supply that is dependable and of adequate quality. It is also not excessively erodible or saturated with water for long periods and has slopes ranging from 0 to 6 percent. Farmland of statewide importance is land that nearly meets the requirements of prime farmland and can economically produce high-yield crops when treated and managed with acceptable farming methods. Both farmland types can be found throughout the basin, and Figure 2-22 depicts their distribution.

Table 2-9. Area of NRCS-categorized farmland in the Santee River basin.

Farmland Type	Area (sq mi)	Percent of Basin
Prime Farmland	823	22%
Farmland of Statewide Importance	1,094	30%
Not Prime Farmland	1,787	48%
Total	**3,704**	**100%**

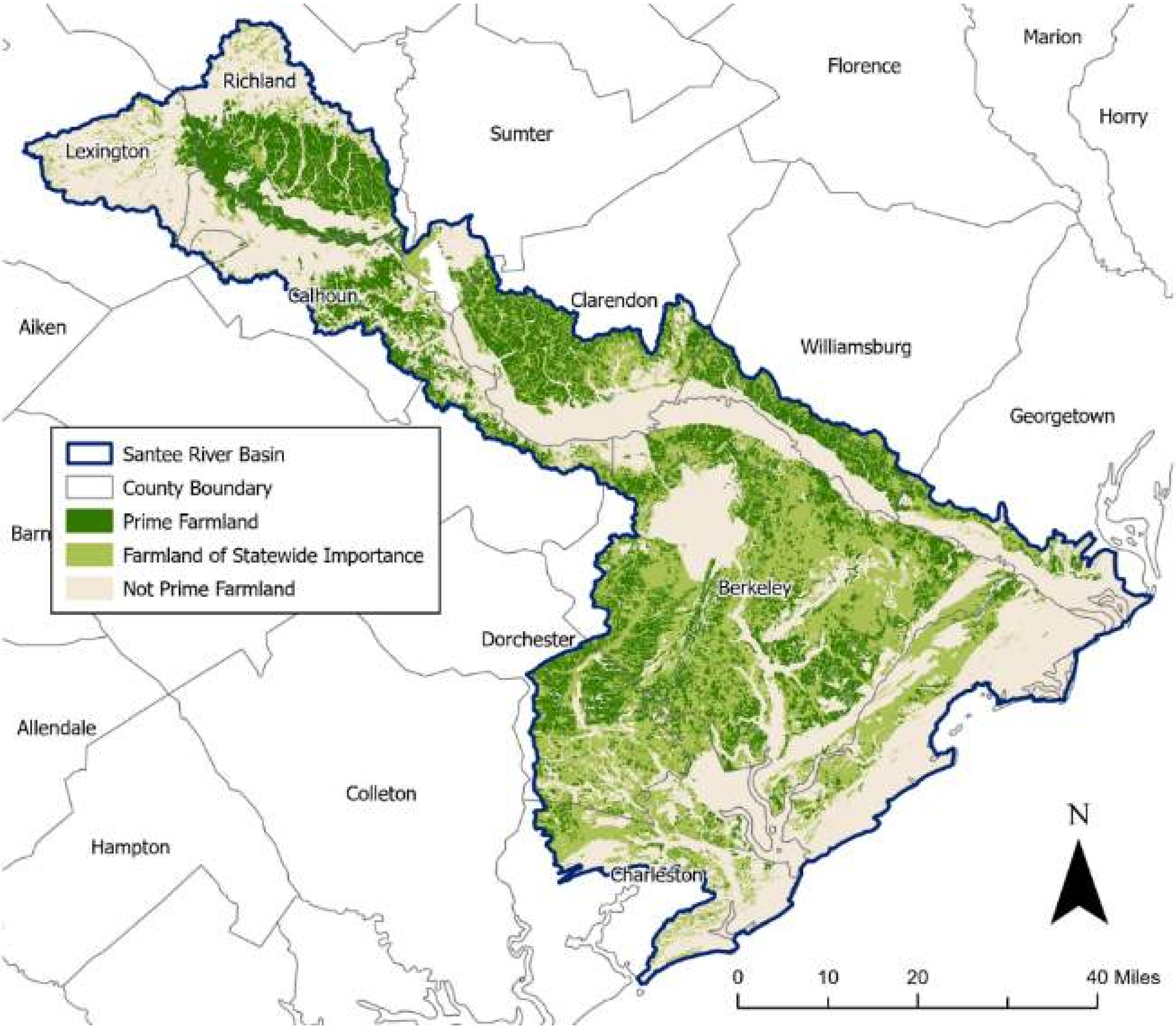


Figure 2-22. Location of NRCS-categorized farmland in the Santee River basin.

Most agricultural output in the Santee River basin is distributed across the upper half of the basin, in Richland, Lexington, Calhoun, Clarendon, and Orangeburg Counties. Based on the locations of prime farmland within the basin (Figure 2-22), these counties are among those with the greatest proportion of prime agricultural land.

As of March 2025, there were 528 livestock operations in the Santee River basin, as shown on Figure 2-23 (SCDHEC 2023). Raising poultry accounts for 78 percent of active operations.

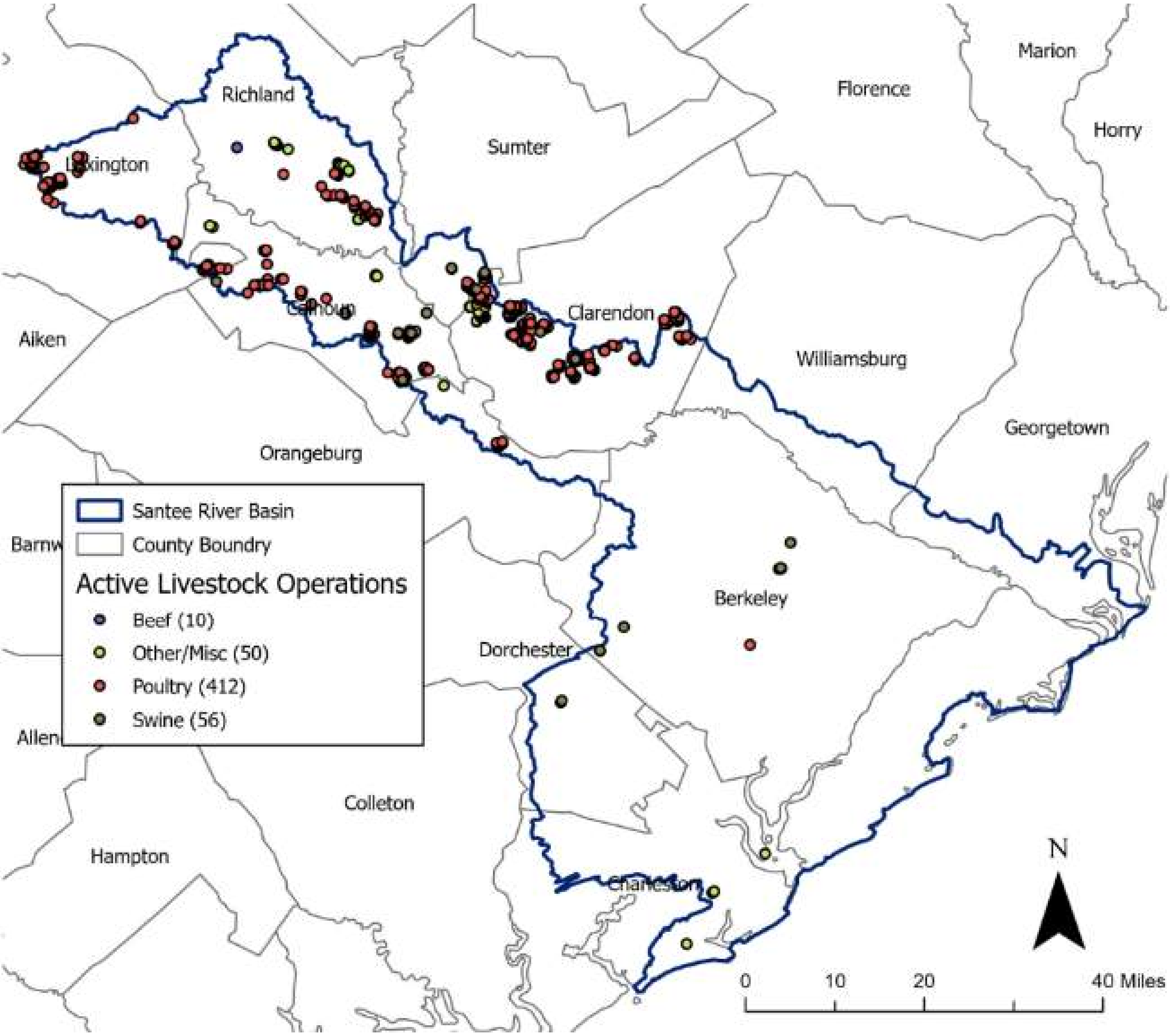


Figure 2-23. Active livestock operations in the Santee River basin.

Data from the Census of Agriculture, gathered by voluntary reporting, suggests that the number of farm operations increased by 88 percent in counties that intersect the Santee River basin during the 30 years between 1992 and 2022 (Figure 2-24). The amount of irrigated acres of farmland in the basin has increased by 188 percent over the same time frame. Agricultural growth trends within the Santee basin generally followed statewide trends until 2017. Since 2017, there has been little growth in the number of irrigated acres of farmland and farm operations in counties that intersect the Santee River basin (USDA NASS 1997, 2007, 2017, 2022).

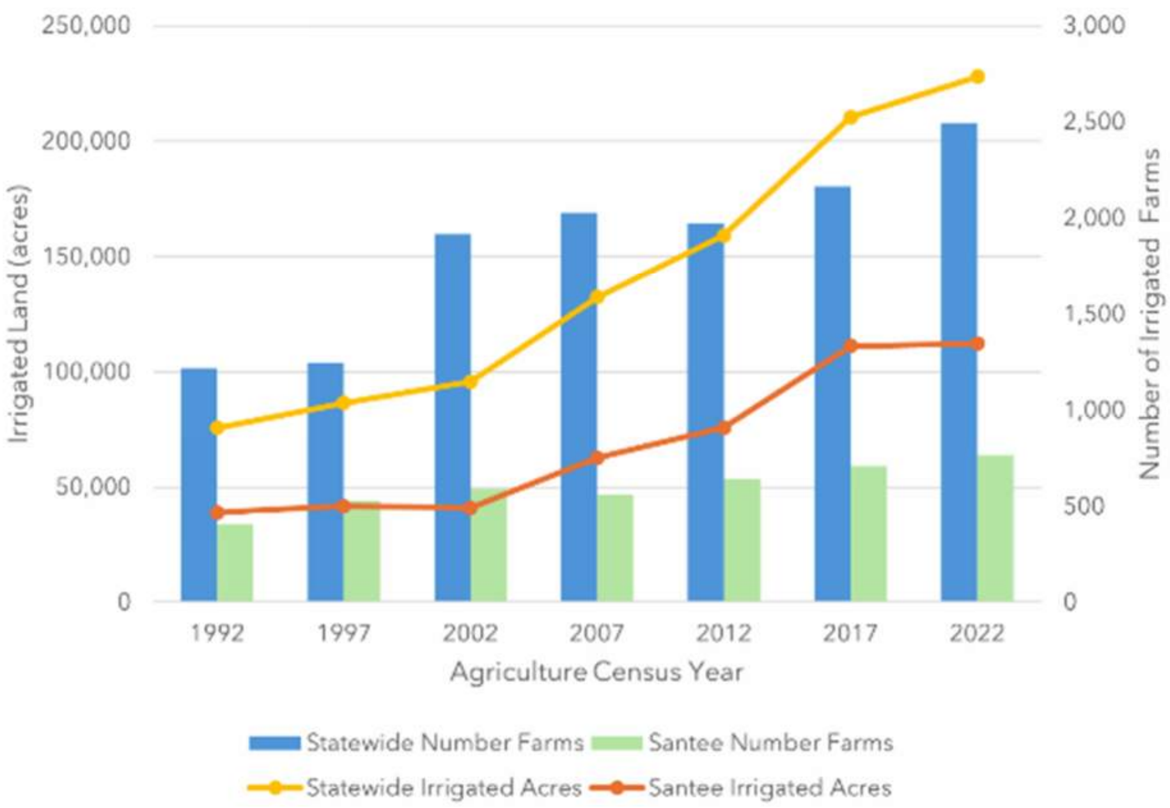


Figure 2-24. Number of farm operations and irrigated acreage for counties within the Santee River basin and statewide, 1992 through 2022 (USDA NASS 1997, 2007, 2017, 2022).

Tables 2-10 and 2-11 provide additional 2022 Census of Agriculture data for counties within the Santee River basin (USDA NASS 2022). These tables omit information from Orangeburg and Sumter Counties, which have less than 10 percent of their total area inside the basin. Top agricultural products include corn, cotton, and soybeans.

Table 2-10. Summary of 2022 Census of Agriculture for counties in the Santee basin, cropland (USDA NASS 2022).

All Values in Acres	Total All Counties*	Berkeley	Calhoun	Charleston	Clarendon	Dorchester	Georgetown	Lexington	Richland	Williamsburg
Percentage of County Area in Santee River Basin	NA	94%	68%	73%	46%	40%	16%	26%	45%	15%
Farm Operations	888,545	78,741	108,019	38,727	156,415	79,233	63,303	79,450	76,011	208,646
Cropland	429,817	11,077	56,369	10,389	111,991	43,418	12,666	37,161	40,270	106,476
Harvested Cropland	345,544	4,614	48,245	4,820	95,567	36,141	5,857	29,555	34,925	85,820
Irrigated Land	63,578	383	19,444	1,089	13,612	3,634	275	11,500	10,962	2,679
Corn (Grain) Harvested	98,563	2,155	8,456	565	39,515	11,470	1,063	3,520	15,644	16,175
Corn (Silage) Harvested	110	-	-	-	-	-	-	-	(D)	110
Wheat Harvested	24,532	86	(D)	225	15,162	2,901	(D)	(D)	3,821	2,337
Oats Harvested	553	(D)	-	-	(D)	370	-	-	183	(D)
Sorgum Grain Harvested	217	-	-	-	(D)	-	-	-	-	217
Berries Harvested	386	31	6	101	2	15	9	100	115	7
Soybeans Harvested	96,252	538	2,924	(D)	33,951	6,395	2,033	2,331	5,249	42,831
Cotton Harvested	69,016	331	20,504	-	5,992	11,550	(D)	4,457	6,404	19,778
Hay and Haylage Harvested	27,758	1,268	1,707	912	5,673	3,164	462	9,189	2,802	2,581
Peanut Harvested	17,586	12	10,220	(D)	1,727	2,445	-	(D)	2,153	1,029
Vegetables Harvested	8,595	66	3,682	1,258	2,896	245	24	(D)	111	313
Orchards Harvested	988	7	101	271	31	77	66	356	63	16

D = Not shown to avoid disclosure of confidential information; estimates are included in higher level totals.

NA = Not applicable.

* Data is only shown for counties that have at least 10% of their extents inside the Santee River basin. The total shown also only includes counties that have at least 10% of their extents inside the basin.

Table 2-11. Summary of 2022 Census of Agriculture for counties in the Santee River basin, livestock (USDA NASS 2022).

Number of Operations with Sales	Total All Counties*	Berkeley	Calhoun	Charleston	Clarendon	Dorchester	Georgetown	Lexington	Richland	Williamsburg
Cattle Operations	283	18	18	21	32	28	8	95	34	29
Hogs Operations	101	21	11	5	9	17	-	18	9	11
Sheep Operations	29	-	1	2	2	4	-	14	-	6
Turkey Operations	20	2	-	2	-	8	-	2	6	-
Chicken Layers (Egg) Operations	64	9	-	5	3	1	-	22	12	12
Chicken Broilers (Meat) Operations	157	10	13	4	20	12	3	87	8	-

* Data is only shown for counties that have at least 10% of their extents inside the Santee River basin. The total shown also only includes counties that have at least 10% of their extents inside the basin.

The amount of water needed annually by the major row crops grown within the Santee River basin varies. Corn requires roughly 1 million gallons per acre over the course of a season, while cotton needs about 435,000 gallons per acre per season (Smith and Buckelew 2023). This usage data, when combined with the Census of Agriculture reported irrigated acres of each crop type, provides a picture of how crop irrigation influences water usage within the basin. For instance, the approximately 97,600 acres of corn grown in counties within the basin use an estimated 98 billion gallons of water in a season. Likewise, the 69,000 acres of cotton grown would consume upward of 30 billion gallons of water in a season.

An agricultural water-use survey conducted by Clemson University in 2018 found that fixed-rate center pivot irrigation is the most commonly used irrigation technique in counties within the Santee River basin, followed by drip surface (Sawyer et al. 2018). The water-use survey represented a limited sample of statewide irrigation practices and was based on responses from 167 participants representing practices used on 75,000 acres of irrigated land in South Carolina. Statewide, most respondents noted groundwater as their main source of irrigation water (141), with other sources being lake/pond (29), river/stream (14), municipal (7), and recycled (2). Table 2-12 lists the irrigation techniques used by survey respondents who own farming operations in the Santee River basin.

Table 2-12. Irrigation techniques used in the Santee River basin (Sawyer 2018).[1]

General	High Efficiency	Precision
Center Pivot-Fixed Rate	Drip Surface	Center Pivot-Variable Rate
Traveling Gun	Drip Subsurface	
Solid Set	Microirrigation	
Portable Pipe		

[1] Center pivot-fixed rate with best nozzle technology (a high-efficiency type) may also be used; however, this category was not included in the survey.

2.4.2 Silviculture

Silviculture plays a significant role in the Santee River basin. Table 2-13 summarizes South Carolina Forestry Commission (SCFC) timber production values for 2022 (SCFC 2023). Harvested timber values are categorized as both "stumpage," which is the value of standing trees on the stump, and "delivered," which is the value of the logs when they are delivered to the mill. The latter considers all costs associated with cutting, preparing, and hauling timber to the plant.

Even though the Santee River basin contains relatively high proportions of wetlands and coastal areas, they are among the most forested river basins in South Carolina and one of the highest in terms of timber value. Four of its 11 counties (and 3 of its 9 counties that have 10 percent of their total area inside the basin) rank in the top 10 statewide in delivered value. Six of its 11 counties rank in the top half.

In total, $324 million in delivered timber value was generated in 2022 within the Santee River basin, roughly 37 percent of the statewide total. Because of the ease of access to the flat forested areas in this basin, the value of timber is higher than other areas of the state (Figure 2-25).

Table 2-13. Value of timber for counties in the Santee basin and state total.

County	Acres of Forestland	Percent Forest	Harvest Timber Value (in Millions of Dollars)		Delivered Value Rank
			Stumpage	Delivered	
Berkeley	561,200	80%	$18.2	$40.3	6
Calhoun	172,858	67%	$5.7	$13.0	36
Charleston	285,779	47%	$8.8	$20.5	25
Clarendon	222,819	58%	$10.0	$21.2	24
Dorchester	261,373	73%	$13.6	$30.0	12
Georgetown	425,045	75%	$27.5	$60.4	1
Lexington	254,887	52%	$5.0	$10.1	40
Orangeburg	437,163	61%	$21.7	$46.1	4
Richland	306,351	66%	$7.4	$17.0	30
Sumter	270,620	64%	$10.9	$24.4	19
Williamsburg	412,990	71%	$19.5	$41.3	5
Statewide	**12,849,182**	**66%**	**$446.0**	**$881.0**	**--**

Based on 2020 estimates from the SCFC (2023).

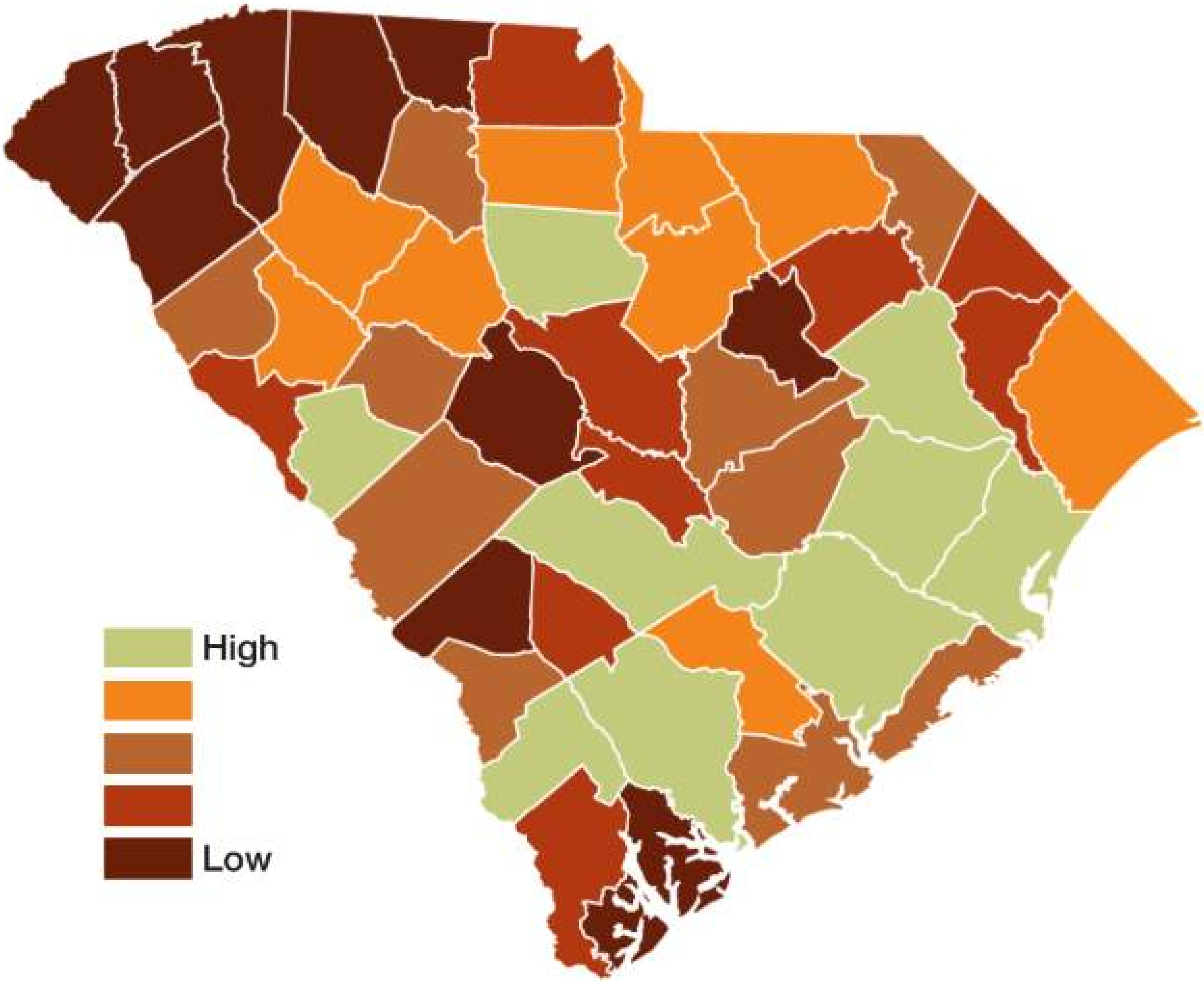


Figure 2-25. South Carolina delivered timber value rating by county (SCFC 2023).

2.4.3 Aquaculture

Aquaculture is a growing industry in the Santee River basin. There are several fisheries in the headwaters of the basin that specialize in commercially raising fish that are used for stocking other waterbodies. Near the coast, the oyster farming industry has grown from 139,000 oysters produced in 2014 to over 1 million oysters produced in 2021 (SC Sea Grant Consortium 2021). The oyster farms in Charleston Harbor account for 9 of the 16 operating oyster farms in South Carolina (USDA NASS 2022). Table 2-14 lists the number of aquaculture farms that reported sales in 2022.

Table 2-14. Number of aquaculture farms in counties of the Santee River basin (USDA NASS 2022).

Aquaculture Type	Total All Counties*	Berkeley	Calhoun	Charleston	Clarendon	Dorchester	Georgetown	Lexington	Richland	Williamsburg
Catfish	4	2	-	-	-	-	-	1	1	-
Trout	0	-	-	-	-	-	-	-	-	-
Other Food Fish	2	2	-	-	-	-	-	-	-	-
Mollusks	9	-	-	9	-	-	-	-	-	-
Ornamental Fish	0	-	-	-	-	-	-	-	-	-
Sport or Game Fish	9	-	-	1	-	-	-	7	1	-

* Data is only shown for counties that have at least 10% of their extents inside the Santee River basin. The total shown also only includes counties that have at least 10% of their extents inside the basin.

2.5 Socioeconomic Environment

2.5.1 Population and Demographics

The Santee River basin is the most populous basin in South Carolina, possessing 21 percent of the state's population in 12 percent of its area. The estimated basin population as of the 2020 census was 1,087,313, which increased by approximately 15 percent since 2010. Figure 2-26 displays a population density map using data from the 2020 census (U.S. Census Bureau 2020).

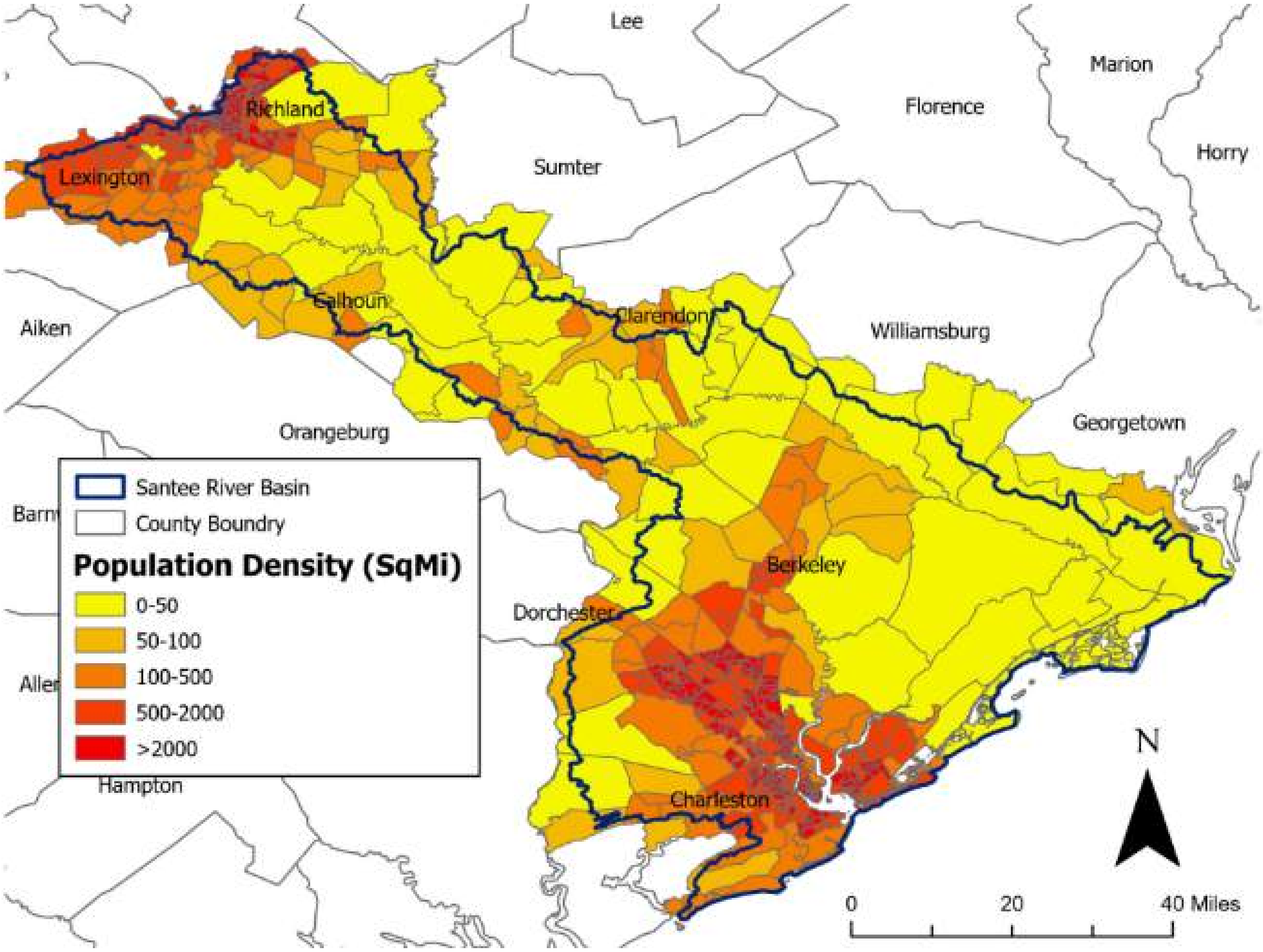


Figure 2-26. Population density of the Santee River basin by census block group (U.S. Census Bureau 2020).

The Santee River basin contains a diverse mix of rural and urban areas. As mentioned in Section 2.1.2, most of the population can be found in the upper and lower extents of the basin. A large part of the city of Columbia and its surrounding metropolitan area, which totals over 850,000 people, lie within the basin. Charleston and its surrounding urban area lie completely within the basin. Charleston and its adjacent municipalities also total near 850,000 people. Outside of these urban areas, the basin is much more rural. The small towns of Moncks Corner (13,000 in population) and St. Stephen (1,700 in population) are located closer to the center of the basin. There are large tracts of land in the basin that have fewer than 50 individuals per sq mi (U.S. Census Bureau 2020).

Population changes within the Santee River basin from 2010 to 2020 are shown in Figure 2-27 (U.S. Census Bureau 2010, 2020). Overall, the population of the basin is growing rapidly. However, the most intensive population growth in the basin is occurring within areas of already existing high population density such as the Charleston and Columbia metropolitan areas. The Charleston area has experienced rapid growth, growing at three times the national average. Outside of these urban areas, the population in the basin has either remained relatively constant or declined slightly. The projected change in future population from 2020 to 2035 is shown in Table 2-15.

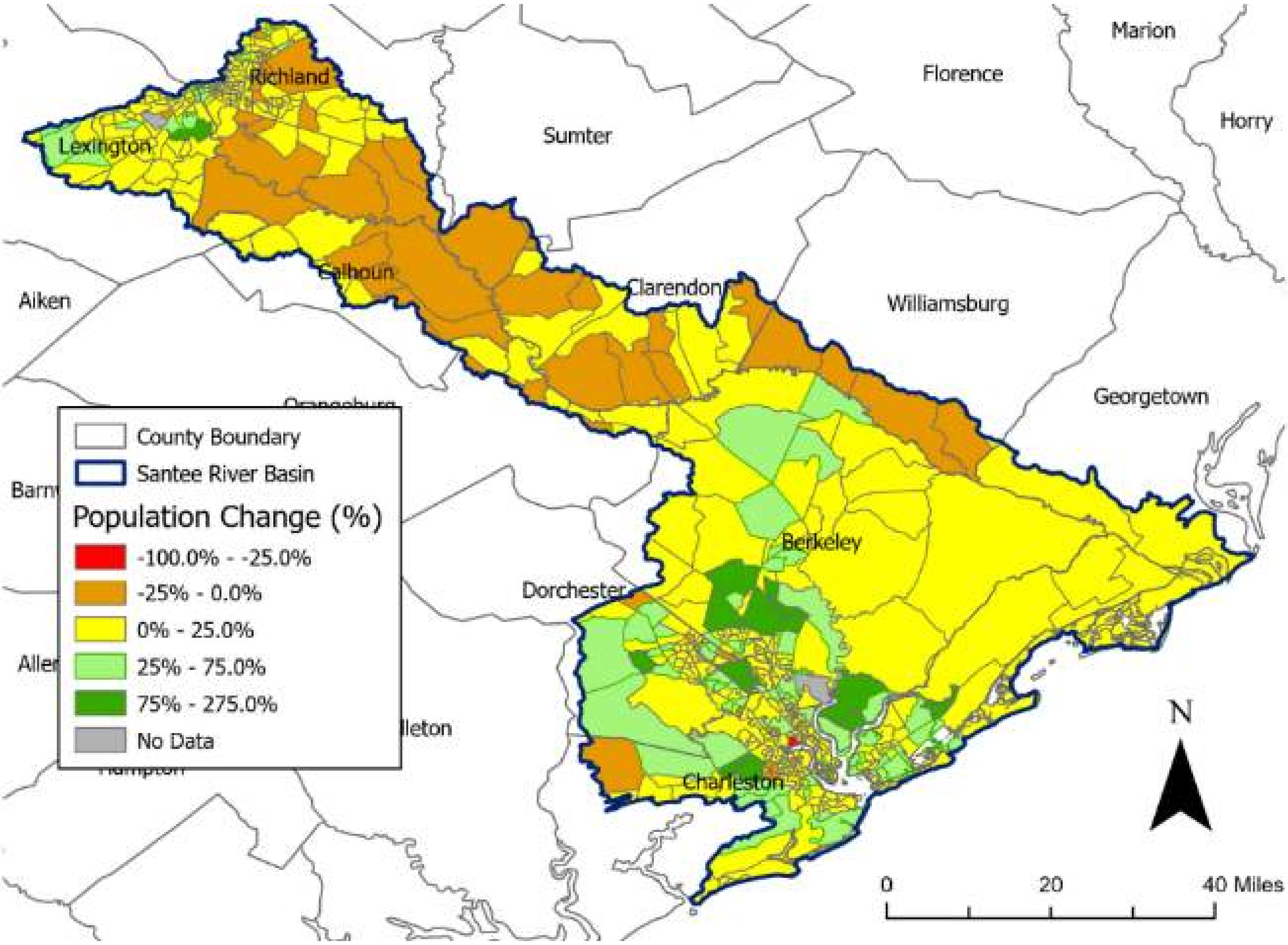


Figure 2-27. Change in the Santee River basin population from 2010 to 2020 by census block group (U.S. Census Bureau 2020).

Table 2-15. Estimated change in population from 2020 to 2035 by county (South Carolina Revenue and Fiscal Affairs Office 2019, U.S. Census Bureau 2020).

County	2020 Population	Estimated 2035 Population	Percent Change
Berkeley	229,861	293,125	27.52%
Calhoun	14,119	13,060	-7.50%
Charleston	408,235	480,890	17.80%
Clarendon	31,144	30,940	-0.66%
Dorchester	161,540	198,030	22.59%
Georgetown	63,404	64,115	1.12%
Lexington	293,991	345,560	17.54%
Orangeburg	84,223	76,480	-9.19%
Richland	416,147	451,000	8.38%
Sumter	105,556	100,870	-4.44%
Williamsburg	31,026	24,955	-19.57%

The U.S. Bureau of Economic Analysis (BEA) provided the 2023 per capita income of counties that are partially or fully within the basin, presented in Table 2-16. Charleston County has the highest per capita income in the state ($83,294), which is more than double the per capita income of Williamsburg County ($40,528), the fifth lowest in the state. The average income across the counties in the basin is $54,969, which is slightly below the statewide average of $57,332. The average percentage of the population below the poverty line of these counties is 15 percent, which is roughly equal to the state average (South Carolina Revenue and Fiscal Affairs Office 2021).

Table 2-16. Per capita income for counties within the Santee River basin Counties (U.S. BEA 2023).

County	2023 Per Capita Personal Income	Rank in State	Percent Change from 2021
Berkeley	$55,131	11	10%
Calhoun	$51,945	16	3%
Charleston	$83,294	1	12%
Clarendon	$48,457	27	6%
Dorchester	$51,555	17	10%
Georgetown	$61,924	4	8%
Lexington	$60,682	6	8%
Orangeburg	$44,277	36	5%
Richland	$57,160	9	6%
Sumter	$49,704	23	6%
Williamsburg	$40,528	42	2%
Basin Average	**$54,969**	-	-
Statewide Average	**$57,332**	-	-

2.5.2 Economic Activity

The U.S. BEA also tracks real gross domestic product (GDP) by county. Table 2-17 presents the 2023 GDP from the sum of all 11 counties of the Santee River basin (U.S. BEA 2025). Data from select counties, including a mix of those with the greatest GDP and the greatest land area within the basin, are included. Several industries, including agriculture and manufacturing, rely heavily on the water resources of the basin. The distribution of employment by industry sector for these counties is provided in Table 2-18 (SC Works 2023).

Table 2-17. GDP of select counties in the Santee River basin in 2023 (in thousands of dollars) (U.S. BEA 2025).

Industry Type	Combined Counties*	Berkeley	Calhoun	Charleston	Richland
Percentage of County Area in Santee River Basin	100%	94%	68%	73%	45%
All industry total	$122,994,750	$12,499,861	$807,335	$45,277,527	$34,730,733
Private industries	$103,541,922	$11,407,870	$743,945	$38,280,145	$27,198,092
Agriculture, forestry, fishing, and hunting	$322,071	$9,957	$32,641	$37,465	$67,671
Mining, quarrying, and oil and gas extraction	$231,898	$63,116	$383	$28,730	$56,112
Utilities	$1,723,432	$709,374	$171,003	$107,255	$230,691
Construction	$6,535,985	$789,539	$48,261	$2,827,779	$1,033,630
Manufacturing	$11,822,855	$1,497,837	$248,720	$3,958,653	$2,022,340
Durable goods manufacturing	$7,039,304	$828,051	$31,980	$3,107,243	$954,756
Nondurable goods manufacturing	$4,563,451	$669,786	$216,740	$851,410	$1,067,584
Wholesale trade	$6,489,125	$772,970	(D)	$1,857,597	$1,959,143
Retail trade	$9,025,056	$875,139	$18,754	$3,148,991	$2,276,931
Transportation and warehousing	$3,528,015	$482,345	(D)	$1,627,564	$369,735
Information	$3,507,132	$642,892	$5,612	$1,194,151	$981,802
Finance, insurance, real estate, rental, and leasing	$26,953,182	$2,893,387	$76,461	$9,439,982	$8,210,070
Finance and insurance	$6,773,961	$266,439	$8,240	$1,861,099	$3,657,343
Real estate and rental and leasing	$20,179,220	$2,626,948	$68,221	$7,578,882	$4,552,726
Professional and business services	$14,845,658	$1,466,142	$40,430	$6,381,311	$4,473,150
Professional, scientific, and technical services	$9,803,906	$1,163,879	$11,442	$4,312,111	$3,109,883
Management of companies and enterprises	$872,959	$63,503	$0	$362,775	$218,882
Administrative and support and waste management and remediation services	$4,072,727	$238,760	$28,988	$1,706,425	$1,144,386
Educational services, health care, and social assistance	$9,300,161	$416,430	$16,469	$3,571,095	$3,434,780
Educational services	$807,640	$40,890	(D)	$343,108	$312,089
Health care and social assistance	$8,428,165	$375,539	(D)	$3,227,988	$3,122,691
Arts, entertainment, recreation, accommodation, and food services	$6,208,108	$420,609	(D)	$3,126,120	$1,423,950
Arts, entertainment, and recreation	$793,405	$81,561	(D)	$348,044	$173,851
Accommodation and food services	$5,402,250	$339,048	(D)	$2,778,077	$1,250,099
Other services (except government and government enterprises)	$2,943,294	$368,133	$14,533	$973,451	$658,086
Government and government enterprises	$19,452,828	$1,091,991	$63,390	$6,997,382	$7,532,641

*Includes only the nine counties with greater than 10% of their area within the Santee River basin.

D = Not shown to avoid disclosure of confidential information; estimates are included in higher level totals.

Table 2-18. Percent employment by industry sector of select counties in the Santee River basin in 2023 (SC Works 2023).

Industry Sector	Average Percent Employment*
Agriculture, forestry, fishing and hunting	Less than 1.0%
Mining, quarrying, and oil and gas extraction	Less than 1.0%
Utilities	1%
Construction	5%
Manufacturing	8%
Wholesale trade	3%
Retail trade	11%
Transportation and warehousing	4%
Information	2%
Finance and insurance	5%
Real estate and rental and leasing	2%
Professional, scientific, and technical services	6%
Management of companies and enterprises	1%
Administrative and support and waste management and remediation services	7%
Educational services	7%
Health care and social assistance	14%
Arts, entertainment, and recreation	2%
Accommodation and food services	11%
Other services (except government and government enterprises)	3%
Government and government enterprises	7%

* Includes only the nine counties with greater than 10% of their area within the Santee River basin.

Chapter 3

Water Resources of the Santee Basin

3.1 Surface Water Resources

3.1.1 Major Rivers and Lakes

The Congaree, Santee, Cooper, and Ashley Rivers are the main watercourses of the Santee River basin in South Carolina. The river basin's headwaters originate at the convergence of the Saluda and the Broad Rivers in the upper Coastal Plain. These rivers form the Congaree River near Columbia, SC. The Congaree is subsequently joined by the Wateree River near Ft. Motte, SC to create the Santee River just upstream of the headwaters of Lake Marion. Lake Marion and Lake Moultrie, collectively known as the Santee Cooper reservoirs, are the largest reservoirs in the basin, and they are hydraulically connected by a Diversion Canal that is located near Cross, SC. Water from the Santee Cooper system can be released directly from Lake Marion into the lower Santee River or can be diverted to Lake Moultrie, where it is released either into the Cooper River near Moncks Corner or can be passed through the USACE St. Stephen Hydroelectric Station, which discharges back to the Santee River. From there, the Santee River flows along the northern part of the Santee River basin into the Atlantic Ocean near Cane Island. From the dam release toward the southern end of Lake Moultrie, the Cooper River is formed and flows towards Charleston, where water is discharged to the Atlantic Ocean. The Ashley River flows south/southeast in the southern portion of this basin, beginning in Dorchester County and discharging to Charleston Harbor.

The Santee River splits into the North Santee River and the South Santee River about ten miles from its mouth. Tributaries of the Ashley River include Eagle Creek, Coosaw Creek, Caton Creek, Black Creek, Partridge Creek, and Captains Creek; tributaries of the Cooper River include Mepkin Creek, Chicken Creek, and Bullhead Run. Two other reservoirs are owned by the Commissioners of Public Works (d.b.a. Charleston Water System).: the Bushy Park (or Back River) Reservoir and Goose Creek Reservoir. Bushy Park Reservoir is fed primarily from the Cooper River, while Goose Creek Reservoir is fed by Goose Creek.

The Santee basin has a combined area of 3,690 sq mi (SCDNR 2009). One river segment in the basin is designated as a State Scenic River: a 24-mile stretch of the Ashley River, which was designated in 1998 (SCDNR 2009). Streamflows in the lower part of the basin have been impacted by controlled releases from Lake Marion and Lake Moultrie since the 1940s, by means of the Santee (or Wilson) Dam and the Jefferies (formerly Pinopolis) Dam, respectively. Surface water development in the subbasin is discussed in more detail in Section 3.1.3.

Figure 3-1 shows the location of the Santee River basin and the major riverine wetland types present.

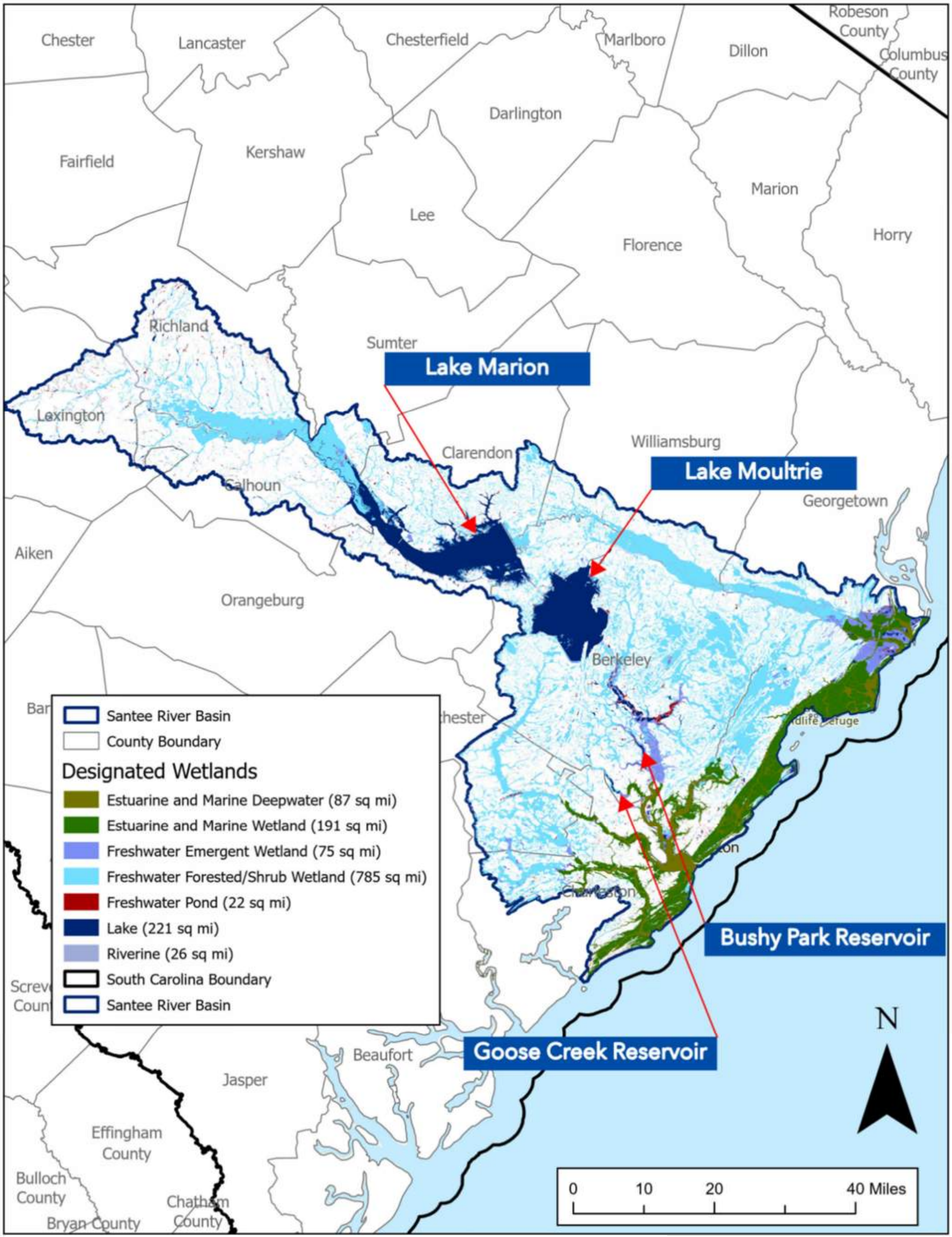


Figure 3-1. Wetland types of the Santee River basin (USFWS 2023).

3.1.2 Surface Water Monitoring

At the end of the 2024 water year (September 30, 2024), there were 43 active monitoring stations operated by the U.S. Geological Survey (USGS) in the Saluda River basin in South Carolina, which report daily data. Twelve of the active stations report daily mean discharge or daily mean tidally-filtered discharge (flow), while 27 report daily mean stage and 4 report daily lake elevation but do not report discharge (flow).

An additional 16 gaging stations are no longer active but provide historical streamflow data. Table 3-1 lists the gaging stations in the basin that report daily data and provides the first and last years of their periods of record, their drainage areas, and select daily streamflow statistics through September 30, 2024 (where available and with USGS provisional data included). Gaging stations that do not record daily mean discharge data or tidally-filtered discharge data are included but streamflow statistics are excluded (cannot be tabulated). The locations of both active and inactive gaging stations are shown in Figure 3-2. The lowest recorded daily mean streamflow on the Santee River during the period of record was 9 cfs, observed in 1947 near Pineville. The highest recorded streamflow on the Santee River was 368,000 cfs at Ferguson in 1916. The lowest recorded daily mean streamflow on the Congaree River during the period of record was 576 cfs, observed in 2007 at Columbia. The highest recorded streamflow on the Congaree River was 150,000 cfs at Columbia in 1976. No gages along the Cooper River report daily discharge data, and streamflows reported on the Ashley River are tidally influenced, which limits their usefulness for comparing historic lowest and highest recorded streamflow.

Table 3-1. Streamflow characteristics at USGS gaging stations in the Santee River basin.

Map Identifier	Gaging Station Name	Station Number	Period of Record[1]	Drainage (sq mi)	Average Daily Flow (cfs)	90% Exceeds Flow[2] (cfs)	Minimum Daily Flow (cfs) and Year	Maximum Daily Flow (cfs) and Year
Congaree Subbasin - HUC 03050110								
1	Broad River Div. Canal At Columbia, SC	02162110	1984-2012	Not reported by USGS	NA	NA	NA	NA
2	Congaree River Above Columbia, SC	02169300	2001-2003	7,840	NA	NA	NA	NA
3	Congaree River At Columbia, SC	02169500	1939-present	7,850	8,584	2,460	576 (2007)	150,000 (1976)
4	Trib To Rocky Branch Ab Gervais St At Columbia, SC	021695045	2007-present	Not reported by USGS	NA	NA	NA	NA
5	Rocky Branch Above Pickens St. At Columbia, SC	021695048	2007-2014	Not reported by USGS	NA	NA	NA	NA
6	Rocky Branch At Pickens St At Columbia, SC	02169505	2011-present	2.2	4.3	1.2	0.77 (2019)	210 (2022)
7	Rocky Branch At Whaley St At Columbia, SC	02169506	2007-present	2	NA	NA	NA	NA
8	Congaree Creek At Cayce, SC	02169550	1959-1980	122	222	146	111 (1970)	1,390 (1964)
9	Pen Branch At Columbia, SC	02169568	1985-present	2.3	NA	NA	NA	NA

Table 3-1. Streamflow characteristics at USGS gaging stations in the Santee River basin (Continued).

Map Identifier	Gaging Station Name	Station Number	Period of Record[1]	Drainage (sq mi)	Average Daily Flow (cfs)	90% Exceeds Flow[2] (cfs)	Minimum Daily Flow (cfs) and Year	Maximum Daily Flow (cfs) and Year
Congaree Subbasin - HUC 03050110 (continued)								
10	Gills Creek At Columbia, SC	02169570	1966-present	60	71	14	1.1 (2007)	1,730 (1986)
11	Congaree River At Sandy Run, SC	02169624	2001-2002	8,290	3,518	1,493	788 (2002)	16,100 (2002)
12	Congaree River At Congaree Np Near Gadsden, SC	02169625	1984-present	8,290	7,366	3,314	2,060 (1994)	36,000 (1994)
13	Big Beaver Creek Near St. Matthews, SC	02169630	1966-1993	10	14	7.1	3.9 (1988)	285 (1971)
14	Cedar Creek Below Myers Creek Nr Hopkins, SC	02169670	1980-1985	67	62	24	4.2 1982)	372 (1983)
15	Cedar Creek At Congaree Np Near Gadsden, SC	02169672	1985-present	71	NA	NA	NA	NA
16	Congaree River At Southern Rr Nr Ft Motte, SC	02169740	2003-2005	Not reported by USGS	NA	NA	NA	NA
17	Congaree River At U.S. Hwy 601 Nr. Fort Motte, SC	02169750	2021-present	8,520	7,809	3,097	2,880 (2023)	50,000 (2024)
18	Santee River Near Fort Motte, SC[5]	02169800	1966-1968	14,100	NA	NA	NA	NA
19	Santee R At Trezesvants Landing Nr Ft Motte, SC	02169810	1986-present	14,100	NA	NA	NA	NA
Lake Marion Subbasin - HUC 03050111								
20	Lake Marion Near Elloree, SC[4]	02169921	1998-present	14,300	NA	NA	NA	NA
21	Santee River At Ferguson, SC	02170000	1907-1941	14,600	18,693	6,950	2,630 (1925)	368,000 (1916)
22	Lake Marion Near Pineville, SC[4]	02171000	1984-present	14,700	NA	NA	NA	NA
Santee Subbasin - HUC 03050112								
23	Santee R At Lk Marion Tailrace Nr Pineville, SC	02171001	1995-present	14,700	NA	NA	NA	NA
24	Santee River Near Pineville, SC	02171500	1942-present	14,700	2,035	492	9.0 (1947)	153,000 (1945)
25	Santee River Near Russellville, SC	02171560	2021-present	Not reported by USGS	NA	NA	NA	NA

Table 3-1. Streamflow characteristics at USGS gaging stations in the Santee River basin (Continued).

Map Identifier	Gaging Station Name	Station Number	Period of Record[1]	Drainage (sq mi)	Average Daily Flow (cfs)	90% Exceeds Flow[2] (cfs)	Minimum Daily Flow (cfs) and Year	Maximum Daily Flow (cfs) and Year
Santee Subbasin - HUC 03050112 (continued)								
26	Rediv Canal At Santee River Nr St Stephen, SC	02171645	1986-present	14,800	7,650	33	-155 (1993)	31,200 (1989)
27	Santee River Below St Stephens, SC	02171650	1966-1982	14,900	2,988	562	481 (1981)	97,300 (1975)
28	Santee River Above Alvin, SC	02171660	1987-1996	Not reported by USGS	NA	NA	NA	NA
29	Wedboo Creek Near Jamestown, SC	02171680	1966-1992	17	14.4	0.43	0 (1967-1969, 1973, 1976, 1977, 1980)	1,220 (1987)
30	Santee River Nr Jamestown, SC[3]	02171700	1987-present	10,750	7,854	678	326 (2022)	93,700 (2016)
31	Santee River Nr Honey Hill, SC	02171730	1974-1995	Not reported by USGS	NA	NA	NA	NA
32	North Santee River Nr North Santee, SC	02171800	1979-present	Not reported by USGS	NA	NA	NA	NA
33	South Santee River Nr Mcclellanville, SC	02171850	1993-present	Not reported by USGS	NA	NA	NA	NA
34	South Santee R At State Pier Nr Mcclellanville, SC	02171905	1987-present	Not reported by USGS	NA	NA	NA	NA
Cooper Subbasin - HUC 03050201								
35	Lk Marion-Moultrie Div Canal Up Nr Pineville, SC[7]	02170500	1943-1986	14,700	14,690	6,090	-1,570 (1986)	40,300 (1983)
36	Lk Moultrie At Rediversion Nr Russellville, SC[4]	02171635	2011-present	Not reported by USGS	NA	NA	NA	NA
37	Lake Moultrie Near Pinopolis, SC[4]	02172000	1942-present	Not reported by USGS	NA	NA	NA	NA
38	Lake Moultrie Tailrace Near Pinopolis, SC[8]	02172001	1963-present	Not reported by USGS	NA	NA	NA	NA
39	Lake Moultrie Tailrace Canal At Moncks Corner, SC[7]	02172002	1978-present	14,800	6,566	3,230	-521 (1993)	33,700 (1979)

Table 3-1. Streamflow characteristics at USGS gaging stations in the Santee River basin (Continued).

Map Identifier	Gaging Station Name	Station Number	Period of Record[1]	Drainage (sq mi)	Average Daily Flow (cfs)	90% Exceeds Flow[2] (cfs)	Minimum Daily Flow (cfs) and Year	Maximum Daily Flow (cfs) and Year
Cooper Subbasin - HUC 03050201 (continued)								
40	W Branch Cooper R At Pimlico Nr Moncks Corner, SC	02172020	1975-present	Not reported by USGS	NA	NA	NA	NA
41	Turkey Creek Above Huger, SC	02172035	2005-present	20	21	0	0 (2006-2019, 2021-2024)	4,980 (2015)
42	French Quarter Creek Near Huger, SC	021720368	2018-present	25	NA	NA	NA	NA
43	Back River At Dupont Intake Nr Kittredge, SC[3]	02172040	1980-present	Not reported by USGS	-526	-906	-1,500 (2022)	1,770 (2018)
44	Cooper R Nr Goose Creek, SC	02172050	1981-present	Not reported by USGS	NA	NA	NA	NA
45	Cooper River Above Goose Creek, SC	021720508	2016-present	Not reported by USGS	NA	NA	NA	NA
46	Cooper R At Mobay Nr N Charleston, SC	02172053	1983-present	Not reported by USGS	NA	NA	NA	NA
47	Back River Below SC Railroad Br. Nr Kittredge, SC[6]	021720603	1990-2015	Not reported by USGS	55	-3.4	-20.6 (2014)	708 (2015)
48	Bushy Park Res. Above Foster Crk, Goose Creek, SC	0217206110	2013-2018	Not reported by USGS	NA	NA	NA	NA
49	Foster Creek At Goose Creek, SC[6]	021720612	2013-2015	Not reported by USGS	11	-0.29	-3.1 (2014)	296 (2015)
50	Turkey Creek At Scdot Maint Yard, N Charleston, SC	021720646	2010-2012	Not reported by USGS	NA	NA	NA	NA

Table 3-1. Streamflow characteristics at USGS gaging stations in the Santee River basin (Continued).

Map Identifier	Gaging Station Name	Station Number	Period of Record[1]	Drainage (sq mi)	Average Daily Flow (cfs)	90% Exceeds Flow[2] (cfs)	Minimum Daily Flow (cfs) and Year	Maximum Daily Flow (cfs) and Year
Cooper Subbasin - HUC 03050201 (continued)								
51	Cooper R At Filbin Creek At North Charleston, SC[3]	021720677	1997-present	Not reported by USGS	-1,299	-9,436	-14,900 (2022)	41,700 (2024)
52	Cooper R At Ports Authority Pier K Charleston, SC	0217206935	2016-present	Not reported by USGS	NA	NA	NA	NA
53	Wando River At Cainhoy, SC	021720696	1992-2005	Not reported by USGS	8.0	7.0	5.6 (1995)	10.6 (1995)
54	Wando River At Cainhoy Below Wando, SC	0217206962	2016-present	Not reported by USGS	NA	NA	NA	NA
55	Wando River Above Mt Pleasant, SC	021720698	1992-present	Not reported by USGS	NA	NA	NA	NA
56	Cooper River At U.S. Hwy 17 At Charleston, SC	021720709	1997-present	Not reported by USGS	NA	NA	NA	NA
57	Cooper R At Customs House Aux At Charleston, SC	021720710	1986-present	Not reported by USGS	NA	NA	NA	NA
58	Cooper River At Customs House At Charleston, SC	021720711	1984-present	Not reported by USGS	NA	NA	NA	NA
59	Sawmill Branch At Ashley Drive Nr Summerville, SC	0217208135	2023-present	Not reported by USGS	NA	NA	NA	NA
South Carolina Coastal Subbasin - HUC 03050202								
60	Old House Creek Near Wando, SC	0217206953	2002-2003	Not reported by USGS	NA	NA	NA	NA
61	Great Cypress Swamp Near Ridgeville, SC	02172076	2001-2003	Not reported by USGS	NA	NA	NA	NA
62	Ashley R Nr Summerville, SC	02172080	2001-2005	Not reported by USGS	212	5.1	3.3 (2001)	3,200 (2003)
63	Ashley River At Cooke Crossroads, SC	02172081	1992-present	Not reported by USGS	NA	NA	NA	NA
64	Ashley River Near Cooke Crossroads, SC[6]	021720812	2001-2003	Not reported by USGS	33.2	-10	-64 (2002)	104 (2002)

Table 3-1. Streamflow characteristics at USGS gaging stations in the Santee River basin (Continued).

Map Identifier	Gaging Station Name	Station Number	Period of Record[1]	Drainage (sq mi)	Average Daily Flow (cfs)	90% Exceeds Flow[2] (cfs)	Minimum Daily Flow (cfs) and Year	Maximum Daily Flow (cfs) and Year
South Carolina Coastal Subbasin - HUC 03050202 (continued)								
65	Sawmill Branch At I-26 Near Summerville, SC	021720813	2001-2003	Not reported by USGS	NA	NA	NA	NA
66	Dorchester Creek Near Cooke Crossroads, SC[6]	021720816	2001-2003	Not reported by USGS	-1.6	-9.96	-22 (2002)	87 (2002)
67	Eagle Creek Near North Charleston, SC[6]	021720817	2001-2003	Not reported by USGS	16.9	-5.3	-35 (2003)	451 (2003)
68	Ashley River Below Summerville, SC	021720825	2017-present	Not reported by USGS	NA	NA	NA	NA
69	Ashley R. At Bakers Lnding Nr North Charleston, SC	02172084	2001-2005	Not reported by USGS	6.3	3.9	3.3 (2003)	13.2 (2004)
70	Ashley River Near North Charleston, SC	021720869	1992-present	Not reported by USGS	NA	NA	NA	NA
71	Charleston Harbor At Ft Sumter Nr Mt Pleasant, SC	02172100	1992-2012	Not reported by USGS	NA	NA	NA	NA
72	Stono River At Main Rd Below Rantowles, SC	021721675	June 2024 - present	Not reported by USGS	NA	NA	NA	NA
Bulls Bay Subbasin - HUC 03050209								
73	Skrine Creek Near Mcclellenville, SC	02171920	2013-present	Not reported by USGS	NA	NA	NA	NA

[1] "Present" indicates that the gage was active at the end of water year 2024 (September 30, 2024).
[2] "90%" exceeds flow" is the flow for which 90% of daily flows are higher and 10% are lower.
[3] These gages are influenced by tidal currents, and report mean tidally filtered discharge instead of a daily mean discharge.
[4] These gages report lake elevation level instead of a daily mean discharge.
[5] This gage reports suspended sediment discharge instead of a daily mean discharge.
[6] These gages are influenced by tidal fluctuations, resulting in occasional negative daily mean discharge flows reported as a result of negative flows during flood tide.
[7] These gages are located on canals to control lake levels, resulting in occasional negative daily mean discharge flows.
[8] This gage reports suspended sediment discharge and gage height.

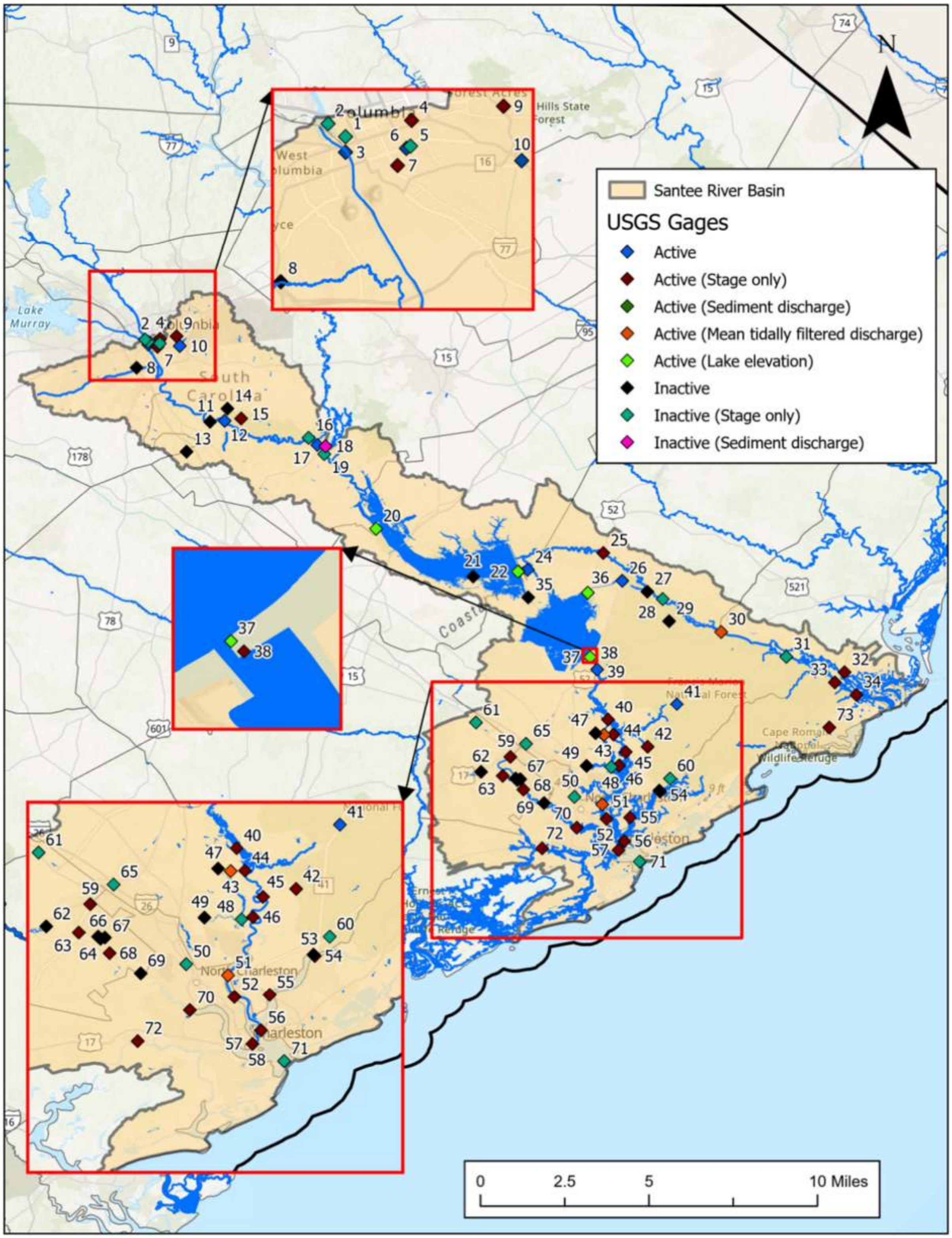


Figure 3-2. USGS gaging stations in the Santee River basin.

Duration hydrographs showing average daily streamflow throughout the year at select gaging stations on the Santee River, Congaree River, and Gills Creek are shown in Figure 3-3. These hydrographs are based on daily streamflow data collected through water year 2024, except for the Santee River at Ferguson, SC, which reported streamflow data from 1907 to 1941. Mean daily flows at three of the selected gages exhibit similar seasonal patterns and are at their greatest in March and April and least from August to October. Streamflow on the Congaree River is influenced by fluctuating releases from hydropower facilities upstream on the Saluda and Broad Rivers, but significant minimum flows are maintained year-round. Gills Creek, located on the eastern side of the Congaree River, originates in an area of nearly impermeable soil and is characterized by more variable, less well-sustained flows (SCDNR 2009). Flood-control and recreational impoundments along Gills Creek also impact natural streamflow. The duration hydrograph for the Santee River at Ferguson gage is based on reported daily discharge between 1907 and 1941, therefore providing insight into Santee River flows prior to construction of Lake Marion. These historic flows were well-sustained. In contrast, the Santee River near Pineville gage (located just below Santee Dam) reports streamflow data starting in 1942 after the construction of Lake Marion. High flows occur from February through May, with lesser flows through the rest of the year. Occasionally, large discharges from Lake Marion are released for flood control purposes.

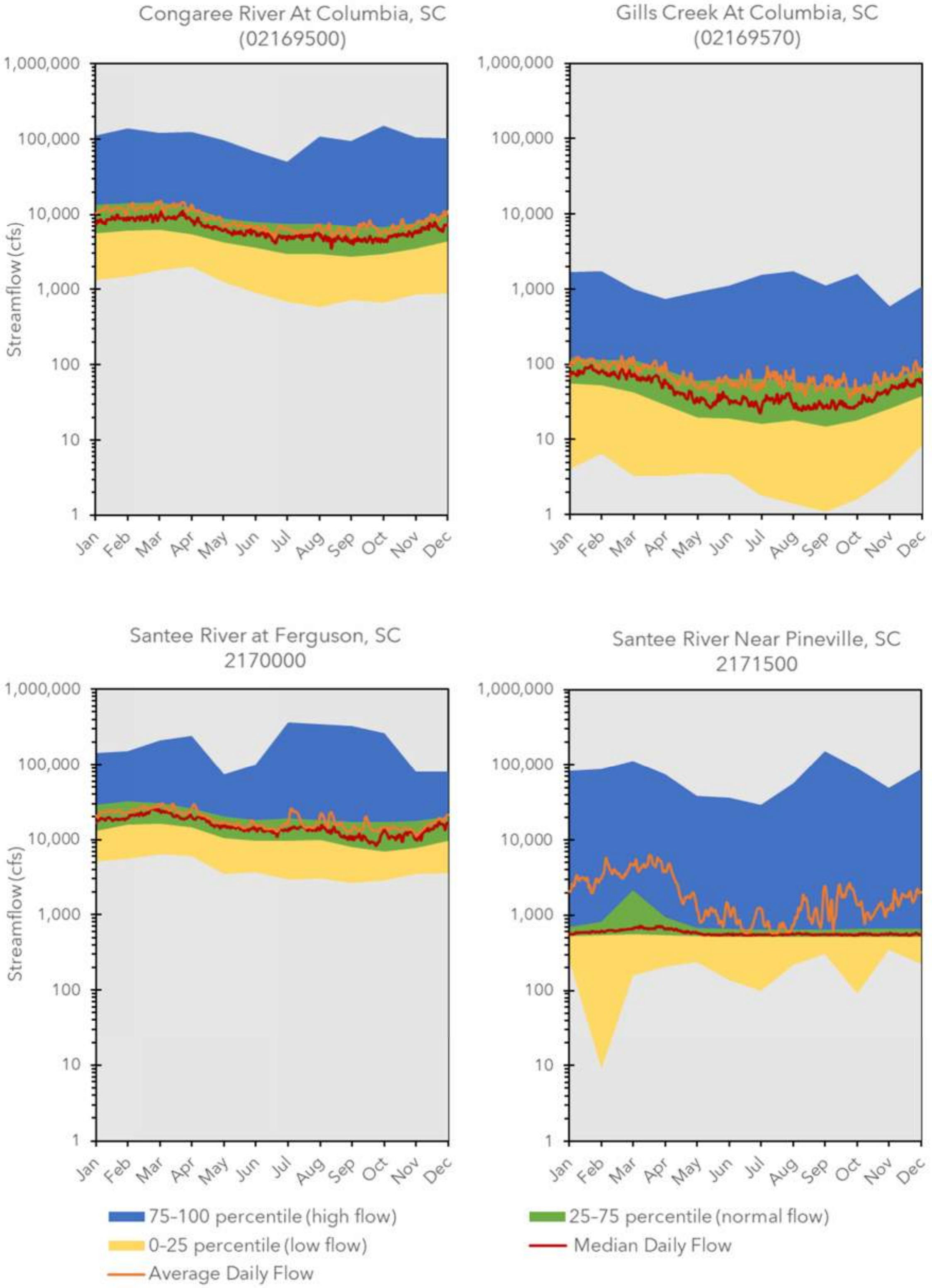


Figure 3-3. Duration hydrographs for select gaging stations on the Congaree River, Gills Creek, and Santee River.

Mean monthly flows at the Congaree River and Gills Creek gaging stations near Columbia over the previous 30 years (October 1994 to September 2024) are shown in Figure 3-4. The fifth percentile of the mean monthly flows over the 85-year period beginning in 1939 is 2,405 cfs at the Congaree River at Columbia station. The fifth percentile of the mean monthly flows over the 58-year period beginning in 1966 is 17 cfs at the Gills Creek at Columbia station. The ratio of the fifth percentile flows at these two stations is similar to the ratio of the acreage of their respective contributing drainage basins; however, both gage stations are influenced by upstream stream modifications (hydroelectric facilities above the Congaree station, and several small impoundments above the Gills Creek station). Mean monthly flows at both stations exhibit similar patterns, with greater flows at the Congaree River station. The fifth percentile flows at the Gills Creek station are used in the graph to distinguish the periods of drought, most of which occurred from 1999 to 2002 and from 2005 to 2007.

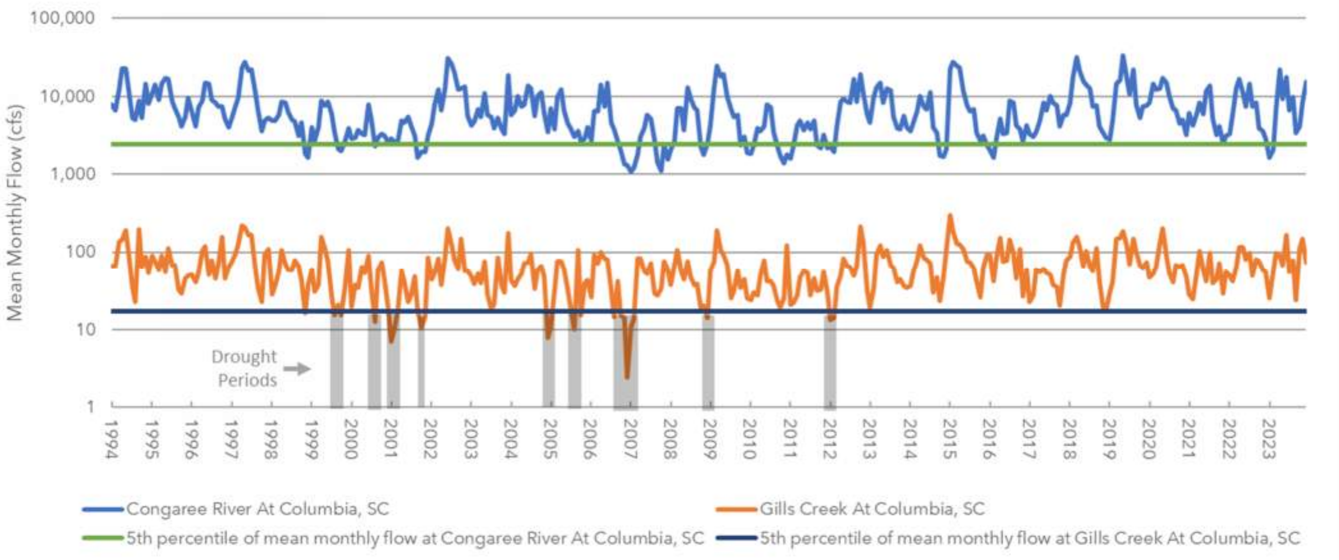


Figure 3-4. Mean monthly flows at gaging stations on the Congaree River and Gills Creek near Columbia.

Figure 3-5 shows the mean monthly flow at the Congaree River at Columbia and the Santee River near Pineville gaging stations for the same 30-year period. The upstream station on the Congaree River has experienced consistently variable flows, whereas the downstream station near Pineville exhibits discrete periods of fluctuations because of controlled reservoir releases at the Santee Dam. Many of the spikes in flow correlate between the two gages.

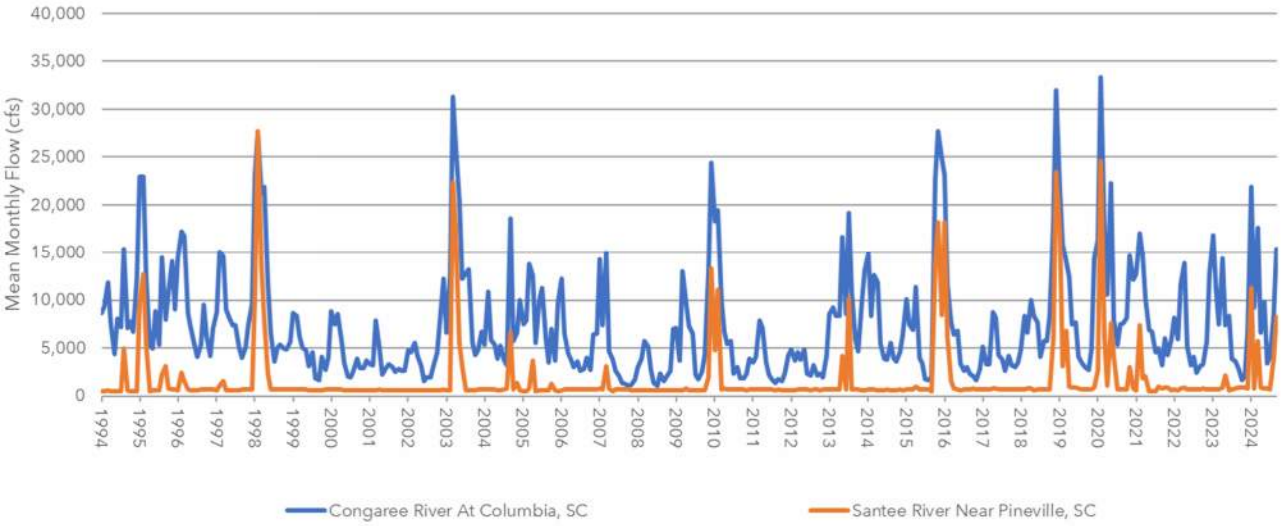


Figure 3-5. Mean monthly flows on the Congaree River at Columbia and on the Santee River near Pineville.

Several of the USGS gages in the Santee River basin monitor reservoir elevations. Figure 3-6 presents the historical water levels in Lake Moultrie and Lake Marion since the start of water year 2005 (including the drought period of 2007 to 2008). These lakes are linked by a Diversion Canal, which results in very similar lake level trends. Lake Marion operates on a seasonal guide curve, with higher water levels in the summer months and lower water levels in the winter months. Generally, Lake Marion lake levels follow the trend of the guide curve, without typically reaching the maximum winter drawdown. Several times during the last 20 years, including during the historic drought of 2007 to 2008, water levels dropped well below guide curve elevations (Figure 3-5).

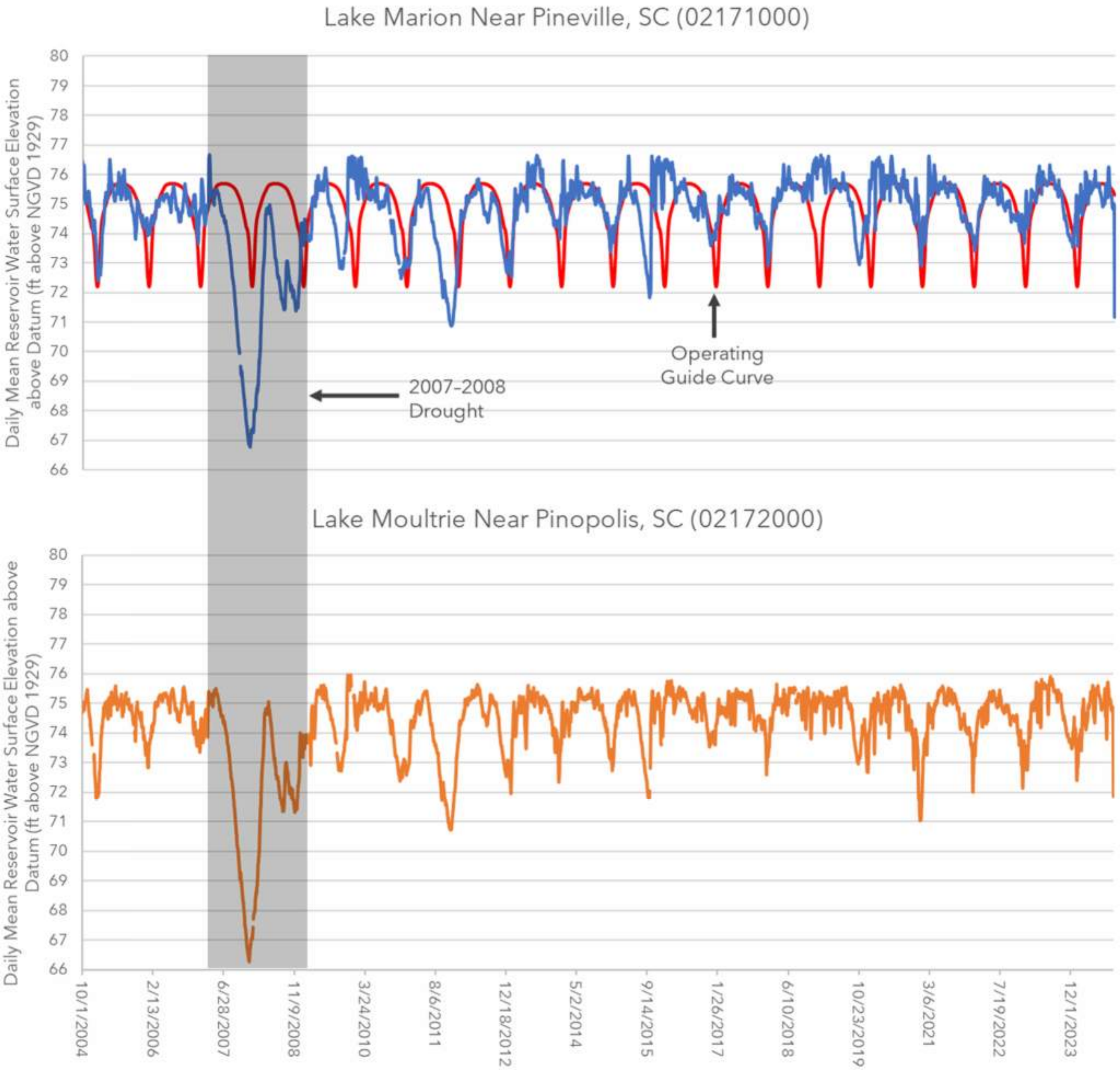


Figure 3-6. Historical water levels in Lake Moultrie and Lake Marion.

Apart from the USGS gaging stations, which measure stage and flow, there are numerous sites throughout the basin where the SCDES collects water quality data as part of their ongoing Ambient Surface Water Physical and Chemical Monitoring program to assess the water's suitability for aquatic life and recreational use. The program includes ongoing fixed-location monitoring and statewide statistical survey monitoring. The fixed-location monitoring includes monthly collection and analysis of water from base sites in a uniform manner to provide consistent baseline water quality data. The statistical survey sites are sampled once per month for one year and change from year to year (SCDES 2025b).

3.1.3 Surface Water Development

The Santee River basin has experienced surface water development primarily for hydroelectric power production, municipal water supply provision, and recreation. Additionally, numerous navigation and flood-control projects have been constructed in and around the port of Charleston. Lakes in the Santee River basin larger than 200 acres are described in Table 3-2. The four largest hydroelectric-power-generating facilities in the Santee River basin are described in Table 3-4.

Surface water development along the Congaree River is limited. The Columbia Canal takes water from the Broad River and discharges it to the Congaree River. The canal is also used for hydroelectric power generation and as municipal water supply for the City of Columbia (SCDNR 2009).

Lake Marion is the largest reservoir in the state by surface area and is fourth in volume (SCDNR 2009). The Santee Dam, which impounds Lake Marion, is located about seventeen miles south of Manning and was initially constructed in 1941 for hydroelectric power production. The lake also supports flood-control efforts, and now also serves recreation and water supply purposes. Since construction of the Santee Dam, river navigation is no longer possible from the lower reaches of the Santee River to the upper reaches.

Located north of Moncks Corner, Lake Moultrie was constructed in 1941 for hydroelectric power production (SCDNR 2009). Lake Moultrie is the fourth largest lake in the state by surface area, and the fifth largest by volume. The Jeffries Hydroelectric Station is located at the outlet of Lake Moultrie into the Cooper River. In 1985, a Rediversion Canal was constructed from Lake Moultrie back into the Santee River, to alleviate silting issues in the Cooper River and Charleston Harbor. Much of the release from Lake Moultrie is returned to the Santee River through this canal. The St. Stephen project is located along the Rediversion Canal and consists of a hydroelectric power station and a fish lift (built by the U.S. Army Corps of Engineers [USACE] and operated by SCDNR) that allows for inland migration of anadromous shad, bass, and sturgeon from the Santee River into Lake Moultrie.

Bushy Park and Goose Creek reservoirs are owned by the Commissioners of Public Works (d.b.a. Charleston Water System); both serve as a backup municipal water supply source.

Table 3-2. Characteristics of lakes 200 acres or larger in the Santee River basin.

Name	Stream	Surface area (acres)	Storage capacity (acre-feet)	Purpose
Lake Moultrie	Cooper River	60,400	1,211,000	Power, recreation, and water supply
Bushy Park Reservoir (Back River Reservoir)	Back River	850	8,500	Water supply, industry, recreation, and power
Goose Creek Reservoir	Goose Creek	600	4,800	Water supply and recreation
Lake Marion	Santee River	110,600	1,400,000	Power, water supply, recreation, and flood control
Weston Pond	Cedar Creek	240	2,300	Recreation

Source: Adapted from SCDNR (2009).

Table 3-3. Major hydroelectric power generating facilities in the Santee River basin.

Facility name and owner	Impounded stream	Reservoir	Generating capacity (megawatts)
Jeffries Hydroelectric Santee Cooper	Cooper River	Lake Moultrie	143
Santee Spillway Santee Cooper	Santee River	Lake Marion	2
St. Stephen Santee Cooper	Lake Moultrie Rediversion Canal	Lake Moultrie	84
Columbia Dominion Energy South Carolina (previously South Carolina Electric & Gas Company [SCE&G])*	Broad/Congaree River	Columbia Canal	10.6

Source: Adapted from Tables 6-23, 6-29, and 7-2 in SCDNR (2009).

*SCE&G was acquired by Dominion Energy in 2019 and now operates under the name Dominion Energy South Carolina (Columbia Business Monthly 2023).

Additionally, numerous regulated and unregulated small dams create small impoundments on many of the Santee River tributaries. Dams that are less than 25 feet in height or impound less than 50 acre-feet are generally exempt from regulation in South Carolina. There are 205 SCDES-regulated dams in the Santee River basin, most of which are classified as Low Hazard, Class 3 dams, as shown in Table 3-4. Most regulated dams, including those designated as high hazard dams, are on the upper reaches of the basin, as shown in Figure 3-7.

Table 3-4. Regulated dams in the Santee River basin.

Dam Type	Number of Dams	Description
High Hazard, Class 1	75	Structure where failure will likely cause loss of life and/or serious damage to infrastructure
Significant Hazard, Class 2	13	Structure where failure will not likely cause loss of life but infrastructure may be damaged
Low Hazard, Class 3	117	Structure where failure may cause limited property damage
Total	**205**	

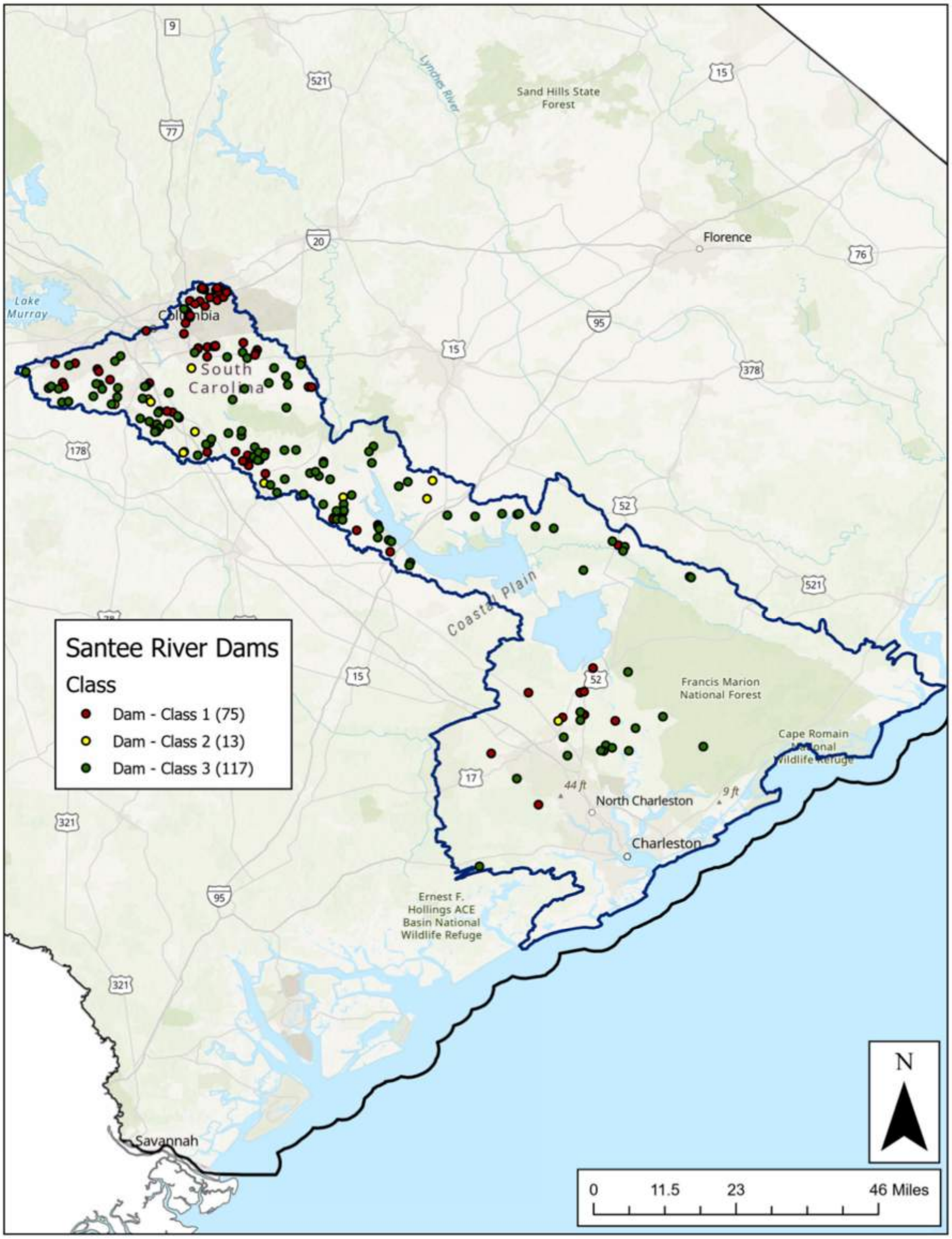


Figure 3-7. Regulated dams in the Santee River basin.

Several flood-control and navigation projects were initiated in the Congaree subbasin but not completed (SCDNR 2009). The USACE initiated and completed 70 percent of a navigation channel along the entire length of the Congaree River, before the project was deauthorized by Congress in 1977. Additionally, the Natural Resources Conservation Service (NRCS) began work on a flood-control project in the Cabin

Branch watershed in 1997; as of 2008, this project was not completed. Toward the southern end of the basin, the USACE has completed numerous navigation projects, including at Charleston Harbor and along the Atlantic Intracoastal Waterway. USACE completed flood-control projects on Sawmill Branch and Eagle Creek in 1971 and 1986, respectively. The NRCS began planning flood-control projects in Mount Pleasant and Moncks Corner in 2006.

Regarding erosion, beach renourishment at Folly Beach was performed in 2005 (SCDNR 2009). Streambank-erosion control projects were completed in Charleston Harbor, the Cooper River, and the Ashley River in the 1980s and 1990s.

Approximately 94 percent of the total water withdrawals in the Santee River basin in 2023 were surface water withdrawals (SCDNR 2025a). The greatest user of surface water that year was the thermoelectric power industry, which reported withdrawals totaling 70 percent of surface water withdrawals that year. Public water suppliers accounted for 17 percent of surface water withdrawals and industrial users accounted for 13 percent. Mining, agricultural irrigation, aquaculture, and golf courses each accounted for less than 1 percent of surface water withdrawals. Additional water use information and water demand projections are provided in Chapter 4, Current and Projected Water Demand.

3.1.4 Surface Water Concerns

While the major rivers of the Santee River basin are completely contained within the borders of the state, the headwaters of the Broad and Catawba River basins originate outside of the state in North Carolina. Consequently, out-of-state withdrawals from the upstream river basins have the potential to impact water availability downstream in the Santee River basin in South Carolina. Known surface water users in the North Carolina portion of the Broad River basin include 10 public water suppliers, 5 golf courses, 3 mining sites, 3 hydroelectric power facilities, and 1 thermoelectric power facility (SCDNR 2022e). Table 4-2 in the Broad River Basin Plan lists the amount of current withdrawal by sector in the North Carolina portion of the Broad River Basin (CDM Smith 2024).

The Catawba Basin is evaluated by a different model (the Computer Hydro-Electric Operations and Planning Software, or CHEOPS model) than the other basins in South Carolina, which rely on the Simplified Water Allocation Model (SWAM), which is introduced below in Section 3.2.1. The CHEOPS model provides the Catawba-Wateree Water Management Group (CWWMG) with information about water use and availability. Its output is provided as input into the Santee Basin in South Carolina. For a detailed accounting of water use rates, in both North and South Carolina portions of the Catawba-Wateree Basin, refer to HDR and McKim & Creed (2014). This report is expected to be updated in 2025.

Streamflow in the western portion of the Santee River basin is generally steady, with constant streamflows (SCDNR 2009). This results in well-sustained flows in the upper reach of the Congaree and Big Beaver Creeks. Flows become increasingly variable with distance downstream, as the river travels through the Coastal Plain, as a result of less precipitation and groundwater discharge than occurs upstream. These fluctuations lead to periods of extremely reduced flow, which can limit navigation, fish migration, and suitable fish habitat (SCDNR 2009). Streamflow data in the Ashley-Cooper subbasin is limited; the impoundment of freshwater streams and transfer of water from outside the subbasin provide most of the available surface water.

All lakes and streams in the northern portion of the Santee River basin are designated as Freshwater (Class FW) water bodies, meaning they are suitable for aquatic life, primary- and secondary-contact recreation, drinking water supply, fishing, and both industrial and agricultural uses. In the southern portion of the Santee River basin, the Ashley-Cooper River Subbasin contains five different classes of water bodies:

- Several water bodies in the basin are designated as Outstanding Resource Waters (Class ORW), which indicates an outstanding recreational or ecological resource that is suitable as a drinking water source with minimal treatment (SCDNR 2009). These include the Copahee Sound, Bullyard Sound, Capers Inlet, Mark Bay, Price Inlet, Bulls Bay, and Cape Romain Harbor.
- Other water bodies are designated as Shellfish Harvesting (Class SFH), which are tidal saltwater bodies protected for shellfish harvesting with the most stringent bacterial standards. These include Gray Sound, Hamlin Sound, Dewees Inlet, Sewee Bay, Five Fathom Creek, Folly River, and parts of the Wando and Stono Rivers.
- Some water bodies are designated Tidal Saltwater (Class SA), which are comprised of tidal saltwater bodies suitable for the survival and propagation of a balanced indigenous aquatic community of marine fauna and flora, suitable for primary- and secondary-contact recreation, crabbing, and fishing. Included in this class of water bodies are portions of the Wando and Ashley Rivers, Bulls Creek, and the Dick Island Canal. This classification of water bodies must maintain daily dissolved oxygen averages of 5.0 mg/L or greater, with a minimum concentration of 4.0 mg/L, and are not protected for harvesting clams, mussels, or oysters for market purposes or human consumption.
- Similarly, Tidal Saltwater (Class SB) is another designation for some water bodies, including the Cooper River, the Goose Creek watershed, the Wando River watershed, the Charleston Harbor, and many other water bodies. Class SB water bodies are the same as Class SA water bodies except that the former must maintain dissolved oxygen averages at or above 4.0 mg/L.
- All other water bodies in the Ashley-Cooper River subbasin are designated as Class FW.

Water quality concerns have been associated with stream and river reaches in the basin that do not meet water quality standards and do not support designated uses. Water quality monitoring conducted by SCDHEC from 2002 to 2006 in the Congaree River subbasin (SCDHEC 2011) and from 2004 to 2008 in the Santee River subbasin (SCDHEC 2013) demonstrated that aquatic life uses were fully supported at 61 percent (65 of 107) of sites sampled and evaluated for aquatic life support. Approximately 19 percent (8 of the remaining 42) of sites not fully supportive of aquatic life uses were biologically impaired due to the types or lack of diversity of macroinvertebrate communities present. Recreational use was fully supported at 73 percent (69 of 94) of sampled sites. Sites not supportive of recreational use were all impaired by high levels of fecal coliform bacteria. It should be noted that sampling sites located in the Cooper River and Santee Coastal Frontage subbasins were not included in summary tables provided in SCDHEC (2013) and are not accounted for in these counts.

More recently, the 2022 Section §303(d) Clean Water Act list of impaired waters documented impairments at 217 sampling stations impacting 118 different streams and lakes in the basin, including portions of the Congaree, Cooper, Santee, and Stono Rivers, as well as Lake Marion and Lake Moultrie (SCDES 2025c). Table 3-5 summarizes the causes of impairments and the associated non-supported designated uses. While recreational use impairments were previously assessed based on fecal coliform, the 2022 303(d) list assessed recreational use impairment based on *Escherichia coli*.

Table 3-5. 2022 303(d) Santee River basin impairment summary.

Designated Use	Number of Stations with Impairments	Causes of Impairments (Number of Impairments)
Aquatic Life	104	Macroinvertebrate (9) Chlorophyll A (10) Copper (7) Dissolved Oxygen (34) Lead (1) pH (6) Total Phosphorus (32) Turbidity (22) Zinc (9)
Fish Consumption	30	Mercury (30)
Recreational Use	59	*Escherichia coli* (30) *Enterococci* (30)
Shellfish	40	Fecal Coliform Bacteria (40)

Other surface water-related concerns have been raised by the RBC members during the planning process. Some of the concerns regarding surface water resources identified by one or more RBC members at the first and subsequent meetings included:

- Maintaining/protecting traditional uses for surface water and groundwater (including recreation, power, agriculture, etc.) should be prioritized, while recognizing economic impact. The Pinewood landfill was identified specifically as a potential water quality threat.
- Expanding public education for water conservation and drought management is needed, especially as it relates to flash drought and aquifer recharge.
- Emphasizing the need to identify new water users in the basin, with special concern for large, new users (e.g., data users), so they can be added to future projections in model simulations.
- Understanding regulatory restrictions, such as for minimum instream flows (MIFs), building consensus on policy recommendations. This is especially relevant at the local level, where other RBCs have recommended land use ordinances (to combat sedimentation that causes reservoir storage loss, for example).
- Knowing the interconnectivity between basins and upstream/downstream customers.

3.2 Surface Water Assessment Tools

3.2.1 Simplified Water Allocation Model

The Simplified Water Allocation Model (SWAM) was used to assess current and future surface water availability and evaluate the effectiveness of proposed water management strategies. From 2014 to 2017, all eight South Carolina surface water quantity models were built in the SWAM platform, including the Saluda River basin model (containing the Congaree River subbasin) and the initial Santee River basin model (CDM Smith 2017a, 2017b). The Saluda River basin SWAM model was updated in 2021 and 2023, and the portion of the model containing the Congaree River subbasin was merged into the Santee River basin SWAM model in 2024. The Santee River basin SWAM model, now representing the planning basin in its entirety, was then updated in 2025. Updates included extending the period of record to 2019, adding new permits and registrations, removing inactive users, and adding minimum reservoir releases.

SWAM uses a framework composed of a network of river reaches, impoundments, withdrawals, and returns, in which water is routed hydrologically between nodes. The model focuses principally on mainstem rivers along with primary and secondary tributaries, and often does not include smaller-order tributaries whose flows are aggregated into flow estimates for primary and secondary tributaries. The model simulates basin hydrology at a daily or monthly timestep.

Inputs to SWAM include:

- Calculated and estimated "unimpaired flows" for the headwaters of the mainstem and major tributaries within the model. Unimpaired flows were calculated by mathematically removing historical influence of storage, withdrawals, and return flows from measured flow at USGS streamflow gaging stations. This allows the model to simulate either historical or hypothetical water use patterns for evaluating future conditions. Many of the unimpaired flow records were synthesized using standard statistical techniques where measured data were not explicitly available for river reaches or time periods.
- Reach Gain/Loss Factors, which are calibrated values used to increase flow as it moves downstream based on additional drainage area or decrease flow for losing river reaches.
- Locations of all withdrawals, return flows, and interbasin transfers (values of which are discussed later as user-adjusted variables).
- Reservoir characteristics, such as capacity, bathymetry, constraints, and flexible operating rules.
- USGS daily flow records, which are embedded in the model for comparative purposes – simulation results can be compared with historical records.

Model variables that can be modified by users to explore future conditions include:

- Withdrawal targets (municipal, industrial, thermoelectric, agricultural, golf courses, and hatcheries)
- Consumptive use, wastewater discharge, and other return flows (which can be estimated automatically)
- Interbasin transfers
- Reservoir operating rules and storage characteristics, if applicable
- Environmental flow targets

Using this information, SWAM calculates available water (physically available based on full simulated flows, and legally available based on permit conditions and other uses), withdrawals, storage, consumption, and return flows at user-defined nodes. The flow from the main river stem, as well as major branches and tributaries, are discretely quantified. Figure 3-8 shows the Santee River basin SWAM framework.

SWAM can be used to simulate current and future demands based on defined scenarios and identify potential shortages in water availability when compared to demands for withdrawals or instream flow targets. The scenarios that were evaluated specifically for the Santee River basin are discussed further in Chapter 4, Current and Projected Water Demand, and Chapter 5, Comparison of Water Resource Availability and Water Demand.

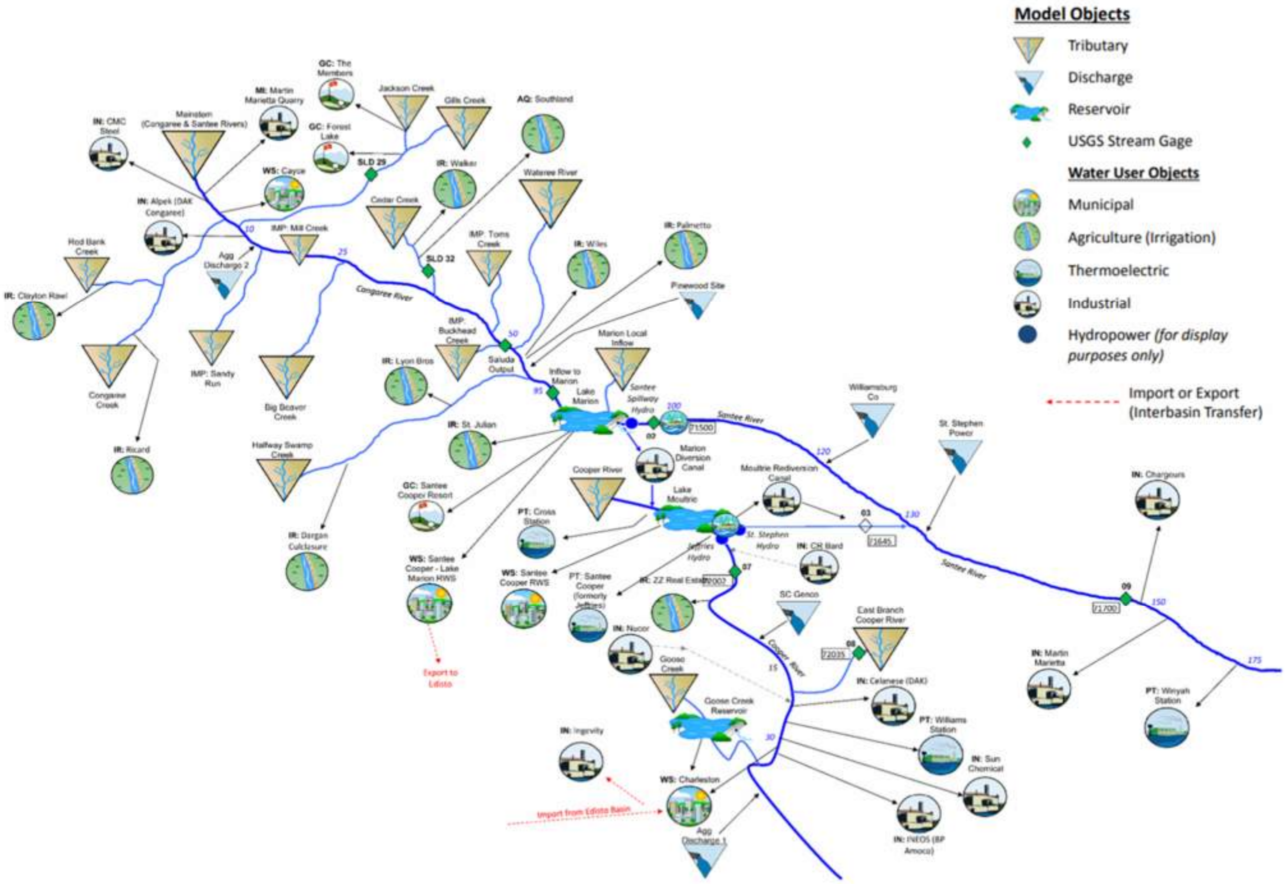


Figure 3-8. SWAM Model interface for the Santee River basin.

The Santee River basin model was calibrated and then tested to demonstrate reasonable ability to recreate historical hydrology and operational conditions. Historical water uses were added into the model to alter the estimated unimpaired flows, and simulated versus gaged flows were compared at key locations throughout the basin. An example verification test result from the initial model development is shown in Figure 3-9. Full verification results and methods are discussed in the *South Carolina Surface Water Quantity Models: Santee Basin Model Report* (CDM Smith 2017b).

While SWAM can quantify water balance calculations for free-flowing streams and reservoirs based on several inputs, it has limitations. The model cannot perform rainfall-runoff or hydraulic routing calculations and cannot be used (by itself) to calculate natural flow in tidally influenced reaches. Groundwater and its impacts are not explicitly modeled by SWAM; however, groundwater inputs and losses to streams and rivers are implicitly accounted for through incorporation of gage records and model calibration and verification. Water quality metrics also cannot be modeled by SWAM. Future climate scenarios can be explored with SWAM by adjusting the tributary input flows and/or net reservoir evaporation rates. Additionally, smaller-scale features such as third or fourth order tributaries and small off-channel storage ponds that are often used to help irrigate individual golf courses or farms are not included in the SWAM model.

The model, model users guide, and full reports on developing and calibrating the initial Saluda River and Santee River basin models are publicly available for download at SCDES's website. The models and associated documentation can be found at: https://des.sc.gov/programs/bureau-water/hydrology/surface-water-program/surface-water-models.

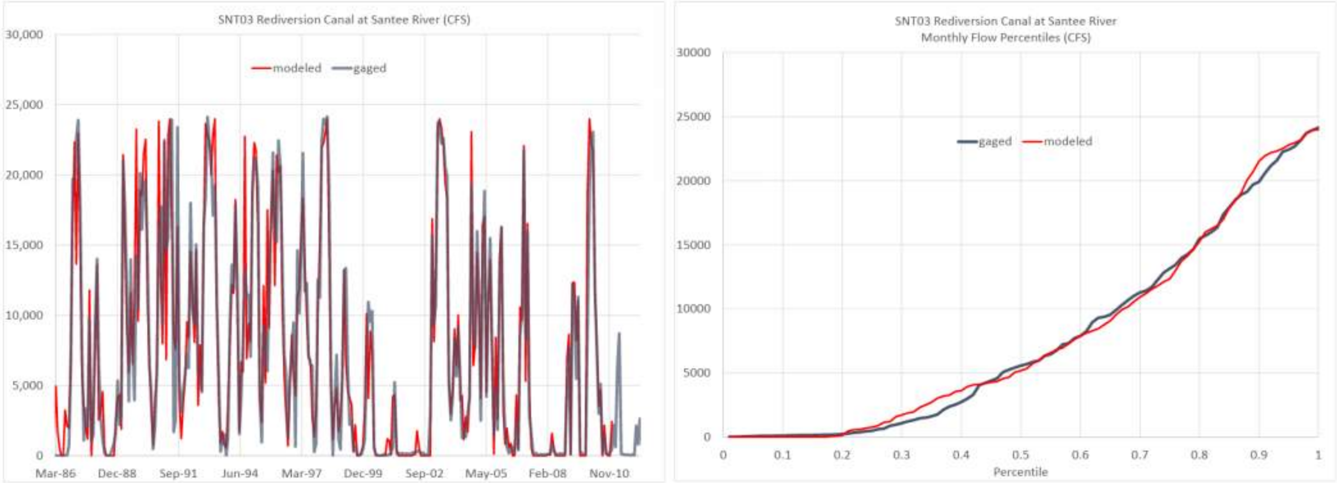


Figure 3-9. Representative Santee River basin SWAM verification graphs (CDM Smith 2017b).

3.2.2 Other Surface Water Analyses

While the models developed in SWAM focus on the hydrology of larger mainstem rivers and primary tributaries in the Santee River basin and other South Carolina basins, other work has focused on the hydrology and flow characteristics in smaller headwater streams, specifically those that are classified as wadeable. To formulate relationships between hydrologic metrics (flow patterns, statistics, and variability in these streams for both pulses and long-term averages) and ecological suitability metrics, daily rainfall-runoff modeling of small headwater streams throughout the state was accomplished using WaterFALL (Watershed Flow ALLocation), as described in Eddy et al. (2022) and Bower et al. (2022). Bower et al. (2022) discusses the biological response metrics that were developed and combined with the hydrologic metrics from WaterFALL to identify statistically significant correlations between flow characteristics and ecological suitability for fish and macroinvertebrates. The results are intended to help guide scientific decisions on maintaining natural hydrologic variations while also supporting consumptive water withdrawals. As a component in the analysis, WaterFALL results augment SWAM results by providing similar hydrologic understanding of the smaller headwater streams not simulated explicitly or individually in SWAM. The use of the ecological flow metrics as performance measures in the Santee RBC planning process is further discussed in Chapter 5, Comparison of Water Resources Availability and Water Demand.

3.3 Groundwater Resources

3.3.1 Groundwater Aquifers

The Santee River basin is underlain by the Coastal Plain aquifer system, a wedge of layered aquifers and confining units that begins at the Fall Line and thickens toward the coast, as shown in Figure 3-10. Aquifers in the Coastal Plain are composed of permeable sand or limestone units, separated by less permeable confining clay units, laid on crystalline bedrock at the base. The thickness of the Coastal Plain sediment ranges from 0 feet at land surface at the Fall Line to 2,800 feet at the coast. The lowermost aquifers in the basin are the Gramling and Charleston aquifers, which are overlain by the McQueen Branch, Crouch Branch, Gordon, and surficial aquifers. The Floridan aquifer, which occurs in the southwestern portion of the state, pinches out just west of the basin. Figure 3-11 shows a schematic illustration of the aquifers underlying the Santee basin, and Figure 3-12 shows the regional extents of these aquifers.

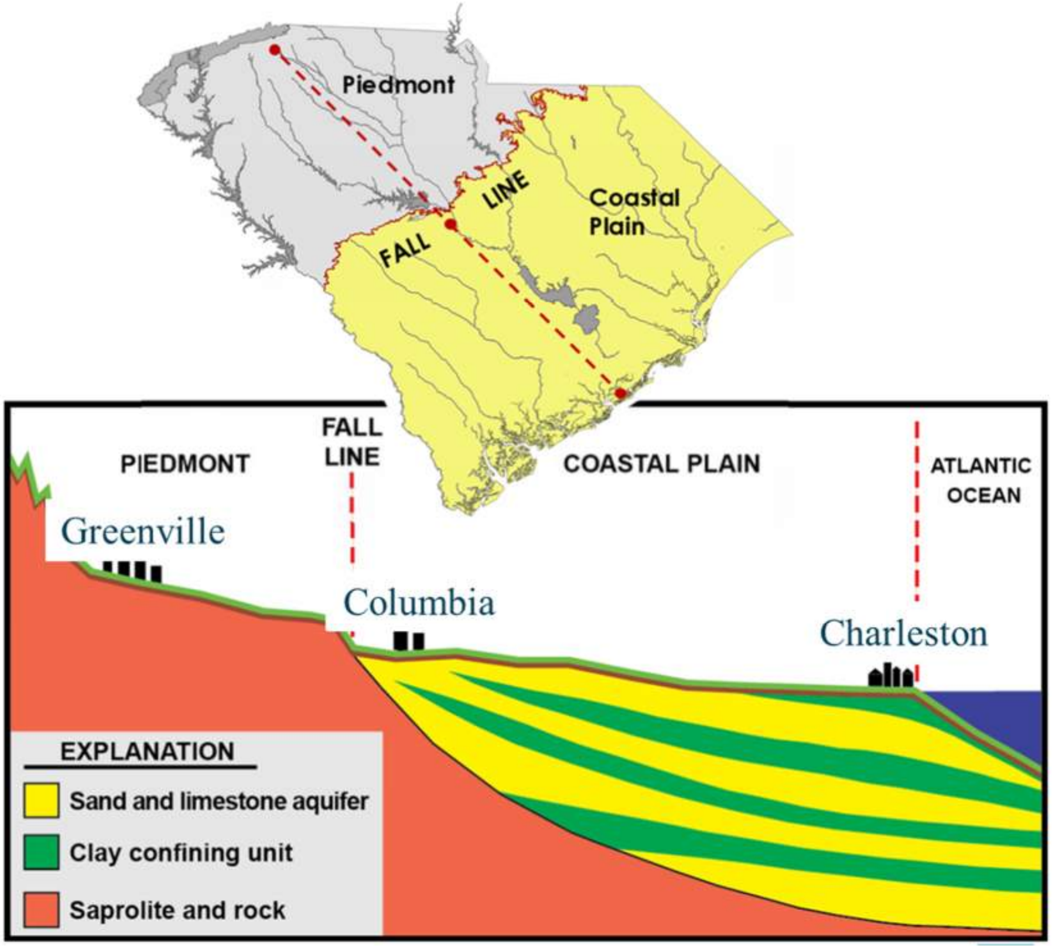


Figure 3-10. Coastal Plain aquifer system schematic cross section (SCDES 2025d).

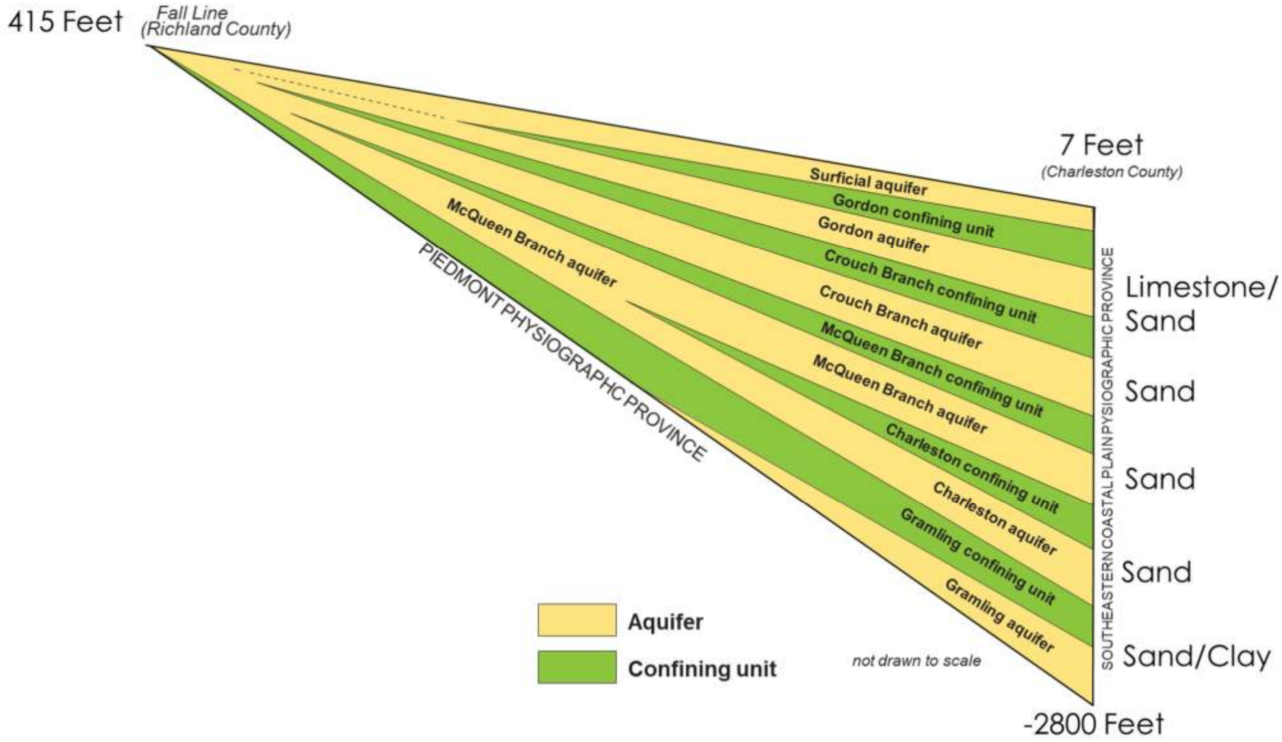


Figure 3-11. Coastal Plain aquifer system schematic underlying the Santee River Basin (SCDES 2025d).

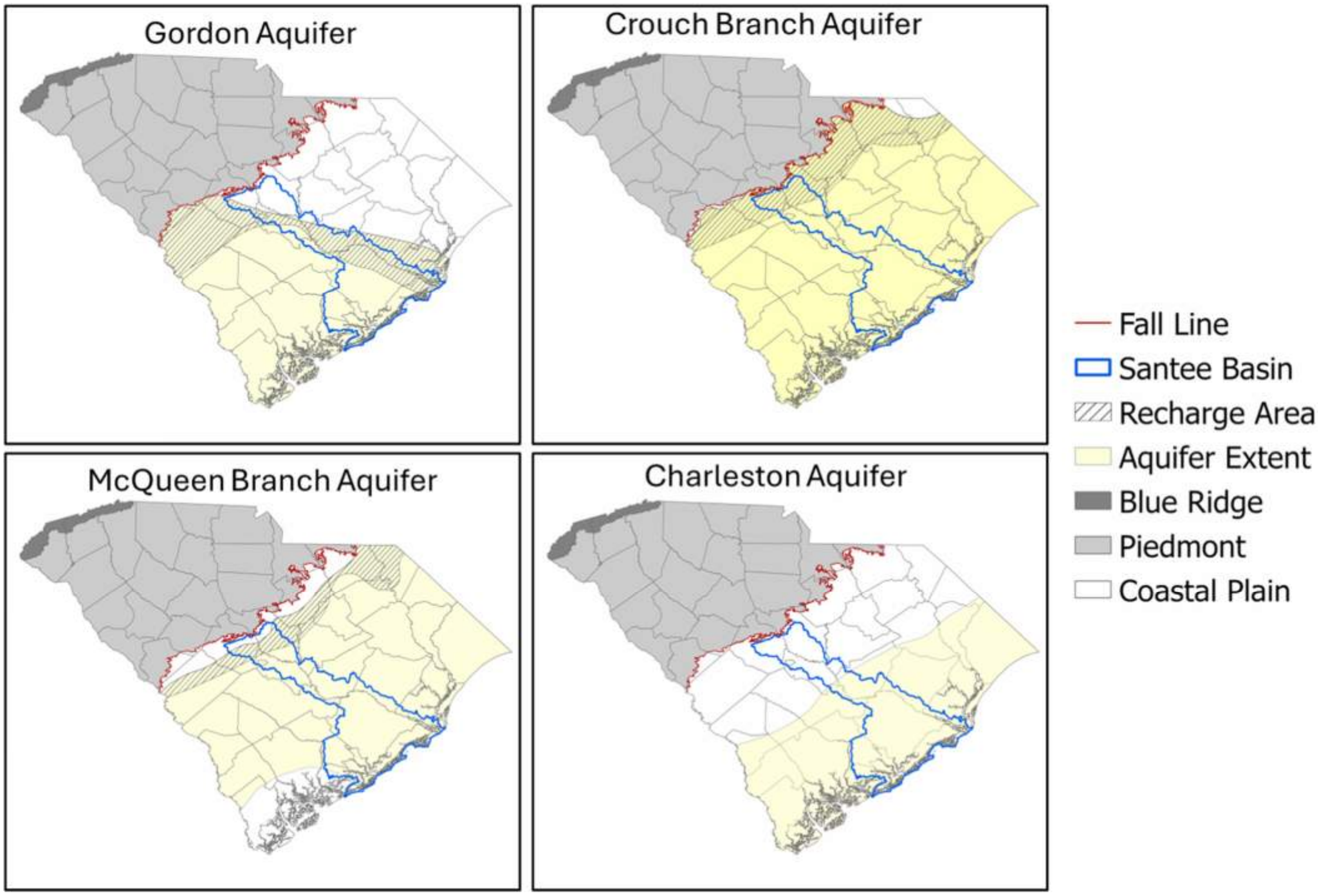


Figure 3-12. Aquifers underlying the Santee River basin (SCDES 2025d).

An older system of South Carolina hydrostratigraphic nomenclature referred to the Gordon aquifer as the Tertiary sand aquifer (the northernmost extent of the Floridan aquifer), the Crouch Branch aquifer as the Black Creek aquifer, the McQueen Branch and Charleston aquifers as the Middendorf aquifer, and the Gramling aquifer as the Cape Fear aquifer (SCDNR 1995; USGS 2010). This alternative naming convention may be found in some publications, particularly those before 2010.

Surficial Aquifer

The surficial aquifer, which occurs throughout the Coastal Plain, consists of the uppermost layer of permeable sediments that lie on the shallowest impermeable confining layer. It is shallow, unconfined, and hydraulically connected to surface water, and is often referred to as the water table aquifer. The surficial aquifer is composed of quartz, sand, and clay, with sediments becoming more fine-grained near the coast, and its thickness is generally less than 100 feet. Groundwater flow routes generally follow surface topography. Due to its unconfined nature and connection with surface water, groundwater levels in the surficial aquifer show more seasonal fluctuation and have more limited available drawdowns compared to those of the deeper confined aquifers. Surficial aquifer wells, which are typically 25 to 60 feet deep and generally yield less than 75 gallons per minute (gpm), are typically used for domestic and light commercial purposes (SCDNR 2009). The surficial aquifer is widely used for domestic water supplies. Ponds that are hydraulically connected to the surficial aquifer may also be used as water supply for golf courses or agricultural irrigation.

Gordon Aquifer

The Gordon aquifer is composed of sand, clay, and clayey limestone and is an important source of water for domestic supply, public supply, irrigation, and industry in much of the basin. The top of the Gordon aquifer occurs near land surface in Calhoun County and slopes down to a depth of 670 feet in southern Charleston County, and it thickens from less than 50 feet in Calhoun County to about 100 feet near the coast. Well yields are typically less than 600 gpm (SCDNR 2009). Gordon aquifer wells are common in the coastal counties due the relatively shallow depth, and higher yields from having two water bearing zones (Santee Limestone and Black Mingo) when compared to the surficial aquifer. Often wells completed the Gordon aquifer are constructed as "open hole" to the water bearing unit to maximize yield. There are many private Gordon aquifer wells used for domestic and light commercial use that do not meet the volume requirements for reporting water use.

In this planning basin, recharge for the Gordon aquifer occurs across the eastern portion of the basin in Charleston County and western portions of Georgetown, Williamsburg, and Calhoun Counties along the Santee River corridor. Where the aquifer is under water table conditions it interacts with local streams and other waterbodies, discharging groundwater as baseflow. Southwest of recharge area, the aquifer deepens and becomes overlain by confining clay beds, creating artesian conditions. Less interaction between groundwater and surface water occurs in those areas.

Crouch Branch Aquifer

The Crouch Branch aquifer is an important source of water for agriculture, public supply, and industry in the upper and middle portions of the basin. The Crouch Branch aquifer underlies the Gordon aquifer and the Crouch Branch confining unit (Figure 3-10) and consists largely of unconsolidated quartz sand and clay throughout the basin. It occurs at or near the surface in the northern parts of Lexington and Richland Counties and reaches depths of over 1,300 feet in coastal areas. Aquifer thickness ranges from 0 feet near the Fall Line to about 280 feet at the coast. Crouch Branch wells are common in Lexington, Calhoun, Clarendon, and Orangeburg Counties, where the yields can exceed 1,000 gpm (SCDNR 2009). The aquifer is used to a lesser extent in Dorchester, Berkeley, and Charleston Counties, where other aquifers are preferred.

In this planning basin, recharge of the Crouch Branch aquifer occurs in Lexington and Richland Counties, where the aquifer is under water table conditions. The Crouch Branch confining unit, which normally separates the Gordon and Crouch Branch aquifers, is generally thin and discontinuous in the recharge areas, and the Crouch Branch aquifer is often in direct contact with the overlying Gordon aquifer. Precipitation moves downward through the Gordon aquifer and recharges the underlying Crouch Branch aquifer. Southeast of the recharge areas, starting in northern Calhoun County, the aquifer is overlain by continuous clay beds that confine the aquifer and create artesian conditions. Less interaction between groundwater and surface occurs in those areas.

McQueen Branch and Charleston Aquifers

The McQueen Branch aquifer is important source of water for agriculture and public supply. The McQueen Branch aquifer underlies the Crouch Branch aquifer throughout the basin (Figure 3-10) and consists largely of unconsolidated quartz, sand, and clay. The aquifer occurs at depths between 140 and 150 feet near Columbia in Lexington County and reaches a depth of almost 1,440 feet in southern Dorchester County. The aquifer reaches a maximum thickness of about 300 feet in Orangeburg County, and its thickness is reduced to less than 100 feet in Dorchester County as the lower part of the aquifer transitions into the confining layer that separates the McQueen Branch aquifer from the Charleston aquifer. McQueen Branch wells in the central part of the basin can produce more than 2,000 gpm (SCDNR 2009). In the middle to lower portion of the basin, beginning in southern Orangeburg County, the sands of the McQueen Branch aquifer become very fine and yield so little water that the unit is no longer defined as a viable aquifer in this area. In the coastal area, the overlying Gordon or Crouch Branch aquifers or deeper Charleston aquifer satisfy groundwater demand.

In this planning basin, recharge of the McQueen Branch aquifer occurs in Lexington and Richland Counties, where the confining layer separating the Crouch Branch aquifer and McQueen Branch aquifer is thin and discontinuous, allowing precipitation to move downward either directly through the overlying Crouch Branch aquifer or through a thin McQueen Branch confining unit. In the absence of confining units, the aquifers are under water table conditions. In these areas of the recharge zone, the McQueen Branch aquifer is hydraulically connected with both the Gordon and Crouch Branch aquifers. Southeast of the recharge areas, starting in Calhoun County, the aquifer is overlain by continuous clay beds that confine the aquifer, hydraulically isolating it from the overlying aquifers and creating artesian conditions. Less interaction between groundwater and surface water occurs in these areas.

The Charleston aquifer underlies the McQueen Branch aquifer in the lower half of the basin. In the upper half of the basin, the confining unit above the Charleston aquifer reduces in thickness until the Charleston aquifer becomes part of the McQueen Branch aquifer. The depth of the Charleston aquifer ranges from almost 870 feet in central Orangeburg County, where it first occurs, to as deep as 2,500 feet at Kiawah Island, where the aquifer is about 150 feet thick. Well yields in the Charleston aquifer in Charleston County exceed 1,000 gpm. Because the Charleston aquifer is never near land surface, its recharge occurs primarily by movement of water from the McQueen Branch aquifer. The Charleston aquifer is used for public water supply, industry, and golf course irrigation.

Gramling Aquifer

The Gramling aquifer underlies the Charleston aquifer (Figure 3-10) and is the basal aquifer of the South Carolina Coastal Plain. It is composed of quartz sand, clayey sand, silt, and clay, and much like the Charleston aquifer, the Gramling aquifer only occurs in the lower half of the Coastal Plain. Depths to the top of the Gramling range from about 1,150 feet in Orangeburg County to 2,480 feet in southern Charleston County, where its thickness is about 700 feet (SCDNR 2009). Primarily because of its depth, very few wells in the basin use this aquifer. Recharge of the Gramling aquifer occurs solely by leakage from overlying aquifers.

3.3.2 Groundwater Monitoring

Groundwater monitoring wells are used to identify short- and long-term trends in groundwater levels and aquifer storage and to monitor drought conditions by providing continuous, long-term records of groundwater levels at specific sites. Most of the actively monitored wells have water level records dating to the 1990s, with one dating as far back as 1955.

Groundwater-level monitoring is performed by SCDES and the USGS. Statewide, the groundwater monitoring network operated by SCDES has more than 180 wells as of 2025, the majority of which are in the Coastal Plain (SCDES 2025d). Most SCDES wells are equipped with automatic data recorders that measure and record water levels every hour, while others are measured manually four to six times per year. The USGS also maintains a groundwater-level monitoring network of 20 wells in South Carolina. SCDES and the USGS currently monitor 24 wells in the Santee basin (SCDES 2025d). The locations of the monitoring wells for each aquifer are shown in Figure 3-13.

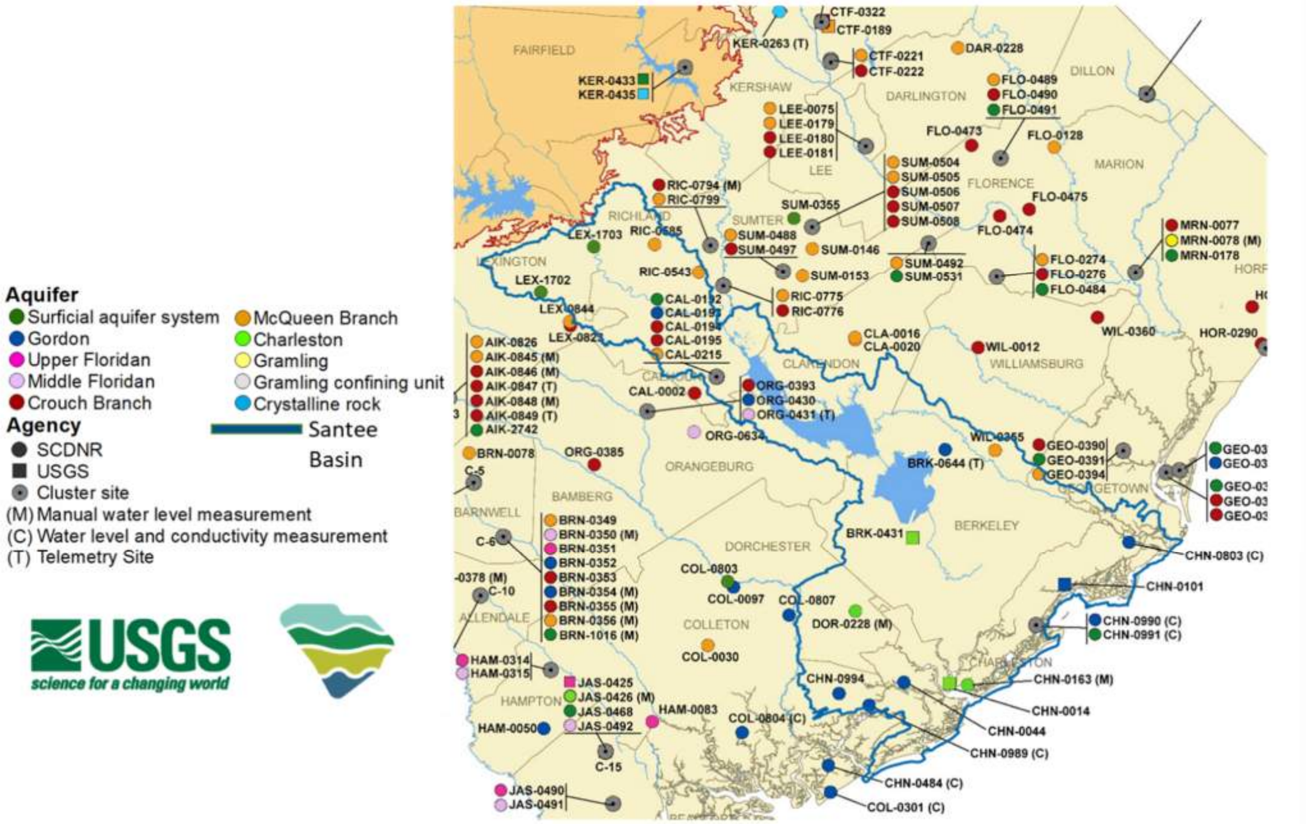


Figure 3-13. SCDES and USGS groundwater monitoring wells (SCDES 2025d).

SCDES also routinely measures water levels in other non-network wells to develop potentiometric maps for the major Coastal Plain aquifers. A potentiometric map is a contour map that illustrates the elevation to which groundwater will rise in a well open to a particular aquifer. Unlike monitoring wells, which provide continuous records of changing aquifer conditions at specific locations, potentiometric maps provide "snapshots" of aquifer conditions over the full extent of the aquifer at one moment in time. Areas of relatively significant groundwater level declines are indicated on potentiometric maps by relatively lower potentiometric elevations, often seen as concentric loops of contours lines known as a cone of depression. Typically, SCDES produces new potentiometric maps for the Floridan, Gordon, Crouch Branch, and McQueen Branch/Charleston aquifers every three years.

Examples of monitoring well hydrographs and potentiometric maps that can be created using water-level data are shown in Figure 3-14 and Figure 3-15, respectively. More detailed descriptions of monitoring well data and potentiometric maps are included in Chapter 5.

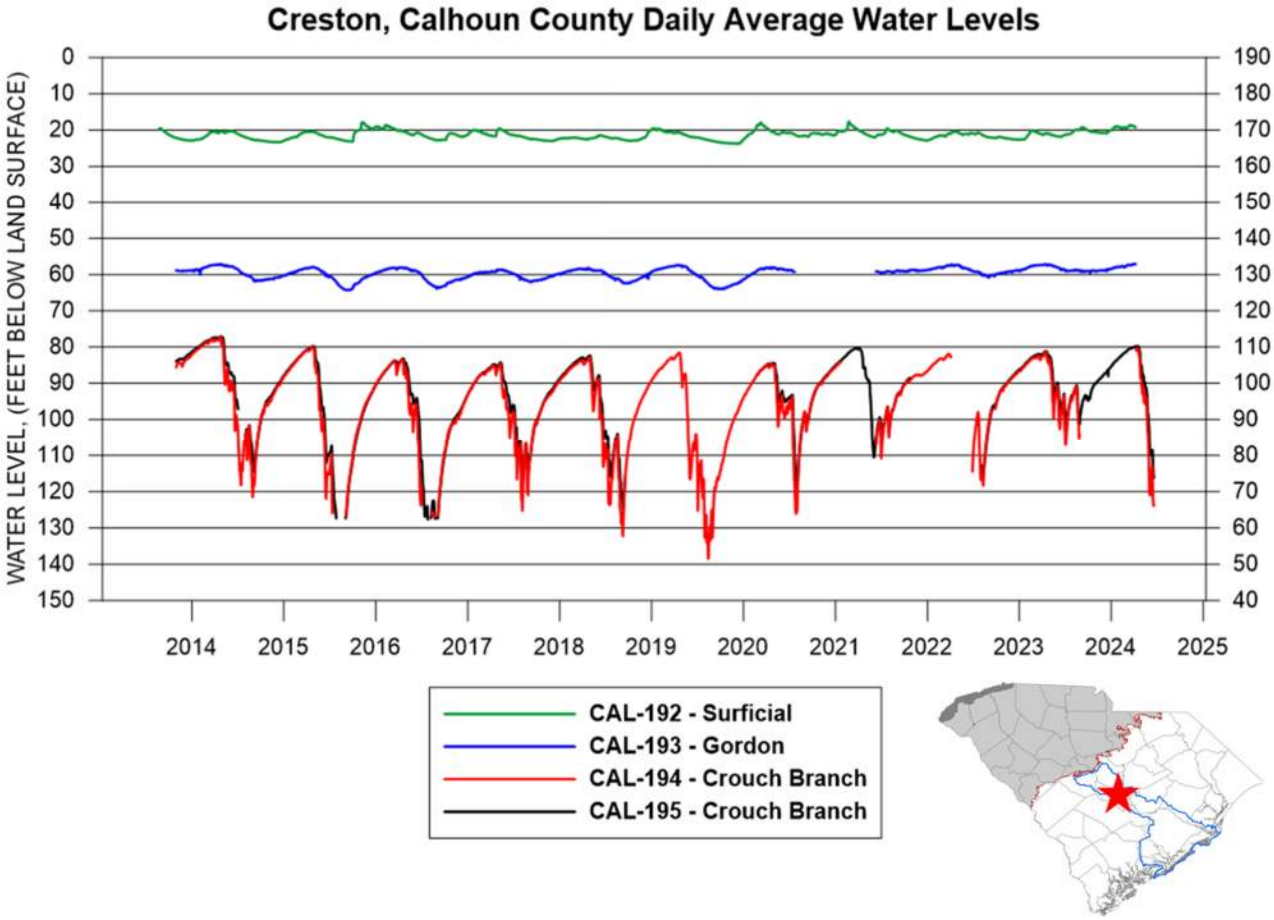


Figure 3-14. Groundwater levels in Crouch Branch, Gordon, and surficial aquifers in Calhoun County.

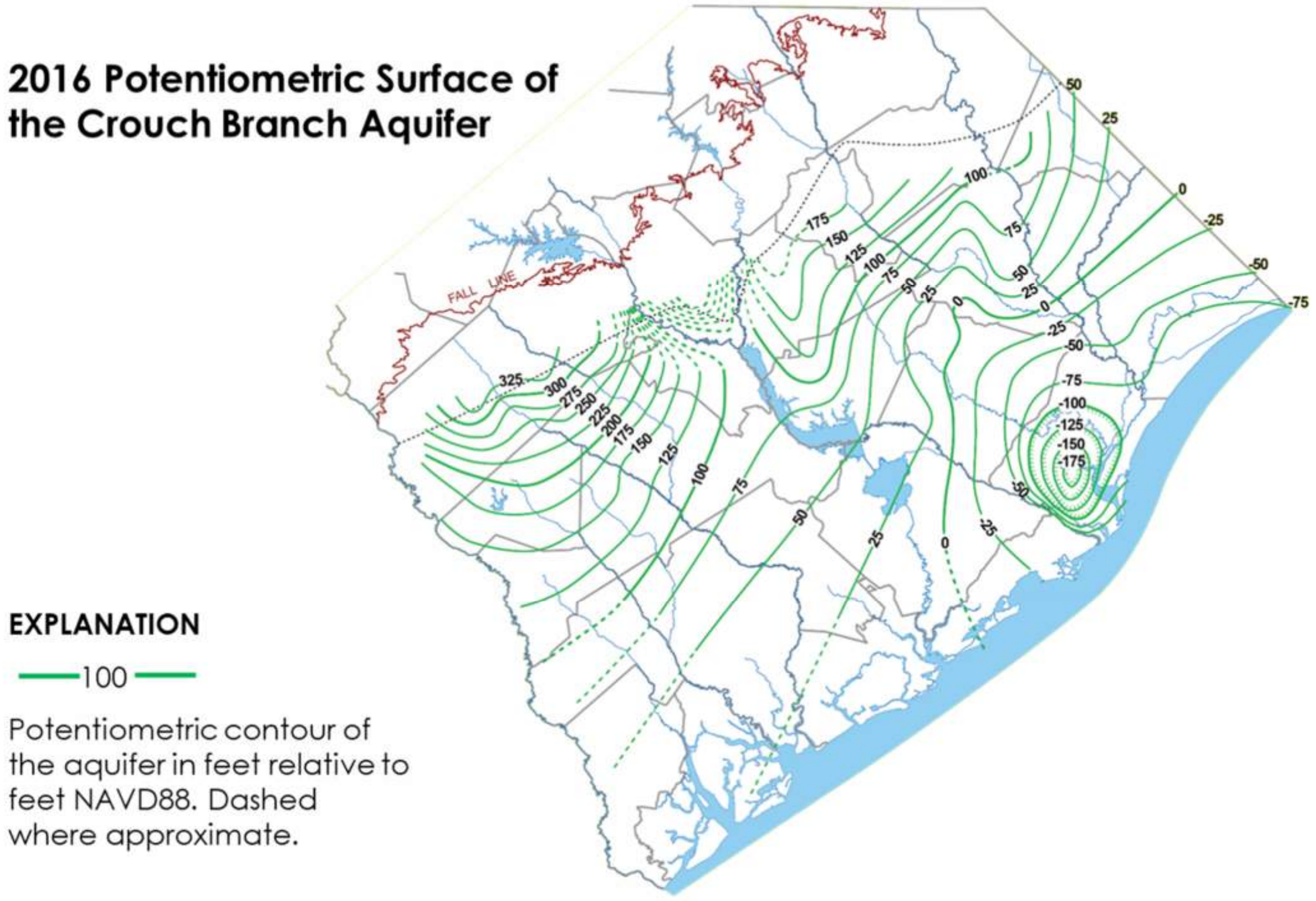


Figure 3-15. Potentiometric surface map of the Crouch Branch aquifer (SCDES 2025d).

3.3.3 Groundwater Development

Groundwater supplies have been developed in the Santee River basin to serve agriculture, water supply, industry, golf courses, and mining. In 2023, the average reported withdrawal of groundwater for all uses was approximately 27 million gallons per day (MGD), or 9.5 billion gallons for the year (SCDES 2025d). This does not include relatively minor withdrawals from domestic and other wells which are below the reporting limit of 3 million gallons per month. Agriculture and public water supply are the two largest groundwater users in the basin, with agricultural withdrawals of 11 MGD (4.0 billion gallons for the year) and public supply withdrawals of 8 MGD (2.9 billion gallons for the year) in 2023. Industrial use was 5 MGD, golf course use was 2 MGD, and mining use was 1.3 MGD.

3.3.4 Capacity Use Areas

Groundwater in South Carolina is regulated by SCDES in areas designated as Capacity Use Areas (CUAs). Under South Carolina's Groundwater Use and Reporting Act (Chapter 5, Section 49-5-60), a CUA is designated where excessive groundwater withdrawals present potential adverse effects to natural resources, public health, safety, or economic welfare. SCDES then coordinates with affected governing bodies and groundwater withdrawers to develop a groundwater management plan for the CUA. The purpose of the groundwater management plan is to conserve and protect the resources by preventing waste and ensure that conditions are met for sustainable development and use of groundwater resources.

The Santee planning basin includes parts of five CUAs, none of which are entirely within the basin (see Figure 1-4). The lower portion of the basin is within the Trident CUA, and middle and upper portions of the basin include portions of the Western and Santee-Lynches CUAs. The Santee basin also includes small portions of the Waccamaw and Pee Dee CUAs.

The Trident CUA, which consists of Berkeley, Charleston, and Dorchester Counties, was designated in August 2002. The primary concern in this area is the water-level decline of up to 200 feet observed in the Charleston aquifer. While significant rebounds have occurred in recent years, maintaining current water levels to prevent saltwater from entering the freshwater zones of the aquifer is a priority.

The Western CUA, consisting of Aiken, Allendale, Bamberg, Barnwell, Calhoun, Lexington, and Orangeburg Counties, was designated in November 2018. In the Santee Basin, there is significant use of the Crouch Branch and McQueen Branch aquifers. Historically, groundwater withdrawals have lowered the potentiometric surfaces by 50 to 75 feet in the basin.

The Santee-Lynches CUA, consisting of Chesterfield, Clarendon, Kershaw, Lee, Richland, and Sumter Counties, was designated in July 2022. Seasonal water level declines associated with agricultural irrigation have been observed in the Crouch Branch and McQueen Branch aquifers. These declines typically rebound each year, but long-term aquifer demand has caused a lowering of water levels by about 50 feet in western Clarendon County.

3.3.5 Groundwater Concerns

In the absence of groundwater modeling, no quantitative groundwater concerns have been identified in the Santee Basin. Water level declines have been observed in all aquifers since predevelopment, but the current declines in much of the basin do not appear to pose risks to the resource. The most significant declines have occurred in the coastal region of the in the Charleston aquifer centered near Mount Pleasant, in Charleston County. This cone of depression is well documented and is the is the cumulative result of historical groundwater use in the coastal areas of the lower basin. In recent years, due to reduced pumping and more reliance on surface water, the center of the cone has rebounded by 20 feet or more. The legacy effects of pumping have created a potentiometric low across much of Charleston and Berkeley Counties in the Charleston aquifer.

There are potential concerns of seasonal groundwater availability in the Crouch Branch and McQueen Branch aquifers near the middle of the basin. Farms and small public water systems dependent of groundwater supply in Orangeburg and Calhoun Counties aquifers are susceptible to seasonal drawdowns during the summer months. Agriculture is plentiful in in the middle of state and farmland occupies much of the land not only in the Santee Basin but in the Pee Dee and Edisto Basins which share a boundary with the Santee.

Water levels in the Gordon aquifer have declined by more than 50 feet since predevelopment. While this is aquifer is not used as frequently for large groundwater withdrawals, it is still an important resource for domestic and commercial needs. Relict seawater that naturally exists at the base of the aquifer at the coast, has encroached landward due to groundwater development.

3.4 Groundwater Assessment Tools

The primary tools used by the RBC to evaluate current and future groundwater conditions and available supplies for this Santee River Basin Plan are groundwater monitoring data and information, potentiometric maps as described in Section 3.3 above, and current and projected groundwater use data.

Groundwater flow models can be useful tools for simulating current and future groundwater levels, predicting changes in aquifer storage and groundwater flow direction, and evaluating the effectiveness and impacts of various groundwater management strategies. The RBC intended to use a groundwater flow model developed by the USGS to estimate future groundwater conditions resulting from various water use scenarios and to quantify the impacts of proposed groundwater management recommendations. Unfortunately, the development of the groundwater model was delayed to the extent that it was not available for use during this phase of the water planning process. Once completed, the Santee RBC can use the groundwater model to more thoroughly evaluate groundwater supply issues and potential management strategies and include those findings in later versions of the water plan.

Chapter 4
Current and Projected Water Demand

This chapter summarizes current and projected water demands over the 50-year planning horizon from 2020 to 2070 in the Santee River basin. Demand projections are based on historical demands and published projection datasets for variables that influence water demand including population, economic development, and irrigated acreage. A statistical model was built to project demands for each major water use category using the current demands and driver variables. Consistent with the Planning Framework, two demand projections were developed: a Moderate Demand Scenario using median rates of water use and moderate growth, and a High Demand Scenario using high rates of water use and high growth. The demand projections were used to assess future water availability as summarized in Chapters 5 and 6.

4.1 Current Water Demand

Current water demands reflect withdrawal data as reported to SCDES that were available at the time of the analysis. Current surface water and groundwater demands are based on average withdrawals reported for the ten years from 2014 to 2023. The withdrawals used for this demand characterization were reported to SCDES by permitted and registered water users in the Santee River basin as required by state regulation. All users withdrawing more than 3 million gallons of surface water or groundwater in any month must either obtain a permit or register their use and report withdrawals to SCDES annually. For surface water withdrawals over the threshold, agricultural water users must register their use while all other users must permit their use in accordance with SCDES's Regulation 61-119, Surface Water Withdrawal, Permitting, Use and Reporting. For groundwater withdrawals over the threshold, users withdrawing within a CUA must permit their use, while those withdrawing outside of a CUA must only register their use. All of the Santee River Basin is in a CUA, therefore, all groundwater users over the 3 MGM threshold are permitted. Registered groundwater users in the Santee are those that have chosen to report their withdrawals voluntarily.

Current withdrawals in the Santee River basin total approximately 547 MGD on average, with 517 MGD from surface water and 30 MGD from groundwater. Of the 517 MGD of surface water withdrawal, only 24 percent (126 MGD) of the water is consumptively used and 76 percent (391 MGD) is returned to streams and rivers after use. Consumptive use was not calculated for groundwater users. Just over half of groundwater withdrawals are for agriculture and golf course irrigation and are assumed to consumptively use all of the groundwater they withdrawal. Due to the type and age of collection systems, discharge data suggests there may be substantial inflow and infiltration which hinders the calculation of consumptive use for the public water supply and manufacturing (i.e. industry) sectors.

Current water use for the Santee River basin is summarized in Table 4-1. The largest water use category is thermoelectric (68 percent of the total basin use). The largest withdrawal user is Williams Station, withdrawing 343 MGD; however, only 21 percent of total withdrawal is consumed, and 79 percent is returned downstream. The next largest use categories are public supply, with 83 MGD of withdrawals (15 percent of basin withdrawals), manufacturing, with 72 MGD of withdrawals (13 percent), agriculture, with 15 MGD of withdrawals (2.7 percent). Minimal withdrawals are from golf course irrigation, mining, aquaculture, and other user categories with less than 1 percent of the total use. Figure 4-1 illustrates the distribution of water use by sector for all sectors in the Santee River basin.

Appendix A includes a table of all water users along with the user's source (surface water or groundwater), withdrawals, and discharges. For surface water modeling purposes, consumptive use percentages (i.e., the amount of water withdrawn that is not returned to surface water or groundwater) for each water user were calculated by comparing withdrawal and discharge amounts as reported to SCDES. For groundwater users, this calculation of consumptive use was not possible for all users. Consumptive use is noted in Appendix A as 100 percent for groundwater users. This is reasonable for agricultural users and users that may return withdrawals to the groundwater system through septic tanks. For groundwater users with National Pollutant Discharge Elimination System (NPDES) discharge permits that discharge to these basins, the discharges are listed separately in the table in Appendix A.

Table 4-1. Current water demand (2014–2023) in the Santee River basin.

Water Use Category	Groundwater (MGD)	Surface Water (MGD)	Total (MGD)
Thermoelectric	-	373.4	373.4
Public Supply	8.3	75.1	83.4
Manufacturing	4.9	67.0	71.8
Golf Course	1.6	0.3	1.9
Agriculture	14.2	0.5	14.7
Aquaculture	0.04	0.08	0.1
Mining	1.4	0.6	2.0
Other	0.01	-	0.01
Total	**30.4**	**517.0**	**547.4**

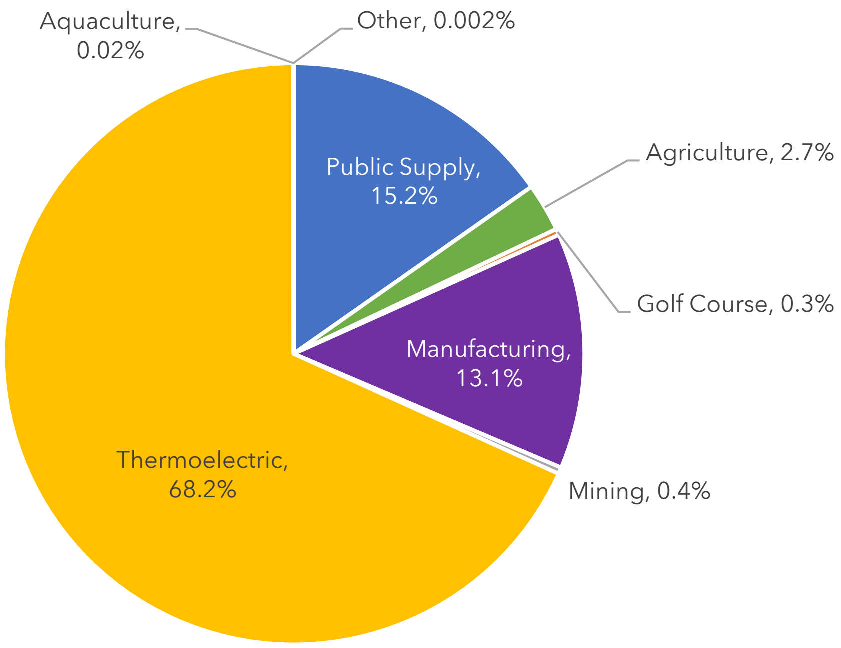


Figure 4-1. Current water use category percentages of total demand.

4.2 Permitted and Registered Water Use

As of June 2025, 1,750 MGD has been permitted or registered in the Santee River basin. Of this total,1,675 MGD of surface water has been permitted, 13 MGD of surface water has been registered, 62 MGD of groundwater has been permitted, and 0.1 MGD of groundwater has been registered. Currently, 31 percent (547 MGD) of the total permitted and registered amount is withdrawn. Groundwater registrations in the Santee River basin consist of all users below the 3 MGM permitting threshold that voluntarily choose to report their use to SCDES. Groundwater registrations do not include a withdrawal limit; the values discussed in this chapter reflect the current use of these registered users.

Figure 4-2 shows the location of all permitted and registered surface water intakes and groundwater wells in the Santee River basin. Table 4-2 summarizes permitted and registered surface water and groundwater withdrawals by water use category for the basin. Appendix A includes a table of all permitted or registered withdrawals for each user.

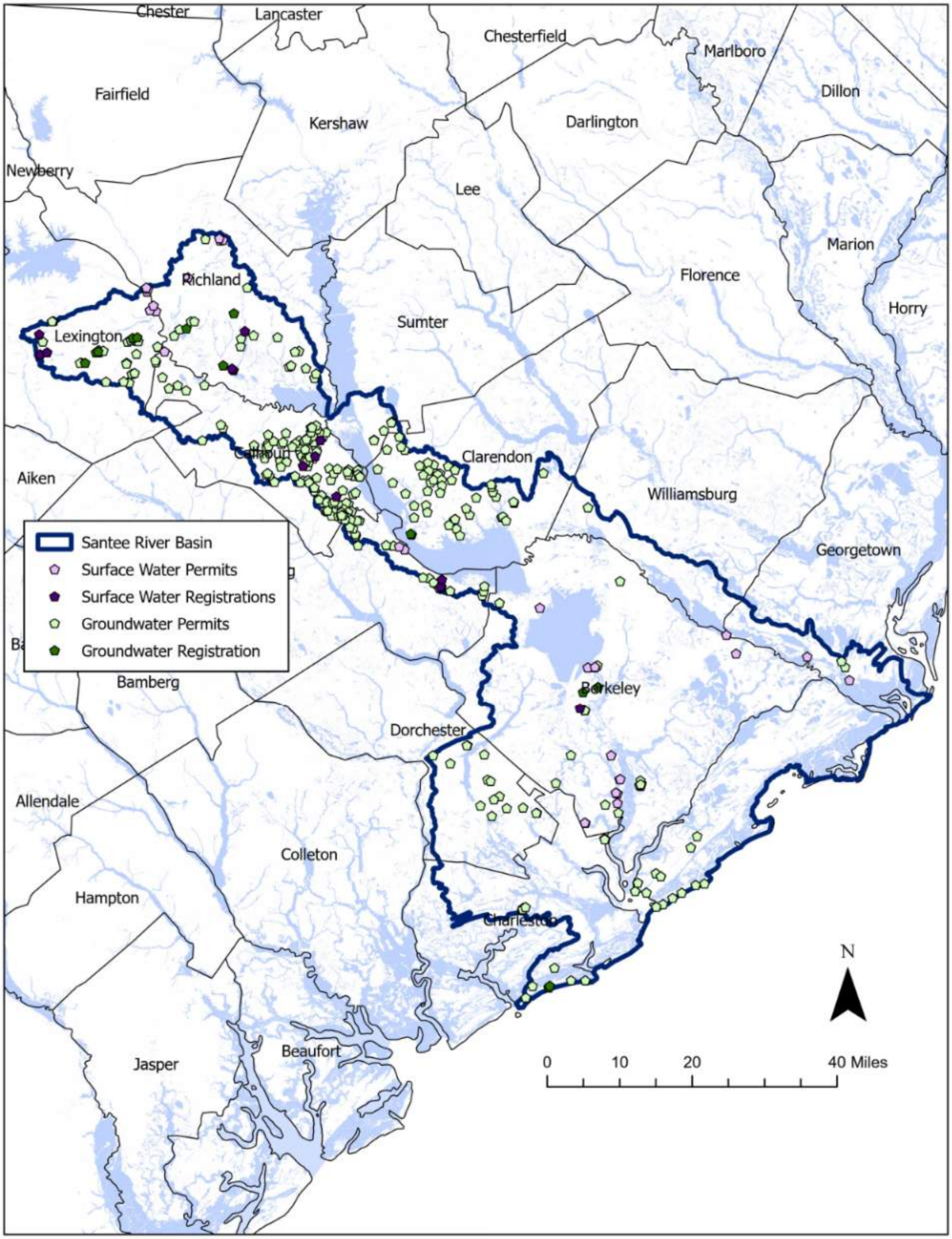


Figure 4-2. Locations of permitted and registered water intakes and groundwater wells in the Santee River basin.

Table 4-2. Permitted and registered surface water totals by category in the Santee River Basin.

Water Use Category	Surface Water (MGD)			Groundwater (MGD)			Total (MGD)		
	Permitted	Registered	Total	Permitted	Registered[1]	Total	Permitted	Registered	Total
Thermoelectric	996.8	0.0	996.8	0.0	0.0	0.0	996.8	0.0	996.8
Public Supply	362.3	0.0	362.3	16.6	0.07	16.7	378.9	0.1	379.0
Manufacturing	309.7	0.0	309.7	11.9	0.03	11.9	321.6	0.03	321.6
Golf Course	1.9	0.0	1.9	5.6	0.0	5.6	7.5	0.00	7.5
Agriculture	0.0	11.8	11.8	25.0	0.01	25.0	25.0	11.8	36.8
Aquaculture	0.0	0.8	0.8	0.0	0.04	0.04	0.0	0.8	0.8
Mining	4.4	0.0	4.4	3.2	0.0	3.2	7.6	0.0	7.6
Other	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.1
Total	**1,675.1**	**12.6**	**1,687.7**	**62.3**	**0.1**	**62.5**	**1,737.5**	**12.7**	**1,750.2**

Water Use Category	Percentage of Total Permitted and Registered Surface Water Currently in Use	Percentage of Total Permitted and Registered Groundwater Currently in Use	Percentage of Total Permitted and Registered Water Currently in Use
Thermoelectric	37.5%	0.0%	37.5%
Public Supply	20.7%	49.8%	22.0%
Manufacturing	21.6%	41.2%	22.0%
Golf Course	15.8%	28.5%	25.3%
Agriculture	4.2%	57.0%	40.0%
Aquaculture	11.1%	100%	15.2%
Mining	13.7%	43.7%	26.2%
Other	0.0%	8.3%	8.3%
Total	**30.6%**	**46.7%**	**31.3%**

[1] Groundwater registrations do not include limits and were assumed to be equal to current use.

4.3 Projection Methodology

The methodology to calculate demand projections followed the guidance in *Projection Methods for Off-Stream Water Demand in South Carolina* (SCDNR 2019c). SCDNR developed this document over several years in collaboration with the South Carolina Water Resources Center at Clemson University and the USACE, with additional input from stakeholders including:

- South Carolina Water Works Association Water Utility Council
- South Carolina Farm Bureau Water Committee
- South Carolina Chamber of Commerce Environmental Committee
- South Carolina Water Quality Association
- PPAC

Following the guidance in the statewide projections report, SCDES developed demands for the Santee River basin with only minor deviations from the initial projection report, as presented in this section. Demands were projected to increase for the public water supply, manufacturing, and agriculture sectors. Demand for the thermoelectric sector is projected to decrease with the closure of two facilities by 2035. Minor demands associated with other uses including golf courses, aquaculture, and mining were assumed to remain stable over the planning horizon.

The projection methodology varies by water use category. Each water use category has an associated driver variable that influences demand growth, as shown in Table 4-3. Projections for these driver variables come from a variety of published sources. Published values were extrapolated to 2070 to match the planning horizon of the River Basin Plan.

Two demand projections were developed for surface water: (1) the Moderate Water Demand Scenario (Moderate Demand Scenario) and (2) the High Water Demand Scenario (High Demand Scenario). The Moderate Demand Scenario was originally referred to as the Business-as-Usual Scenario in the Planning Framework. The Moderate Demand Scenario is based on median rates of water use in recent reporting and moderate growth projections, while the High Demand Scenario is based on the maximum monthly rates of water use in recent reporting and high-growth projections. While it is unlikely that the conditions of the High Demand Scenario would occur for an extended time or universally across the basin, the scenario is useful for establishing an upper bound for the projected demand. The subchapters present additional details on the calculation of demand for each water use category.

Table 4-3. Driver variables for each water use category.

Water Use Category	Driver Variable	Driver Variable Data Source	Moderate Demand Scenario	High Demand Scenario
Public Supply	Population	South Carolina Office of Revenue and Fiscal Affairs (SC ORFA)	SC ORFA projection to 2038; for 2039-2070, extend straight-line growth or assume constant population if the population projection is negative	Assumes exponential growth, with projected county growth rates set to 10% above the county rate or the state average rate, whichever is higher
Manufacturing	Economic production	Subsector growth rates from the U.S. Energy Information Agency (EIA)	Manufacturing subsector growth with the minimum adjusted to 0% to 2050 and then 0.3% from 2051-2070	Manufacturing subsectors with growth rates above EIA national average are increased by 10%, otherwise, growth is set to EIA national average (2.1%)
Agriculture	Irrigated acreage	National-scale studies: Brown et al. 2013 and Crane-Droesch et al. 2019	Assume irrigated acreage increases with an annual growth rate of 0.65%	Assume irrigated acreage increases with an annual growth rate of 0.73%
Thermoelectric	Electricity demand	Information provided by electric utilities	Assume constant demands and include projected decommissioning	Assume constant demands and include projected decommissioning
Other (Golf Course, aquaculture, mining)	NA	NA	Assumed constant	Assumed constant

NA – not applicable

4.3.1 Public Supply Demand Projections Methodology

Public supply is the second largest water use sector in the Santee River basin after thermoelectric. Demand projections for public supply were developed based on county-level population and water use projections. Population projections for the Moderate Demand Scenario were obtained from SC ORFA. These projections, which end in 2038, were extended to 2070. For the Moderate Demand Scenario, projections are extended linearly. If SC ORFA projections indicate a decline in population, then the extension to 2070 is flatlined at 2038 levels. For the High Demand Scenario, populations are projected to grow exponentially. If SC ORFA projected growth, then the exponential growth rate was increased by 10 percent. If the SC ORFA projection for a county was less than the state average, then the high-scenario population projection is set at the state average. As shown in Figure 4-3, some counties are projected to experience population declines while others may experience substantial growth in both the Moderate and High Demand Scenarios. Under current conditions, approximately 90 percent of public supply water use in the Santee River basin is from surface water with the remaining 10 percent coming from groundwater.

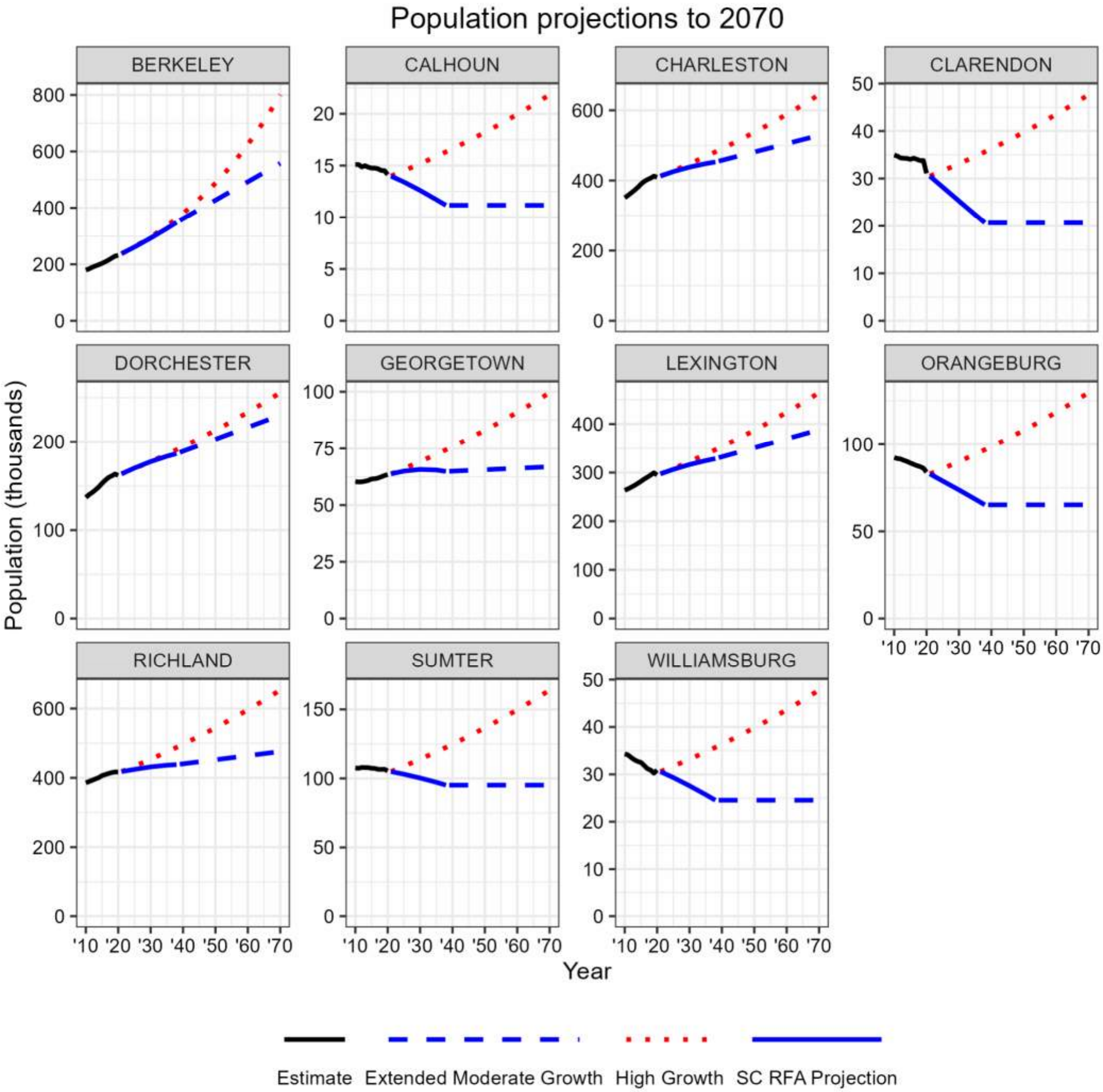


Figure 4-3. Population projections for counties withdrawing water from the Santee River basin (Harder 2025).

4.3.2 Manufacturing Demand Projections Methodology

Water is used for manufacturing in the Santee River basin for producing products such as chemicals, computers and electronics, food, paper, plastics and rubber, primary metals, and textiles. Manufacturing demand projections were based on projected subsector growth rates from EIA, which ranged from 0.1 to 2.4 percent for the sectors present in the Santee River basin (EIA 2023). The Moderate Demand Scenario used EIA projected growth rates. If the projected growth rate was negative, the rate was set to zero through 2050 then 0.3 percent through 2070. For the High Demand Scenario, growth rates greater than the national average were increased by 10 percent and growth rates less than the national average were set to the national average (2.1 percent). Under current conditions, approximately 93 percent of manufacturing water use in the Santee River basin is from surface water with the remaining 7 percent coming from groundwater.

4.3.3 Agriculture Demand Projections Methodology

Water demand projections for agriculture were developed using existing unit use rates and projections of increases in irrigated area. Moderate Demand Scenario projections were based on regional projections of irrigation in the southeast growing 0.65 percent per year (Brown et al. 2013). For the High Demand Scenario, the growth rate was increased to 0.73 percent per year, based on projections of climate change impacts on agricultural irrigation (Crane-Droesch et al. 2019). Under current conditions, nearly all (97 percent) of the water demand for agriculture in the Santee River basin is met by groundwater.

For input to the SWAM model, the limited projected growth of surface water for agricultural irrigation was assigned to subbasin outlets in the model. This method represents a relatively robust assumption that irrigation will expand somewhere in each subbasin where irrigation currently occurs but might underrepresent expansion of irrigation withdrawals on small tributaries within each subbasin.

4.3.4 Thermoelectric Demand Projections Methodology

There are no public plans for the expansion of thermoelectric facilities in the Santee River Basin; however, there are plans for two facilities to be decommissioned. For each facility, water demands are held constant into the future to 2070 or until the facility is projected to be decommissioned. The projections assume that Winyah Station will be decommissioned by 2030 and Williams Station will be decommissioned by 2035. Since the development of these demand projections, recent work on Santee Cooper's Integrated Resource Plan has moved the decommissioning of Winyah Station to 2033; however, in this chapter its demands are removed starting in 2030.

4.3.5 Other Demand Projections Methodology

Other water withdrawals in the Santee River basin support golf course irrigation, mining, and aquaculture. Combined, water use for these use categories makes up less than one percent of current demands and demands were held constant into the future. For the Moderate Demand Scenario, demands for these use categories were held constant at median rates of recent historic use. For the High Demand Scenario, demands for these use categories were held constant at the maximum rates of recent historic use. This approach means that while demands for these use categories are held constant within a scenario, the demands differ between scenarios.

4.4 Projected Water Demand

For the Santee River basin, from 2025 to 2070, total withdrawals are projected to decrease by 41 percent in the Moderate Demand Scenario and decrease by 30 percent in the High Demand Scenario. The reduction in total withdrawals is driven by the closure of thermoelectric facilities. Excluding thermoelectric demands, demands for the remaining use categories are projected to increase 78 percent from 175 MGD to 313 MGD in the Moderate Demand Scenario and by 125 percent from 252 MGD to 566 MGD in the High Demand Scenario. The Moderate and High Demand Scenarios have different starting points from one another and differ from the current use because the Moderate Demand Scenario is based on each user's median recent use, the High Demand Scenario is based on each user's maximum recent use, and the Current Use Scenario is based on each user's average recent use. As such, the starting point for the High Demand scenarios is higher than the starting point for the Moderate Demand Scenarios equal to the difference between the users median and maximum recent use. This difference is substantial in cases of users which have substantially different use throughout the year. Total water demand is expected to reach 19 to 33 percent of currently permitted and registered total water withdrawals by 2070 for the Moderate and High Demand Scenarios, respectively.

Table 4-4 shows and Figure 4-4 summarizes projected surface water and groundwater demands over the planning horizon for the Santee River basin. The figures include stacked area graphs, with total demand shown as thick black lines and shaded areas showing which portion of total demand comes from groundwater or surface water. For example, in 2025, the Moderate Demand Scenario total demand is 579 MGD. Of that, 26 MGD is from groundwater and 553 MGD is from surface water. Figure 4-5 shows the total projected withdrawals categorized by water user category. Figure 4-5 shows how, while demands are decreasing overall, that decrease is dominated by the reduction in thermoelectric demand while demand grows in public supply, manufacturing, and agriculture. Figure 4-6 summarizes the projected total demand and consumptive use over the planning horizon. Figure 4-6 shows that both total demand and consumptive use are projected to be lower in 2070 than in 2025. Although thermoelectric water demands are largely non-consumptive, in this case the current consumptive use of the two thermoelectric stations planned for decommissioning represents 49 percent of the current total consumptive use of the basin. The two thermoelectric stations planned for decommissioning are located on the lower part of the Santee and Cooper Rivers, below most other surface water users in the basin.

Table 4-4. Projected surface water and groundwater demands.

Year	Moderate Demand Scenario (MGD)			High Demand Scenario (MGD)		
	Surface Water	Groundwater	Total	Surface Water	Groundwater	Total
2025	552.6	26.2	578.9	792.1	58.3	850.5
2030	562.6	27.3	589.9	803.1	61.1	864.3
2035	203.5	28.2	231.8	265.2	64.2	329.4
2040	216.7	29.3	246.0	288.9	67.4	356.3
2050	244.5	31.4	276.0	345.8	74.6	420.5
2060	272.5	33.7	306.2	415.3	83.2	498.5
2070	303.1	36.0	339.0	503.0	93.2	596.2
Percent Change 2025-2070	**-45%**	**37%**	**-41%**	**-37%**	**60%**	**-30%**

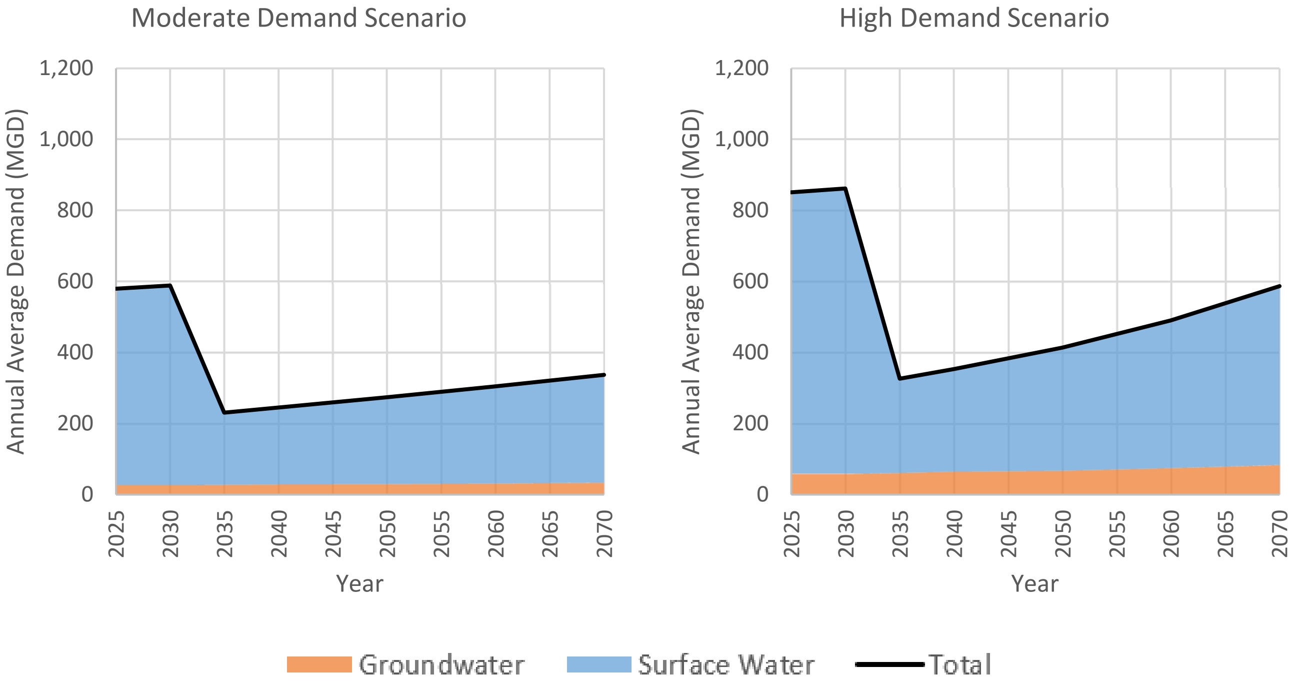


Figure 4-4. Santee River basin demand projections by water source.

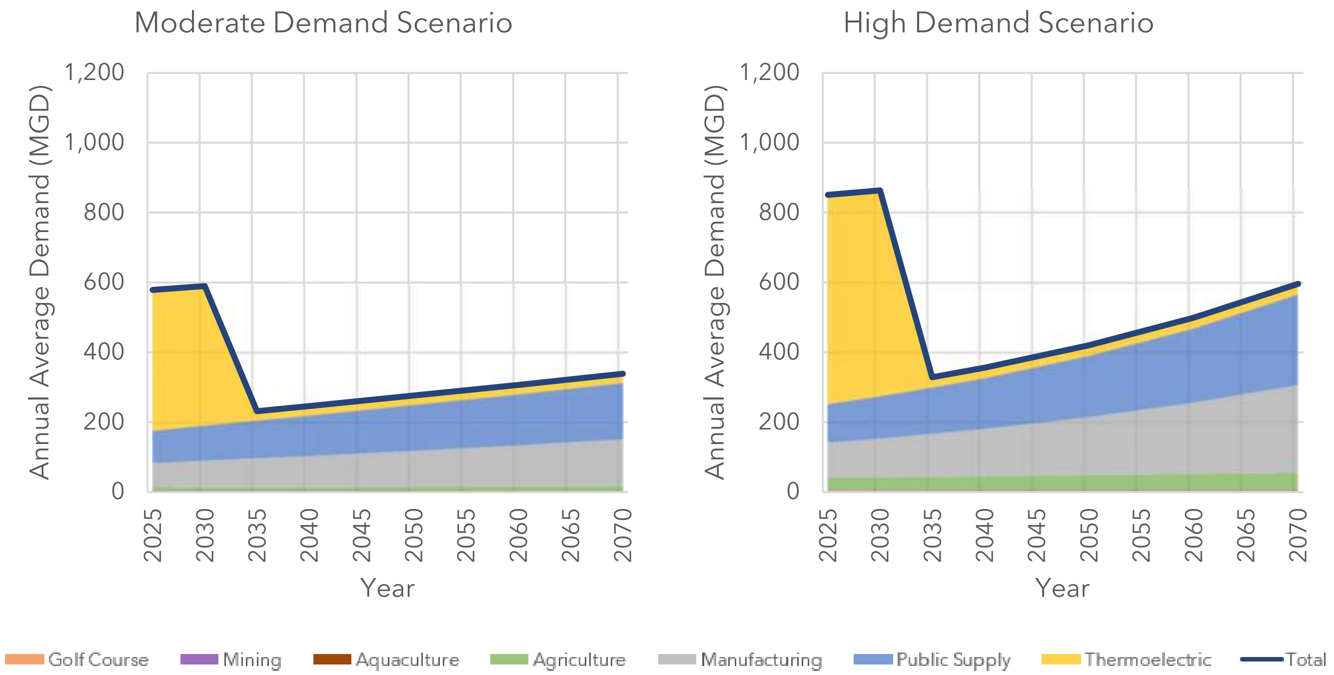


Figure 4-5. Santee River basin demand projections by water use category. (Golf course, mining, and aquaculture demands make up less than 1 percent of the total 2070 demands and may be too small to be seen on this chart.)

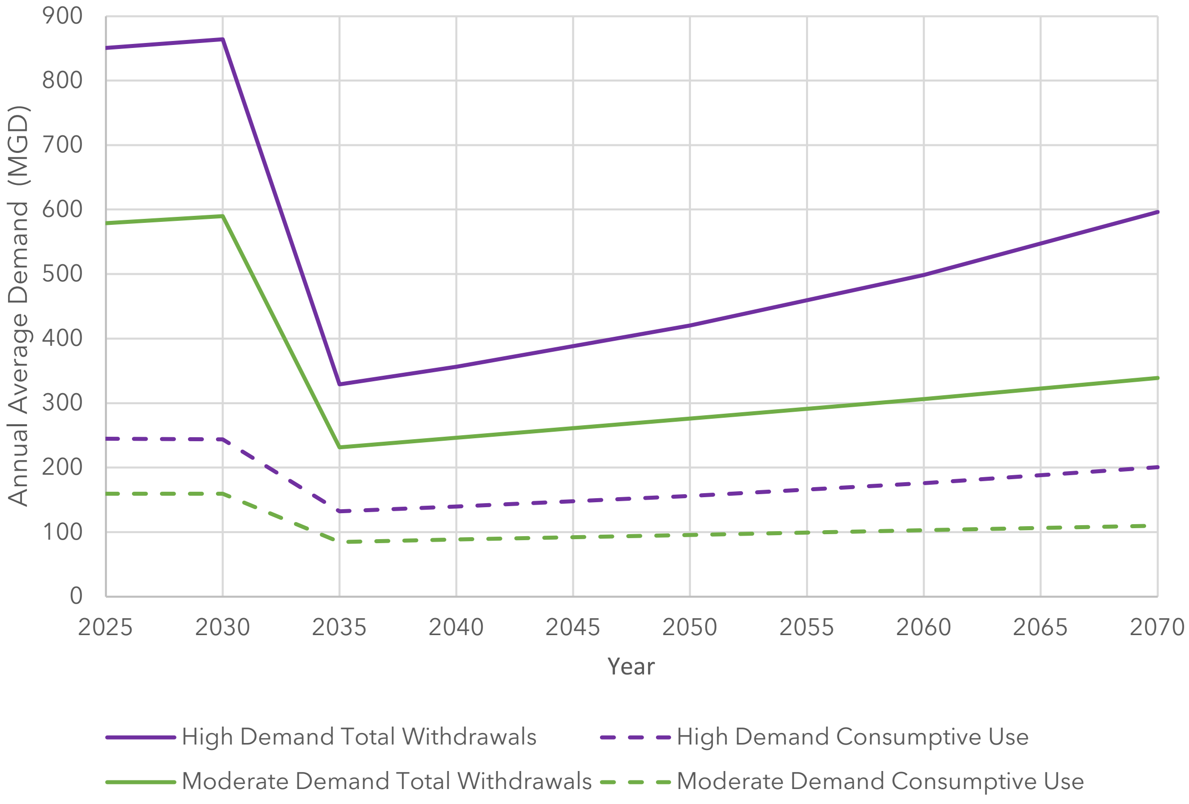


Figure 4-6. Santee River basin projections for total demand and consumptive use.

4.4.1 Public Supply Demand Projections

Approximately half of the water demand growth in the Santee River basin is expected to come from increasing demand for public water supply. Table 4-5 presents projected populations for counties that are located in the Santee River basin.

Table 4-5. Projected population (in thousands) (provided by SCDES).

Scenario	County	2025	2030	2035	2040	2050	2060	2070
Moderate Demand Scenario	**Berkeley**	261.1	293.0	327.0	361.7	427.1	492.5	557.9
	Calhoun	13.4	12.6	11.7	11.2	11.2	11.2	11.2
	Charleston	425.5	438.2	448.1	457.6	481.3	505.0	528.7
	Clarendon	28.2	25.3	22.4	20.7	20.7	20.7	20.7
	Dorchester	170.3	177.6	183.6	189.4	202.9	216.5	230.0
	Georgetown	65.0	65.7	65.5	65.0	65.6	66.3	66.9
	Lexington	306.6	316.5	324.6	332.4	351.0	369.5	388.1
	Orangeburg	78.8	73.7	68.5	65.2	65.2	65.2	65.2
	Richland	424.3	431.6	436.4	440.5	452.3	464.0	475.8
	Sumter	103.1	100.3	97.2	95.1	95.1	95.1	95.1
	Williamsburg	29.3	27.6	25.7	24.5	24.5	24.5	24.5
High Demand Scenario	**Berkeley**	262.3	296.9	336.1	380.5	487.7	625.1	801.1
	Calhoun	14.5	15.2	15.9	16.6	18.2	19.9	21.8
	Charleston	427.9	447.9	468.7	490.6	537.3	588.6	644.7
	Clarendon	31.6	33.1	34.7	36.3	39.7	43.5	47.7
	Dorchester	169.7	177.6	185.9	194.5	213.1	233.4	255.7
	Georgetown	66.1	69.2	72.4	75.8	83.0	90.9	99.6
	Lexington	308.3	322.6	337.6	353.4	387.1	424.0	464.4
	Orangeburg	86.0	90.0	94.2	98.6	108.0	118.3	129.6
	Richland	433.6	453.8	474.9	497.1	544.5	596.4	653.2
	Sumter	108.8	113.9	119.2	124.8	136.7	149.7	164.0
	Williamsburg	31.7	33.2	34.7	36.4	39.8	43.6	47.8

In the Moderate Demand Scenario, public supply demands are projected to increase 75 percent between 2025 and 2070 (92 MGD to 161 MGD). In the High Demand Scenario, public supply demands are projected to increase by 135 percent (110 MGD to 259 MGD). Approximately 90 percent of the public supply demand will be met by surface water for both the High Demand and Moderate Demand Scenarios. Projected 2070 public supply withdrawals for the Moderate and High Demand Scenarios are approximately 42 and 68 percent of the currently permitted and registered amount for public supplies, respectively. Figure 4-7 shows and Table 4-6 summarizes public supply demand projections by water source.

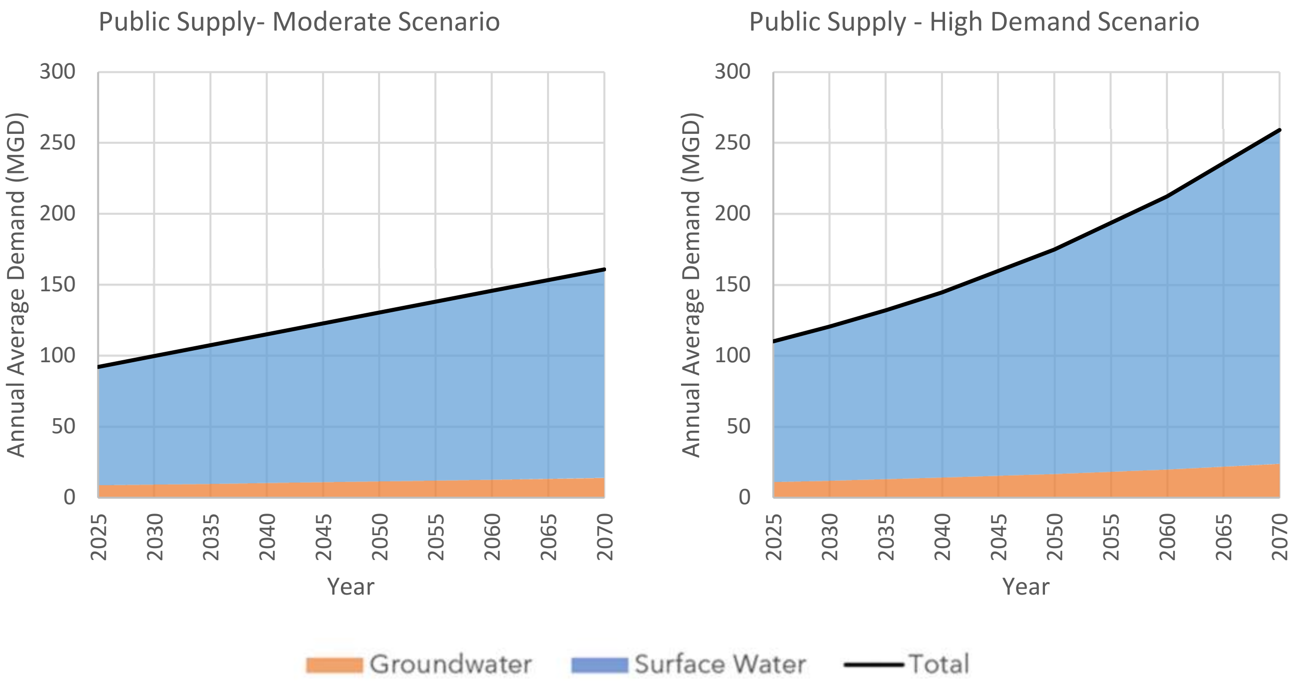


Figure 4-7. Santee River basin projected public supply water demands.

Table 4-6. Santee River basin projected public supply water demands.

Year	Moderate Demand Scenario (MGD)			High Demand Scenario (MGD)		
	Surface Water	Groundwater	Total	Surface Water	Groundwater	Total
2025	83.3	8.8	92.1	99.0	11.0	110.1
2030	90.3	9.3	99.6	108.4	12.1	120.4
2035	97.4	9.8	107.2	118.9	13.1	131.8
2040	104.6	10.4	115.0	130.5	14.1	144.6
2050	118.8	11.5	130.3	158.0	16.7	174.6
2060	132.9	12.7	145.6	192.3	19.9	212.2
2070	147.0	13.9	160.9	235.3	23.9	259.2
Percent Increase 2025-2070	**76%**	**58%**	**75%**	**138%**	**116%**	**135%**

4.4.2 Manufacturing Demand Projections

In the Santee River basin, manufacturing demands are projected to increase 94 percent between 2025 and 2070 (69 MGD to 134 MGD) in the Moderate Demand Scenario. In the High Demand Scenario, manufacturing demands are projected to increase 152 percent between 2025 and 2070 (99 MGD to 250 MGD). Projected 2070 manufacturing withdrawals for the Moderate and High Demand Scenarios are approximately 42 and 78 percent of currently permitted and registered manufacturing withdrawals, respectively. Figure 4-8 shows and Table 4-7 summarizes manufacturing demand projections.

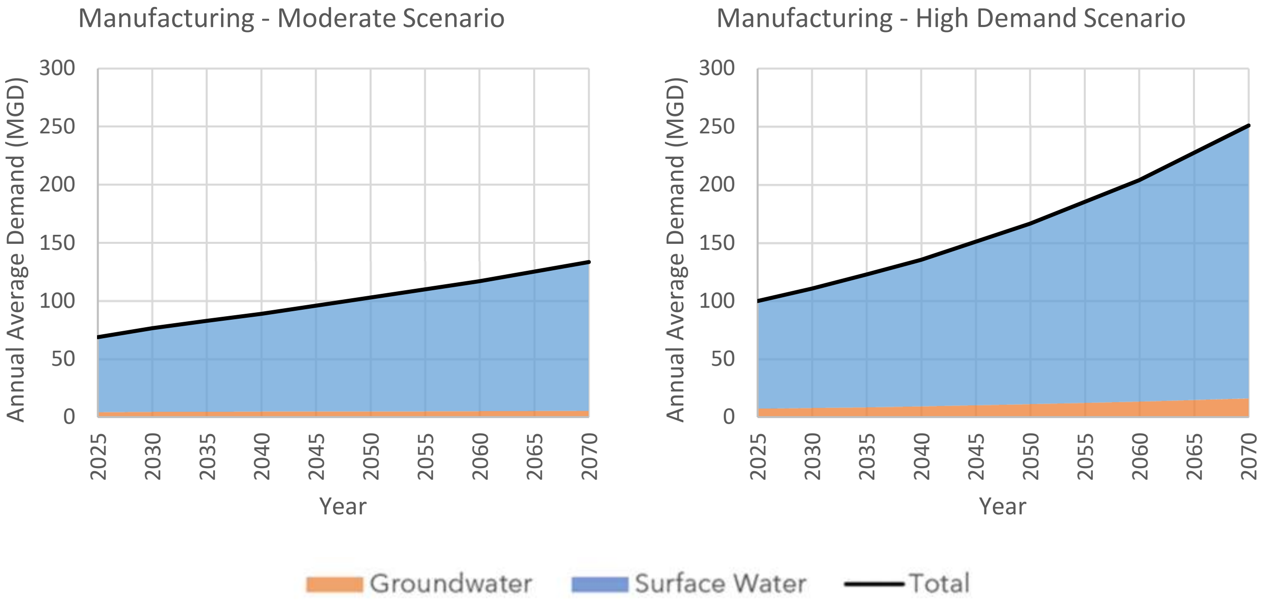


Figure 4-8. Santee River basin projected manufacturing water demands.

Table 4-7. Santee River basin projected manufacturing water demands.

Year	Moderate Demand Scenario (MGD)			High Demand Scenario (MGD)		
	Surface Water	Groundwater	Total	Surface Water	Groundwater	Total
2025	64.4	4.7	68.8	91.9	7.4	99.2
2030	71.7	4.6	76.4	101.9	8.0	109.9
2035	78.2	4.7	82.9	113.1	8.7	121.7
2040	84.1	4.8	89.0	125.1	9.4	134.5
2050	97.8	5.0	102.8	154.4	11.2	165.7
2060	111.6	5.3	116.9	189.6	13.5	203.1
2070	128.0	5.6	133.6	234.0	16.2	250.2
Percent Increase 2025-2070	**99%**	**27%**	**94%**	**155%**	**120%**	**152%**

4.4.3 Agriculture Demand Projections

In the Santee River basin, agriculture demands are projected to increase 34 percent between 2025 and 2070 (10 MGD to 14 MGD) in the Moderate Demand Scenario. In the High Demand Scenario, agriculture demands are projected to increase 39 percent between 2025 and 2070 (35 MGD to 49 MGD). Projected 2070 agriculture withdrawals for the Moderate and High Demand Scenarios are approximately 38 and 132 percent of currently permitted and registered agriculture withdrawals, respectively. Nearly all agriculture demands are projected to be met with groundwater. Figure 4-9 shows and Table 4-8 summarizes agriculture demand projections.

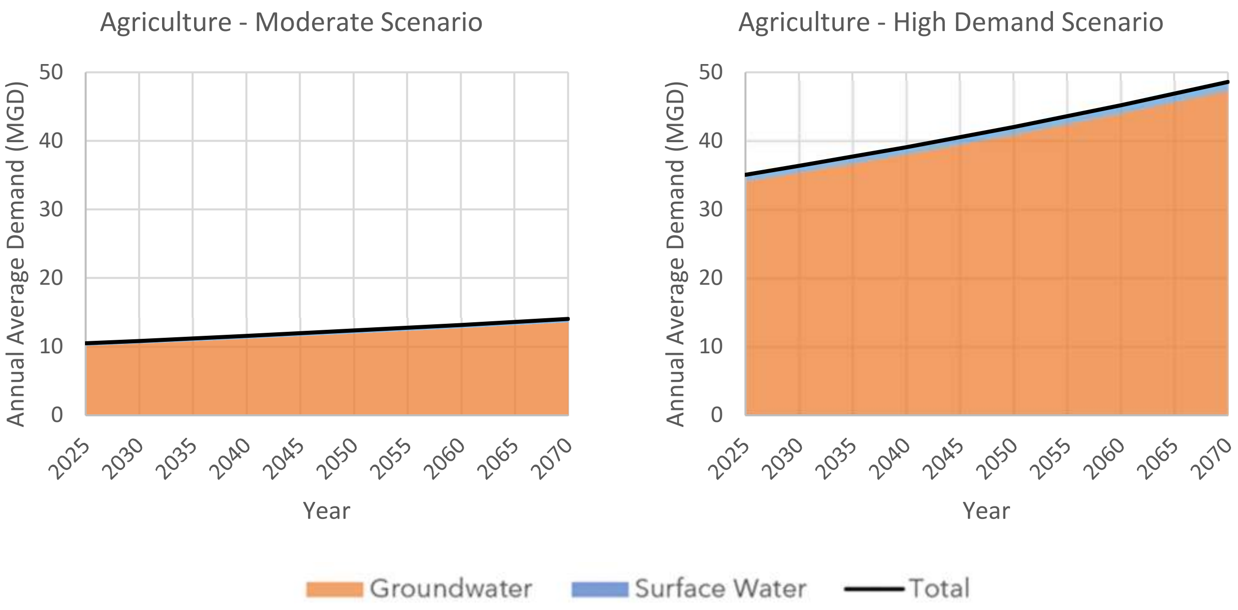


Figure 4-9. Santee River basin projected agriculture water demands.

Table 4-8. Santee River basin projected agriculture water demands.

Year	Moderate Demand Scenario (MGD)			High Demand Scenario (MGD)		
	Surface Water	Groundwater	Total	Surface Water	Groundwater	Total
2025	0.4	10.1	10.5	1.0	34.1	35.0
2030	0.4	10.4	10.8	1.0	35.3	36.3
2035	0.4	10.8	11.2	1.1	36.6	37.7
2040	0.4	11.1	11.6	1.1	38.0	39.1
2050	0.4	11.9	12.3	1.2	40.9	42.0
2060	0.5	12.7	13.2	1.3	43.9	45.2
2070	0.5	13.5	14.0	1.4	47.3	48.6
Percent Increase 2025-2070	**33%**	**34%**	**34%**	**38%**	**39%**	**39%**

4.4.4 Thermoelectric Demand Projections

In the Santee River basin, thermoelectric demands are projected to decrease 93 percent between 2025 and 2070 (403 MGD to 26 MGD) in the Moderate Demand Scenario and to decrease 95 percent between 2025 and 2070 (599 MGD to 31 MGD) in the High Demand Scenario. Winyah Station is projected to be decommissioned by 2030, and Williams Station is projected to be decommissioned by 2035, leaving only Cross Station with projected demands in 2070. Figure 4-10 shows and Table 4-9 summarizes thermoelectric demand projections.

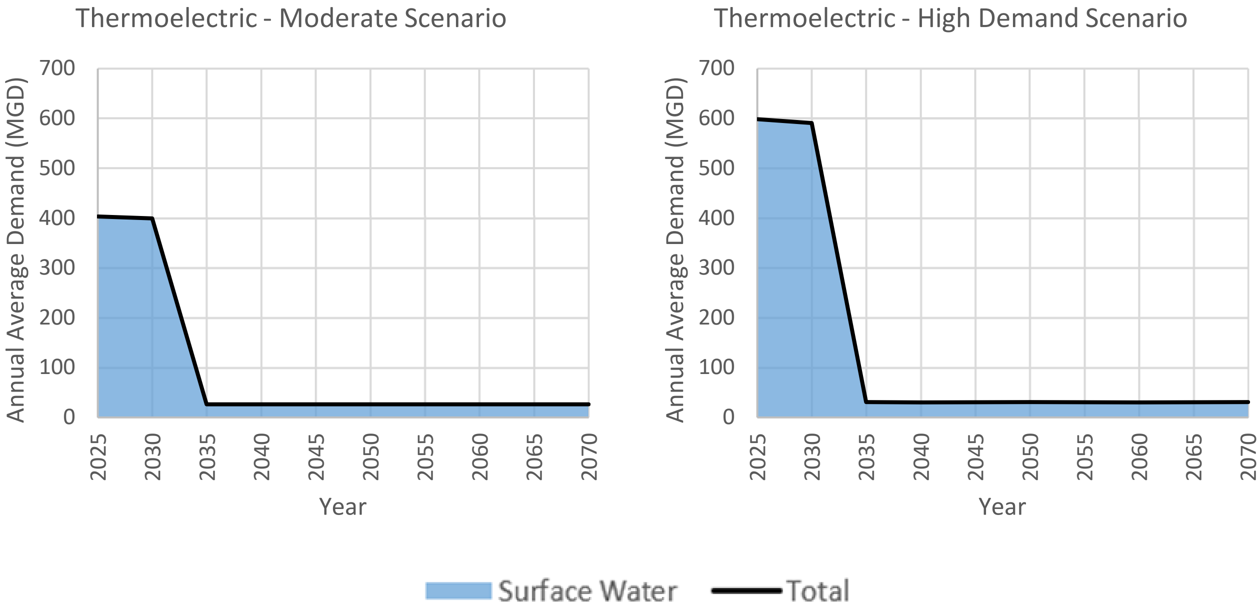


Figure 4-10. Santee River basin projected thermoelectric water demands.

Table 4-9. Santee River basin projected thermoelectric water demands.

Year	Moderate Demand Scenario (MGD)			High Demand Scenario (MGD)		
	Surface Water	Groundwater	Total	Surface Water	Groundwater	Total
2025	403.5	0.0	403.5	598.6	0.0	598.6
2030	399.1	0.0	399.1	590.1	0.0	590.1
2035	26.5	0.0	26.5	30.6	0.0	30.6
2040	26.5	0.0	26.5	30.5	0.0	30.5
2050	26.5	0.0	26.5	30.6	0.0	30.6
2060	26.5	0.0	26.5	30.5	0.0	30.5
2070	26.5	0.0	26.5	30.6	0.0	30.6
Percent Change 2025-2070	**-93%**	**-**	**-93%**	**-95%**	**-**	**-95%**

4.4.5 Other Demand Projections

Other demands are held constant into the future. Golf course demands were assumed to be 2.0 MGD and 4.1 MGD in the Moderate and High Demand Scenarios, respectively, over the planning horizon. Of this demand, approximately 85 percent is from groundwater. Mining demands were assumed to be 1.9 MGD and 3.0 MGD in the Moderate and High Demand Scenarios, respectively, with approximately two thirds coming from groundwater. Aquaculture demands were assumed to be 0.1 MGD and 0.3 MGD in the Moderate and High Demand Scenarios, respectively, with approximately one third coming from groundwater.

Demand projections were previously developed for the Broad, Saluda and Catawba River basins, which drain into the Santee River basin. Surface water modeling of the Moderate and High Demand Scenarios detailed in Chapter 5 incorporated the demand projections for these upstream basins, and their impact on flows entering the Santee River basin. In the Saluda and Broad River basins, demand projections for the Moderate and High Demand Scenarios were developed following the same methodology as was used for the Santee. The Catawba-Wateree Water Management Group (CWWMG), who is preparing an Integrated Water Resources Plan (IWRP) for the Catawba River basin, used different methodology for projecting demands through year 2075. The CWWMG's IWRP developed a single deterministic projection based on best estimates of future demand and a range of probabilistic projections to represent lower and higher ranges of possible future use considering uncertainties. The IWRP's 50th percentile projection is considered with the other basins' Moderate Demand Scenario projections, and the IWRP's 95th percentile projection is considered with the other basins' High Demand Scenario projections. The *Integrated Water Resources Plan: Water Demand Projection Updates* report summarizes additional information for water demand projections for the Catawba basin (HDR 2023).

Chapter 5

Comparison of Water Resource Availability and Water Demand

This chapter describes the methods used to assess surface water availability in the Santee River basin. A surface water quantity model was used to evaluate water availability using current and projected water demands. Water availability was also assessed assuming surface water withdrawals at permitted and registered amounts. The results of these assessments are presented and compared, and potential water shortages and issues are identified. No calibrated groundwater model was available for the Santee basin during this initial planning period; however, groundwater resources were evaluated by considering historical trends in aquifer levels and accounting for past, present, and projected future groundwater pumping.

5.1 Methodology

5.1.1 Surface Water

Surface water planning scenarios were constructed and simulated using the previously developed Santee River basin surface water quantity model (CDM Smith 2017b). This model was developed with CDM Smith's SWAM software. It simulates river basin hydrology, water availability, and water use across a dendritic network and over an extended timeseries.

SWAM was designed to provide efficient planning-level analyses of Surface Water Supply systems. Beginning with naturally occurring water flowing in the river reaches, it calculates physically and permitted or allowable water, diversions, storage, consumption, and return flows at user-defined nodes in a networked river system. A range of water user types can be represented in the model, including municipal water suppliers, agricultural irrigators, and industrial water users, with time-variable demands either prescribed by the user or, in some cases, calculated internally. Multiple layers of complexity are available as options in SWAM to allow for easy development of a range of systems, from the very simple to the more complex. As an example, SWAM's reservoir object can include only basic hydrology-dependent calculations (storage as a function of inflow, outflow, and evaporation) or can include operational rules of varying complexity: prescribed monthly releases, a set of prioritized monthly releases or storage targets, or a set of conditional release rules (dependent on hydrology). Municipal water conservation programs can similarly be simulated with sets of rules of varying complexity. The model user chooses the appropriate level of complexity given the modeling objectives and data availability.

The Santee River basin SWAM model simulates 37 years of variable historic hydrology (Jan 1982 through December 2019) with either a monthly or daily user-specified calculation timestep (the surface water scenarios presented in this chapter represent monthly analyses, unless noted otherwise). It is designed for three primary purposes:

- Accounting of current and past basin inflows, outflows, and consumptive uses
- Simulating streamflow and lake storage across a range of observed historical climate and hydrologic conditions, given current water use and operations
- Simulating future "what if" scenarios associated with changes in basin water use, management, and/or operations

The Santee River basin model includes four municipal, eight industrial, one mining, three golf course, four thermoelectric, one aquaculture, and nine discrete agricultural (irrigation) water users. Hydroelectric projects, which are not operated as strictly run-of-river model, are represented through a separate water user object, or through operating rules incorporated into reservoir objects. All water users with permitted withdrawals greater than 0.1 MGD are represented, either explicitly or implicitly. In the model version that represents current conditions, monthly water use is set equal to the average of a recent 10-year period (2010 through 2019) of reported use, with several exceptions. Exceptions include new surface water users and surface water users with recent demands that are significantly different from demands in the early part of the 10-year period. Model users also can adjust water use patterns to explore future water management scenarios, as discussed in this chapter.

A total of 17 "tributary objects" (rivers and streams) are represented discretely in the model, including the Mainstem Santee and Cooper Rivers. Boundary condition (headwater) flows for each tributary object are prescribed in the model based on external analyses (see CDM Smith 2017b), which estimated naturally-occurring historical flows "unimpaired" by human uses. Historic, current, and/or future uses then can be simulated against the same natural hydrology of the basin. Hydrologic flow gains (or losses) for each tributary are simulated in SWAM using lumped gain (or loss) factors, which are set based on a model calibration exercise, using gaged flow data, and/or guided by changes in reach drainage area. SWAM implicitly accounts for interaction between groundwater and surface water through the assignment of the gain/loss factors.

The Santee River basin SWAM model was used to simulate current and potential future scenarios to evaluate surface water availability. Chapter 5.3 provides detailed descriptions of the surface water scenarios and their results.

Following are several key terms of the surface water modeling, introduced in the Planning Framework, used throughout this chapter.

- **Physically Available Surface Water Supply** – The maximum amount of water that occurs 100 percent of the time at a location on a surface water body with no defined Surface Water Conditions applied on the surface water body.
- **Reach of Interest** – A stream reach defined by the RBC that experiences undesired impacts, environmental or otherwise, determined from current or future water demand scenarios or proposed water management strategies. Such reaches may or may not have identified Surface Water Shortages. The Santee RBC did not identify any Reaches of Interest in the Santee River basin.
- **Reservoir Safe Yield** – The Surface Water Supply for a reservoir or system of reservoirs over the simulated hydrologic period of record.

- **Strategic Node** – A location on a surface water body or aquifer designated to evaluate the cumulative impacts of water management strategies for a given model scenario and that serves as a primary point of interest from which to evaluate a model scenario's performance measures. The RBC selected the Strategic Nodes.

- **Surface Water Condition** – A limitation, defined by the RBC, on the amount of water that can be withdrawn from a surface water source and that can be applied to evaluate Surface Water Supply for planning purposes. The Santee RBC did not establish a Surface Water Condition for any location in the Santee River basin.

- **Surface Water Shortage** – A situation in which water demand exceeds the Surface Water Supply for any water user in the basin.

- **Surface Water Supply** – The maximum amount of water available for withdrawal 100 percent of the time at a location on a surface water body without violating any applied Surface Water Conditions on the surface water source and considering upstream demands.

5.1.2 Groundwater

No calibrated groundwater model was available for the Santee River basin during the planning period, but this did not eliminate groundwater management from the topics of discussion. Therefore, the RBC assessed groundwater availability generally based on a review of potentiometric maps, groundwater monitoring well data, groundwater development in the basin, groundwater concerns, and groundwater withdrawals by various water users and industries. Chapter 3.3 discusses potentiometric maps, monitoring data, development in the basin, and groundwater concerns. Chapter 4 discusses groundwater withdrawals and future demand projections.

5.2 Performance Measures

Performance measures were developed as a means for comparing water resource impacts (negative and positive) of each scenario. A performance measure is a quantitative measure of change in a user-defined condition from an established baseline, used to assess the performance of a proposed water management strategy or combination of strategies. Performance measures establish an objective means with which to compare scenarios. Performance measures were selected in collaboration with the RBC.

5.2.1 Hydrologic-based Performance Measures

Table 5-1 presents the hydrologic surface water performance measures used to evaluate and compare simulation results. For each simulated scenario, performance measures were calculated as a post-processing step in the modeling. All metrics were calculated for the entire simulation period. Changes in performance measures between scenarios were particularly useful for the planning process. The first set of performance metrics were calculated for model output nodes that were identified by the RBC as Strategic Nodes. These Strategic Nodes are distributed throughout the river basin. Strategic Nodes are defined at 6 of the USGS streamflow gaging stations in the basin as well as the inflow to Lake Marion. Figure 5-1 shows all Strategic Node locations.

Table 5-1. Surface water performance measures.

Strategic Node Metrics **(generated for each Strategic Node)**
Mean flow (cfs)
Median flow (cfs)
25th percentile flow (cfs)
10th percentile flow (cfs)
5th percentile flow (cfs)
Basinwide Metrics **(generated in aggregate for the entire modeled river basin)**
Total basin annual mean shortage (MGD) - Sum of the average shortage for all users over the simulation period
Maximum water user shortage (MGD) - Maximum monthly shortage experienced by any single user over the simulation period
Total basin annual mean shortage (% of demand) - Sum of the average shortage for all users over the simulation period divided by the sum of the average demand for all users over the simulation period
Average frequency of shortage (%) - Average frequency of shortage of all users who experience a shortage, where each user's frequency of shortage is calculated as the number of months with a shortage divided by the total months in the simulation (for a monthly timestep simulation)

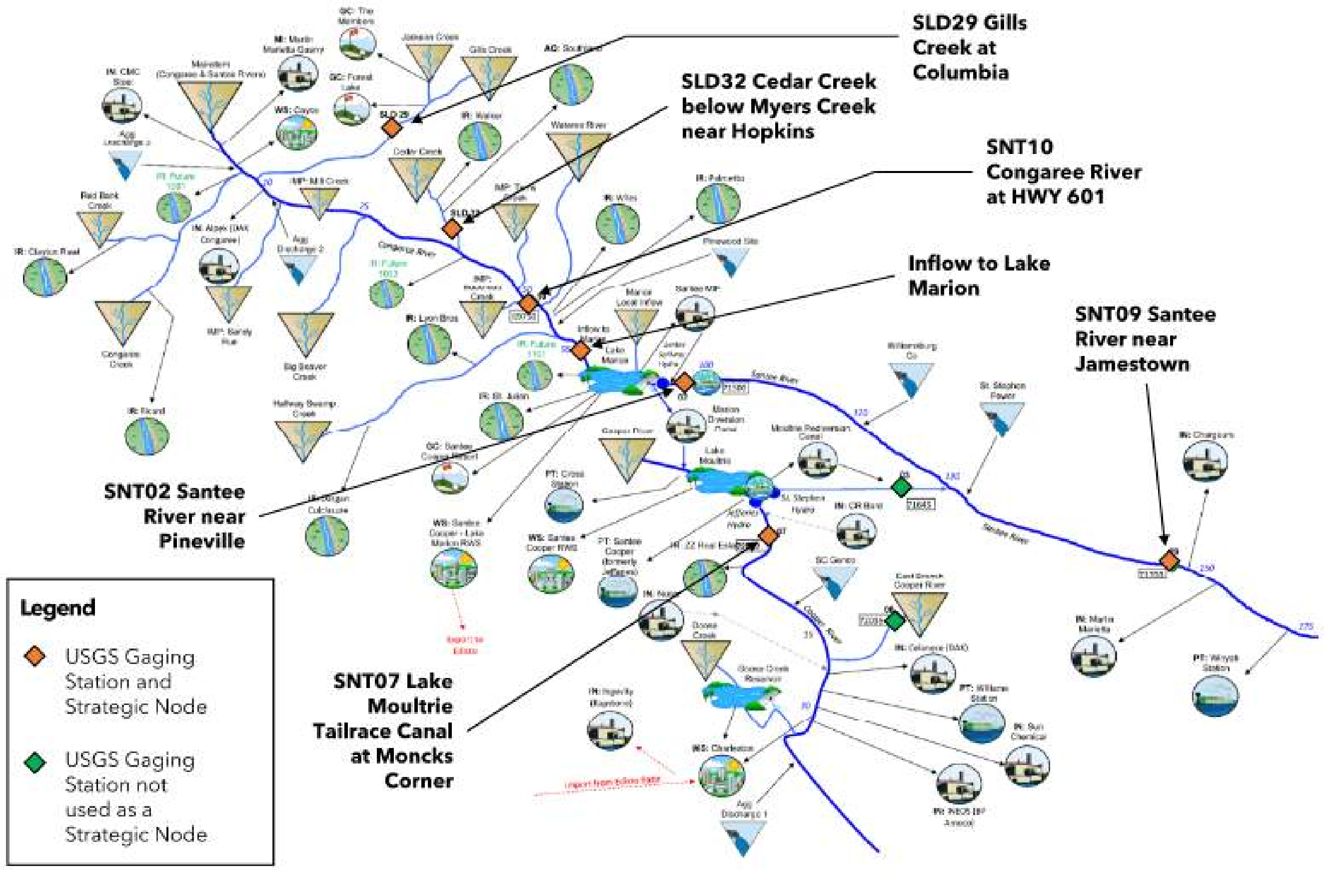


Figure 5-1. Strategic node locations.

5.2.2 Biological Response Metrics

Applying ongoing research at Clemson University, the RBCs in most of the state's river other basins had the opportunity to relate flow characteristics in streams to the quality of fish habitat. In a collaboration between Clemson, SCDNR, SCDHEC, The Nature Conservancy, and RTI International, nearly 1,000 fish and aquatic insect samples were combined with mean daily flow and other stream dynamics to create biological response metrics. Biological response metrics, such as species richness (the number of species found at a given site), were developed and combined with hydrologic metrics, such as mean daily flow or timing of lowest observed flow, to identify statistically significant relationships between flow characteristics and ecological suitability for fish and macroinvertebrates. These streamflow characteristics could be calculated from the SWAM model simulations to estimate how future demands may impact the ecology of the basin.

In most other river basins of the state, flow-ecology relationships were developed using data from streams and small rivers that are considered wadeable. In the Santee River basin, an analysis of the biological response metrics was not conducted because of the Santee RBC's expedited schedule and the fact that there are a limited number of wadeable streams in the basin where biological response metrics could be applied.

5.3 Scenario Descriptions and Surface Water Simulation Results

Four scenarios were used to evaluate surface water availability and to identify any anticipated Surface Water Shortages: the Current Surface Water Use Scenario (Current Scenario); the Permitted and Registered Surface Water Use Scenario (P&R Scenario); the Moderate Water Demand Scenario (Moderate Scenario); and the High Water Demand Scenario (High Demand Scenario). The Moderate Scenario was originally referred to as the Business-as-Usual Scenario in the Framework. The reasons for this are discussed in Section 5.3.5. The following scenarios were simulated over the approximately 37-year period of variable climate and hydrology spanning January 1982 to December 2019. All simulation results, except where noted, are based on model simulations using a monthly timestep.

Much of the hydrology in the Santee River basin depends on upstream basin hydrology (i.e., outputs from them and inputs to the Santee River basin), and this extends to how these basins are simulated with models. While the Broad and Saluda models were developed with the same SWAM software, methods, data, and assumptions as the Santee model, the two models used for water planning in the Catawba River basin were developed by different consultants working with different software. The Santee RBC was not involved in development or application of those models. Therefore, the results of modeling in the Santee River basin presented in this chapter are contingent on the appropriateness of assumptions, methods, and results of modeling in the Catawba River basin. Although the Catawba River basin planning effort used a different methodology to project moderate and high demands, the projected demands are deemed to be reasonably comparable to projected scenario demands in the Broad, Saluda, and Santee River basins. Chapter 4 discusses the development of projected demands in greater detail.

In every scenario, surface water availability for many users is heavily influenced by the operating rules of Lakes Marion and Moultrie. These reservoirs are required to release a certain amount of water depending on the time of year per their Federal Energy Regulatory Commission (FERC) license. The FERC license was recently updated in 2023 with new, significantly increased, minimum target releases. These increased minimum target releases increase the frequency and magnitude at which lake levels drop below their seasonal target elevations during periods of low upstream flow. More information on the updated FERC rules and their impacts is discussed in section 5.3.6.

5.3.1 Current Surface Water Use Scenario

The Current Scenario represents current operations, infrastructure, and water use in the Santee River basin. Water demands were generally set based on reported water usage in the 10-year period spanning 2010 to 2019, with several minor exceptions. This simulation provides information on the potential for Surface Water Shortages that could immediately result under a repeat of historic drought conditions in the basin and highlights the need for short-term planning initiatives, including the development of strategies to mitigate shortages and/or increase Surface Water Supply.

Tables 5-2 through 5-5 summarize simulation results (using a monthly timestep) for the Current Scenario assuming zero minimum instream flow requirements. Table 5-2 lists the surface water users with one or more months of a simulated Surface Water Shortage (6 of 35 users). Figure 5-2 shows the locations of these water users on the SWAM model framework. Also shown are the average annual demand for each water user experiencing a shortage; the minimum physically available (monthly average) flow at the point of withdrawal; the maximum (monthly average) shortage; and the frequency of shortage.

Two agricultural, two golf course, and two municipal water users experience simulated shortages. The golf course The Members is located adjacent to small impoundments that are not included in the model. The impoundments may provide enough water to prevent the projected physical shortages at times when Jackson Creek is simulated to have a very low flow. The agricultural water users with a simulated shortage on Halfway Swamp Creek do not have impoundments visible from aerial imagery, but Halfway Swamp Creek consists of numerous wetlands and braided channels that could temporarily provide water when river flow declines. The other shortages in the Current Scenario all occur because they withdraw from either Lake Marion or Lake Moultrie, which both drop to their deadpool for one month (a 0.2 percent shortage equates to one month in the monthly timestep model). When a lake hits its deadpool, water users are unable to withdraw from it. Santee Cooper has indicated that municipal water users on Lakes Marion and Moultrie have capability to withdraw slightly below the deadpool. These municipal water users are represented in the model as WS: Santee Cooper - Lake Marion RWS, and WS: Santee Cooper – RWS (which is on Lake Marion). Additionally, as modeled, water availability shortages for water users withdrawings from Lake Moultrie and Lake Marion are highly dependent on Santee Cooper's reservoir operations under low inflow conditions. This sensitivity is discussed further in Section 5.3.6. The results described here assume that fish passage releases are maintained until Lake Marion is approximately 1 foot below its rule curve. This approach is more aggressive in maintaining these releases than Santee Cooper's reservoir operations would likely be during periods of low inflow, and thus provides a conservative analysis of water availability in Santee Cooper's reservoirs during periods of severe drought. Operations that prioritize maintaining pool elevations at higher levels may reduce or eliminate the shortages from Lake Moultrie and Lake Marion.

Table 5-3 presents the mean flow, median flow, and Surface Water Supply at each Strategic Node. Also presented are the 25th, 10th, and 5th percentile flows, which are useful in characterizing low flows. Table 5-4 presents the basinwide performance metrics.

Table 5-2. Identified Surface Water Shortages, Current Scenario.

Water User Name	Source Water	Average Annual Demand (MGD)	Minimum Physically Available Flow (MGD)	Maximum Shortage (MGD)	Frequency of Shortage
WS: Santee Cooper - Lake Marion RWS	Mainstem	1.05	0.00	1.07	0.2%
GC: Santee-Cooper Resort	Mainstem	0.05	0.00	0.04	0.2%
GC: The Members	Jackson Creek	0.12	0.17	0.02	0.4%
IR: Dargan Culclasure	Halfway Swamp Creek	0.13	0.00	0.44	5.7%
IR: Lyons Bros	Halfway Swamp Creek	0.03	0.00	0.10	3.5%
WS: Santee Cooper RWS	Cooper River	21.60	0.00	20.01	0.2%

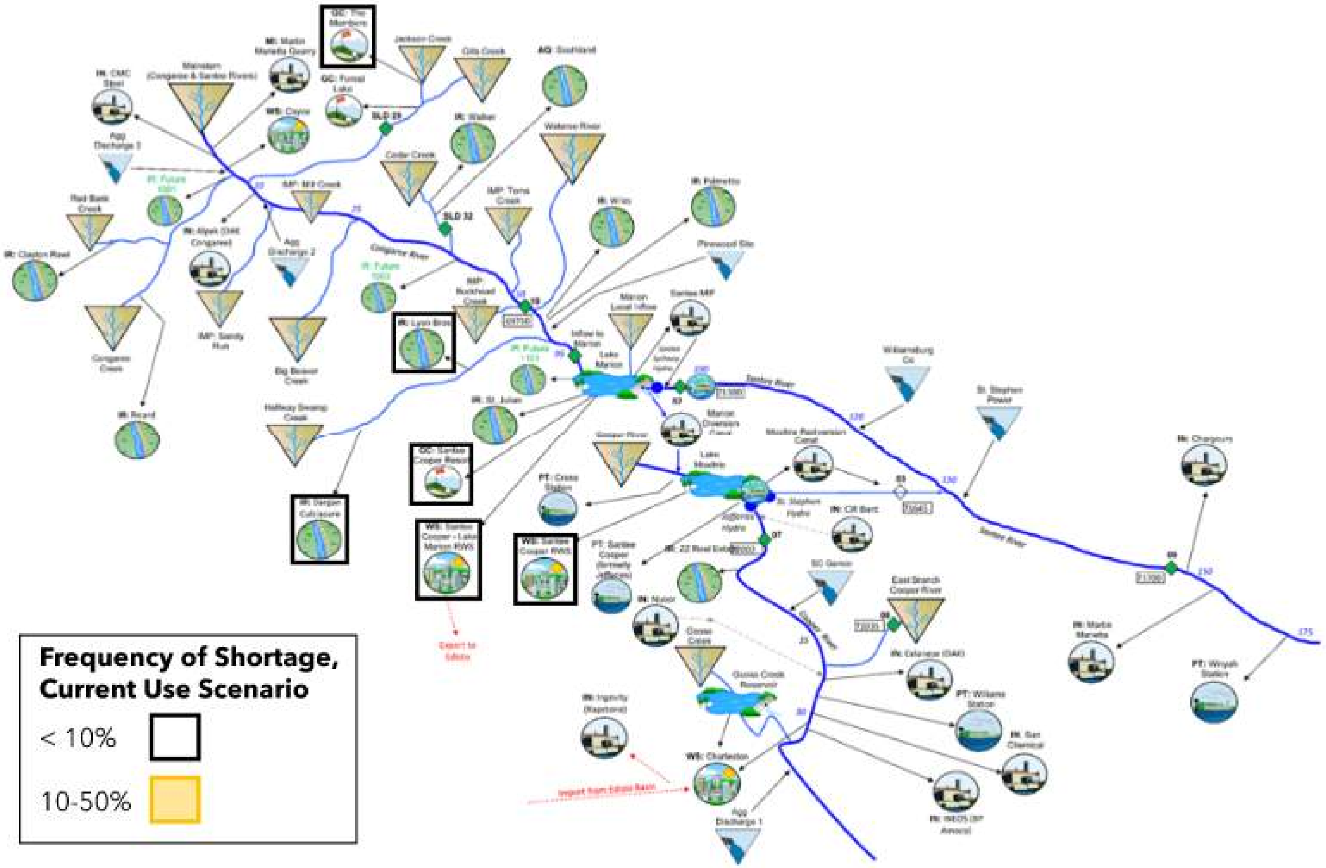


Figure 5-2. Water users with Surface Water Shortages and frequency of shortages, Current Scenario.

Table 5-3. Surface water model simulation results at Strategic Nodes, Current Scenario.

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs) 25th	10th	5th
SNT10 Congaree River at HWY 601	7,411	5,693	1,515	3,843	2,775	2,187
Inflow to Lake Marion	13,576	10,482	2,679	6,995	5,528	4,501
SNT02 Santee River near Pineville, SC	1,809	1,202	1[1]	1,201	601	601
SNT09 Santee River near Jamestown, SC	8,408	5,542	7[1]	1,653	642	628
SLD29 Gills Creek at Columbia	67	56	2	34	20	15
SLD32 Cedar Creek below Myers Creek near Hopkins	54	42	7	27	17	14
SNT07 Lake Moultrie Tailrace Canal at Moncks Corner, SC	5,168	5,087	4,502	4,841	4,653	4,546

1. Low surface water supply flows to the Santee downstream of Lakes Moultrie and Marion can be attributed to release rules on the lakes.

Table 5-4. Basinwide surface water model simulation results, Current Scenario.

Performance Measure	Result
Total basin annual mean shortage (MGD)	0.06
Maximum water user shortage (MGD)	20.01
Total basin annual mean shortage (% of demand)	0.01%
Percentage of water users experiencing shortage	18.8%
Average frequency of shortage (%)	0.3%

5.3.2 Permitted and Registered Surface Water Use Scenario

In the P&R Scenario, modeled demands were set to permitted or registered values for all water users. In other words, this simulation explored the question of, "What if all water users used the full volume of water allocated through permits and registrations?". The scenario provides information to determine whether surface water is currently over-allocated in the basin, and if so, where. The scenario also accounts for lower inflows into the Santee River basin resulting from surface water withdrawals in the upstream Saluda, Broad, and Catawba River basins simulated at their fully permitted and registered amounts.

Tables 5-5 and 5-6 summarize the simulation results for the P&R Scenario (monthly timestep). In this scenario, river flows are predicted to decrease, compared to the Current Scenario, throughout the basin, resulting in Surface Water Shortages for several surface water users. Table 5-5 lists only the surface water users with one or more months of a simulated Surface Water Shortage. Figure 5-3 shows locations of these water users on the SWAM model framework. Also shown are the average annual demand for each water user experiencing a shortage; the minimum physically available (monthly average) flow at the point of withdrawal; the maximum (monthly average) shortage; and the frequency of shortage.

Table 5-5. Identified Surface Water Shortages, P&R Scenario.

Water User Name	Source Water	Average Annual Demand (MGD)	Minimum Physically Available Flow (MGD)	Maximum Shortage (MGD)	Frequency of Shortage (%)
IR: St. Julian	Mainstem	1	0.00	0.91	1.3%
WS: Santee Cooper - Lake Marion RWS	Mainstem	26	0.00	25.83	1.8%
GC: Santee-Cooper Resort	Mainstem	1	0.00	0.90	1.5%
PT: Winyah Station	Mainstem	129	2.35	127.08	1.5%
GC: The Members	Jackson Creek	1	0.17	0.49	1.1%
IR: Dargan Culclasure	Halfway Swamp Creek	1	0.00	0.97	16.4%
IR: Lyons Bros	Halfway Swamp Creek	0.3	0.00	0.30	9.0%
WS: Santee Cooper RWS	Cooper River	77	0.00	77.50	2.4%

IR = agricultural (irrigation) water user; WS = water supply water user; GC = golf course water user, PT: thermoelectric power water user
.

Table 5-6 presents the mean flow, median flow, and Surface Water Supply at each Strategic Node. Also presented are the 25th, 10th, and 5th percentile flows, which are useful in characterizing low flows. Table 5-7 shows the percent decrease in P&R Scenario flow statistics compared to the Current Scenario. Modeled reductions are most pronounced during low-flow periods. At the most upstream Strategic Node on the Congaree River (SNT10) median flows are predicted to decrease by approximately 15 percent, and low flows by about 41 percent. At the most downstream Strategic Node on the Santee River (SNT09) median flows are predicted to decrease by approximately 48 percent, and low flows by about 36 percent. The impact of full allocation withdrawals on downstream water users is evident in the predicted increase in mean annual water shortage and the increase in the number and frequency of water users experiencing a shortage during the simulation period, as shown in Table 5-8. As explained in Chapter 4, the P&R withdrawal rates greatly exceed current use rates. Despite the low likelihood of the P&R Scenario, results demonstrate that portions of the basin are over-allocated based on existing permit and registration amounts. Many users were issued permits prior to implementation of the 2011 Surface Water Withdrawal, Permitting, Use, and Reporting Act and have permits based on the maximum volume of their intake rather than safe yield calculations.

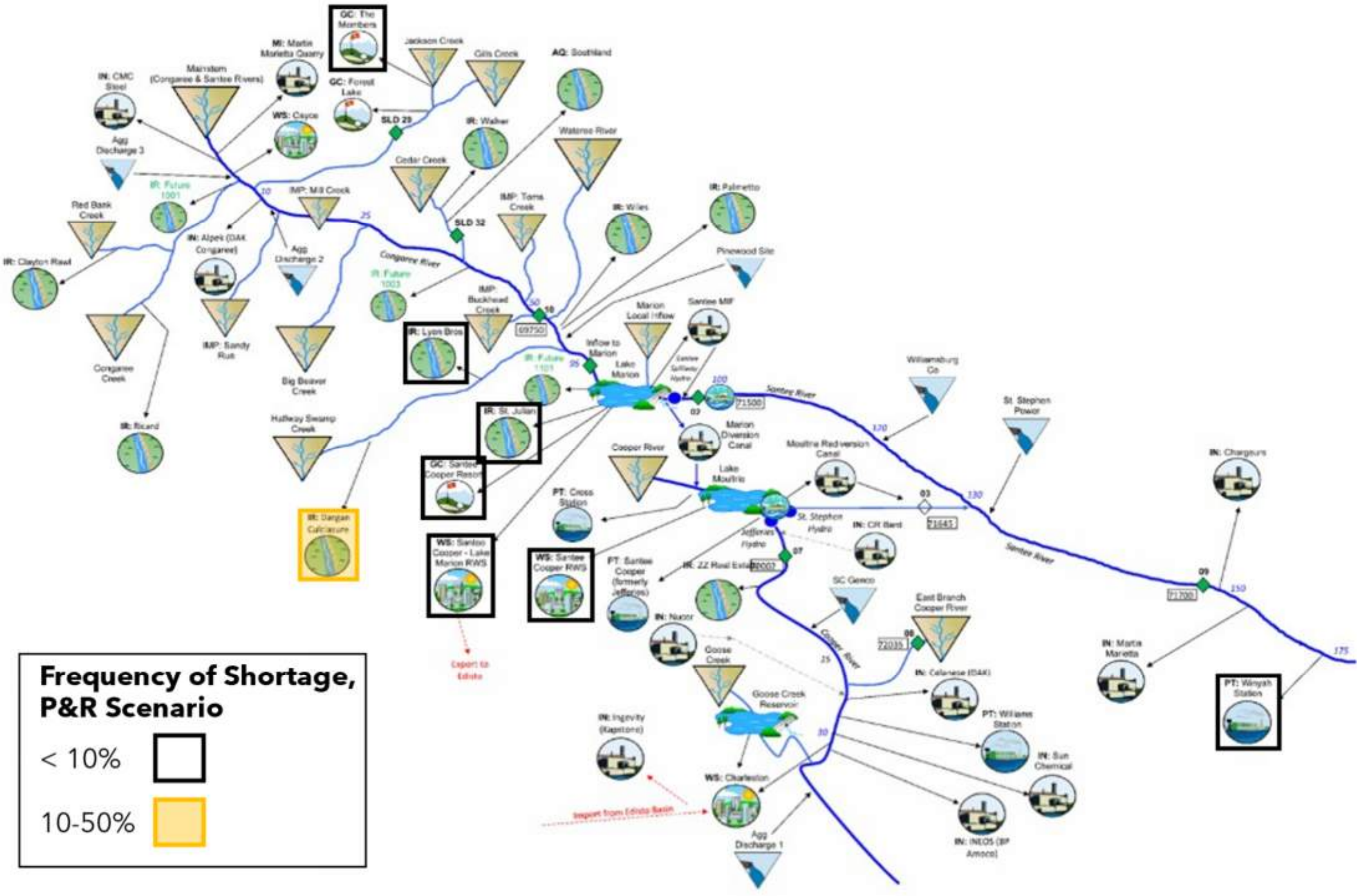


Figure 5-3. Water users with Surface Water Shortages and frequency of shortages, P&R Scenario.

Table 5-6. Surface water model simulation results at Strategic Nodes, P&R Scenario.

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
SNT10 Congaree River at HWY 601	6640	4830	896	3133	2128	1679
Inflow to Lake Marion	12232	9260	2111	6081	4629	3714
SNT02 Santee River near Pineville, SC	1407	1201	0	603	601	601
SNT09 Santee River near Jamestown, SC	6970	2897	5	659	631	619
SLD29 Gills Creek at Columbia	66	55	2	33	19	14
SLD32 Cedar Creek below Myers Creek near Hopkins	53	41	6	26	16	12
SNT07 Lake Moultrie Tailrace Canal at Moncks Corner, SC	21	9	0	2	1	0

Table 5-7. Percent change in P&R Scenario flows at Strategic Nodes relative to Current Scenario flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
SNT10 Congaree River at HWY 601	-10%	-15%	-41%	-18%	-23%	-23%
Inflow to Lake Marion	-10%	-12%	-21%	-13%	-16%	-17%
SNT02 Santee River near Pineville, SC	-22%	0%	-85%	-50%	0%	0%
SNT09 Santee River near Jamestown, SC	-17%	-48%	-36%	-60%	-2%	-1%
SLD29 Gills Creek at Columbia	-2%	-2%	-13%	-4%	-3%	-7%
SLD32 Cedar Creek below Myers Creek near Hopkins	-2%	-3%	-16%	-4%	-8%	-11%
SNT07 Lake Moultrie Tailrace Canal at Moncks Corner, SC	-6%	-5%	-68%	-6%	-6%	-6%

Table 5-8. Basinwide surface water model simulation results, P&R Scenario.

Performance Measure	Result
Total basin annual mean shortage (MGD)	4.19
Maximum water user shortage (MGD)	127.08
Total basin annual mean shortage (% of demand)	0.19%
Percentage of water users experiencing shortage	24.2%
Average frequency of shortage (%)	1.1%

5.3.3 Moderate Water Demand Projection Scenario

For the Moderate Scenario, modeled demands were set to projected future levels based on an assumption of moderate population and economic growth, as described in Chapter 4.3. The Moderate Scenario explores a plausible future where water demands increase with moderate population growth and climate change impacts are negligible, in both the short- and long-term. The year 2070 planning horizon was targeted using the demand projections developed by SCDES and presented in Chapter 4.4. At the request of the RBC, flows at the Mainstem headwaters tributary object at the top of the model were decreased by 62 cfs to reflect a recently proposed future expansion of the VC Summer Nuclear Generating Plant. This plant is in the Broad River Basin, but impacts of the expansion were not included in the Broad scenario models.

Tables 5-9 through 5-12 summarize the Moderate 2070 Scenario (monthly timestep) simulation results for the 2070 planning horizon. Calculated water shortages in the Moderate 2070 Scenario exist for the same six water users that also experience shortages in the Current Scenario. Most of the water users experiencing a shortage see little change in the max shortage and frequency of shortage between the Current and Moderate 2070 Scenario, except WS: Santee Cooper RWS. This municipal water user has a 22.6 MGD increase in max shortage, however the frequency of shortage remains the same. Figure 5-4 shows the locations of these water users on the SWAM model framework.

In the Moderate 2070 Scenario, flows remain fairly constant compared to the Current Scenario. Strategic Nodes SLD29 and SLD32 are located downstream of golf course and agricultural water users, which withdraw so little that they do not impact minimum flows in the Moderate 2070 Scenario. Flows at Strategic Nodes downstream of Lakes Marion and Moultrie are controlled by releases from the lakes. The SWAM model attempts balance lake levels by adjusting the flow from Lake Marion to Lake Moultrie, which at the monthly timestep causes slightly different lake elevations for each scenario. Especially for SNT02 and SNT09, small changes in lake elevation can trigger releases from either lake, significantly impacting the surface water supply flows downstream. For the Moderate 2070 Scenario, lake levels were slightly higher in the month prior to when the lakes first hit their deadpool, November 2007, when compared to the Current Scenario. Therefore, Lake Marion was able to release more flow to the Santee River before it hit its deadpool. This impact can be seen in the change in surface water supply for SNT02 (which increases from about 1 cfs to 56 cfs) and SNT09 (which increases from about 7 cfs to 63 cfs). More discussion on regulated releases of these lakes can be found in Section 5.3.6. Overall, the median flow on the most downstream strategic node of the mainstem, SNT09 decreases by about 7 percent.

Table 5-9. Identified Surface Water Shortages, Moderate 2070 Scenario.

Water User Name	Source Water	Average Annual Demand (MGD)	Minimum Physically Available Flow (MGD)	Maximum Shortage (MGD)	Frequency of Shortage (%)
WS: Santee Cooper - Lake Marion RWS	Mainstem	2.94	0.0	2.72	0.2%
GC: Santee-Cooper Resort	Mainstem	0.03	0.0	0.02	0.2%
GC: The Members	Jackson Creek	0.12	0.2	0.02	0.2%
IR: Dargan Culclasure	Halfway Swamp Creek	0.12	0.0	0.48	5.5%
IR: Lyons Bros	Halfway Swamp Creek	0.01	0.0	0.06	2.6%
WS: Santee Cooper RWS	Cooper River	45.35	0.0	42.61	0.2%

IR = agricultural (irrigation) water user; WS = water supply water user; GC = golf course water user

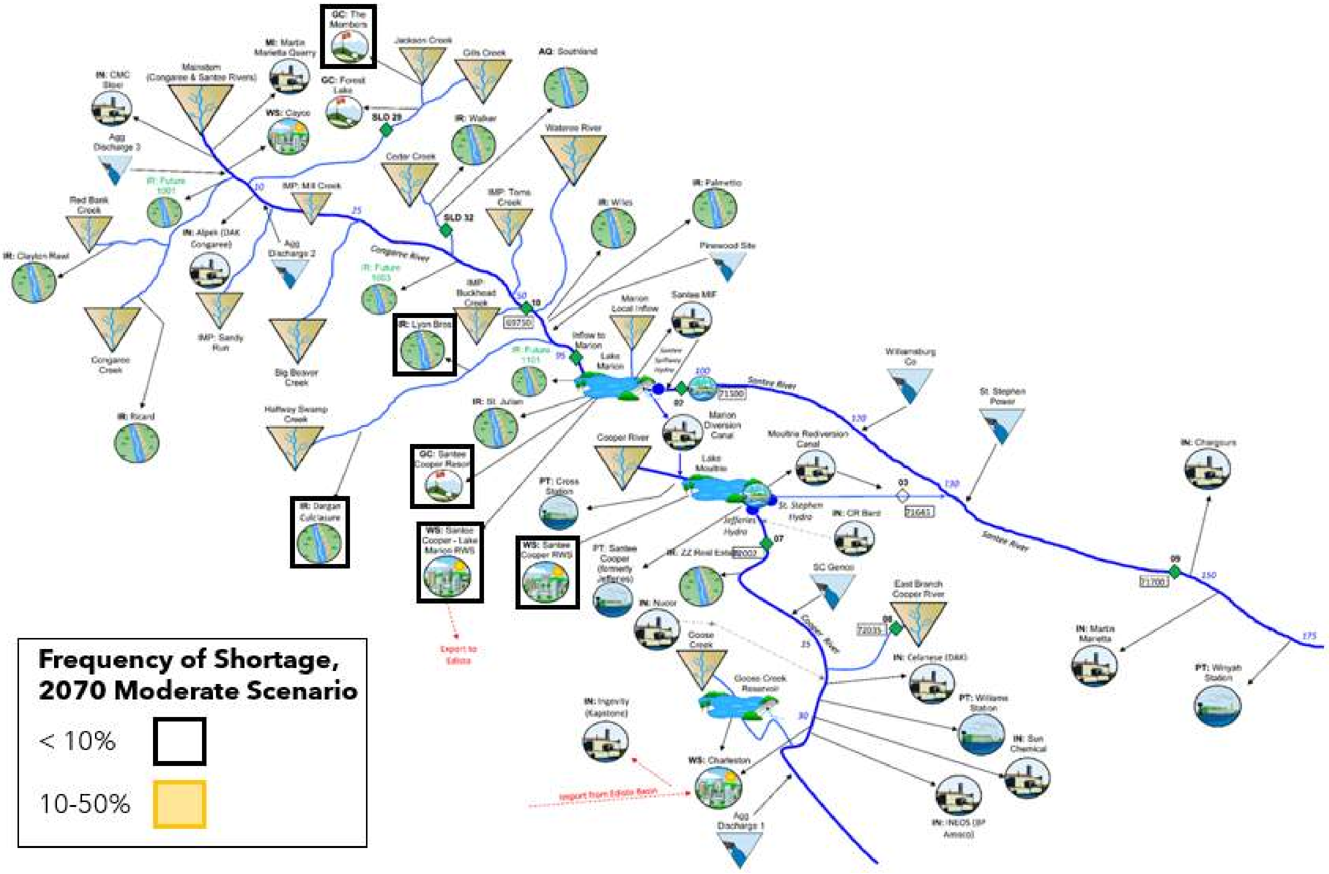


Figure 5-4. Water users with Surface Water Shortages and frequency of shortages, Moderate 2070 Scenario.

Table 5-10. Surface water model simulation results at Strategic Nodes, Moderate 2070 Scenario.

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
SNT10 Congaree River at HWY 601	7,351	5,637	1,465	3,795	2,697	2,136
Inflow to Lake Marion	13,322	10,286	2,655	6,983	5,495	4,511
SNT02 Santee River near Pineville, SC	1,780	1,202	56	1,201	601	601
SNT09 Santee River near Jamestown, SC	8,117	5,162	63	1,240	640	625
SLD29 Gills Creek at Columbia	67	56	2	34	20	15
SLD32 Cedar Creek below Myers Creek near Hopkins	54	42	7	27	17	14
SNT07 Lake Moultrie Tailrace Canal at Moncks Corner, SC	5,170	5,087	4,504	4,843	4,655	4,548

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Table 5-11. Percent change in Moderate 2070 Scenario flows at Strategic Nodes relative to Current Scenario flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
SNT10 Congaree River at HWY 601	-0.8%	-1.0%	-3.3%	-1.3%	-2.8%	-2.4%
Inflow to Lake Marion	-1.9%	-1.9%	-0.9%	-0.2%	-0.6%	0.2%
SNT02 Santee River near Pineville, SC	-1.6%	0.0%	6993.6%[1]	0.0%	0.0%	0.0%
SNT09 Santee River near Jamestown, SC	-3.5%	-6.9%	752.0%[1]	-25.0%	-0.3%	-0.5%
SLD29 Gills Creek at Columbia	0.0%	0.0%	0.1%	0.1%	0.0%	0.1%
SLD32 Cedar Creek below Myers Creek near Hopkins	0.0%	0.1%	0.5%	0.2%	0.2%	0.3%
SNT07 Lake Moultrie Tailrace Canal at Moncks Corner, SC	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

1. Increase in surface water supply due to Lake Marion release rules at time of drought of record.

Table 5-12. Basinwide surface water model simulation results, Moderate 2070 Scenario.

Performance Measure	Result
Total basin annual mean shortage (MGD)	0.11
Maximum water user shortage (MGD)	42.61
Total basin annual mean shortage (% of demand)	0.03%
Percentage of water users experiencing shortage	18.2%
Average frequency of shortage (%)	0.3%

5.3.4 High Water Demand Projection Scenario

The High Demand Scenario projections are based on, and begin with, each user's maximum recent use. The modeled demands are then set to the 90th percentile of variability in reported withdrawals for each user. The projections are based on aggressive growth within the range of uncertainty of the referenced driver variable projections, as described in Chapter 4. The projections were further increased by the addition of a 69 cfs decrease in Mainstem headwater flows to reflect a recently proposed future expansion of the VC Summer Nuclear Generating Plant, as discussed in Section 5.3.3.. Like the Moderate Scenario, a year 2070 planning horizon was targeted using the demand projections developed by SCDNR. This set of scenarios represents the combined impacts of all sectors experiencing high growth and all water users experiencing conditions of high water demand. These assumptions are intended to represent an unlikely maximum for total water demand; it is very unlikely these demands would occur month after month and year after year for all water users. The purpose of this scenario is to provide the RBC with information on which to base conservative management strategies. Other methods and assumptions used in constructing the High Demand 2070 Scenario were the same as for the Moderate Scenario.

Tables 5-13 through 5-16 summarize the High Demand 2070 Scenario (monthly timestep) simulation results for the 2070 planning horizon. The same six water users with shortages in the Moderate 2070 Scenario exhibit shortages under the High Demand 2070 Scenario, albeit with a greater magnitude. Figure 5-5 shows the locations of these water users on the SWAM model framework.

In the High Demand 2070 Scenario, river flows are predicted to decrease moderately to substantially, compared to the Current Scenario, throughout the basin. Median flows at the most downstream site of the Mainstem (SNT09) are predicted to decrease by approximately 19 percent, based on 2070 demands. Regulated releases cause SNT02 to increase its surface water supply flows, however both the Current and High Demand 2070 Scenario surface water supply flows round to 1 cfs.

Table 5-13. Identified Surface Water Shortages, High Demand 2070 Scenario.

Water User Name	Source Water	Average Annual Demand (MGD)	Minimum Physically Available Flow (MGD)	Maximum Shortage (MGD)	Frequency of Shortage (%)
WS: Santee Cooper - Lake Marion RWS	Mainstem	4.44	0.0	4.14	0.2%
GC: Santee-Cooper Resort	Mainstem	0.16	0.0	0.15	0.2%
GC: The Members	Jackson Creek	0.23	0.2	0.18	0.4%
IR: Dargan Culclasure	Halfway Swamp Creek	0.23	0.0	0.79	6.8%
IR: Lyons Bros	Halfway Swamp Creek	0.04	0.0	0.15	3.9%
WS: Santee Cooper RWS	Cooper River	68.35	0.0	70.67	0.9%

IR = agricultural (irrigation) water user; WS = water supply water user; GC = golf course water user

Table 5-14. Surface water model simulation results at Strategic Nodes, High Demand 2070 Scenario.

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
SNT10 Congaree River at HWY 601	7,330	5,644	1,492	3,798	2,698	2,155
Inflow to Lake Marion	12,996	9,979	2,679	6,902	5,299	4,321
SNT02 Santee River near Pineville, SC	1,741	1,201	1	1,201	601	601
SNT09 Santee River near Jamestown, SC	7,754	4,515	8	1,229	637	624
SLD29 Gills Creek at Columbia	67	56	2	33	20	15
SLD32 Cedar Creek below Myers Creek near Hopkins	54	41	7	27	17	13
SNT07 Lake Moultrie Tailrace Canal at Moncks Corner, SC	5,168	5,089	3,905	4,841	4,648	4,550

Table 5-15. Percent change in High Demand 2070 Scenario flows at Strategic Nodes relative to Current Scenario flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
SNT10 Congaree River at HWY 601	-1.1%	-0.9%	-1.5%	-1.2%	-2.8%	-1.5%
Inflow to Lake Marion	-4.3%	-4.8%	0.0%	-1.3%	-4.1%	-4.0%
SNT02 Santee River near Pineville, SC	-3.7%	0.0%	87.2%	0.0%	0.0%	0.0%
SNT09 Santee River near Jamestown, SC	-7.8%	-18.5%	5.3%	-25.7%	-0.7%	-0.6%
SLD29 Gills Creek at Columbia	-0.5%	-0.3%	-12.5%	-1.0%	-2.1%	-2.1%
SLD32 Cedar Creek below Myers Creek near Hopkins	-0.4%	-0.8%	-3.4%	-0.9%	-1.4%	-2.3%
SNT07 Lake Moultrie Tailrace Canal at Moncks Corner, SC	0.0%	0.0%	-13.3%	0.0%	-0.1%	0.1%

Table 5-16. Basinwide surface water model simulation results, High Demand 2070 Scenario.

Performance Measure	Result
Total basin annual mean shortage (MGD)	0.53
Maximum water user shortage (MGD)	76.07
Total basin annual mean shortage (% of demand)	0.08%
Percentage of water users experiencing shortage	18.2%
Average frequency of shortage (%)	0.4%

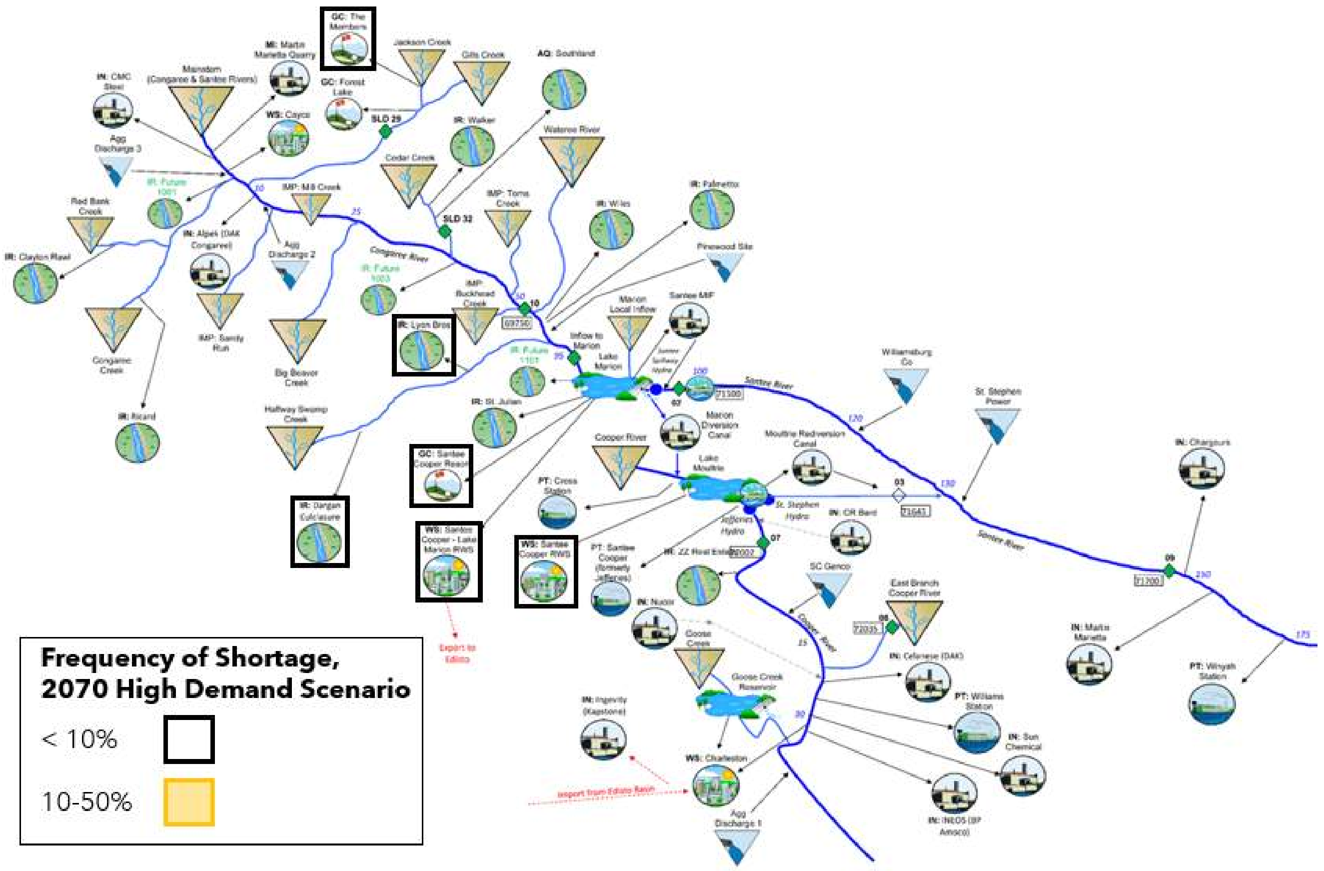

Figure 5-5. Water users with Surface Water Shortages and frequency of shortages, High Demand 2070 Scenario.

5.3.5 Unimpaired Flow Scenario

An analysis of unimpaired flows was not conducted in the Santee River basin. An Unimpaired Flow Scenario would consist of setting water demands and discharges in the model to zero and removing all manmade waterbodies from the river basin. In other words, results would represent "naturalized" surface water conditions in the basin. Lakes Marion and Moultrie contain diversion canals that significantly alter the flow patterns to both the Santee and Cooper Rivers. Removing the impact of these diversion canals would create conditions so far from today's reality that the RBC determined such a scenario would offer limited practical value. Therefore, the RBC opted to not conduct this scenario.

5.3.6 Minimum Instream Flows

As previously mentioned, Lakes Marion and Moultrie are required to release a certain amount of water into the Santee and Cooper Rivers depending on the time of year as directed by their FERC license. Per the updated FERC license, the target weekly minimum release from Lake Marion to the Santee River is 2,400 cfs in December through April and 1,200 cfs the rest of the year. When Lake Marion drops below its operating curve range for an extended time period, the target minimum release drops to 600 cfs. The required weekly average minimum release from Lake Moultrie to the Cooper River is 4,500 cfs. An additional 5,600 cfs is released from Lake Moultrie into the Santee River via the Rediversion Canal to support fish passage operations at the St. Stephen Hydroelectric Station in March, April, and part of May.

The 4,500 cfs weekly average discharge from the Jefferies Hydroelectric Generating Station into the Cooper River is intended to prevent saltwater from migrating up the Cooper River. The 5,600 cfs release from the St. Stephen Hydroelectric Generating Station is for fish passage and is routed through the Rediversion Canal back to the Santee River. Santee Cooper has the ability to reduce the 5,600 cfs release when necessary to preserve reservoir levels, meet the other target minimum releases, or ensure adequate water is available for the Lake Marion and Lake Moultrie RWS withdrawals.

Through discussions with Santee Cooper staff, a simplified version of the new FERC rules was included in the SWAM Model. One component of the FERC rules is reduction of target weekly releases based on the duration of time over which the reservoirs drop below a certain threshold. For example, in the case of a "flash drought", a period for when Lake Marion's water elevation drops below its operating range for 2 consecutive weeks or up to 2 months, flow can be reduced in the Rediversion Canal to help meet minimum flow requirements to the Santee and Cooper Rivers. This can be challenging to account for in the SWAM Model, which typically uses monthly timesteps for most water planning purposes. Therefore, a simplified version of the FERC rules was created based solely on lake elevation. Figure 5-6 shows Lake Marion's operating curve, taken from the Santee Low Flow and Contingency Plan (Santee Cooper 2024) and with notes detailing how SWAM Model Release rules were created based on lake elevation.

Operators of the lakes are able to adjust release rates on a daily or hourly basis, which provides more flexibility in downstream flow maintenance than what is approximated with the monthly timestep scenario modeling.

Lakes Marion and Moultrie are hydraulically connected, and thus their pool elevations are typically close to the same elevation. For the Santee Model, the lakes were modeled as two separate objects with release triggers intended to equalize flow as much as possible under normal conditions.

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Last Revised 11/13/2024

	Curve	Curve Triggers
━ ━	Top of Operating Range	Full pool, lake at capacity
━	Rule Curve	Normal operating target elevation
━	1/2' from bottom of Operating Range	Fish Passage flow is cut off if Lake drops below this curve
━ ━	Bottom of Operating Range	Flow to Santee reduced to 600 cfs if Lake drops below this curve
━	Deadpool	All flow to Santee from Lake Marion is cut off if Lake drops to just above this curve

Figure 5-6 Rule Curves of Lakes Marion and Moultrie, and how the Curves effect the SWAM Model.

To track the ability of Lakes Marion and Moultrie to meet the FERC license minimum target releases, instream flow objects were added to the model. These objects operate similar to gages, in that they track the amount of flow passing through a certain stream location in the model. However, instream flow objects have additional capability to compare flows based on certain rules and track instances when the flow cannot meet such rules. In the Santee Model, three instream flow objects were added tracking target minimum release for as follows, which are also shown in Figure 5-7:

- Santee River ISF – Lake Marion to the Santee River
- St. Stephen ISF – Lake Moultrie to Santee River (for fish passage)
- Jefferies Hydro ISF - Lake Moultrie to Cooper River (to prevent saltwater migration)

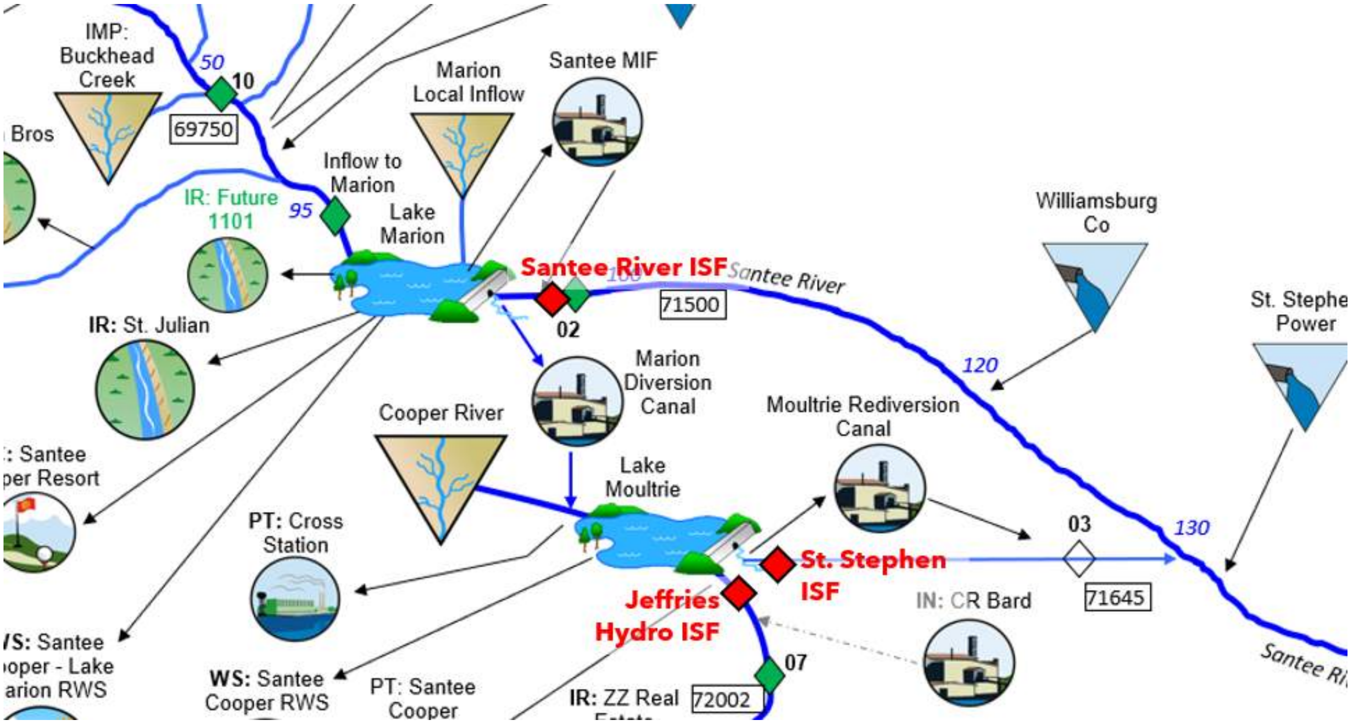


Figure 5-7. Location of Instream Flow Objects in the Santee Model.

Table 5-17 shows shortages at the three instream flow objects in the Santee River basin across the current, Moderate 2070, and High Demand 2070 Scenarios. The max shortage for the Santee River ISF is about 1,800 cfs, which occurs at a time of the year when Lake Marion's target minimum release to the Santee is 2,400 cfs, but the Lake is below the bottom of its operating curve, prompting the lake to release only 600 cfs. This shortage aligns with the provisions of Santee Cooper's Low Inflow & Drought Contingency Plan, which allows for minimum flows in the Santee River to be reduced during periods of low inflow. For all scenarios, there is one month in which Lake Marion reaches its deadpool and is thus not able to release even 600 cfs: November 2007. Since the target release is 1,200 cfs in November, this shortage does not appear as a max shortage in the table.

The shortage at Jefferies Hydro ISF suggests that it is just slightly unable to meet the target flow requirement in order to prevent saltwater migration at the mouth of the Cooper River in current conditions. This shortage increases in the Moderate and High Demand Scenarios.

Table 5-17. Instream Flow Object Shortages, Per Scenario.

Performance Measure		Current	2070 Mod	2070 HD
Santee River ISF[1]	frequency of shortage	22.1%	23.5%	24.3%
	mean shortage (cfs)	205	213	223
	max shortage (cfs)	1,799	1,799	1,799
Jefferies Hydro ISF	frequency of shortage	0.4%	0.4%	1.1%
	mean shortage (cfs)	0.0	0.6	4.5
	max shortage (cfs)	15	275	1,022
St. Stephen ISF	frequency of shortage	8.1%	8.6%	9.4%
	mean of shortage (cfs)	373	396	428
	max shortage (cfs)	5,598	5,599	5,599

1. When Lake Marion drops below its operating curve, the target minimum release drops to 600 cfs, which is classified as a shortage by Santee River ISF.

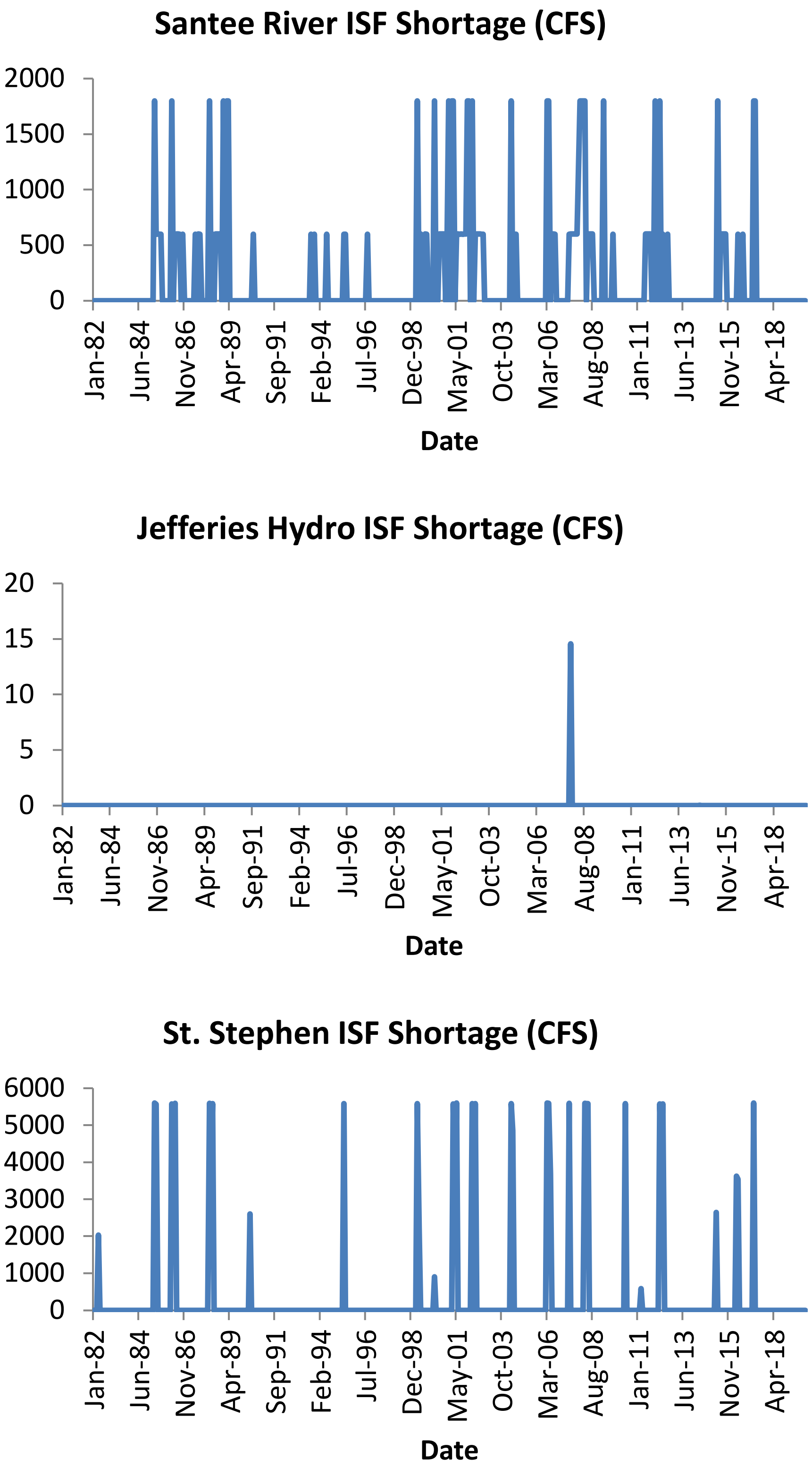


Figure 5-8. Shortages on Instream Flow Objects in the Current Scenario Model.

Overall, these minimum target releases drive potential water user shortages in the Santee River basin when current demands are compared to surface water availability during the drought of record (2007 to 2008). The target releases are much larger than what any single water user is withdrawing within, or downstream of the dams, to prevent saltwater intrusion and support fish passage, etc. As such, the targeted release volumes potentially contribute to lowering the water elevations of Lakes Marion and Moultrie during drought events if they are not reduced during drought in acknowledgment of reduced inputs to Lake Marion and Moultrie. This can cause the reservoirs to hit their deadpool during extreme drought, which in turn creates shortages for water users on the reservoirs. Two public water suppliers and one golf course withdraw from the reservoirs and experience a shortage in the Current Scenario. Figure 5-8 shows when the instream flow objects experiences shortages and the extent of their shortage for the Current Scenario.

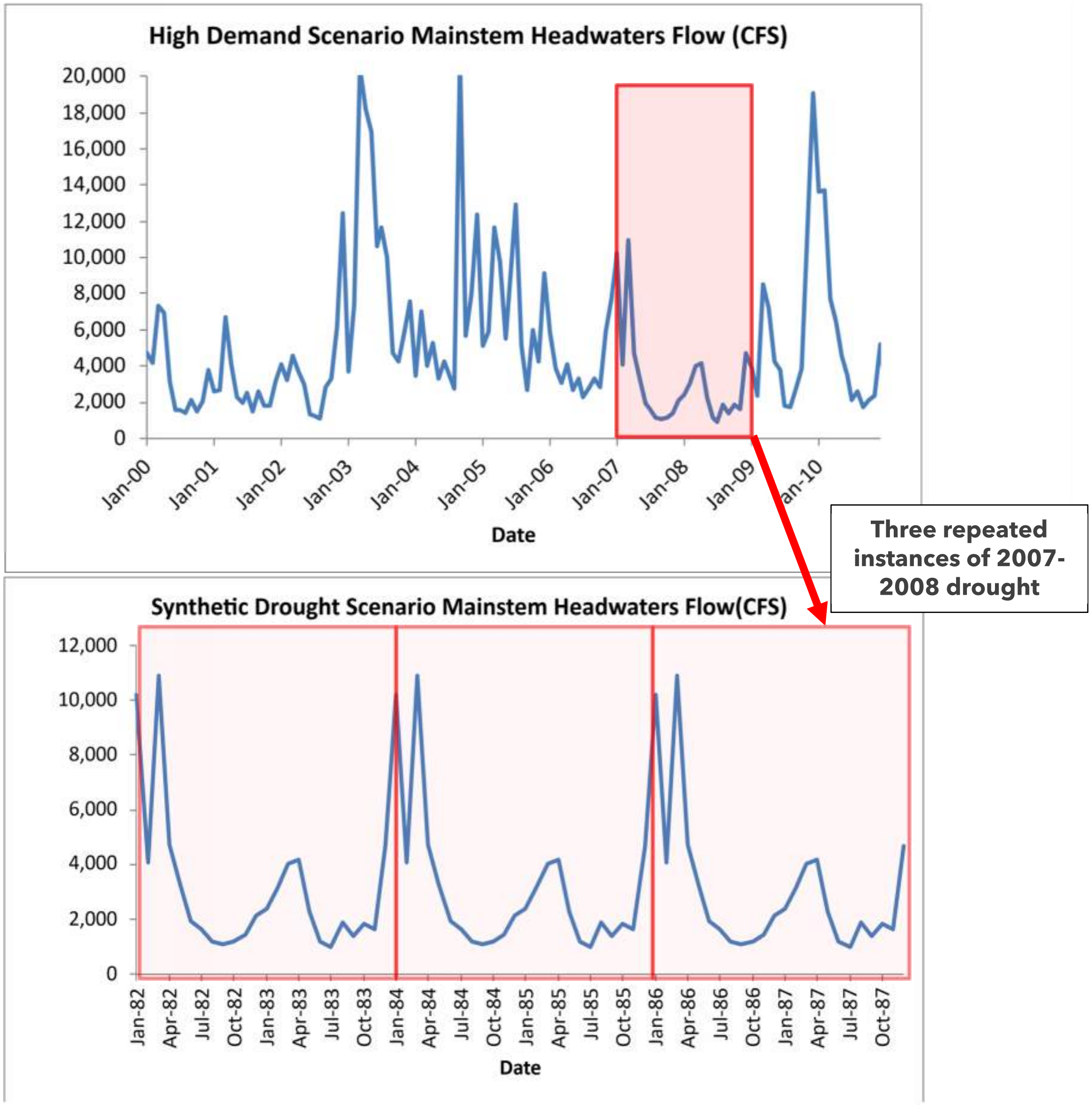
It should be noted that shortages in Lakes Marion and Moultrie are highly sensitive to reservoir operations. The model seeks to maintain reservoir levels at the operating curve (shown in Figure 5-6), Historically, Santee Cooper has often maintained reservoir levels slightly above the operating curve in recognition of the criticality of the reservoirs for water supply. Furthermore, in the model, additional flow for fish passage at the St. Stephen facility ceases if reservoir levels fall to within half a foot of the bottom of operating range (see Figure 5-6). This value is conservative in that it allows reservoir levels to drop closer to their deadpool before fish passage attraction flows are curtailed. Santee Cooper has indicated that they would likely stop additional flow for fish passage at St. Stephen if the reservoirs dropped below the target operating rule curve, thus preserving more water in the reservoirs.

To test this sensitivity, a version of the Current Scenario was simulated with the trigger elevation for fish passage releases set to the operating rule curve itself, i.e., where the additional flow for fish passage ceases if reservoir levels drop below the target operating rule curve. This change in reservoir release rules resulted in the reservoirs no longer reaching their respective deadpool elevations during the drought of 2007-2008, thus alleviating shortages for water users with lake withdrawals. However, shortages still persisted in the Moderate and High Demand Scenarios under this adjustment to the fish passage attraction flow release rule. Running the models under a daily (rather than monthly) timestep further reduces the amount and duration of shortages, although shortages in the Moderate and High Demand Scenarios still exist even with the fish passage release rule adjustment.

Overall, the model has been set up to provide values that are closer to a conservative, “worst case” scenario. Though fine-tuned management of Lakes Marion and Moultrie can resolve shortages for current conditions and assuming historical hydrology, model results indicate that future demands may still cause shortages during periods of extreme or prolonged drought.

5.3.7 Extended Drought Scenario Analysis

One of the uncertainties in the planning process identified by the RBC is future climate and hydrologic conditions. The RBC recognizes that climate conditions may be different in the future than the modeled period. Given the uncertainty about future climate conditions and to further evaluate water supply resiliency, the SWAM model was used to test additional, hypothetical hydrologic conditions. The Synthetic Drought Scenario was set up using the High Demand 2070 Scenario water demands. The scenario hydrologically matches inflows from 2007 and 2008, consecutively repeating these flows three times. An example of how the Santee Mainstem Headwater flows were repeated for the Synthetic Drought Scenario is shown in Figure 5-9.



High Demand Scenario Mainstem Headwaters Flow (CFS)

Synthetic Drought Scenario Mainstem Headwaters Flow(CFS)

Three repeated instances of 2007-2008 drought

Figure 5-9. Repeating Hydrology for Synthetic Drought Scenario.

The results of the Synthetic Drought Scenario reflect the simulated combination of projected (High Demand 2070) water demands and a low-flow supply condition based on historical observed surface flows. While the sequences of monthly flows and reservoir evaporation rates are synthetic, the magnitudes of the values are grounded in the historical baseline. No attempts have been made in the modeling to directly incorporate future hydrologic or climate projections. Further, the modeling approach applied neglects any potential changes in groundwater/surface water interactions that could result from reduced recharge and depleted alluvial groundwater storage.

Nonetheless, the Synthetic Drought Scenario provides insight on how certain aspects of the river basin might respond to prolonged droughts. As shown in Figure 5-10 Lakes Marion and Moultrie are able to refill enough between reaching their deadpool so that the next sequential simulated shortage is not exacerbated by the first. This refilling is a result of the relatively high inflows that occurred in January and February 2007. Water users that withdraw from the lakes have the same maximum shortage as they did in the High Demand 2070 Scenario. The same statement is true for other water users upstream of Lakes Marion and Moultrie that experience shortages in the High Demand 2070 Scenario.

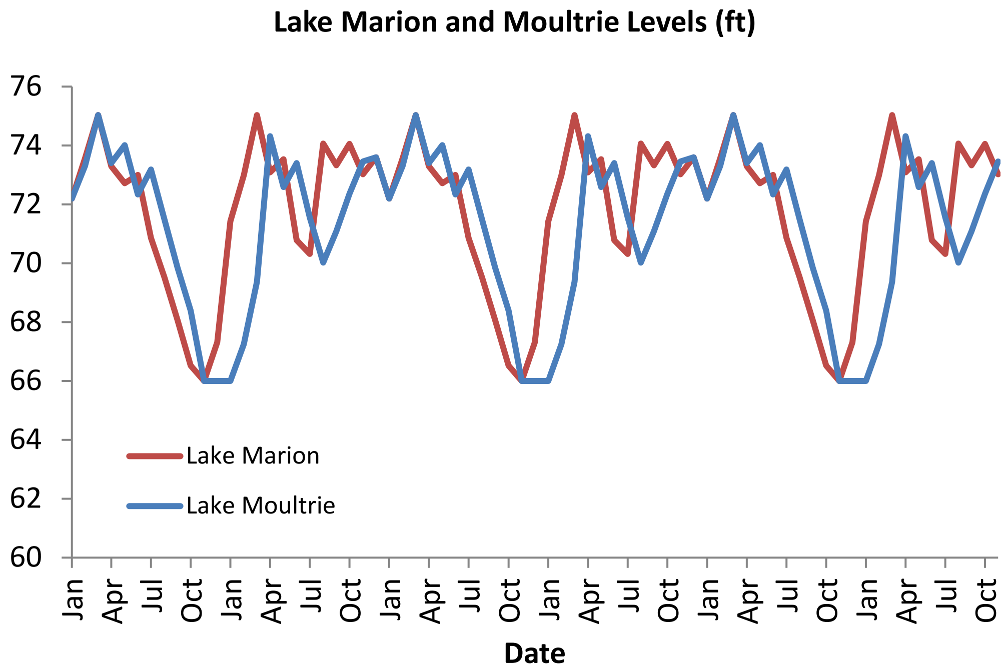


Figure 5-10. Lake Marions and Moultrie Levels during Synthetic Drought Scenario.

5.4 Safe Yield of Reservoirs

An important factor in estimating the reliability of current water supply systems against future demand forecasts is the ability of reservoir systems to provide anticipated levels of supply without interruption. The safe yield of a reservoir, or system of reservoirs, is a measure of its long-term reliability. The Planning Framework defines Reservoir Safe Yield as *the Surface Water Supply for a reservoir or system of reservoirs over the simulated hydrologic period of record*. Since the Surface Water Supply *is the maximum amount of water available for withdrawal 100 percent of the time*, the safe yield of a reservoir or system of reservoirs can be thought of as *the maximum annual average demand that can be sustained through the period of record without fully depleting available storage.*

For the Santee River basin, the Planning Framework specified that safe yield be computed for Lake Marion and Lake Moultrie. Because of the interconnectedness of these two reservoirs both hydraulically and operationally, they were evaluated as a single storage system. Standard methods were employed, in which the SWAM model was used to test hypothetical water withdrawals over the entire period of record to identify the withdrawal level at which the interconnected reservoirs could not satisfy that demand with 100 percent reliability.

Several important factors in the analysis include:

- Future demand assumptions at the point of withdrawal are not relevant to safe yield calculations, since the question is simply "how much water could be supplied consistently and reliably based on historical hydrology." However, if there are upstream withdrawals, the demand scenarios used for RBC planning purposes are important, as these can reduce the availability of water flowing into the reservoir(s). For any demands upstream of the reservoirs being evaluated, the conservative High Demand 2070 assumptions were applied.
- Because the reservoirs were examined as a coupled system, and because operational goals and hydraulic connectivity result in synchronized drawdown and recovery patterns, equivalent withdrawals were assumed from both reservoirs. This assumption is not a reflection of an operational requirement, but its efficacy was checked by observing reasonable synchronization in the drawdown and recovery of the simulated reservoirs during the safe yield experiments.
- New FERC requirements apply to both the Santee and Cooper Rivers downstream of the two reservoirs. Lake Marion is required to release between 1,200 and 2,400 cfs, with allowances down to 600 cfs based on lake levels during dry periods. Lake Moultrie is required to release 4,500 cfs to the Cooper River. Per the FERC regulations, this target minimum release volume is 4,500 cfs is specified as a weekly average flow, with an instantaneous allowed range from 0 to 28,000 cfs daily for peak power operation mode of the Jefferies stations (explicitly outlined in both the underlining contract from which the release volume is derived and both the old and new FERC licenses and is demonstrated in decades of release volumes/flows to the Tailrace Canal). For modeling purposes, especially at a monthly timestep, the value of 4,500 cfs is held constant as a target, and at a daily timestep may be a conservative simplification of true operational flexibility. While other seasonal flow targets apply for the Rediversion Canal downstream of the St. Stephen Hydropower facility, these are not regulatory requirements. The two absolute flow targets, therefore, for the establishment of safe yield were the minimum regulatory requirements in each river: 600 cfs in the Santee, and 4,500 cfs in the Cooper. The safe yield of the combined reservoir system, therefore, is further defined here as the amount of water that can be continuously withdrawn *while still providing these two flow requirements downstream*.
- The deadpool for both reservoirs is simulated at a uniform 66 feet, even though there may be some variability in this number (and therefore, additional usable storage below 66 feet) in certain operational situations.
- Because of the numerous assumptions about distribution of withdrawals between the reservoirs, hydraulic connectivity, etc., no seasonal pattern of demand was applied. Rather, demand was simulated at a constant value.
- The time period used for the analysis was 1982—2019, which matches the available data and includes the drought of 2007—2008, which is generally considered to be the "drought of record" in the Santee River basin.

Analysis was conducted at both the monthly and daily levels, though monthly simulation for reservoirs of this size is typically an accurate reflection of their yield because the within-month averaging of inflows and outflows reasonably accommodates uncertainties in data, conditions, and human decisions. Daily analysis is considered supplemental.

Figure 5-11 illustrates the response of the reservoir system at a monthly timestep with zero withdrawal. The top two graphs illustrate drawdown and recovery patterns over the period of record. The middle graphs illustrate the downstream flow as simulated to meet FERC requirements in the Santee and Cooper

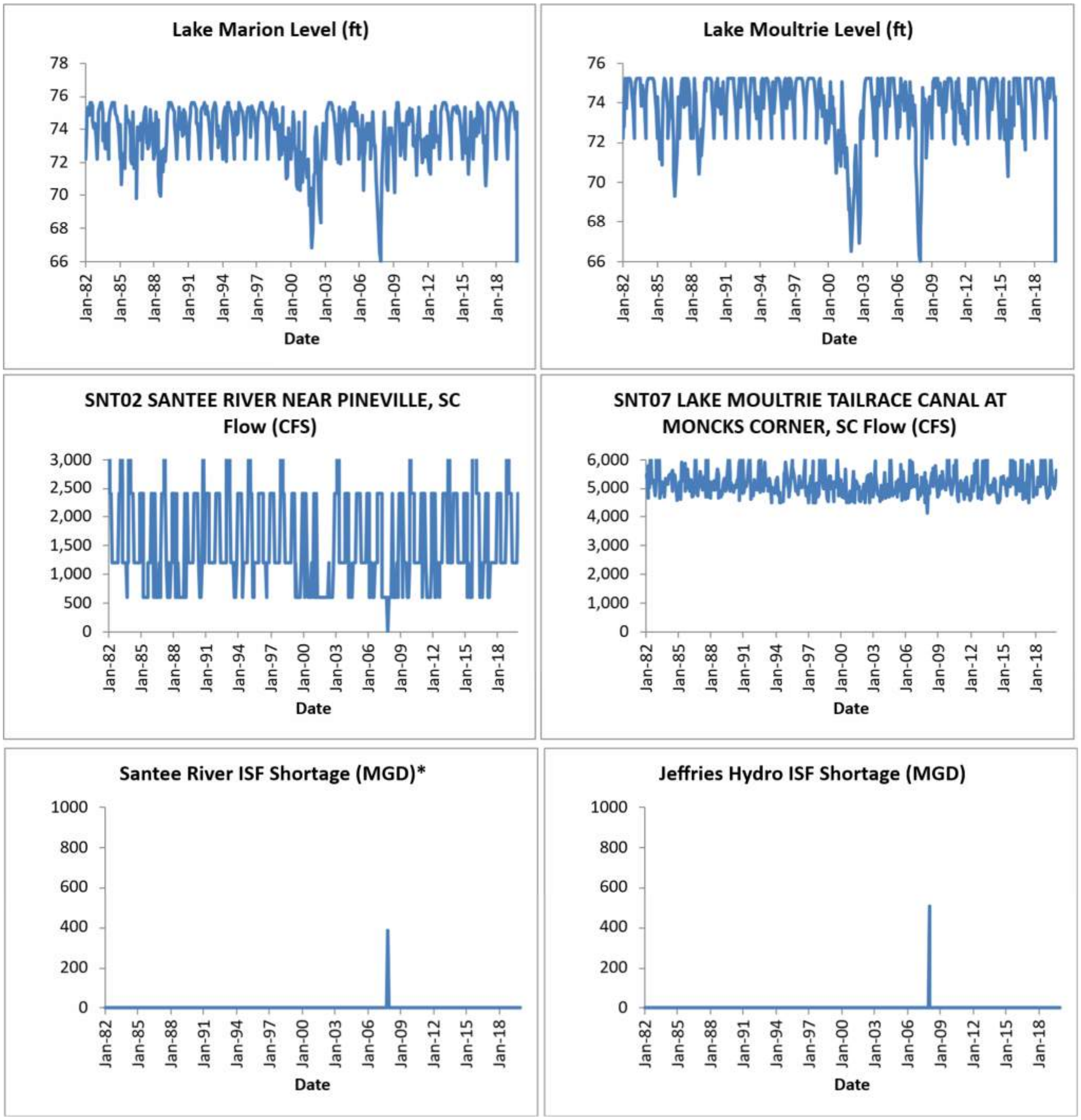
Rivers. The lower graphs illustrate simulated shortages of these instream flow targets (“ISF”). As is shown, even with no withdrawal, the system cannot fully sustain the new downstream flow requirements 100 percent of the time if reservoir storage is not considered. In recognition of this, the FERC license stakeholders distinguished between different types of release volumes (i.e., contractual, target, minimum, etc.) from the various projects to the two downstream rivers (Santee River and Cooper River). On a monthly level, then, based on historical hydrology and new FERC requirements, the safe yield of these systems is 0 MGD if reservoir storage below the deadpool elevation is not considered, since even without withdrawals, the system cannot satisfy downstream FERC flow requirements 100 percent of the time. It should be understood that this is based on numerical simulation, and that contingency plans are, or will be, in place to help manage water needs from the reservoirs during periods of extreme drought.

Because the analysis suggested a safe yield of 0 MGD with a monthly simulation timestep (if storage below the deadpool elevation is not considered), the model was run again with a daily timestep. Scenarios were conducted at withdrawal levels of 0, 4, 12, 18, and 20 MGD (from each reservoir). These daily results should be treated with caution, as they are based on the assumption of identical daily hydrologic flow sequence as have occurred historically, and monthly simulation is typically preferred to account for expected variations and uncertainty in flow sequences and operations, even with similar seasonal trends.

Results showed that there were no shortages in withdrawal nor downstream flows for constant withdrawal from both reservoirs up to 18 MGD (total withdrawal of 36 MGD) if storage below the deadpool elevation is not considered. Shortages in downstream flow begin to appear when constant withdrawals from each reservoir reach 20 MGD. Figure 5-12 shows the safe yield with a daily timestep of 36 MGD from the system (18 from each reservoir) without shortages, and Figure 5-13 shows shortages occurring when this simulated withdrawal is increased to 40 MGD total (20 MGD from each reservoir).

Therefore, the results of the safe yield analysis for Lakes Marion and Moultrie as a combined system can be summarized as follows:

- At a monthly timestep, the simulated safe yield of the combined system is 0 MGD if reservoir storage below the deadpool elevation is not considered, since even without withdrawals, the system cannot satisfy downstream FERC flow requirements 100 percent of the time.
- At a daily timestep, the simulated safe yield of the system is 36 MGD (18 MGD from each reservoir) if reservoir storage below the deadpool elevation is not considered, though these results should be used with caution as they are based on exact repetition of daily hydrologic patterns.



Lake Marion Level (ft)

Lake Moultrie Level (ft)

SNT02 SANTEE RIVER NEAR PINEVILLE, SC Flow (CFS)

SNT07 LAKE MOULTRIE TAILRACE CANAL AT MONCKS CORNER, SC Flow (CFS)

Santee River ISF Shortage (MGD)*

Jeffries Hydro ISF Shortage (MGD)

Figure 5-11. Monthly Safe Yield Simulation of Lakes Marion and Moultrie with 0 MGD withdrawal.

(Note – In this analysis, the Santee River ISF shortages reflect the minimum release requirement to the Santee River of 600 cfs. In the analysis presented in section 5.3, shortages were defined when releases to the Santee River are less than 1,200 or 2,400 cfs, depending on time of year.)

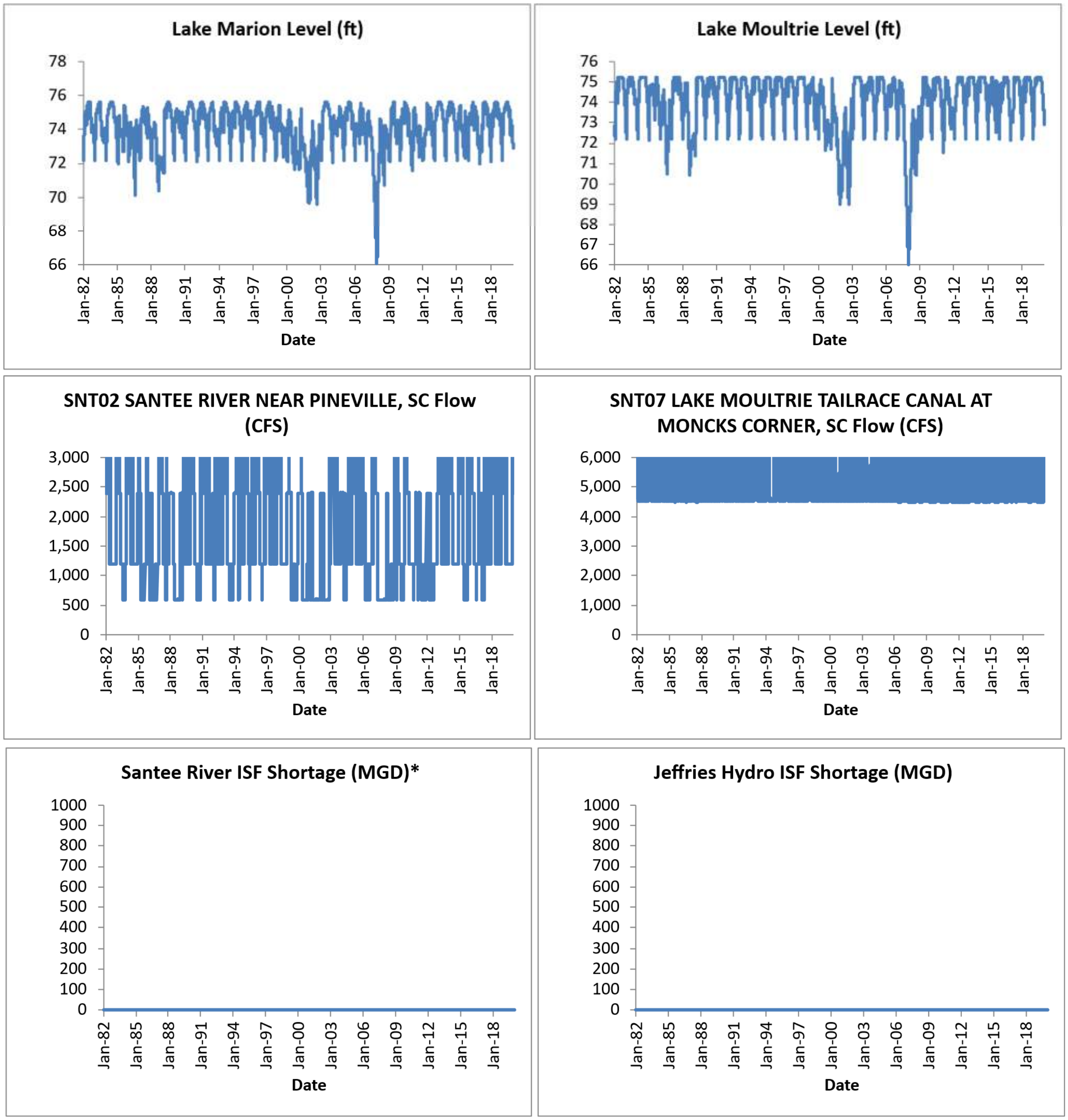


Figure 5-12. Daily Safe Yield Simulation of Lakes Marion and Moultrie with 18 mgd withdrawal from each reservoir (36 MGD total).

(Note – In this analysis, the Santee River ISF shortages reflect the minimum release requirement to the Santee River of 600 cfs. In the analysis presented in section 5.3, shortages were defined when releases to the Santee River are less than 1,200 or 2,400 cfs, depending on time of year.)

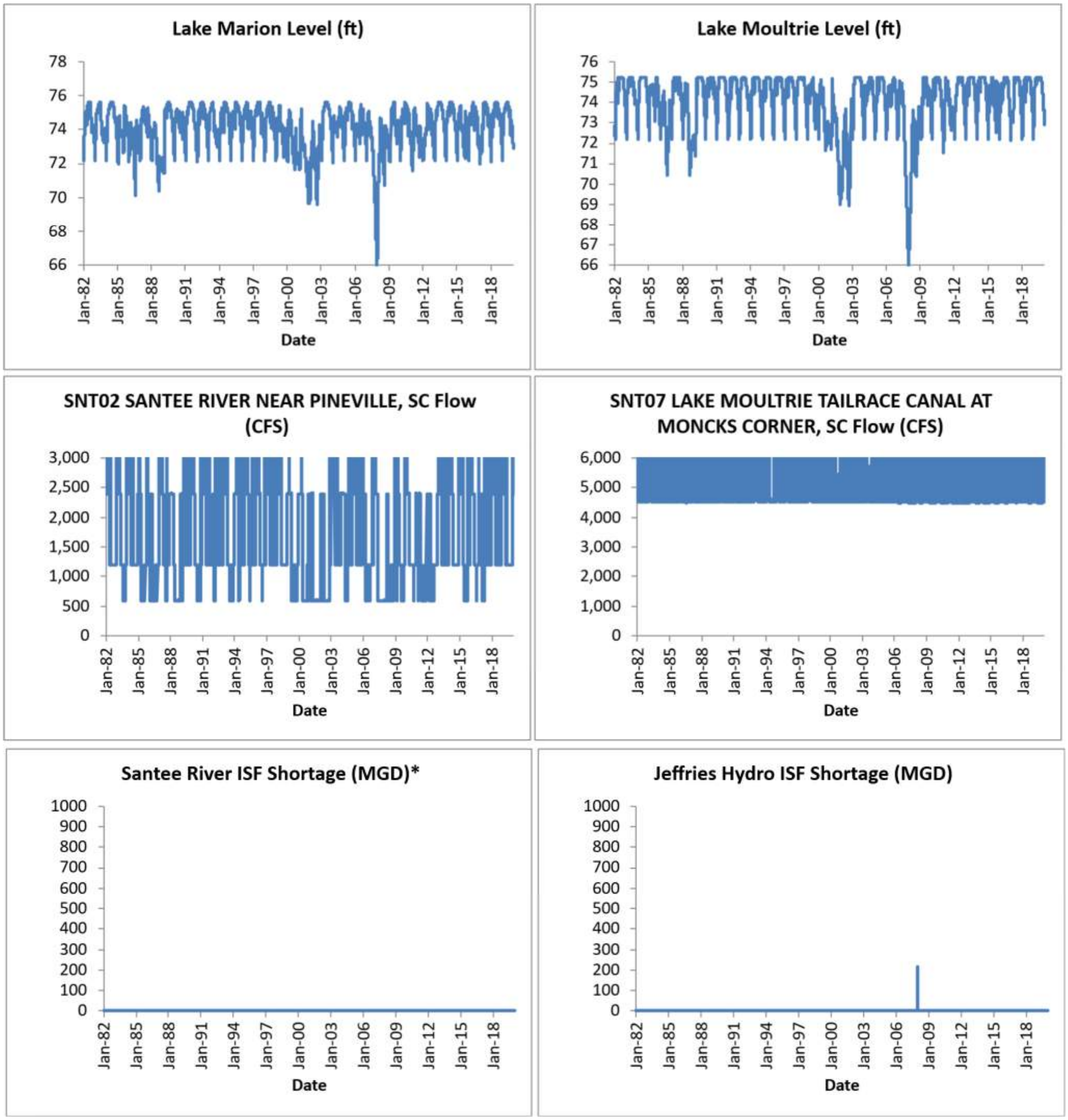


Figure 5-13. Daily Safe Yield Simulation of Lakes Marion and Moultrie with 20 mgd withdrawal from each reservoir (40 mgd total).

(Note – In this analysis, the Santee River ISF shortages reflect the minimum release requirement to the Santee River of 600 cfs. In the analysis presented in section 5.3, shortages were defined when releases to the Santee River are less than 1,200 or 2,400 cfs, depending on time of year.)

5.5 Groundwater Conditions

5.5.1 Evaluating Groundwater Conditions

Groundwater conditions in the Santee River basin were evaluated using available groundwater-level data, potentiometric surface contour maps, and current and historical groundwater usage. The impacts of future water demand on aquifer conditions and groundwater availability in the basin were estimated based on current groundwater trends and assumptions about where additional pumping would occur.

SCDES, with the assistance of the USGS, maintains a network of groundwater monitoring wells completed in each of the major aquifers present in the Santee basin. Most of the wells in this network are equipped with automated water level data recorders that record groundwater levels every hour; water levels in those wells not equipped with data recorders are measured manually several times each year. Wells in this monitoring network are referred to as trend network wells, as they provide information about short- and long-term trends in groundwater levels and, thus, changes in aquifer storage at specific sites. In the Santee Basin there are 21 actively monitored wells completed in 5 aquifers, each having from 5 to 45 years of water level data. Figure 5-14 shows the locations of active monitoring wells in and near the Santee basin.

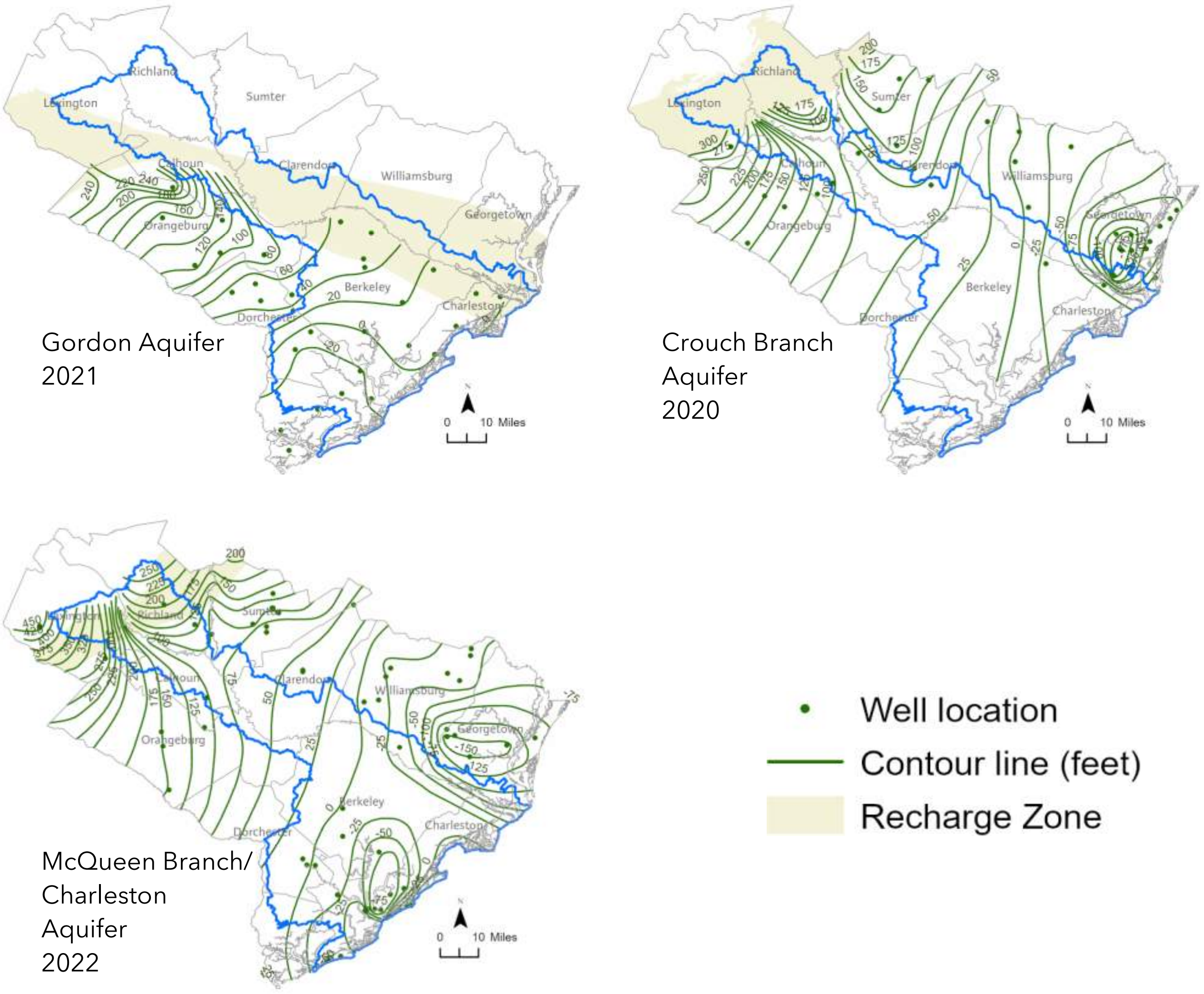
Changes in groundwater levels over time correspond to changes in groundwater storage. Declining water levels indicate the amount of water stored in an aquifer is decreasing, which occurs when the volume of water pumped from an aquifer exceeds the volume of water recharging into it. The severity of an observed groundwater level decline is dependent on several factors, including the magnitude of the decline, the groundwater level relative to the top of the aquifer, and the depths of the pump intakes in the wells withdrawing water.

While monitoring wells provide long-term, continuous records of aquifer conditions at specific points, potentiometric maps provide “snapshots” of aquifer conditions over the full extent of the aquifer at one moment in time. A potentiometric map is a contour map that illustrates the elevation to which groundwater will rise in wells open to a particular aquifer and is made using water level measurements from numerous wells located throughout an aquifer’s extent, all measured at nearly the same time. Because the number of monitoring network wells is inadequate to create potentiometric maps, water levels of additional, non-network “synoptic” wells are used to fill spatial data gaps for these maps. Typically, SCDES produces new potentiometric maps for the Floridan, Gordon, Crouch Branch, and McQueen Branch/Charleston aquifers every three years. Figure 5-14 shows recent potentiometric surface maps of the major aquifers present in the Santee basin. A description of the South Carolina Coastal Plain aquifer system can be found in Chapter 3.3 Groundwater Resources.

Unlike continuous groundwater level data, which show changes in groundwater conditions over time at specific sites, potentiometric maps show aquifer conditions for only the time when the water level data were collected, but these maps show conditions throughout an entire aquifer.

Areas of relatively significant groundwater aquifer level declines are indicated on potentiometric maps by locally lower potentiometric elevations, usually centered near the pumping causing the decline. These potentiometric lows, known as cones of depression, are often seen on potentiometric maps as concentric loops of contour lines, and changes in the magnitude or areal extent of a cone of depression can be seen on successive potentiometric maps. Potentiometric maps also indicate the direction of groundwater flow within an aquifer, as groundwater flows from areas of higher pressure to areas of lower pressure.

Groundwater demand and groundwater availability occur basinwide, but different aquifers are primarily used in different regions. In the upper basin (Lexington, Richland, Calhoun, Clarendon, and Orangeburg Counties), most production wells are completed in the Crouch Branch or McQueen Branch aquifers. In the lower basin (Berkeley, Dorchester, and Charleston Counties), the Gordon, Crouch Branch, and Charleston aquifers are primarily used. Use of the very deep Gramling aquifer, which exists only in the lower part of the basin, is very limited, and there are no wells that solely tap the Gramling aquifer; wells that tap this aquifer also tap the overlying Charleston aquifer.



Gordon Aquifer
2021

Crouch Branch
Aquifer
2020

McQueen Branch/
Charleston
Aquifer
2022

Figure 5-14. Maps showing the locations of wells used by SCDES for water-level measurements and recent potentiometric surface maps in the Santee basin, by aquifer.

5.5.2 Current Aquifer Conditions

Water level data from a selection of monitoring wells are presented here to illustrate groundwater conditions and significant trends observed in the aquifers of the Santee basin, and to evaluate if there are potential concerns regarding groundwater availability in the basin for the duration of the 50-year planning horizon.

Due to the narrow shape of the Santee Basin and high concentration of production wells in the upper and middle basin, it is difficult to locate monitoring wells that are not influenced by nearby pumping. Because Crouch Branch and McQueen Branch aquifer wells in the upper basin are unconfined or minimally confined, they can be useful for examining the relationship between precipitation, recharge, and groundwater levels. Water levels in these aquifers in this area tend to be highly responsive to weather changes because of their high permeability and sandy composition. Water levels in a well completed in the McQueen Branch aquifer (RIC-0585) aquifer are compared to precipitation trends recorded at nearby Columbia Metropolitan Airport (NOAA 2024) in Figure 5-15. The RIC-0585 hydrograph illustrates how successive years of lower-than-average precipitation (1999–2001) reduces aquifer recharge that would typically occur during the wet winter months. In the absence of sufficient recharge during the years 1998 to 2003, nearby pumping lowered water levels in the aquifer. Similarly, years having normal to above average precipitation and only occasional dry periods (2013–2025) provide adequate recharge in both wells during the wet winter months. RIC-0585 also shows the response of pumping on McQueen Branch water levels during hot and dry summer conditions (2019, 2021, 2022). Figure 5-16 shows water levels for a well completed in the Crouch Branch aquifer (LEX-0823) in Lexington County. The period of record at a LEX-0823 only spans about a decade but reinforces how critical rainfall is for recharge. The recharge aquifers receive here eventually is conveyed deeper into the aquifers lower in the basin.

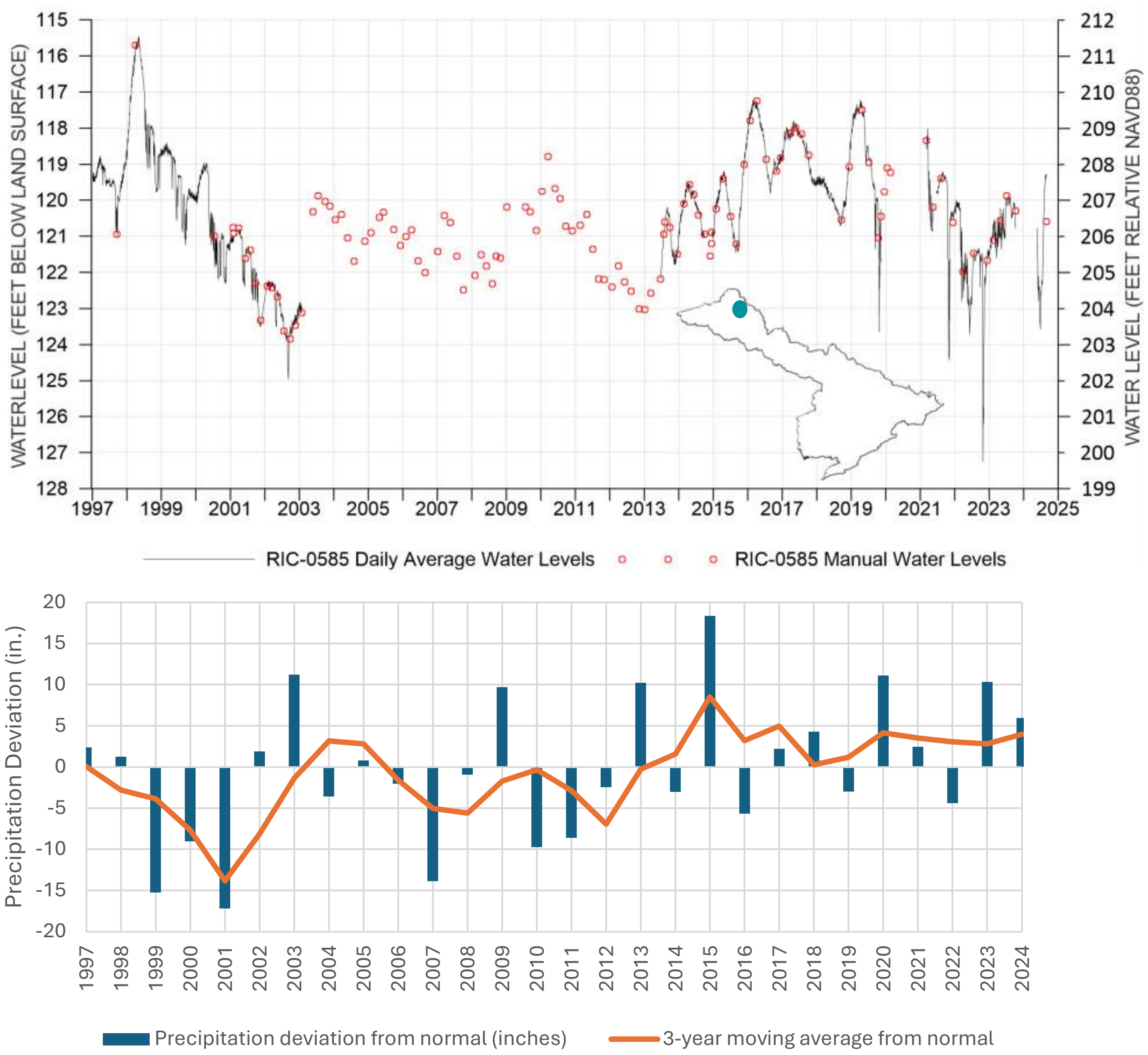


Figure 5-15. Groundwater levels in the McQueen Branch well RIC-0585 (top graph) and precipitation deviation from normal (bottom graph) in Richland County.

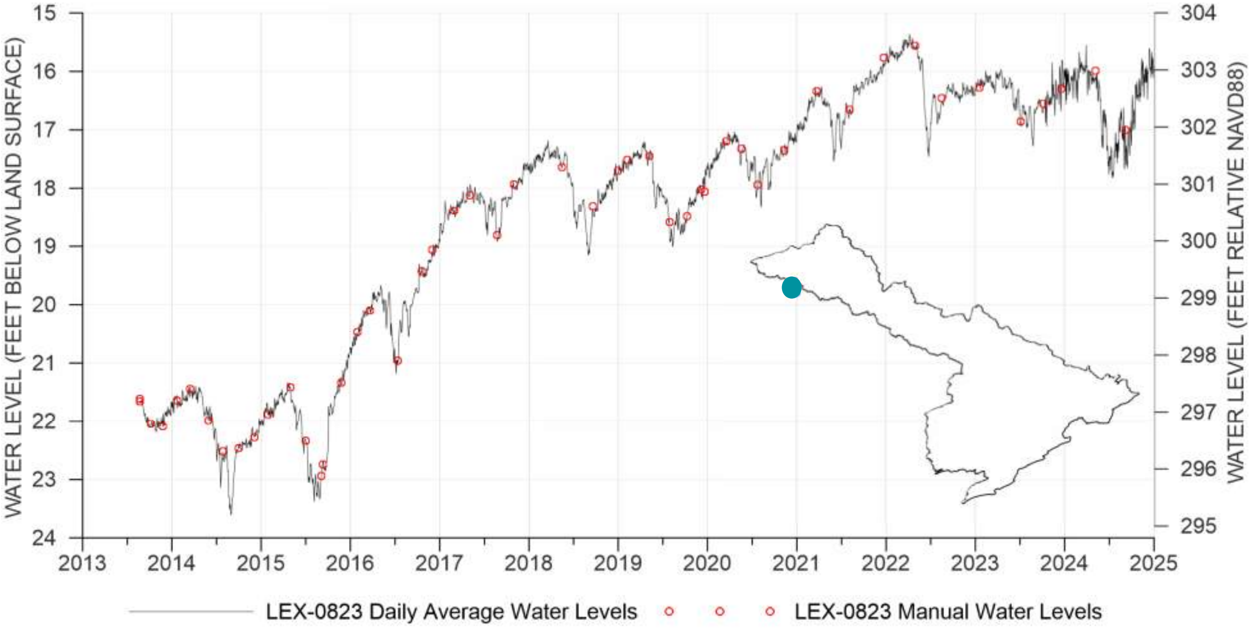


Figure 5-16. Groundwater levels in the Crouch Branch well LEX-0823 in Lexington County.

Agricultural irrigation is the largest sector of reported groundwater use in the Santee Basin, with most of that use and largest irrigators located in Calhoun, Clarendon, Orangeburg, Richland, and Sumter Counties. The total average reported use in 2023 within these counties was 9.2 MGD with nearly all the water coming from the Crouch Branch and McQueen Branch aquifers. The Crouch Branch aquifer is the primary aquifer used for irrigation in Calhoun and Orangeburg Counties. The 2023 reported use in these counties was 6.3 MGD, and projections suggest that in 2070, the demand for irrigation could increase to 8.7 MGD in the Moderate Demand Scenario or 31.2 MGD in the High Demand Scenario. Figure 5-17 shows water levels in a Crouch Branch well (ORG-0393) in Orangeburg County just outside the basin boundary. Over the 24-year period of record, water levels in the Crouch Branch show a strong seasonal pumping signal with seasonal drawdowns of up to 33 feet followed by recoveries of similar magnitudes.

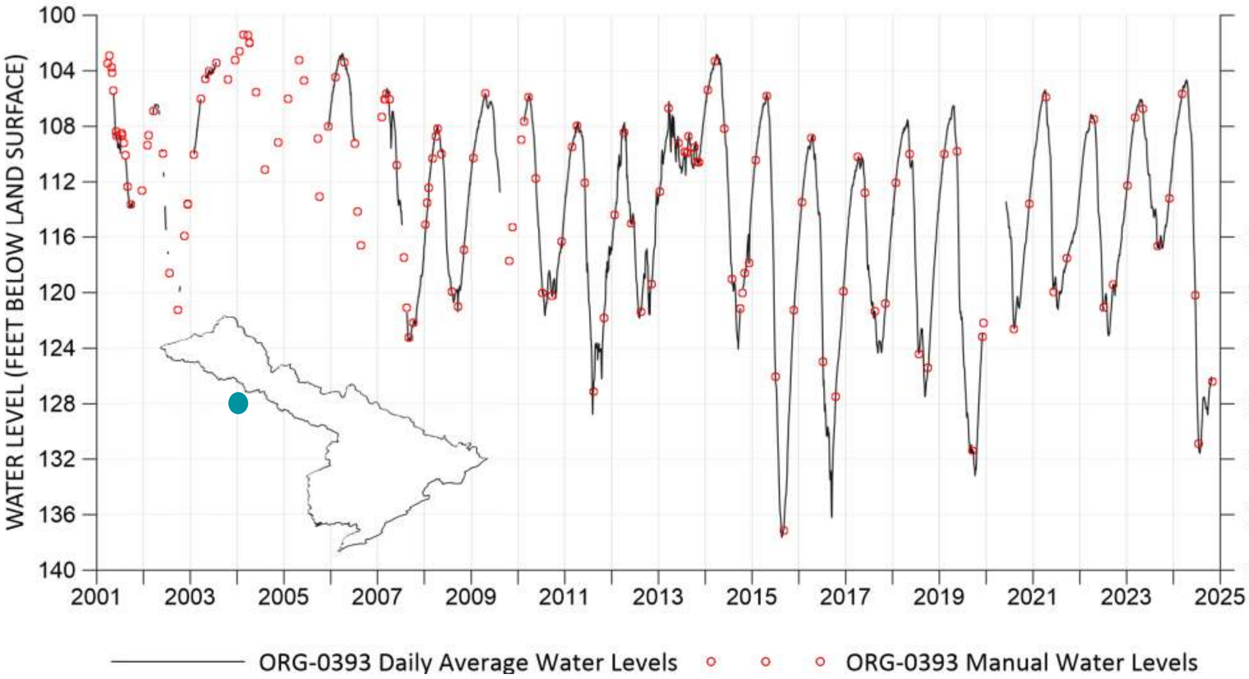


Figure 5-17. Groundwater levels in the Crouch Branch well ORG-0393 in Orangeburg County.

The McQueen Branch aquifer is the primary aquifer used for irrigation in Clarendon, Richland, and Sumter Counties. The reported use in 2023 for these counties was 4.6 MGD. Projections suggest that in 2070, demand would remain at 4.6 MGD in the Moderate Demand Scenario or increase to 15.4 MGD in the High Demand Scenario. Figure 5-18 shows water levels in a McQueen Branch well (CLA-0020) in Clarendon County just outside the basin boundary. Over the 10-year period of record, water levels in the McQueen Branch show a muted pumping signal with seasonal fluctuations in the range of approximately 8 feet. It should be noted that public supply wells located near this monitoring well may be impacting the observed water levels.

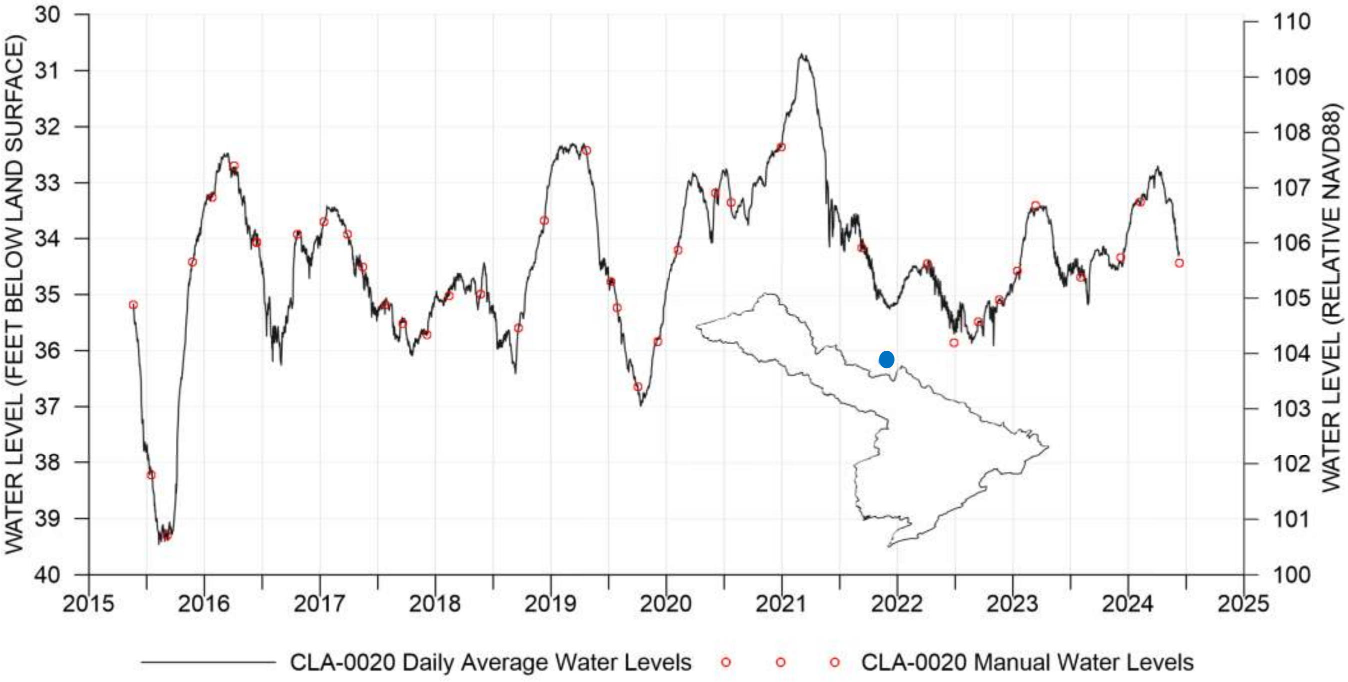


Figure 5-18. Groundwater levels in the McQueen Branch well CLA-0020 in Clarendon County.

Because there is several hundred feet of available drawdown for the Crouch Branch and McQueen Branch aquifers in this area, excessive withdrawals in this central part of the basin currently are not a cause for concern, nor are they likely to be under future demand. Recent potentiometric maps for the Crouch Branch and McQueen Branch aquifers (Figure 5-14) indicate a water level decline of 50–100 feet from predevelopment water levels, despite many decades of groundwater development. This suggests a high likelihood that groundwater resources will remain sustainable in the upper to middle portion of the Santee basin over the planning horizon.

In the lower portion of the basin, because of the abundance of surface water held in reservoirs, most of the water demand for the basin is satisfied by a complex network of direct-retail and wholesale connections that are ultimately supplied with drinking water by Santee Cooper Regional Water Authority and Charleston Water System. These water utility systems distribute water to many small to medium municipalities in the basin who may also operate wells to support water demand. There is significant groundwater use for industry in Berkeley County and public water supply in Charleston and Dorchester Counties. Future groundwater demand will be primarily satisfied by the Charleston aquifer. The reported public water supply in 2023 was 4.0 MGD and is projected to increase to 9.5 MGD in the Moderate Demand Scenario and 15.8 MGD in the High Demand Scenario. Reported water use in 2023 for industrial supply in Berkeley County was 2.9 MGD, and projections suggest that this could increase to 3.9 MGD in the Moderate Demand Scenario and 11.4 MGD in the High Demand Scenario. Due to the depth of the Charleston aquifer, there are few monitoring wells in the aquifer, but one USGS well (BRK-0431) located near Moncks Corner shows a long, steady decline with periods of stabilization (Figure 5-19). Overall, water levels in this well have declined by approximately 70 feet since 1989. A decline in water elevation in a confined aquifer is indicative of reduced pressure at that location. Increased demand in Berkeley County could reduce the amount of recharge that wells in coastal Charleston County receive, which could worsen or expand the existing cone of depression centered over Mt. Pleasant (discussed in the next section). Additional dedicated monitoring wells and groundwater modeling would improve assessment of this potential risk, and alternative sources of water such as surface water or lesser used aquifers should be explored.

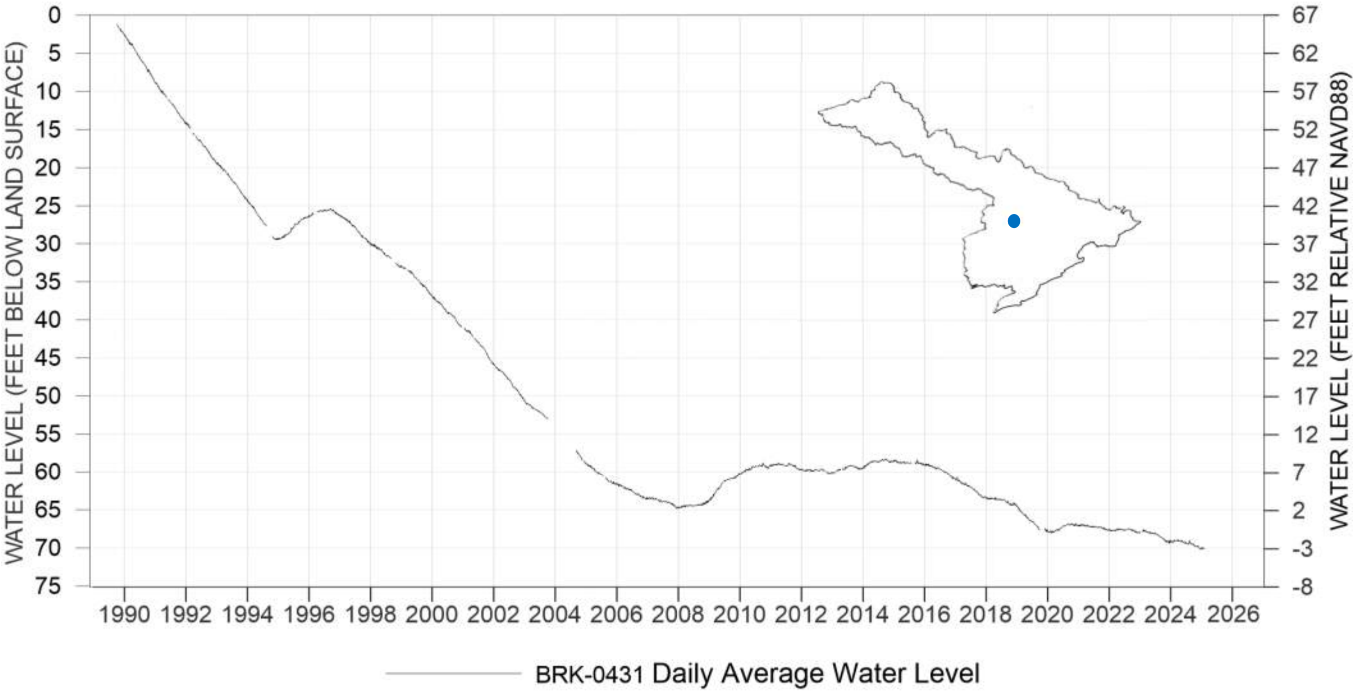


Figure 5-19. Groundwater levels in the Charleston aquifer well BRK-0431/USGS 331022080021801 in Berkeley County.

The Gordon aquifer is the least used aquifer in the Santee basin but is an important resource for private domestic supply and small public water systems. Because there are few permitted wells, most of this aquifer's water use is not recorded or regulated by the Capacity Use Program. A well in southern Charleston County (CHN-0044) illustrates how seasonal pumping and, to a lesser extent, climate patterns influence water levels in the Gordon aquifer. Figure 5-20 shows water levels declining about a foot a year between the 1980s and early 2010s, a pattern observed in many SCDES Gordon aquifer monitoring wells located in the lower basin. Increased rainfall in the area caused water levels to rebound by about 10 feet since 2012, and water levels have since ranged within that same 10 feet due to normal to above normal rainfall. Small irrigators who also use the Gordon aquifer may have needed to irrigate less. Compared to predevelopment levels, water levels in coastal counties have declined between 25 and 50 feet. The zero contour line in the Gordon aquifer runs along the northern Charleston County coastline and bends inland towards Dorchester County where wells tapping the Gordon aquifer are more prevalent. Elevated chloride levels have been identified in most of the Gordon aquifer monitoring wells measured by SCDES in the basin, presumably the result of brackish water moving inland along the base of the aquifer as water pressure in the aquifer has dropped over time.

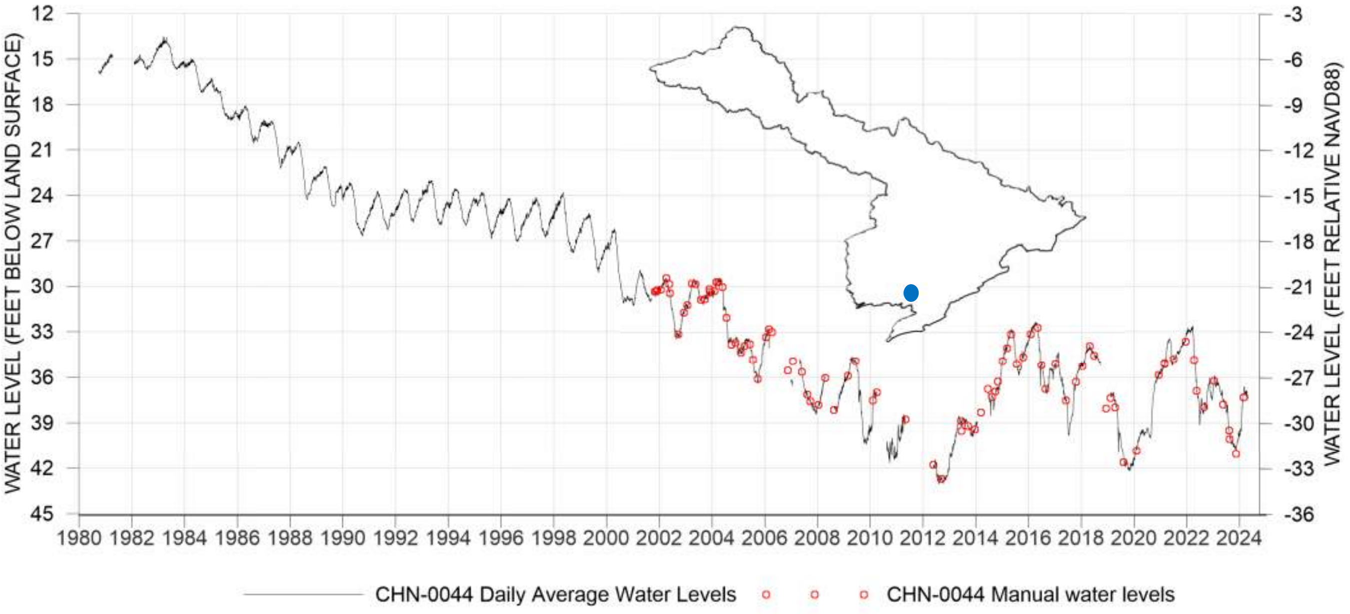


Figure 5-20. Groundwater levels in the Gordon aquifer well CHN-0044 in Charleston County.

5.5.3 Charleston Area Cone of Depression

The most significant change in groundwater levels in the Santee basin has occurred in response to pumping in the coastal region of Charleston County, where withdrawals from the Charleston aquifer have lowered local groundwater levels within the aquifer by more than 200 feet from predevelopment conditions. Large groundwater withdrawals from the Charleston aquifer are regulated through the Trident CUA program, which was established in 2002 to address declining water levels in the Charleston area and the cone of depression centered over Mt. Pleasant. This designation was made due to both the magnitude of water level declines and the potential for saltwater encroachment toward pump intakes, resulting from reduced freshwater discharge at the coast that would otherwise maintain the natural freshwater–saltwater interface in the aquifer (SCDES 2022).

Prior to groundwater development, water levels near the coast in the Charleston aquifer ranged from approximately 100 to 125 feet above mean sea level. In other words, if wells were tapped into this deep, pressurized aquifer, water would be pushed upward to over 100 feet above the land surface. Figure 5-21 illustrates the changes in water levels within the Charleston aquifer between 1982 and 2022. In 1982, wells in the area were flowing, with potentiometric levels of +75 to +100 feet above mean sea level. Groundwater development between 1982 and 1996 caused a decline in water levels, resulting in the initial development of a cone depression centered at Mount Pleasant.

Groundwater use from the Charleston aquifer peaked between 2002 and 2004; with reported use reaching approximately 0.63 MGD. The 2004 map shows water levels in the aquifer more than 200 feet below predevelopment levels at Mount Pleasant and Kiawah Island. A multi-year period of significant drought between 1998–2002 may have also contributed to the high use and low water levels observed during that time.

In the years that followed, groundwater use declined owing to reduced pumping and increased reliance on surface water. The 2011 map shows that the cones of depression had rebounded an average of 50 feet across the area. Between 2011 and 2023, water withdrawals stabilized, averaging 0.38 MGD. The 2022 map indicates an additional rebound of 25 feet compared to the 2011 map in the areas where pumping was most concentrated.

As a result of conjunctive water use and regulatory measures, the cone of depression has stabilized between 100-150 feet below predevelopment levels. However, the zero-contour line has migrated inland across Berkeley County towards Lake Moultrie, indicating the entire area has become a regional zone of lowered aquifer pressure. Over the last 40 years, there have been substantial declines across the region in the Charleston aquifer. These observations highlight the need for exploring and implementing supply- and demand-side water management strategies to meet the growing demand for groundwater in the Santee basin.

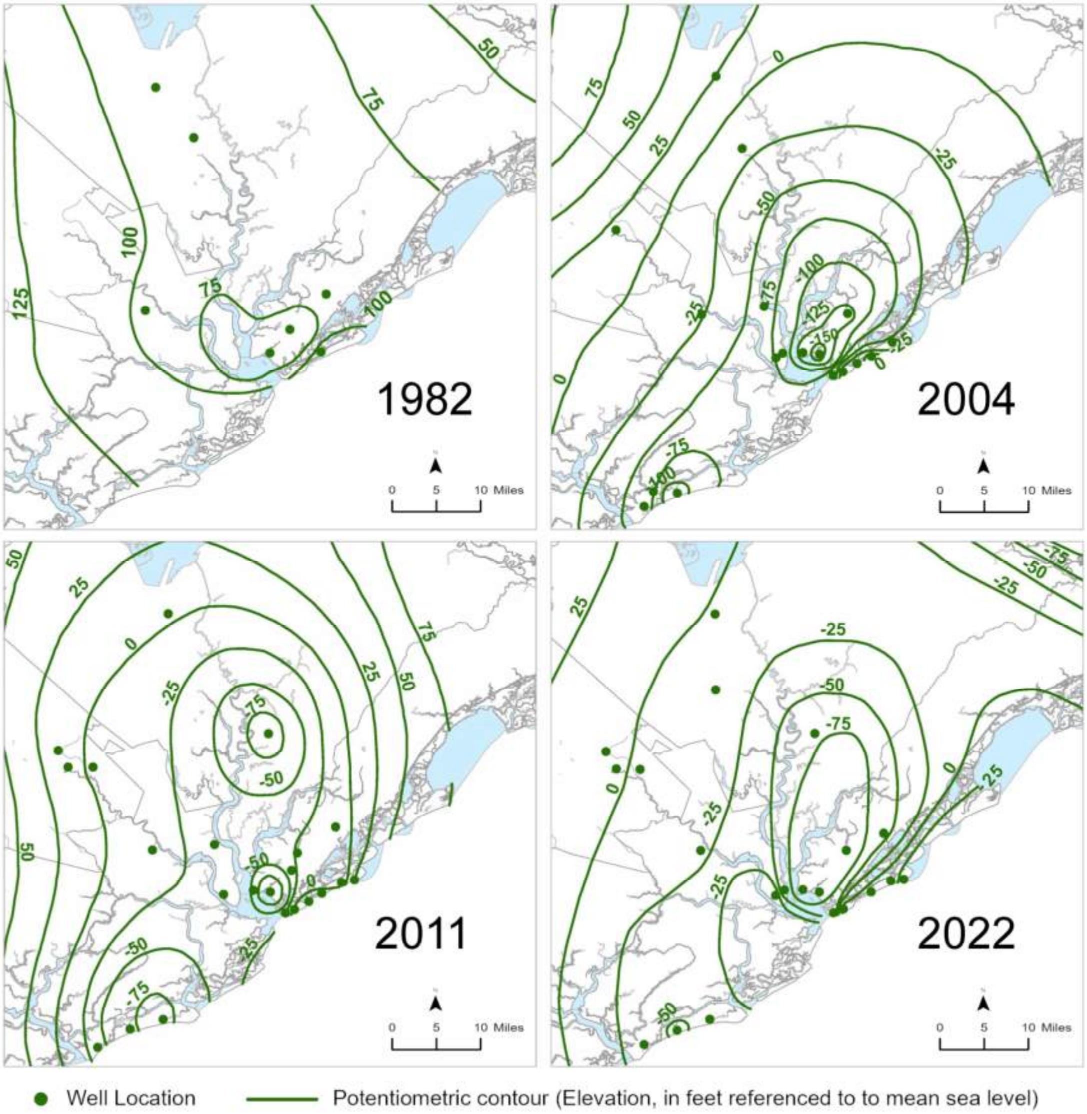


Figure 5-21. Potentiometric water level maps of the Charleston aquifer between 1982 and 2022.

5.6 Summary of Water Availability Assessments

The application of the surface model using current and projected rates of water withdrawals resulted in the identification of several key observations and conclusions regarding the availability of surface water resources in the Santee River basin. Several observations and conclusions were also identified for groundwater resources. Although lacking a model to simulate current and future groundwater demand scenarios, the approach of using current and historical water level and water use trends resulted in the identification of areas where water management strategies have been successfully employed through regulatory action that has maintained the current supply. Areas were also identified that are lacking information for a thorough assessment. The approach for evaluating groundwater resources was developed to be data-ready when the groundwater model becomes available.

The key conclusions from water availability assessments, presented below, led to the RBC identifying and evaluating a suite of water management strategies to protect surface water supply and maintain adequate river flows, especially during low flow conditions, as well as address potential groundwater issues. The evaluation of water management strategies is presented in Chapter 6 – Water Management Strategies and the strategies recommended for use in the Santee River basin are presented in Chapter 7 – Water Management Strategy Recommendations.

5.6.1 Surface Water Observations and Conclusions

Following are specific observations and conclusions coming from the surface water assessment relative to each planning scenario.

- Surface water availability modeling suggests a risk of water supply shortages under the Current Use Scenario. Six water supply shortages were identified using current, monthly average demands when considering the 37-year period of record covering hydrologic conditions observed from 1982 and 2019. The shortages were for two public water suppliers, two golf courses, and two agricultural operations. The public water suppliers experiencing shortages withdraw water from Lakes Marion and Moultrie, both of which drop to their deadpool elevations for one month in the Current Use Scenario (during the 2007—2008 drought). Overall, the model has been set up to provide values that are closer to a conservative, "worst case" scenario. Fine-tuned management of Lakes Marion and Moultrie may resolve shortages for current conditions.
- The P&R Scenario explored the question of, "What if all water users in the Santee River basin and in the upstream Saluda, Broad, and Catawba River basins used the full volume of water allocated through permits and registrations?" The results, which include projected shortages for two public water suppliers, two golf courses, three agricultural operations, and one thermoelectric power plant, demonstrate that the surface water resources of the basin are overallocated in certain places based on existing permit and registration amounts. Projected mean, median, and low flows at Strategic Nodes for the P&R Scenario are significantly lower than the same performance measures for the Current Use Scenario. At the most downstream Strategic Node on the Mainstem (SNT09) median flows are predicted to decrease by approximately 48 percent, and low flows by about 36 percent.

- For the Moderate Scenario, modeled demands were set to projected future levels based on an assumption of moderate population and economic growth. Given current climate conditions and existing basin management and regulatory structure, basin surface water supplies are predicted to be adequate to meet increased demands, resulting from moderate economic and population growth. Based on 2070 demands, the same six water users that are experiencing a shortage in the Current scenario experience a shortage in the Moderate Scenario. The magnitudes and frequencies of shortages for these water users are about the same as the Current Use Scenario for all but one water user. Also similar to the Current Use Scenario, Lakes Marion and Moultrie both drop to their deadpool elevation for one month. Model sensitivity testing to release rules indicate that, even with fine-tuned management of Lakes Marion and Moultrie, water user shortages will occur under even moderate future demands. River flows are predicted to decrease slightly or stay relatively consistent, depending on location, compared to the Current Use Scenario. Low flows downstream of Lakes Marion and Moultrie are subject to release rules of the reservoirs, which actually increase the low flows for nodes SNT02 and SNT09. That said, the median flow at SNT09, the most downstream Strategic Node on the Santee Mainstem, decreases by approximately 7 percent based on 2070 demands.

- The High Demand Scenario projections are based on, and begin with, each user's maximum recent use. The modeled demands are then set to the 90th percentile of variability in reported withdrawals for each user. The projections are based on aggressive growth within the range of uncertainty of the referenced driver variable projections, as described in Chapter 4. The projections were further increased by the addition of a 69 cfs decrease in Mainstem headwater flows to reflect a recently proposed future expansion of the VC Summer Nuclear Generating Plant, as discussed in Section 5.3.3. This scenario represents an unlikely maximum for total water demand because it is very unlikely these demands would occur month after month and year after year for all water users; however, this scenario provides the RBC with information on which to base conservative management strategies. The same six water users with shortages in the Moderate Demand 2070 Scenario exhibit slightly greater shortages under the High Demand 2070 Scenario. River flows are predicted to decrease moderately to substantially compared to the Current Use Scenario throughout the basin. Median flow at the most downstream site of the Santee River Mainstem (SNT09) is predicted to decrease by approximately 19 percent, based on 2070 demands.

- Lakes Marion and Moultrie are required to release a certain amount of water depending on the time of year per their FERC license. The FERC license was recently updated in 2023 with new, significantly increased, minimum target releases. Even in the Current Use Scenario, the lakes are unable to meet their minimum target releases all of the time without utilizing storage during periods of low inflow, or without enacting low inflow protocols, which allow for reductions in the minimum release targets at the Santee Dam until inflows return to normal. In the Moderate Demand 2070 and High Demand 2070 Scenario, the frequency of time at which the minimum target releases cannot be met increases.

- A Synthetic Drought Scenario was developed, which involves consecutively repeating the hydrology of the 2007—2008 drought with High Demand 2070 Scenario water demands. This scenario seeks to answer the question, “What if the drought of 2007—2008 repeated three times, for six years total?” The results of this Scenario showed that while water users had a similar maximum shortage as they did in the High Demand 2070 Scenario, Lakes Marion and Moultrie were able to refill enough between periods of the lowest flow that max shortage for water users did not increase during successive low flow periods.

Results and conclusions are based on modeling that assumed historical climate patterns supplemented by analysis of a more severe, extended drought. In subsequent phases of river basin planning, the RBC may decide to evaluate potential impacts to Surface Water supply availability resulting from plausible future climate conditions such as increasing temperatures and more variable precipitation.

5.6.2 Groundwater Observations and Conclusions

Groundwater levels are relatively stable basinwide across all aquifers in response to groundwater development, and for a majority of the basin, especially in the upper portion, declines in aquifer levels from predevelopment have been minimal. The greatest concern in the Santee River basin exists in the Charleston aquifer, which has historically been affected by a large cone of depression.

The aquifers underlying the basin can transmit large volumes of groundwater to support projected water demand over the planning horizon, but in the absence of testing the demand scenarios with a calibrated groundwater model, this evaluation is an educated guess. The updated Coastal Plain groundwater model will help to better estimate potential groundwater declines related to future projected use.

Specific observations, conclusions, and recommendations coming from the groundwater assessment are presented below.

- Although the Crouch Branch and McQueen Branch aquifers have experienced declines of up to 100 feet from predevelopment levels in the upper part of the basin because of consistent and continued use for agriculture and water supply, recharge to both aquifers is generally adequate. It is likely that no groundwater supply shortages will occur under projected use scenarios in the upper basin.
- Agricultural irrigation is the largest groundwater use in the basin and is concentrated in the upper to middle basin in Calhoun, Clarendon, Orangeburg, Richland, and Sumter Counties. Irrigation in this area is projected to increase over the planning horizon. There are too few trend and synoptic monitoring wells in the Crouch Branch and McQueen Branch aquifers to adequately evaluate groundwater trends in this area. Additional monitoring wells are needed to understand how future pumping may impact aquifer levels in the area.
- Public water supply demand is expected to increase in Berkeley, Charleston, Dorchester, Lexington, and Richland Counties over the next several decades. While most large public suppliers already use both groundwater and surface water, additional supply-side and demand-side groundwater management strategies, such as aquifer storage and recovery or the use of underutilized or deeper aquifers, should be explored to meet the growing demand.
- Groundwater levels should be monitored routinely, particularly in the lower Coastal Plain and coastal counties. In addition to the measurement of static water levels, water levels in actively pumping wells should also occasionally be measured.

Chapter 6
Water Management Strategies

This chapter summarizes the evaluation of potential water management strategies identified by the Santee RBC. The Planning Framework identifies a two-step process to evaluate water management strategies. As a first step, the Planning Framework states that the proposed management strategies are to be simulated, where possible, using the available models to assess each strategy's effectiveness in eliminating or reducing identified shortages, or in increasing surface water or groundwater supply. For strategies deemed effective, a second step addresses each strategy's feasibility for implementation. The Planning Framework identifies multiple considerations for determining feasibility, including potential costs and benefits, consistency with state regulations, reliability, environmental and socioeconomic impacts, and potential interstate or interbasin impacts.

6.1 Surface Water Management Strategies

Under the Planning Framework, a surface water management strategy is any water management strategy proposed to eliminate a surface water shortage, reduce a surface water shortage, or generally increase surface water supply to reduce the probability of future shortages. Water management strategies may also help maintain required releases from reservoirs. Strategies include demand-side management strategies that reduce supply gaps by reducing demands, and supply-side strategies that reduce supply gaps by directly increasing supply.

6.1.1 Overview of Strategies

The Santee RBC identified and discussed a portfolio of demand-side strategies consisting of municipal water conservation and efficiency practices and irrigation (agricultural and golf courses) water efficiency practices, as listed in Tables 6-1 and 6-2, respectively. While the demand-side strategies were identified for surface water withdrawers, they also apply to the basin's groundwater withdrawers. The RBC also discussed several strategies that increase the amount of surface water available for withdrawal (supply-side strategies), and evaluated them under the 2070 High Demand Scenario. Existing supply-side strategies, such as conjunctive use of both surface water and groundwater, interbasin transfers, aquifer storage and recovery (ASR), and use of small impoundments to provide storage during low flow periods are already effectively used in the Santee River basin.

Table 6-1. Municipal water conservation and efficiency practices[1].

Municipal Practices	
Development, Update, and Implementation of Drought Management Plans	Recycled Water Programs
Public Education of Water Conservation	Water Waste Ordinance
Conservation Pricing Structures/Drought Surcharge	Building Code Requirements
Residential Water Audits	Toilet Rebate Program
Landscape Irrigation Programs and Codes	Car Wash Recycling Ordinances
Leak Detection and Water Loss Control Programs (Including AMI and AMR)	

[1] Here, and throughout Chapter 6, "municipal" includes local governments, special purpose districts, authorities, and other organizations that provide water to the public.

Table 6-2. Irrigation (agricultural and golf courses) water efficiency practices.

Irrigation Practices	
Water Audits and Nozzle Retrofits	Irrigation Equipment Changes
Irrigation Scheduling and Smart Irrigation	Future Technologies
Soil Management and Cover Cropping	Wetting Agents to Reduce Water Use at Golf Courses
Crop Variety, Crop Types, and Crop Conversions	

The RBC additionally outlined water conservation approaches for manufacturing (industrial) and energy water users. The identified strategies are water audits, rebates on energy-efficient appliances, water recycling programs, water-saving equipment and efficient water systems, water-saving fixtures and toilets, and educating employees about water conservation. Several of these approaches overlap those listed for municipal users, described in Section 6.1.2.

These strategies do not represent an exhaustive list of possible strategies that water users in the Santee River basin could implement. Similarly, not all strategies will be applicable to all users in the basin. The most appropriate strategies for a water withdrawer will depend on their location, end use, water source, financial resources, and other constraints or opportunities.

The sections that follow detail the surface water management strategies reviewed and discussed by the RBC. Technical evaluation of their potential effectiveness, and assessment of their feasibility are also presented.

6.1.2 Municipal Water Efficiency and Conservation Demand-Side Strategies

This subchapter describes the municipal water efficiency practices that were considered for inclusion as part of a toolbox of strategies. These demand-side strategies also apply to groundwater users.

Development, Update, and Implementation of Drought Management Plans

This strategy is already ongoing in the basin because public suppliers were required to develop drought management plans as part of the state's Drought Response Act of 2000. Each drought management plan has a set of measurable triggers indicating when conditions enter one of three phases of drought, and the corresponding response actions to reduce demand by a target percentage. Chapter 8 describes the drought management plans in the Santee basin. Under this strategy, public suppliers would continue to implement their drought management plans during drought conditions and update their plans to reflect any changes to the system. The Santee RBC recognizes the importance of the drought management plans for reducing demand and conserving water during critical low-flow periods.

Public Education of Water Conservation

This strategy would involve expanding existing public education programs or developing new programs as needed. Water conservation education could occur through public schools, civic associations, or other community groups. Water utilities and local governments could create informational handouts and/or include additional water conservation information on water utility bills. For this strategy to remain effective, public outreach would need to continue on a regular basis to maintain public engagement and motivation. The RBC discussed the possibility of larger water utilities sharing staffing or other conservation resources with smaller utilities. The South Carolina American Water Works Association (SCAWWA) and the South Carolina Rural Water Association (SCRWA) have many resources including standards and guidances that water utilities can utilize on conservation resources.

In the Santee basin, organizations such as the Clemson Cooperative Extension Service could offer programs that help educate the public about water conservation. One potential action to support this strategy is for the Santee RBC to coordinate with groups like Clemson, that have existing education and outreach efforts.

The Santee RBC could also look to the 2014 Water Use Efficiency Plan developed by the Catawba-Wateree Water Management Group (CWWMG) for an example of a basinwide approach to reduce demand. The 2014 Plan includes measures such as a public information campaign, education and outreach, and landscape water management and demonstration gardens. The Santee RBC may request that members of the CWWMG provide an update on actions and results since the 2014 Plan to guide Santee RBC actions.

Conservation Pricing Structures/Drought Surcharges

Conservation pricing structures increase the unit cost of water as consumption increases. Utilities may have pricing structures that use a flat rate, rates that vary with consumption, or some combination of the two. Conservation pricing sets higher unit-use rates for customers whose usage exceeds set thresholds. This strategy assumes that consumers will curtail their personal use to avoid paying higher prices. The extent of demand reduction depends on the magnitude of the price increase and the local price elasticity of demand for water usage.

In the Santee River basin, Mount Pleasant Waterworks, which sources water from groundwater and purchases water from the Charleston Water System, has implemented conservation pricing that penalizes excessive use. The plan includes four pricing blocks where the first block starts when a user exceeds

9,200 gallons in a month. If a user exceeds the minimum for the next tier, they will be charged an increased rate that is associated with Block 2. The amount charged increases as the user exceeds higher tiers until Block 4 is reached. The Commissioners of Public Works (d.b.a Charleston Water System), a surface water user, has drought surcharges in place that can be implemented during extreme conditions. The surcharge amount is broken up into different tiers that may be implemented at the discretion of the Commissioners. These pricing structures/surcharges primarily discourage landscape irrigation, filling of swimming pools, and other uses of water beyond what is normally required for human health purposes.

Residential Water Audits

Residential water audits allow homeowners to better understand their personal water use and identify methods to reduce water use. Homeowners can perform these audits themselves using residential water audit guides, or water utilities may provide free residential water audits to their customers. Residential water audits involve checking indoor uses (e.g., toilets, faucets, showerheads) and outdoor uses (e.g., lawn sprinklers). Based on the results of the audit, homeowners may invest in low-flow systems, repair leaks, and/or adjust personal water use behaviors.

Landscape Irrigation Programs and Codes

Landscape irrigation programs or water-efficient landscaping regulations can encourage or require homeowners to adopt water-efficient landscaping practices. Such practices seek to retain the natural hydrological role of the landscape, promote infiltration into groundwater, preserve existing natural vegetation, and conserve water. Water-efficient landscaping may include incorporating native or low-water-use plants into landscape design (City of Commerce, CA 2021).

Local governments can require use of these water efficiency measures through municipal codes or encourage their use through incentives or educational programs. Potential practices include:

- Smart Irrigation Controller Rebate – Utilities may offer rebates to homeowners who replace their existing irrigation controllers with smart irrigation controllers that adjust irrigation according to soil moisture levels. Smart irrigation controllers incorporate soil moisture sensors (SMSs) and/or precipitation and/or evapotranspiration sensors (called weather-based irrigation controllers [WBICs]). Controllers can be WaterSense-certified by meeting U.S. Environmental Protection Agency (EPA) criteria.

- Turf Replacement Rebate – Utilities may offer rebates to homeowners or businesses who replace irrigable turf grass with landscaping that requires minimal or no supplemental irrigation.

- Developer Turf Ordinance – Ordinances can be set that require new developments to have reduced irrigable turf grass area. Such development may be required to have low flow or microirrigation in plant beds, spray or rotor heads in separate zones for turf grass, or smart irrigation controllers to manage remaining turf areas.

- Education Programs – Programs could be offered for homeowners to learn about water-efficient landscaping practices. Some examples of landscape irrigation improvements include:
  - Verifying the best irrigation schedule for the climate and soil conditions
  - Verifying the recommended nozzle pressure in sprinklers

  - Adjusting sprinkler locations to ensure water falls on lawns and/or gardens (not on sidewalks or other impervious surfaces)
  - Using a water meter to measure the water used in landscape irrigation
- A time-of-day watering limit prohibits outdoor watering during the hottest part of the day, usually 10:00 a.m. to 6:00 p.m. This practice reduces water loss from evaporation.

The need for landscape irrigation programs and codes can potentially be reduced with effective conservation pricing structures.

Leak Detection and Water Loss Control Programs

A water loss control program identifies and quantifies water uses and losses from a water system through a water audit. Once identified, sources of water loss can be reduced or eliminated through leak detection, pipe repairs or replacement, and/or changes to standard program operations or maintenance protocols. Following these interventions, the water loss program can evaluate the success of the updates and adjust strategies as needed.

Automated meter reading (AMR) and advanced metering infrastructure (AMI) are technologies that can assist with leak detection. AMR technology allows water utilities to automatically collect water use data from water meters, either by walking or driving by the property. AMI systems automatically transmit water usage data directly to the utility without requiring an employee to travel to the property. AMI systems collect data in real time. Both technologies reduce the staff time required to read meters and allow utilities to more frequently analyze actual consumption (as opposed to predicting usage based on less frequent manual meter readings). Most utilities already perform manual and/or AMR on a monthly basis where the user and utility both become aware of any atypical usage and potential leaks. AMI allows for leak detection even sooner and can allow the user to understand the types of water use are most responsible for their bill. Higher-than-expected readings can be flagged as potential leaks. Because of their ability to collect data more frequently, AMI systems may detect consumption anomalies sooner than AMR systems. AMI systems allow for earlier detection of smaller leaks so repairs can be made before a major pipe breaks. However, AMI systems are more expensive to install than AMR systems and therefore may not be economical for smaller utilities. Hybrid systems on the market allow for future migration from AMR to AMI.

An example of a basinwide water audit and water loss control program is that of CWWMG, which is undertaking a significant water audit project to identify real (leaks) and apparent (meter inaccuracy) water losses throughout the basin. This project identified 17 billion gallons of nonrevenue water that could be managed, thereby increasing utility revenue by $16.8 million (CWWMG 2023). Subsequent phases involve conducting economic analyses and identifying water loss goals for each CWWMG member and the entire group. A similar effort could be pursued within the Santee River basin.

Georgia is one of the few states that have implemented statewide water loss control requirements. In 2010, the Georgia Water Stewardship Act was enacted. The Act set water loss control requirements that apply to public water systems serving populations over 3,300, which include:

- Completing an annual water loss audit using American Water Works Association (AWWA) M36 Methodology
- Developing and implementing a water loss control program

- Developing individual goals to set measures of water supply efficiency
- Demonstrating progress toward improving water supply efficiency

Recycled Water Programs

Recycled water programs reuse highly treated wastewater for other beneficial purposes, reducing demands on surface water and groundwater. Water can be reclaimed from a variety of sources then treated and reused for beneficial purposes such as irrigation of crops, golf courses, and landscapes; industrial processes including cooling water; cooling associated with thermoelectric plants; and environmental restoration. The quality of reclaimed water would need to be matched with water quality requirements of the end use.

The national WateReuse Association defines terminology around water reuse in the following way. **Recycled water** generally refers to treated domestic wastewater that is used more than once before it passes back into the water cycle. The terms "reused" and "recycled" are often used interchangeably depending on geographical region. **Reclaimed water** is not reused or recycled until it is put to some purpose. It can be reclaimed and be usable for a purpose, but not recycled until somebody uses it. This River Basin Plan uses both terms, recycled water and reclaimed water, depending on the context and in accordance with these definitions. The difference in terminology is shown in Figure 6-1, where treated wastewater effluent that undergoes further, advanced treatment becomes reclaimed water, and when that reclaimed water is put to use it becomes recycled water.

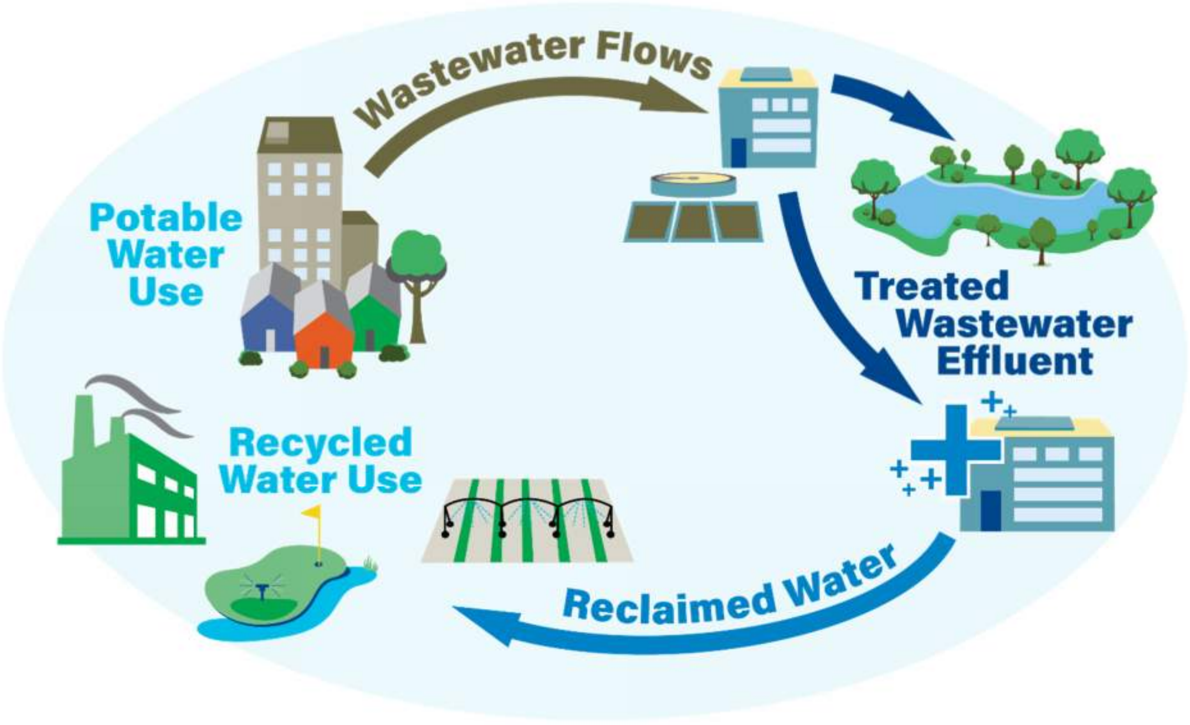


Figure 6-1. Recycled water cycle and definitions.

Water Waste Ordinances

Local governments can establish a water waste ordinance to prohibit the watering of impervious surfaces, such as sidewalks or driveways, and/or prohibit runoff from private properties onto public streets.

Building Code Requirements (Water Efficiency Standards for New Construction)

Local ordinances can require that renovations and new construction meet established water efficiency metrics. These ordinances may either be set by the local government or rely on existing water efficiency certification programs such as LEED or U.S. EPA's WaterSense. These programs have set water efficiency requirements for all household fixtures, such as a maximum rating of 2.5 gpm flow rate for showers and maximum rating of 1.6 gpf for toilets (Mullen 2022).

Toilet Rebate Program

Residents can be incentivized to replace household appliances and fixtures with low-flow alternatives that meet standards and requirements such as those from the Leadership in Energy and Environmental Design (LEED) or U.S. EPA's WaterSense programs. For example, toilet rebate programs offer rebates for applicants who replace old, inefficient toilets with water-efficient ones. If a toilet being replaced uses 3.5 gallons per flush (gpf) and the replacement toilet uses 1.28 gpf, there will be a savings of 2.22 gpf per rebate. Assuming a use rate of five flushes per day per person (DeOreo et al. 2016) and an average of 2.5 persons per household results in savings of 27.8 gallons per household per day for each rebate.

Car Wash Recycling Ordinances

In-bay automatic car wash systems use approximately 35 gallons of water per vehicle. Touch-free car wash systems, which rely solely on chemicals and high-pressure spray rather than on the gentle friction of a soft-touch wash, use approximately 70 gallons of water per vehicle. Assuming one bay and 100 customers per day, these two common types of systems use between 3,500 and 7,000 gallons of water per day. To reduce water usage, car wash recycling ordinances require all new car washes to be constructed to include recycled water systems. Recycled water systems allow for water used in washing or rinsing to be captured and reused. Ordinances can set a percentage of recycled water to total water used. Typical ordinances require at least 50 percent use of recycled water.

6.1.3 Irrigation Water Efficiency Demand-Side Strategies

This section provides a more detailed description of the irrigation (agricultural and golf courses) water efficiency practices considered as part of the toolbox of strategies. These demand-side strategies also apply to groundwater users.

Water Audits and Nozzle Retrofits

Water audits monitor water use in an agricultural irrigation system to identify potential opportunities for water efficiency improvements. Water audits consider water entering the system, water uses, water costs, and existing water efficiency measures. Water audits gather information on the size, shape, and topography of the agricultural field, depth to groundwater, vulnerability to flooding, pumping equipment, irrigation equipment, and past and present crop use and water use (Texas Water Development Board 2013).

Across South Carolina, Clemson University Cooperative Extension Service specialists and researchers have held meetings to talk with farmers about center pivot irrigation and discuss the Clemson Center Pivot Irrigation Test Program, a type of water audit offered by the Clemson Extension Water Resources, Agronomic Crops, and Horticulture Teams. These audits measure irrigation uniformity—the consistency of irrigation depth across the irrigated area. Without irrigation uniformity, some crops may experience overirrigation and some may experience underirrigation, leading to wasted water and lost profit. The Center Pivot Irrigation Test Program can provide growers with a map of irrigation depths, observed issues such as leaks and clogs, estimated costs of over- or underwatering, estimated costs for nozzle retrofits, and design versus observed flow rates and system pressure (Clemson Cooperative Extension 2022a). After the audit, a report is provided that includes an estimated cost of under- or overirrigation based on crop type. The cost of suboptimal irrigation is compared to the estimated cost of a sprinkler retrofit.

The South Carolina Mobile Irrigation Laboratory pilot project is another example water audit program. This project was the result of a partnership with South Carolina Department of Agriculture (SCDA) and Aiken Soil and Water Conservation District. Pilot project audits identified areas of over- and underwatering, suggested energy savings opportunities, and recommended upgrades or operational changes (SCDNR 2019d). The project provided no-cost water and energy audits of 24 agricultural center pivot irrigation systems throughout South Carolina over 3 years (SCDNR 2020).

Irrigation Scheduling and Smart Irrigation

Irrigation scheduling refers to the process of scheduling when and how much to irrigate crops based on the needs of the crops and the climatic/meteorological conditions. It ensures that crops are receiving the correct amount of water at the right time. The three main types of irrigation scheduling methods are soil water measurement, plant stress sensing, and weather-based methods. To measure soil water, farmers can use SMSs at varying depths. SMSs are of two types: those that measure volumetric water content and those that measure soil tension (University of Minnesota Extension 2024). Water application can be controlled and limited by identifying precise periods when irrigation is needed by using soil moisture measurements and other factors such as soil temperature, crop growth stage, localized evapotranspiration, and even weather forecasts. For weather-based methods, farmers can research regional crop evapotranspiration reports to develop an irrigation schedule. Additionally, farmers can use thermal sensors to detect plant stress (Freese and Nichols, Inc. 2020). The use of thermal and/or moisture sensors to automatically schedule irrigation is referred to as smart irrigation. Advanced irrigation scheduling and use of sensors and smart irrigation technology may reduce water use by 15 percent on average (Smart Irrigation 2019).

A Clemson University study on intelligent water and nutrient placement (IWNP) combines smart watering strategies with smart fertilizer applications. IWNP uses smart sensing with model-based decision support systems to determine the irrigation water and nutrient application required by crops at a given time (Clemson College of Agriculture, Forestry and Life Sciences 2021). The IWNP systems are installed on existing overhead irrigation systems as a retrofit. Clemson seeks to develop the IWNP system, then develop a training program to teach farmers how to use the system.

Soil Management and Cover Cropping

Soil management includes land management strategies such as conservation tillage, furrow diking, and the use of cover crops in crop rotations. The USDA defines conservation tillage as "any tillage or planting system that covers 30 percent or more of the soil surface with crop residue, after planting, to reduce soil erosion by water" (USDA 2000). Conservation tillage can conserve soil moisture, increase water use efficiency, and decrease costs for machinery, labor, and fuel. Types of conservation tillage include:

- No Till – Soil is left undisturbed from harvest to planting except for nutrient injection. Planting is done in narrow seedbeds and a press wheel may be used to provide firm soil–seed contact (Janssen and Hill 1994).
- Strip Till – This practice involves tilling only the seed row prior to planting, disturbing less than one-third of the row width (Conservation Technology Information Center 1999).
- Ridge Till – This practice involves planting into a seedbed prepared on ridges using sweeps, disk openers, coulters, or row cleaners. Residue is left on the surface between ridges to reduce soil loss (Janssen and Hill 1994).
- Mulch Till – This practice uses chisel flows, field cultivators, disks, sweeps, or blades to till soil in such a way that it does not invert the soil but leaves it rough and cloddy (Janssen and Hill 1994).
- Furrow Diking – The practice of creating small dams or catchments between crop rows to slow or prevent rainfall runoff and increase infiltration. Increased water capture reduces the supplemental irrigation needed, resulting in direct water savings.
- Cover Crops – This practice involves planting cover crops, such as cereal grains or legumes, following the harvest of summer crops. Cover crops use nutrients not used by previous crops, and protect against nutrient runoff and soil erosion. Cover crops can increase infiltration and the water-holding capacity of the soil, which may indirectly result in water savings because applied water is used more efficiently.

Crop Variety, Crop Type, and Crop Conversion

Changing crop types from those requiring relatively large amounts of water to those requiring less water can save significant amounts of irrigation water. Exact savings vary by crop, but could potentially be on the order of 15.8 acre-inches per acre (Freese and Nichols, Inc. 2020). Switching the variety of a particular crop may also be a water conservation strategy. For example, switching from full/mid-season corn to short-season corn could result in a savings of 3.7 acre-inches per acre. However, such a change could also result in substantial yield loss, making it an unviable option for some growers (Freese and Nichols, Inc. 2020).

In South Carolina, transitioning away from corn and small grains, such as wheat, rye, oats, and barley, and increasing cotton crops can reduce water use. However, because the choice of crops is market-driven and certain machinery, infrastructure, and skills are specific to different crops, changing crop type may not be economical for growers, especially in the Santee River basin. Conversion programs that offer growers incentives may be necessary.

Irrigation Equipment Changes

Changing from low-efficiency to higher-efficiency irrigation equipment can reduce water use but requires significant financial investment. Irrigation methodologies may include mid-elevation, low-elevation, low-elevation precision application, or drip/trickle irrigation. These methodologies have application efficiencies of 78, 88, 95, and 97 percent, respectively (Amosson et al. 2011).

Future Technologies

There are several emerging technologies to improve irrigation efficiency and water conservation that are under development or in the early stages of being adopted on a larger scale. An example of a future technology, as discussed herein, is smart irrigation systems that rely on soil moisture levels, weather conditions, and crop water needs in real time. High-efficiency irrigation control systems use weather data to adjust irrigation schedules automatically (HydroPoint 2012). Precision agriculture methods use Global Positioning System and satellite imagery to apply water, fertilizers, and pesticides more accurately. As new technologies are developed and commercialized, agricultural water users in the basin should consider how they might apply these technologies to conserve water.

Wetting Agents to Reduce Water Use at Golf Courses

Adding wetting agents can reduce the surface tension of water, allowing irrigation water to penetrate deeper into the root zone. Also known as soil surfactants, wetting agents can be applied for a number of different reasons including preventing localized dry spots, improving moisture uniformity, increasing water infiltration to the root zone, and improving moisture retention.

6.1.4 Supply-Side Strategies

As discussed in Chapter 5, potential surface water shortages were identified through scenario modeling. The majority of these are irrigation and golf course users, which are generally small and have localized opportunities for small amounts of storage to provide a buffer against small and infrequent shortages. Larger shortages are possible for users that depend on Lakes Marion and Moultrie operations, either by direct withdrawal or by receiving downstream flows. These include the Santee Cooper RWS supply systems under all scenarios, and the Winyah Power Station under the Fully Permitted and Registered scenario.

The projected shortages are possible because of the downstream flow requirements into the Santee and Cooper Rivers imposed by FERC licensing. The impact of these increased flows during periods of low inflow is acknowledged, and reductions in outflows from Lake Marion and Lake Moultrie can be implemented during periods of low inflow in accordance with Santee Cooper's Low Inflow & Drought Contingency Plan for the Santee Cooper Project. Other potential contingency plans include adding temporary intakes and pumping if reservoir elevations drop below existing intakes. There may also be opportunities to negotiate appropriate balances between water supply and instream flow during drought emergencies. These were not simulated or evaluated by the RBC, but discussed as potential supply-side mitigation strategies.

6.1.5 Technical Evaluation of Strategies

The effectiveness of surface water management strategies in the Santee River basin was evaluated using the SWAM surface water model. This analysis focused on the impact of demand-side strategies on projected shortages and water availability in the 2070 High Demand Scenario. Technical analysis consisted of creating scenarios (using a monthly timestep) that evaluated the aggregated impact of municipal, industrial, and agricultural (including golf courses) demand-side management strategies. The municipal and industrial demand-side strategies were evaluated as a portfolio of strategies by assuming a decrease in projected municipal and industrial water demands resulting from implementing one or more strategies from the toolbox, such as water audits, low-flow appliances, public and employee education, conservation pricing structures, and water loss control programs. For irrigators, the same methodology was used to evaluate the impact of incremental reductions in overall water demands resulting from a combination of irrigation water efficiency techniques.

There is high uncertainty regarding the effective, combined reduction in demand for individual demand-side management strategies because their effectiveness depends on the extent of implementation and the magnitude of impact for each instance of implementation. For example, water savings associated with a landscaping program such as turf replacement will depend on the number of water users who participate in the program, the area of turf replaced, water demands for the existing turf landscape, water demands for the replaced landscaping, and the individual's adjustment of irrigation habits in response to the increased efficiencies. Because of this uncertainty, the effectiveness of the toolbox of demand-side strategies was simulated at three levels ranging from moderate to aggressive: 10 percent reduction in demand, 15 percent reduction in demand, and 20 percent reduction in demand. This represents a reasonable expected range of outcomes since many strategies may already be implemented to some extent (low flow appliances, pricing structures, etc.). In the SWAM model, a demand multiplier of 0.90, 0.85, or 0.80 was applied to all surface water users to simulate the 10, 15, and 20 percent demand reductons.

Table 6-3 summarizes the simulated frequency and magnitude of shortages for the 2070 High Demand Scenario and three scenarios representing moderate to aggressive demand-side management strategies which are assumed to result in 10, 15, and 20 percent reductions in projected demands. At a 20 percent demand reduction, the simulated shortages for water users that withdraw from Lake Marion, (WS: Santee Cooper - Lake Marion RWS and GC: Santee-Cooper Resort) no longer occur. For the rest of the water user objects experiencing shortages in the 2070 High Demand Scenario, implementing demand-side management strategies alone may not be enough to eliminate the simulated shortages, but the evaluation shows the strategies can be successful in reducing the frequency and magnitude of shortage.

Table 6-3. 2070 High Demand Scenario shortages with three levels of implementation of municipal demand-side management strategies.

	Frequency of Shortage (%)				Maximum Shortage (MGD)			
Water User	**2070 High Demand**	**10% Demand Reduction**	**15% Demand Reduction**	**20% Demand Reduction**	**2070 High Demand**	**10% Demand Reduction**	**15% Demand Reduction**	**20% Demand Reduction**
WS: Santee Cooper - Lake Marion RWS	0.2	0.2	0.2	0.0	3.93	3.72	3.52	0.00
GC: Santee-Cooper Resort	0.2	0.2	0.2	0.0	0.14	0.14	0.13	0.00
GC: The Members	0.4	0.4	0.4	0.4	0.15	0.13	0.11	0.09
IR: Dargan Culclasure	6.8	6.8	6.8	6.6	0.75	0.71	0.67	0.63
IR: Lyons Bros	3.9	3.7	3.7	3.7	0.14	0.13	0.12	0.12
WS: Santee Cooper RWS	0.7	0.4	0.4	0.2	63.30	59.97	56.63	48.65

6.1.6 Feasibility of Surface Water Management Strategies

The Santee RBC assessed the feasibility of the strategies described in Section 6.1.2 considering consistency with regulations, reliability of water source, environmental impacts, socioeconomic impacts, potential interstate or interbasin impacts, and water quality impacts. Table 6-4 presents this assessment. Irrigation (agricultural and golf courses) practices are presented first, followed by municipal practices.

Color coding was used to identify the expected effect of the strategy within each category. Expected effects range from moderate to high adverse effects to moderate to high positive effects. The assignment of effects, whether adverse, neutral, or positive, was largely subjective and based on professional judgment and feedback from the RBC. The color coding used for the expected effects listed in Table 6-4 are shown below.

Color Coding for Assigning Expected Effects in Table 6-4.

Potential Moderate/High Adverse Effect	Potential Low Adverse Effect	Likely Neutral Effect (either no effect, or offsetting effects)	Potential Low Positive Effect	Potential Moderate/High Positive Effect

Table 6-4. Water management strategy feasibility assessment.

Water Management Strategy	Strategy Type	Consistency with Regulations	Reliability of Water Source	Environmental Impacts and Benefits[1]	Socioeconomic Effects	Potential Interstate or Interbasin Effects	Other Water Quality Considerations
Demand-Side Irrigation (Agricultural and Golf Courses) Practices							
Water Audits and Nozzle Retrofits	Demand-side – Irrigation/ Agriculture	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands.	**Impacts:** None anticipated. **Benefits:** Prevention of overwatering may limit runoff, erosion, and sedimentation.	No to low anticipated effects – Financial gains from reduced delivery and pumping costs likely outweigh costs of audit and nozzle retrofits.	No anticipated effects	See Environmental Benefits.
Irrigation Scheduling and Smart Irrigation	Demand-side – Irrigation	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands.	**Impacts:** None anticipated. **Benefits**: May reduce overfertilization and prevention of overwatering may limit runoff, erosion, and sedimentation.	Low to moderate effects – Initial costs of advanced technology may be partially offset by savings from reduced water and nutrient use.	No anticipated effects	See Environmental Benefits.
Soil Management and Cover Cropping	Demand-side – Irrigation/ Agriculture	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands.	**Impacts:** Low anticipated impacts – Increase in herbicides may be required. **Benefits:** May improve soil quality and reduce runoff.	Low to moderate effects – Initial costs of new equipment plus training and operations and maintenance (O&M) costs. Costs may be partially offset by reduction in soil, water, and nutrient loss.	No anticipated effects	No to low anticipated impacts – Conservation tillage may increase potential leaching of nitrogen or pesticide to groundwater. See also Environmental Benefits.
Crop Variety, Crop Type, and Crop Conversions	Demand-side – Irrigation/ Agriculture	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands.	**Impacts:** Low anticipated impacts – Variation in chemical application for different crops must be considered.	Medium to high anticipated effects – Potential profit loss from switching to lower demand crop or from a full season to short-season crop.	No anticipated effects	No anticipated impacts.

Table 6-4 (continued). Water management strategy feasibility assessment.

Water Management Strategy	Strategy Type	Consistency with Regulations	Reliability of Water Source	Environmental Impacts and Benefits[1]	Socioeconomic Effects	Potential Interstate or Interbasin Effects	Other Water Quality Considerations
Demand-Side Irrigation (Agricultural and Golf Course) Practices							
Irrigation Equipment Changes, including Drip/Trickle Irrigation	Demand-side – Irrigation/ Agriculture	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands.	**Impacts:** Low anticipated impacts – Changing equipment may disturb environmentally sensitive areas.	Low anticipated effects – Initial costs of equipment changes may be partially offset by water use savings. Investments in drip/trickle irrigation may not be economical for low value crops.	No anticipated effects	No anticipated impacts.
Future Technologies	Demand-side – Irrigation	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands.	**Impacts:** None anticipated. **Benefits**: May reduce overfertilization and overwatering; may limit runoff, erosion, and sedimentation.	Low to moderate effects – Initial costs of advanced technology may be partially offset by savings from reduced water and nutrient use.	No anticipated effects	See Environmental Benefits.
Wetting Agents to Reduce Water Use at Golf Courses	Demand-side – Golf Course/ Irrigation	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** None assuming bio-degradable and use of environmentally friendly surfactants. **Benefits**: Prevention of overwatering may limit runoff, erosion, and sedimentation	Low to no effects – Effective use of wetting agents can result in water and energy savings, reducing overall cost.	No anticipated effects	Low to none assuming bio-degradable and environmentally friendly surfactants are used

Table 6-4 (continued). Water management strategy feasibility assessment.

Water Management Strategy	Strategy Type	Consistency with Regulations	Reliability of Water Source	Environmental Impacts and Benefits[1]	Socioeconomic Effects	Potential Interstate or Interbasin Effects	Other Water Quality Considerations
Demand-Side Municipal Practices							
Development, Update, and Implementation of Drought Management Plans	Demand-side – Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability during droughts.	**Impacts:** None anticipated.	Low anticipated effects – Effects to utility revenue if demand reductions are substantial. Positive effect to residential users from reduced water bills (if billed at unit rates).	No anticipated effects	No anticipated impacts.
Public Education of Water Conservation	Demand-side – Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands.	**Impacts:** None anticipated.	Low to no anticipated effects – Effects to utility revenue if demand reductions are substantial. Positive effects to residential users from reduced water bills (if billed at unit rate).	No anticipated effects	No anticipated impacts.
Conservation Pricing Structures	Demand-side – Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands.	**Impacts:** None anticipated.	Moderate anticipated effects – Customers who cannot reduce water use may face economic hardship. Reduced billing revenue for utilities may cause financing issues or lead to further rate increases.	No anticipated effects	No anticipated impacts.

Table 6-4 (continued). Water management strategy feasibility assessment.

Water Management Strategy	**Strategy Type**	**Consistency with Regulations**	**Reliability of Water Source**	**Environmental Impacts and Benefits**[1]	**Socioeconomic Effects**	**Potential Interstate or Interbasin Effects**	**Other Water Quality Considerations**
Demand-Side Municipal Practices							
Residential Water Audits	Demand-side – Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands.	**Impacts:** None anticipated.	No to low anticipated effects – Revenue effects to utility from reduced demand may be offset by lower delivery costs. Effects to homeowners from repairs may be offset by reduced water bills (if billed at unit rate). The need to hire implementation and compliance staff would contribute to rate increase.	No anticipated effects	No anticipated impacts.
Landscape Irrigation Program and Codes	Demand-side – Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands.	**Impacts:** None anticipated. **Benefits:** Water quality of receiving waters may be improved by reducing runoff from landscaping.	Low anticipated effects – Mandates to meet standards may cause financial hardship for homeowners. No anticipated effects to homeowners from educational programs. The need to hire implementation and compliance staff would contribute to rate increase.	No anticipated effects	See Environmental Benefits.
Leak Detection and Water Loss Control	Demand-side – Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands.	**Impacts**: None anticipated.	Cost of program implementation could result in rate increase, no impact, or potential rate decrease, depending on circumstances.	No anticipated effects	No anticipated impacts.

Table 6-4 (continued). Water management strategy feasibility assessment.

Water Management Strategy	Strategy Type	Consistency with Regulations	Reliability of Water Source	Environmental Impacts and Benefits[1]	Socioeconomic Effects	Potential Interstate or Interbasin Effects	Other Water Quality Considerations
Demand-Side Municipal Practices							
Recycled Water Programs	Demand-side – Municipal	SCDES regulates reclaimed wastewater systems for irrigation use with public contact; there are no laws or regulations pertaining to indirect potable reuse or direct potable reuse	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** Low to moderate anticipated impacts: Depending on the extent of reclaim demand, reduced discharge from wastewater treatment facilities may reduce low flow levels **Benefits:** Depending on the extent of reclaim demand, reduced discharge from wastewater treatment facilities may result in improved receiving water quality	Moderate anticipated effects – Higher initial water bills to finance a recycled water program may be offset by long-term savings from postponing the need for new supplies and raw water treatment facilities. The need to hire operations staff could contribute to rate increase.	No anticipated effects	See Environmental Benefits Need to match end use with quality of reclaimed water.
Water Waste Ordinance	Demand-side - Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** Low anticipated impacts **Benefits:** Water quality of receiving waters may be improved by reducing runoff from landscaping	Low anticipated effects – Homeowners and business owners may face economic hardship from required modifications to irrigation system. The need to hire implementation and compliance staff would contribute to rate increase	No anticipated effects	See Environmental Benefits

Table 6-4 (continued). Water management strategy feasibility assessment.

Water Management Strategy	Strategy Type	Consistency with Regulations	Reliability of Water Source	Environmental Impacts and Benefits[1]	Socioeconomic Effects	Potential Interstate or Interbasin Effects	Other Water Quality Considerations
Demand-Side Municipal Practices							
Building Code Requirements	Demand-side - Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** None anticipated	Low anticipated effects – Efficiency standards may make renovations or construction more expensive and limit access to renovate or build. The need to hire implementation and compliance staff would contribute to rate increase	No anticipated effects	No anticipated impacts
Toilet Rebate Program	Demand-side - Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts**: Low anticipated impacts – Minor additional waste from discarded inefficient toilets	Low anticipated Effects – Positive benefit for homeowners from upgrading appliances for lower cost and reduced water billings (if billed at unit rate). Adverse effect due to need to hire implementation and compliance staff which would contribute to rate increase.	No anticipated effects	No anticipated impacts
Car Wash Recycling Ordinances	Demand-side – Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** Low anticipated impacts – renovation or construction may impact sensitive areas **Benefits:** Positive environmental benefit of reduced pollutant runoff	Low anticipated effects – Financial burden to developer or owner of car wash for construction/ renovation. The need to hire implementation and compliance staff would contribute to rate increase.	No anticipated effects	See Environmental Benefits

6.1.7 Cost-Benefit Analysis

Cost and benefit information for each strategy, in terms of potential cost or water savings, is discussed in this section. These are generalized values from literature or other locations and should be considered for planning-level assessment only, to help screen and understand the alternatives. Implementation planning would require more specific cost-benefit analysis by each of the stakeholders being asked to implement the various strategies.

The information provided in this chapter is not intended to rule any alternative into or out of a recommended River Basin Plan for the Santee River basin. Rather, the information is for comparison purposes, so that the potential benefits, risks, and impacts of the alternatives can be better understood and decision-makers can make more informed decisions about priorities.

Demand-Side Municipal Strategies

Development, Update, and Implementation of Drought Management Plans

Drought management plans in South Carolina generally have targets to decrease overall demands by 15 percent reduction in moderate drought, 20 perecent reduction in severe drought, and 25 percent reduction in extreme drought. Water suppliers may incur minor costs associated with plan updates, communication and enforcement.

Public Education of Water Conservation

Building water conservation awareness will not only save water but will reduce operational and production costs. Savings are estimated at 5,000 gallons per household per year for 30 percent of households targeted. Public education and outreach costs more per person in smaller communities than in larger ones ($2.75 per person per year for communities less than 20,000 and $1.80 per person per year for communities with more than 20,000) (Freese and Nichols, Inc. 2020).

Conservation Pricing Structures/Drought Surcharge

Implementing conservation pricing rate structures that discourage the inefficient use or waste of water is a cost-effective option for utilities because there are no direct costs to them to achieve a reduction in demand. However, reduction in billing revenue associated with decreased customer usage must be considered. On average, in the United States, a 10 percent increase in the marginal price of water in the urban residential sector can be expected to diminish demand by about 3 to 4 percent in the short run (Olmstead and Stavins 2009). An example application in the Texas Panhandle assumed 10 percent of households would respond and change their water consumption behavior, resulting in 6,000 gallons saved per household per year (Freese and Nichols, Inc. 2020).

Residential Water Audits

Residential water audits may result in implementing various strategies, retrofits, and other measures that may save up to 20 to 30 gallons of water per day per household. Costs include costs for water audits (if applicable) and for replacing or repairing household water systems.

Landscape Irrigation Programs and Codes

If water efficiency measures are required, costs would be associated with enforcement. If not required, costs would be associated with incentives or education programs. If programs include rebate offerings, the cost of the rebate itself and costs for administering the program must be considered. Smart irrigation controllers with an U.S. EPA WaterSense certification are commercially available for between $120 and $280. These costs assume there is already a compatible irrigation system in place. Costs to the homeowner would be greater if irrigation system installation or renovation is required. Irrigation with a smart irrigation meter rather than a standard irrigation meter may result in a water use efficiency reduction of 30 percent. An example of a turf replacement rebate is from California's Metropolitan Water District, which offers a $2 per square foot rebate for up to 5,000 square feet. The cost to the utility or municipality would be dependent on the rebate rate and percent uptake by customers.

Leak Detection and Water Loss Control Programs

U.S. EPA estimates that the average water loss in water systems is 16 percent, with up to 75 percent of the water loss potentially recoverable through a water loss control program (U.S. EPA 2013). Since 2010, Georgia's public water systems have reported, on average, between 13.5 and 17.4 percent water loss; however, 43 of 263 systems reported over 30 percent average annual water loss since 2010. Costs for a water loss control program would include the time spent conducting the water audit and costs for needed repairs, which would be system-dependent. However, water audits generally have been proven to be cost-effective. The AWWA M36 Manual of Water Audits and Loss Control Programs includes an example of a utility with a $79,000 water audit cost, which, in 2022 dollars, translates to a unit cost of $310 per water main mile (AWWA 2016).

AMI and AMR technologies greatly reduce the labor required for water meter reading. Davie County Public Utilities, a water system in North Carolina, required 50 days (with frequent misreads) to manually read all 11,000 service connections in their network. After using AMR technology, they reduced their meter reading rate to 3,000 meters in 2 days, with nearly 100 percent accuracy (Atkinson 2016). In Michigan, the Oakland County Water Resources Commission achieved a 99 percent read success rate and reduced their meter reading staff by half after implementing an AMR system (Atkinson 2016).

A cost-benefit analysis for Washington Suburban Sanitary Commission Water concluded that an AMI system would pay for itself in 11 years, and savings would exceed $286 million over a 20-year period (Arcadis 2020). The project cost was estimated to total $208 million dollars, with the primary cost driver of replacing 492,000 meters. The analysis estimated that 29 of the existing 37 meter reader employee positions would be eliminated, and the utility would have a revenue gain of more than $580 million over 20 years because of improved meter accuracy. The improved domestic leak detection would save customers approximately $56 million over 20 years. Intangible benefits include safer working environments for utility employees from reducing meter reading field activities, water and energy conservation by customers, identification of meter tampering and potential water theft, and benefits from more frequent billing cycles.

Another example is Red Star Water District, a small water system in Leedey, Oklahoma. The district conducted a water loss audit and found real losses of 28.9 million gallons per year, valued at $71,962 and representing 25.2 percent of the total water supplied to the system. After identifying 29 leaks, the district adopted an aggressive program of leak repair and was able to repair all leaks, saving the system 26 million gallons of water per year at a value of $71,000 annually (Oklahoma Department of Environmental Quality 2021).

Recycled Water Programs

Benefits include increased water supply, increased reliability, and reduced effluent disposal. Initial costs may be substantial and include construction/retrofit costs to wastewater facilities for full reuse capabilities and construction of distribution lines to end users. Benefits may result by lowering demand on highly treated potable water, thereby extending the source of supply and delaying the need for future upgrades to treatment processes or procuring additional water sources. The overall cost-benefit is dependent on the system, the end user, the cost of treatment, and many other factors. Utilities and others that have implemented recycled water programs have typically done so after careful analysis and planning to demonstrate the long-term financial viability of a recycled water program.

Water Waste Ordinances

Costs of this practice would be related to enforcement of the ordinance. Estimates range from $2,500 (communities less than 20,000 people) to $10,000 (communities with more than 20,000 people). Savings are estimated at 3,000 gallons per year per household (Freese and Nichols, Inc. 2020).

Building Code Requirements (Water Efficiency Standards for New Construction)

High efficiency toilets can save more than $100 per family per year (Mullen 2022). U.S. EPA estimates that fixtures meeting the WaterSense requirements can save approximately 700 gallons of water per year per household (U.S. EPA 2021). The costs associated with implementing local ordinances outlining water efficiency standards is low. There are numerous examples that can be used to guide ordinance development and implementation.

Toilet Rebate Program

Rebate programs to encourage use of low flow fixtures, toilets, and appliances have been used to lower residential water demand. The costs to the utility or local government are based on the rebate amount per fixture, toilet, or appliance, plus any program management costs. Reduced total water use in the community results in lower operating costs for the utility but may also result in lower billing revenue depending on the fee structure used.

Toilets made prior to 1980 typically used 5.0 to 7.0 or high gpf and toilets made from the early 1980s to 1992 typically used 3.5 gpf or more. The current federal standard is 1.6 gpf.

An example of an existing rebate requires customers to purchase a toilet using 1.1 gpf or less to receive a $75 rebate (Metropolitan North Georgia Water Planning District 2022). Metro Atlanta utilities have proven toilet rebate programs can be successful by replacing more than 150,000 toilets with low flow models between 2008 and 2019. Assuming an average water savings of just 2.4 gpf, this equates to a savings of 360,000 gpf. Since the average household flushed about 5 times per day, the combined water savings of these 150,000 low flow toilet replacements is a staggering 657 million gallons over the span of one year.

Car Wash Recycling Ordinances

Costs of this practice are associated with purchase and installation of a recycled water system by the car wash owner or developer. The initial cost for a water recycling system can range between $20,000 and $40,000 (in 2022 dollars) depending on the car wash size and requirements (Taylor 2013). Operating costs would be higher than a nonrecycled wash water system because of increased energy usage, replacement of filters and membranes, and other factors. Depending on whether the water was obtained from a public water system or (private) well, there would be a reduction in raw water costs since water demand would be reduced. Ordinances can set a percentage of recycled water to total water used. Typical ordinances require at least 50 percent use of recycled water.

Demand-Side Irrigation (Agricultural and Golf Courses) Strategies

Water Audits and Nozzle Retrofits

The cost of a Clemson Center Pivot Irrigation Test Program audit is $125.00 per pivot. Costs of other water audits vary significantly depending on whether they are conducted internally, by a consultant, or by a government entity. While the process of conducting a water audit does not alone provide benefits, if improvements such as nozzle retrofits are made, benefits can include increased water efficiency and energy savings. An approximately 15 percent reduction in water use could be expected from nozzle retrofits made following a center pivot sprinkler audit (Walther, pers. comm. 2021).

A sample audit report provided by Clemson Cooperative Extension estimates the cost of a retrofit sprinkler package at $5 per foot of pivot length (Clemson Cooperative Extension 2022b). In this example, the total cost to retrofit is estimated at $2,982. Using an assumed crop value, irrigation need, and cost of under- or overirrigation, the estimated suboptimal irrigation cost is $4.39 per acre. With an irrigated area of 37.4 acres, this is an estimated loss of $164. Over the estimated 23.6-year lifespan of the retrofit, this equates to $3,875 in savings compared to the total cost of $3,107 ($2,982 cost of the retrofit plus the $125 cost of the initial audit).

Irrigation Scheduling and Smart Irrigation

According to the 2021 Texas Panhandle Water Plan, the cost of a typical smart irrigation system ranges from $6.50 to $12.00 per acre and benefits amount to approximately 10 percent of the water used on each crop seasonally (Freese and Nichols, Inc. 2020). Other studies suggest that irrigation scheduling may reduce water use by 15 percent on average (Smart Irrigation 2019). The overall cost savings is hard to quantify, given the variability in irrigation rates, the cost of pumping, the potential increase in crop yield that results from optimizing irrigation, and other factors. A simple example assuming a center pivot irrigated area of 81 acres, a cost of $648 for a smart irrigation system ($8 per acre), and an annual cost of $1,374 ($16.96 per acre) for energy associated with pumping (North Carolina State University 2007), suggests that if a smart irrigation system is able to reduce water use by 15 percent, then the $648 capital cost of the system will be recovered in just over 3 years.

Soil Management and Cover Cropping

The 2021 Texas Panhandle Water Plan assumed a 1.75 acre-inches per acre of water savings from soil management strategies (Freese and Nichols, Inc. 2020). While conservation tillage may result in savings from reduced machine, fuel, and labor costs, depending on the conservation type implemented, it also has initial costs to transition from conventional to conservation tillage, including the purchase of new equipment and any chemical control costs (herbicides or pesticides). For example, ridge tilling requires specially designed equipment such as a ridge cultivator or ridge planter.

Implementing furrow diking can range from less than $2,000 to several thousand dollars. Per crop per season per acre estimates range from $5 to $30. The Texas Water Development Board estimates water savings of 3 inches per season (0.2 acre-feet per acre), but savings will vary by field and season. Using the irrigation of corn with a 113-day growing season as an example, a reduction in 3 inches per season would be expected to lower the seasonal irrigation need from 9.9 inches to 6.9 inches, assuming average seasonal precipitation of 16 inches, and an average seasonal corn crop watering need of 25.9 inches. The reduction of 3 inches would save approximately $10 per acre in irrigation system operating cost.

Crop Variety, Crop Type, and Crop Conversion

The cost of implementation and the actual reduction in irrigation water used will depend on numerous local factors including market pricing, cost of seed, cost of harvesting, and the value of crops.

If farmers are encouraged to switch from long-season varieties to short-season varieties, they may experience loss in yield and therefore revenue. However, they will see savings from reduced seed, pumping, fertilizer, harvest, and water use costs.

Irrigation Equipment Changes

Irrigation equipment changes may focus on lowering the elevation of nozzles on center pivot systems. Total replacement of a system (assumed 125-acre, 30-inch spacing) with a new 60-inch spacing system is estimated at $151.20 an acre, including labor and new hoses, heads, and weights. Conversion instead of full replacement of the same system is estimated at $44 per acre. Costs assume that the system is converting from low elevation spray application (LESA) or mid-elevation spray application (MESA) systems to low elevation precision application (LEPA) systems (Freese and Nichols, Inc. 2020). This transfer in irrigation practice may result in a 7 to 17 percent increase in irrigation efficiency and, consequently, decreased water usage. In most cases, irrigation equipment changes will be a combination of replacement and conversion.

Drip irrigation systems can cost between $500-$1,200 per acre (Simonne et al. 2024). Drip irrigation can improve the efficiency of both water and fertilizer applications, lowering the cost associated with pumping water and lowering fertilizer cost. Nutrient applications may also be better timed to meet plant needs. Drip systems can also be easily automated, lowering labor costs. One Texas cotton grower reported increasing their yield to 3 bales of cotton per acre using 16 inches of drip system water, compared to only 2.25 bales of cotton per acre using 16 inches of water from a center pivot system (Toro 2010). A Kansas corn grower who installed a drip system on 4,000 acres experienced a combined savings considering fuel, labor, chemical/fungicide, fertilizer, and cultivation of $160.05 per acre, compared to flood irrigation. At an initial capital cost of $1,200 per acre, the payback period for the drip system was 3.6 years (Toro 2007).

Wetting Agents to Reduce Water Use

Effective wetting agent programs can yield overall water savings. One study resulted in an approximately 20 percent savings the first season of application, and an average annual savings of $12,500 to $15,000 (U.S. Golf Association [USGA] 2024). Turfgrass loss during the summer was reduced to a level that allowed for the elimination of annual fairway overseeding, saving an additional $15,000 per year. The combined savings of water and seed completely offset the cost of the wetting agent program.

6.2 Groundwater Management Strategies

Under the Framework, a groundwater water management strategy is any water management strategy proposed to address a Groundwater Area of Concern or groundwater shortage. Strategies may include demand-side management strategies that reduce supply gaps by reducing demands, and supply-side strategies that increase or augment supply. Examples of demand-side strategies include municipal and agriculture conservation and water use efficiency measures. Examples of supply-side strategies include ASR, relocating pumping from one aquifer to another, and conjunctive use of both surface and groundwater.

In the Santee River basin, just over 5 percent of current demands are met by groundwater. Groundwater demands are projected to increase by approximately 60 percent over the planning horizon under the High Demand Scenario. The Santee RBC focused the evaluation and selection of water management strategies on surface water management strategies; however, the demand-side strategies described in the previous section for surface water withdrawers also apply to the basin's groundwater withdrawers. Should utilities begin to rely more on groundwater as a water source or for developing redundancy, additional analysis may be needed.

Chapter 7

Water Management Strategy Recommendations

The Santee RBC considered a variety of both demand and supply-side water management strategies for implementation in the Santee River basin. As water management strategies were identified and discussed, the RBC considered their ability to eliminate projected shortages observed and increase water availability. While demand-side strategies are not likely to be needed for the purpose of reducing or eliminating projected shortages, they may have other benefits including reducing the cost of water production and use, building resilience, mitigating potential localized shortages that are difficult to capture in the modeling, and sustaining and extending surface water supplies if unforeseen conditions occur such as changes in climate patterns, higher than expected growth, or higher than expected water use.

The water management strategy recommendations presented in this chapter align with the RBC vision and goal statements for the basin. By assessing and recommending a portfolio of demand-side strategies, the stakeholders comprising the RBC are recommending actions that help achieve the RBC's vision statement: ***"A resilient and sustainably managed Santee River Basin that balances human and ecological needs now and in the future."*** The selection and recommendation of the demand-side strategies also support the RBC-identified goal to: ***"Identify information and management gaps and develop new policy and water management strategy recommendations, as may be required, to ensure that water resources are maintained to support stakeholder's and ecological needs."***

7.1 Selection, Prioritization, and Justification for each Recommended Water Management Strategy

Demand-side and supply-side strategies recommended by the Santee RBC to conserve surface water resources, enhance instream flows, and increase water supply availability are identified and discussed below.

Municipal Demand-side Strategies: The recommended municipal demand-side water management strategies are summarized in Table 7-1. The RBC did not prioritize the remaining strategies because of the significance of individual utility circumstances (e.g., current operations and programs, utility size, financial means) in determining which is the most desirable strategy to pursue. The strategies represent a "toolbox" of potential approaches to reduce water demands. Utility managers may find the descriptions and feasibility assessment presented in Chapter 6 helpful for determining which strategies to pursue.

Table 7-1. Municipal demand-side water management strategies.

Water Management Strategy	Prioritization
Public Education of Water Conservation	Toolbox of strategies. Applicability and priority vary by utility (see discussion below)
Conservation Pricing Structures/ Drought Surcharge	
Leak Detection and Water Loss Control Programs including AMI and AMR	
Landscape Irrigation Program and Codes/Time-of-Day Watering Limit	
Recycled Water Programs and Promotion of Water Recycling Practices to Customers	
Residential Water Use Review	

As part of their discussions, the RBC identified several considerations related to these municipal demand-side water management strategies:

- RBC members noted that although the up-front cost of AMI implementation is high, it can allow utilities to instantaneously identify and control areas of potential leakages. This strategy can help support the Leak Detection and Water Loss Control Programs strategy.
- RBC members initially considered water recycling for car washes, and while they support this strategy, they wanted to make their recommendation broader to include additional types of businesses and industry for water recycling programs.

Agricultural Demand-side Strategies: The RBC-recommended agricultural water management strategies are summarized in Table 7-2. The RBC chose not to prioritize strategies to recognize that the most appropriate strategy for a given agricultural operation will depend on the size of the operation, crops grown, current irrigation practices, and financial resources of the owner/farmer. The descriptions and feasibility assessment presented in Chapter 6 may be helpful to owners/farmers for determining which strategies to pursue.

Table 7-2. Agricultural water management strategy prioritization.

Water Management Strategy	Prioritization
Water Audits and Nozzle Retrofits	Toolbox of strategies. Priority varies by operation.
Irrigation Scheduling	
Moisture Sensors/ Smart Irrigation Systems	
Soil Management and Cover Cropping	
Crop Variety, Crop Type, and Crop Conversion	
Irrigation Equipment Changes	
Future Technologies	
Wetting Agents (golf courses)	

Industrial and Energy Sector Demand-side Strategies: The RBC identified and discussed water conservation approaches for manufacturing (industrial) and energy water users. Existing and new industrial users, whether purchasing through public water supply or directly withdrawing, need to follow best practices for water efficiency. The strategies identified by the RBC are water audits, rebates on energy-efficient appliances, water recycling, water saving equipment and efficient water systems, water-saving fixtures and toilets, and educating employees about water conservation. Water audits could involve adding meters throughout the system and pressure transducers to identify leaks where and when they occur. As with municipal strategies, these represent a "toolbox" of potential approaches to reduce water demands for the industrial and energy sectors.

Supply-side Strategies: The RBC identified supply-side strategies that are already implemented in the basin and discussed which of these should be recommended for expansion. Strategies currently implemented in the basin include reservoir low inflow and drought contingency plans; recycled water programs; conjunctive use of surface water and groundwater; and ASR. Although recycled water programs are considered demand-side strategies since they lower demands on existing sources, they could also be considered supply-side strategies since they provide new sources of supply. The RBC recognized that recycled water programs already exist in the basin and noted that the use of reclaimed water for new golf courses, agriculture, construction, and industry could potentially be expanded. The value of ASR varies based on the characteristics of the aquifer being utilized. The RBC discussed the value of interconnections for emergency use as well as redundancy. In parts of the basin, opportunity for interconnections may be limited by the distance between systems and financial constraints of building extensive pipelines.

7.2 Remaining Shortages

As discussed in Chapter 5, numerous potential surface water shortages were identified through scenario modeling. The majority of these are irrigation and golf course users, which are generally small and have localized opportunities for small amounts of storage to provide a buffer against small and infrequent shortages. Larger shortages are possible for users that depend on Lakes Marion and Moultrie operations, either by direct withdrawal or by receiving downstream flows. These shortages may also be mitigated by adding temporary intakes, or negotiating FERC license downstream flow requirements.

Analysis presented in Chapter 6 assesses how demand-side strategies recommended by the RBC may reduce projected shortages, assuming those shortages are not already mitigated by the strategies noted above. Table 6-3 summarizes the simulated frequency and magnitude of shortages for the 2070 High Demand Scenario for three scenarios representing moderate (10 percent reduction in demand) to aggressive (20 percent reduction in demand) implementation of demand-side management strategies. At a 20 percent demand reduction, the simulated shortages for water users that withdraw from Lake Marion, (WS: Santee Cooper - Lake Marion RWS and GC: Santee-Cooper Resort) no longer occur. For the rest of the water user objects experiencing shortages in the 2070 High Demand Scenario, implementing demand-side management strategies did not fully eliminate the simulated shortages, but did reduce the frequency and magnitude of shortage in many cases.

Demand-side strategies could be implemented alongside the mitigation strategies noted previously or by utilizing RBC recommended supply-side strategies of recycled water programs, conjunctive use of surface water and groundwater, and ASR. Users with projected shortages can consider an adaptive management strategy, where they can track demand growth compared to what was projected, assess the need for and success of any implemented demand-side strategies, estimate the remaining supply need, and determine the next strategy to implement. Adaptive management is discussed further in Chapter 7.4.

7.3 Remaining Issues Regarding Designated Reaches of Interest or Groundwater Areas of Concern

The evaluation presented in Chapters 5 and 6 enabled the RBC to identify any Reaches of Interest or Groundwater Areas of Concern. Reaches of Interest are defined in the Framework as "specific stream reaches that may have no identified Surface Water Shortage but experience undesired impacts, environmental or otherwise, determined from current or future water-demand scenarios or proposed water management strategies" (SCDNR 2019a). The RBC did not identify any Reaches of Interest.

A Groundwater Area of Concern is defined in the Framework as "an area in the Coastal Plain, designated by a River Basin Council, where groundwater withdrawals from a specified aquifer are causing or are expected to cause unacceptable impacts to the resource or to the public health and well-being" (SCDNR 2019a). The RBC did not officially designate any Groundwater Areas of Concern; however, the RBC recognized that continued groundwater declines in certain aquifers, given projected increases in pumping, were an ongoing concern and should continue to be monitored.

7.4 Adaptive Management

Adaptive management is a flexible framework used to implement options as the future unfolds in a structured way to avoid the pitfalls of either underperformance or overinvestment. This allows for management adjustments based on real-time data and evolving conditions. Adaptive management can provide a means to more effective decisions and enhanced benefits while helping meet environmental, social, and economic goals; increasing scientific knowledge; and reducing tensions among stakeholders (National Research Council 2004).

Several pitfalls may occur because of uncertainties identified during river basin planning. The Santee RBC identified and discussed the following potential uncertainties, which an adaptive management approach may help to address (Bing 2024a, 2024b) as the planning process continues:

- **Future Climate** – Adaptive management involves monitoring climate data, updating hydrologic models, and adjusting water management strategies accordingly. If a region experiences more frequent droughts than anticipated, water conservation measures can be implemented or intensified, and alternative water sources can be explored.

- **Population growth** – Population projections can be incorporated into water resource models and updated periodically. This allows planners to anticipate future water needs and develop infrastructure accordingly. If a municipality is expected to grow rapidly, adaptive management might involve expanding water treatment facilities or developing new water sources to meet an increasing demand.

- **Infrastructure maintenance** – Regular inspections and maintenance of water resources infrastructure allow for data-driven decision-making. Planners can prioritize maintenance activities based on the condition and criticality of infrastructure components. This approach helps in extending the lifespan of infrastructure and reducing the likelihood of unexpected failures.

- **Industrial growth and types of industry in the basin** – Adaptive management considers the types of industries present and their water usage patterns and may include monitoring industrial growth and adjusting water allocation and treatment processes to ensure that industrial water needs are met without compromising the overall water supply. An approach to monitor industrial growth may be to study and map changes in industrial parks and associated properties. LocateSC and the SC PowerTeam have statewide industrial property databases that can be used. With the increasing use of cloud computing, artificial intelligence (AI), and crypto mining, data centers have just recently become a more prominent user of energy and water and present an uncertainty in future demands.

- **Cyberwarfare** – Adaptive management involves the integration of cybersecurity measures into water resources planning. This may include regular updates to security protocols, continuous monitoring for potential threats, and developing contingency plans to ensure the resilience of water management systems against cyberattacks.

- **PFAS and emerging contaminants** – Adaptive management allows for incorporating new scientific findings and regulatory changes into water quality management practices. By continuously updating treatment processes and monitoring programs, planners can better address the technical, financial, and human health risks posed by emerging contaminants and ensure the safety of water supplies.

- **Future land use patterns** – Land use changes (and related impacts on water supplies) should be continuously assessed. This could be accomplished through studying the counties' land use plans. The RBC has developed recommendations (discussed in Chapter 9) and implementation actions (discussed in Chapter 10) that are intended to provide information on the potential impact to water quantity and quality from land use changes.

- **Extreme flood events** – Adaptive management could involve using hydrological models and real-time data to predict and respond to flood risks. This approach enables planners to implement adaptive flood management strategies, such as dynamic reservoir operations and floodplain management, to mitigate the impacts of floods.

- **Modeling and data gaps** – Adaptive management addresses modeling and data gaps by continuously updating models with new data and refining them based on observed outcomes. This iterative process helps improve the accuracy of water resource models and ensures they remain relevant and reliable.

- **Energy uncertainty and loss of power** – Adaptive management plans for power outages by incorporating backup power systems and alternative energy sources into water management infrastructure. This ensures that water supply and treatment processes can continue uninterrupted during power outages.

As part of future Plan updates, the RBC will review these uncertainties, determine if and to what degree they have impacted current and projected water demand, water availability, or other factors, and identify or update strategies and develop recommendations to address them as needed.

Chapter 8

Drought Response

8.1 Existing Drought Management Plans and Drought Management Advisory Groups

8.1.1 Statewide Drought Response

The South Carolina Drought Response Act of 2000 (Code of Laws of South Carolina, 1976, Section 49-23-10, et seq., as amended) was enacted to provide the state with a mechanism to respond to drought conditions (SCDNR 2009). The Act stated that SCDNR will formulate, coordinate, and execute a statewide drought mitigation plan. The Act also created the South Carolina Drought Response Committee (DRC) to be the major drought decision-making entity in the state. The DRC is a statewide committee chaired and supported by SCDNR's SCO with representatives from local interests.

To help prevent overly broad response to drought, the Act assigned SCDNR the responsibility of developing smaller Drought Management Areas (DMAs) within the state. SCDNR split the state into four DMAs that generally follow the boundaries of the four major river basins but are delineated along geopolitical county boundaries rather than basin boundaries. The Santee River basin is split between the Central (Santee Basin) DMA and the Southern (ACE Basin) DMA as shown in Figure 8-1. The Governor appoints members from various sectors to represent each DMA within the DRC. The organizational relationship of the DRC, DMAs, SCDNR, and SCO are illustrated in Figure 8-2.

In accordance with the Drought Response Act of 2000, SCDNR developed the South Carolina Drought Response Plan, which is included as Appendix 10 of the South Carolina Emergency Operations Plan. South Carolina has four drought alert phases: incipient, moderate, severe, and extreme. SCDNR and the DRC monitor a variety of drought indicators to determine when drought phases are beginning or ending. Examples of drought indicators include streamflows,

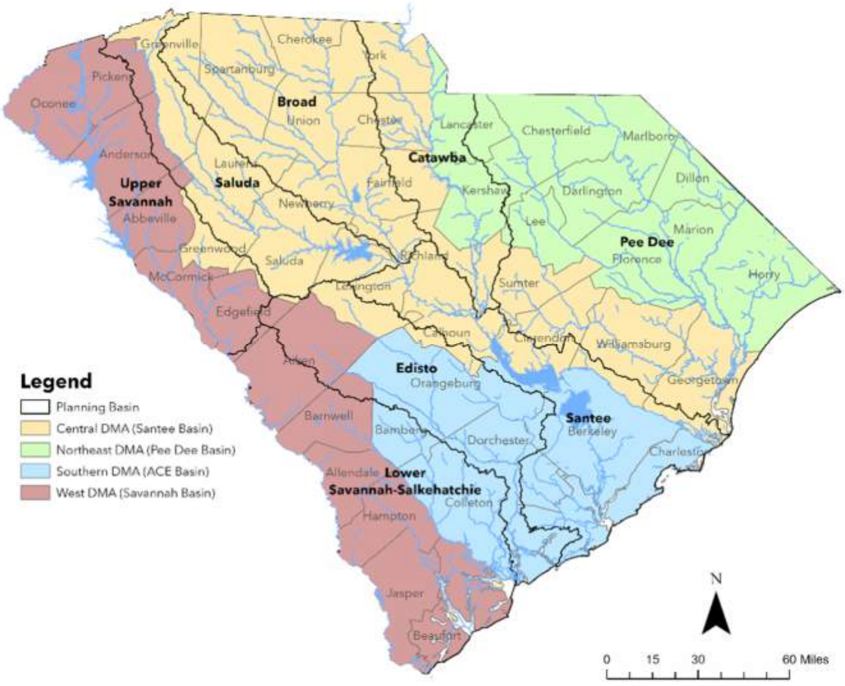


Figure 8-1. The four Drought Management Areas.

groundwater levels, the Palmer Drought Severity Index, the Crop Moisture Index, the SPI, and the United States Drought Monitor. The South Carolina Drought Regulations establish thresholds for these drought indicators corresponding to the four drought alert phases. Declaration of a drought alert phase is typically not made based only on one indicator, rather a convergence of evidence approach is used. The need for the declaration of a drought alert phase is also informed by additional information including water supply and demand, rainfall records, agricultural and forestry conditions, and climatological data.

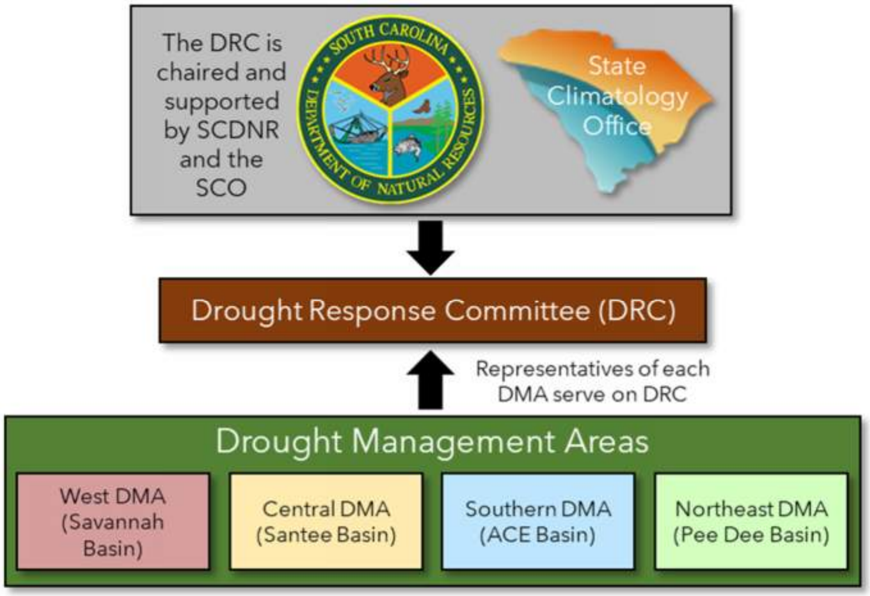


Figure 8-2. Drought Act organizational chart.

Based on their assessment of drought conditions, SCDNR and the DRC coordinate the appropriate response with the affected DMAs or counties. Local drought response is discussed in more detail in the following section. Under Section 49-23-80 of the Drought Response Act, if SCDNR and the DRC determine that drought has reached a level of severity such that the safety and health of citizens are threatened, the DRC shall report such conditions to the Governor. The Governor is then authorized to declare a drought emergency and may require curtailment of water withdrawals.

8.1.2 Local Drought Response

At a local level, Section 49-23-90 of the Drought Response Act states that municipalities, counties, public services districts, and commissions of public works shall develop and implement drought response plans or ordinances. These local plans must be consistent with the State Drought Response Plan. The SCO developed a model drought management plan and response ordinance for local governments and water systems to use as templates, and more recently prepared a Drought Planning Guidebook which serves as a sister document to the model drought plan and helps provide context for building a robust local drought plan for water systems. The guidebook uses case studies and best practices taken from water systems within South Carolina.

In a drought mitigation plan, each phase of drought has a set of responses that are set in motion to reduce demand, bolster supply, or both. The drought plans and ordinances include system-specific drought indicators, trigger levels, and responses. Responses include a variety of actions that would be taken to reduce water demand at the levels indicated in Table 8-1. When drought conditions have reached a level of severity beyond the scope of the DRC and local communities, the State Drought Response Plan, Emergency Management Division, and State Emergency Response Team are activated.

The drought response plans and ordinances prepared by public water suppliers located in the Santee River basin or those who draw water from the basin largely follow the templates prepared by SCDNR. The drought response plans for all water systems in the Santee River basin are summarized in Table 8-2. Many of the plans were submitted to SCDNR in 2003, shortly after the Drought Response Act went into effect in 2000. As such, they may present information that is outdated. The Drought Response Act of 2000 did not explicitly require drought plans to be updated at a specific interval.

Table 8-1. Demand reduction goals of drought response plans in South Carolina.

Drought Phase	Response
Incipient	None specified
Moderate	Seek voluntary reductions with the goal of: ▪ 20% reduction in residential use ▪ 15% reduction in other uses ▪ 15% overall reduction
Severe	Mandatory restrictions for nonessential use and voluntary reductions of all use with the goal of: ▪ 25% reduction in residential use ▪ 20% reduction in other uses ▪ 20% overall reduction
Extreme	Mandatory restrictions of water use for all purposes with the goal of: ▪ 30% reduction in residential use ▪ 25% reduction in other uses ▪ 25% overall reduction

Table 8-2. Drought response plans for water suppliers withdrawing water from the Santee River basin.

Water Supplier	Year	DMA	Water Source	Drought Indicator/Trigger Types[1]	Alternative Water Supply Agreements
Calhoun County Municipal Water and Sewer - Belleville	2003	Central	**Groundwater** - 5 wells	- Storage falls below 25%, 50%, or 75% of capacity and is unable to recover. - Pumping levels in wells drop 25%, 50%, or 75% under normal pumping levels.	None
City of Cayce	2003	Central	**Surface Water** - Congaree River	- Average daily demand for a consecutive 7-day period equals 80% of the water treatment plant (WTP) capacity, 90% of the WTP capacity, or is equal to or greater than the WTP capacity.	Can purchase from City of West Columbia and the City of Columbia's water system through existing connections.
Charleston Water System (CWS)	2021	Southern	**Surface Water** - Edisto River and Bushy Park and Goose Creek Reservoirs (in the Santee River basin)	- Edisto River: Edisto River flow 90%, 75%, 50%, or 25% of 7Q10.[2] - Bushy Park Reservoir: Specific conductance of water in Durham Canal is between 260 and 500, 500 and 1,500, or greater than 1,500 microSiemens for a period greater than 48 hours.	None
Dorchester County (DCPW)/Edisto Tribal Council	2003	Southern	**Purchase** - CWS	- Edisto River: Edisto River flow 90%, 75%, or 50% of 7Q10. - Bushy Park Reservoir: Specific conductance of water in Durham Canal is between 260 and 500, 500 and 1,500, or greater than 1,500 microSiemens for a period greater than 48 hours.	No Cooperative agreements; has connections to Dorchester Water Authority and the Town of Ridgeville

[1] When three trigger points are listed, those reflect trigger points for the (1) moderate, (2) severe, and (3) extreme drought phases, respectively.

[2] CWS maintains four system triggers based on Edisto River flow, the last two of which (Edisto River flow at 50% and 25% of 7Q10) falling within the extreme drought phase with a defined demand reduction for each. The 7Q10 is defined as the lowest 7-day average streamflow that occurs, on average, once every 10 years.

Table 8-2. Drought response plans for water suppliers withdrawing water from the Santee River basin (Continued).

Water Supplier	Year	DMA	Water Source	Drought Indicator/Trigger Types[1]	Alternative Water Supply Agreements
Dorchester County Water Authority-Knightsville	2003	Southern	**Groundwater** - 6 wells (Tertiary Sand Aquifer)	- Static water levels drop 20 ft, 40 ft, or 60 ft below average. - Pumping water levels drop 20 ft, 40 ft, or 60 ft below average.	Works in conjunction with Summerville Commission of Public Works to meet demands if supplies are low for either supplier.
Mount Pleasant Waterworks	2020	Southern	**Groundwater and Purchase** – 6 deep wells (Charleston Aquifer) and 2 connections to CWS	- Average system storage levels fall below 60%, 40%, or 20% for 48 hours. - Well pumping levels less than 100 ft, 75 ft, or 50 ft above pump in one or more wells.	Water purchase agreement with CWS.
Seabrook Island Utility Commission	2003	Southern	**Purchase** – St. Johns Water Company (SJWC) **Groundwater** - 1 well (non-potable)	- The primary supplier's (CWS) water shortage indicators would be by advanced notice from SJWC, after receiving notice from Charleston.	Agreement with SJWC of a maximum contract capacity, subject to availability.
Town of St. Matthews	2003	Central	**Groundwater** - 2 wells	- Average daily use greater than 0.65 MGD, 0.70 MGD, or 0.80 MGD for 5 consecutive days.	None
Santee Cooper Lake Marion Regional Water System	2014	Central	**Surface Water** – Lake Marion	- Reservoir elevation less than or equal to 68 ft, 67 ft, or 66 ft. - Average daily use greater than 27 MGD for Moultrie or 6 MGD for Marion; 28 MGD for Moultrie or 7 MGD for Marion; or 29 MGD for Moultrie or 8 MGD for Marion.	None
Santee Cooper Lake Moultrie Regional Water System	2003	Central	**Surface Water** - Lake Moultrie	- Reservoir elevation of 68 ft, 67 ft, or 66 ft. - Average daily use greater than 27 MGD for 4 consecutive days, 28 MGD for 5 consecutive days, or 29 MGD for 6 consecutive days. - Treatment plant is deemed in immediate danger.[3]	No agreements. However, its four customers have various backup capabilities and cooperative agreements as are applicable and described in their plan.
Town of Sullivan Island Water & Sewer Department	2003	Southern	**Purchase** - CWS **Groundwater** - 2 wells (for emergency use only)	- CWS institutes its Moderate, Severe, or Extreme drought response. - The average daily demand exceeds 80% of, exceeds 90% of, or exceeds or is equal to the Town's available purchased capacity.	None, outside of agreement with CWS.
Town of Summerton	2003	Central	**Groundwater** - 2 wells (Main St. and I-95 Wells)	- Fluctuation in storage capacity with normal wells running: 1. A mild decrease in well operation over a two-week period of time; 2. A severe decrease in well operation over a five-day period; or 3. Immediate inability to provide potable water and fire protection.	None
Summerville Commissioners of Public Works (SCPW)	2003	Southern	**Purchase** - Santee Cooper Regional Water System; **Original Source is Surface Water** - Lake Moultrie	- Reservoir elevation of 68 ft, 67 ft, or 66 ft. - Average daily flow greater than 27 MGD for 4 consecutive days, 28 MGD for 5 consecutive days, or 29 MGD for 6 consecutive days.	Charleston Water System for short-term water assistance if necessary. SCPW also owns 3 emergency wells.

[1] When three trigger points are listed, those reflect trigger points for the (1) moderate, (2) severe, and (3) extreme drought phases, respectively.

[3] If the treatment plant is deemed in immediate danger is a trigger for all three drought phases.

8.1.3 Santee Cooper Project Drought Response

Santee Cooper operates the Santee Cooper Project, consisting of Lake Marion and Lake Moultrie, which are large surfacewater reservoirs located just north of Charleston, under a Federal Energy Regulatory

Commission (FERC) license order. The Santee Dam diverts the flow of the Santee River into Lake Moultrie via the Diversion Canal. Water in Lake Moultrie is then discharged either into the Santee River via the Rediversion Canal or into the Cooper River via the Jefferies Hydroelectric Generating Station. The Santee Spillway is used for flood control.

The Santee Cooper Project's Low Inflow and Drought Contingency Plan (LIDCP) was required per License Article 406 as part of the new 50-year license granted by FERC to the South Carolina Public Service Authority for the Santee Cooper Project (Santee Cooper 2024). Water management during droughts has been a major issue, with droughts occurring in 1950-1958, 1998-2002, 2007-2009, and 2015-2016.

The LIDCP triggers and responses are summarized in Table 8-3. Reductions in releases generally occur when Lake Marion's elevations drop below the rule curve operating range as shown in Figure 8-3, and other conditions are met. The level of response varies depending on the magnitude and duration of hydrologic drought on the Congaree and Wateree Rivers. For rising lake levels, the need to ease restrictions is triggered when Lake Marion's level displays a sustained rise towards the operating range of the response curve. When the elevation of Lake Marion is at or above the operating range of the response curve, the streamflow restrictions can be removed. The guidelines for easing and removing streamflow restrictions are summarized in Table 8-4.

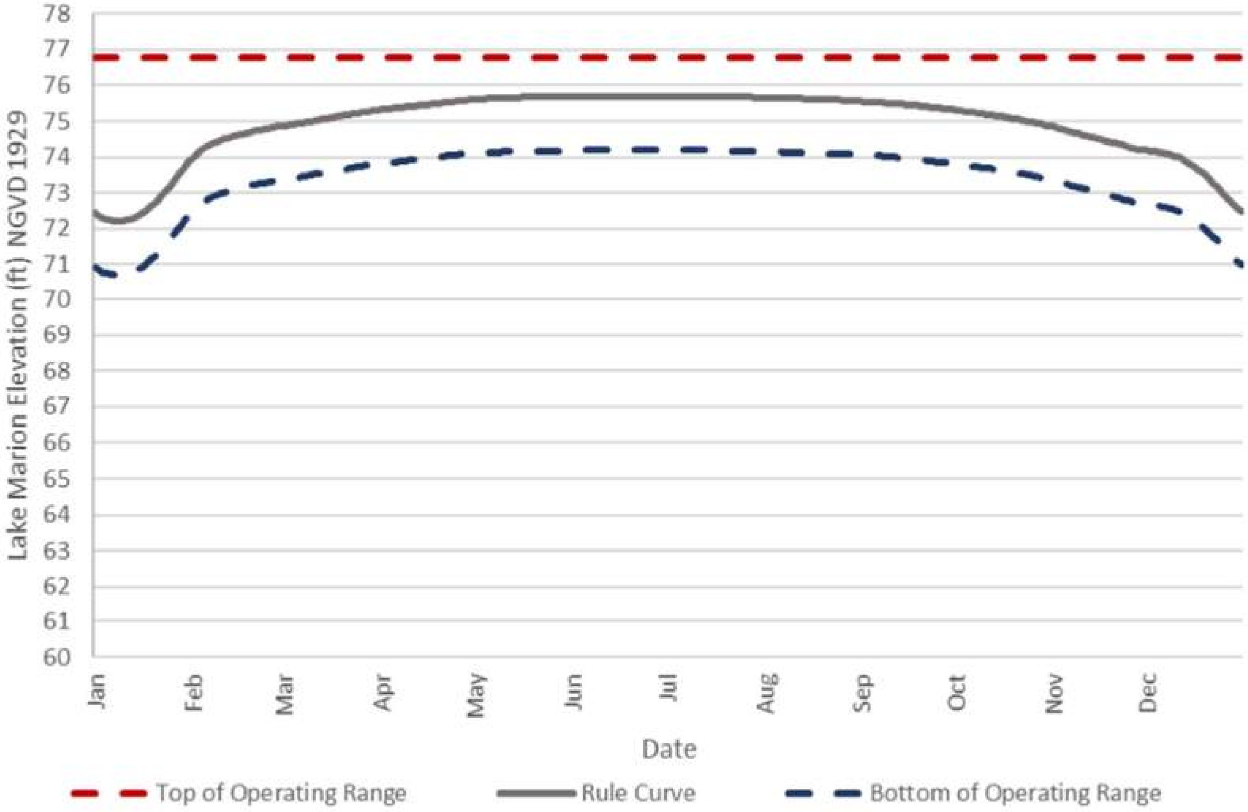


Figure 8-3. Lake Marion rule curve with target operating range (Santee Cooper 2024).

Table 8-3. Lake Marion drought triggers and responses (Santee Cooper 2024).

Condition	Lake Marion Elevation	Response[1]
Short-term low inflow (Flash Drought)	Weekly average inflow to Lake Marion declines rapidly and the daily elevation of Lake Marion is below the bottom of the operating range for 2 consecutive weeks and up to 1 month.	If CR28>CR28Q10 and/or WR28>WR28Q10, reduce St. Stephen outflows to help restore Lake Marion elevation to reach the bottom of the operating range (rule curve – 1.5 ft), but do not reduce minimum outflows at Jefferies Generating Station (JGS) or the Santee Dam as required for the time of year.
Drought Level 1	The daily elevation of Lake Marion is consistently below the bottom of the operating range for at least 1 month and up to 3 consecutive months.	If CR28>CR28Q10 and/or WR28>WR28Q10, reduce St. Stephen outflows to help restore Lake Marion elevation to reach the bottom of the operating range (rule curve – 1.5 ft), but do not reduce minimum outflows at JGS or the Santee Dam as required for the time of year. If CR28<CR28Q10 and/or WR28<WR28Q10, reduce St. Stephen outflows and target remaining water available for outflow to match the inflow. If inflow is less than the sum of JGS weekly average and Santee Dam minimum, reduce Santee Dam outflows to balance inflows but not less than 600 cfs.
Drought Level 2	The daily elevation of Lake Marion is consistently below the bottom of the operating range for 3 consecutive months and up to 6 consecutive months.	If CR28>CR28Q10 and/or WR28>WR28Q10, reduce St. Stephen outflows to help restore Lake Marion elevation to reach the bottom of the operating range (rule curve – 1.5 ft), but do not reduce minimum outflows at JGS or the Santee Dam as required for the time of year. If CR28<CR28Q10 and/or WR28<WR28Q10, reduce St. Stephen outflows and target remaining water available for outflow to match the inflow. If inflow is less than the sum of JGS weekly average and Santee Dam minimum, reduce Santee Dam outflows to balance inflows but not less than 600 cfs. OR with Resource Management Team input, evaluate withdrawing water from storage and stakeholder impacts.
Drought Level 3	The daily elevation of Lake Marion is consistently below the bottom of the operating range for more than 6 consecutive months.	If CR28<CR28Q10 and/or WR28<WR28Q10 target outflows to 4,500 cfs-weeks at Jefferies, 0 cfs at St. Stephen, and 600 cfs at the Spillway OR with Resource Management Team input, evaluate withdrawing water from storage and stakeholder impacts, AND request the Corps approve a reduction in the weekly discharge from Jefferies.

[1] CR28 and WR28 refer to the 28-day running average streamflow for the USGS gages on the Congaree River at Columbia (USGS 02169500) and the Wateree River near Camden (USGS 02148000), respectively. CR28Q10 and WR28Q10 refer to the 10th percentile (Q10) of the historical 28-day running average streamflow for that particular day of the year at the same two USGS gages. The 10th percentile is used by USGS as the breakpoint to delineate between below normal conditions and moderate hydrologic drought.

Table 8-4. Lake Marion rising lake triggers and responses (Santee Cooper 2024).

Condition	Lake Marion Elevation	Response [1]
Remove Low-Inflow Protocols and Enter Normal Operations	The daily elevation of Lake Marion is at or above the bottom of the operating range.	If CR28>CR28Q10 and/or WR28>WR28Q10, target outflows to sustain Lake Marion elevation within the normal operating range, but not less than the minimum outflows at JGS or the Santee Dam as required for the time of year. St. Stephen discharge can increase if excess water is available.
Remove Drought Level 1 Protocol and Enter Low-Inflow Protocols	The daily elevation of Lake Marion is consistently below the bottom of the operating range and rises for three to six consecutive months.	If CR28>CR28Q10 and/or WR28>WR28Q10, target outflows to restore Lake Marion elevation to reach the bottom of the operating range (rule curve – 1.5 ft) but not less than the minimum outflows at JGS and the Santee Dam for the time of year.
Remove Drought Level 2 Protocols and Enter Drought Level 1 Protocols	The daily elevation of Lake Marion is consistently below the bottom of the operating range and rises for one to three consecutive months.	If CR28>CR28Q10 and/or WR28>WR28Q10, target outflows to restore Lake Marion elevation to reach the bottom of the operating range (rule curve-1.5 ft) AND with Resource Management Team input evaluate increases to minimum outflows at the Santee Dam as required for the time of year.
Remove Drought Level 3 Protocols and Enter Drought Level 2 Protocols	The daily elevation of Lake Marion is consistently below the bottom of the operating range and rises for one consecutive month.	If CR28>CR28Q10 and/or WR28>WR28Q10, target outflows to restore Lake Marion elevation to reach the bottom of the operating range (rule curve-1.5 ft) AND with Resource Management Team input evaluate increases to minimum outflows at the Santee Dam as required for the time of year.

[1] CR28 and WR28 refer to the 28-day running average streamflow for the USGS gages on the Congaree River at Columbia (USGS 02169500) and the Wateree River near Camden (USGS 02148000), respectively. CR28Q10 and WR28Q10 refer to the 10th percentile (Q10) of the historical 28-day running average streamflow for that particular day of the year at the same two USGS gages. The 10th percentile is used by USGS as the breakpoint to delineate between below normal conditions and moderate hydrologic drought.

8.2 RBC Drought Response

8.2.1 Roles and Responsibilities

Under the Planning Framework, the RBC will support drought response, collect drought information, and coordinate drought response activities. With the support of SCDNR and SCDES, the RBC will:

- Collect and evaluate local hydrologic information for drought assessment
- Provide local drought information and recommendations to the DRC regarding drought declarations
- Communicate drought conditions and declarations to the rest of the RBC, stakeholders, and the public
- Advocate for a coordinated, basinwide response by entities with drought management responsibilities (e.g., water utilities, reservoir operators, large water users)
- Coordinate with other drought management groups in the basin as needed.

8.2.2 Recommendations

Through consideration and discussion, the Santee RBC developed the following consensus-based recommendations related to drought planning and response. The steps to implement these recommendations, where applicable, are detailed in the 5-year and long-range implementation plans in Chapter 10.

1. The RBC recommends that water utilities review their drought management plan and response ordinance every 5 years and review and update every 10 years or more frequently if conditions change. Once updated, the plans should be submitted to the SCO for review. Changing conditions that could merit an update might include:

- Change in the source(s) of water
- Significant increase in water demand (such as the addition of a new, large wholesale customer)
- Significant change in the proportion of water used by one sector compared to another (e.g., residential versus commercial use)
- Addition (or loss) of another user relying on the same source of water
- New water supply agreement with a neighboring utility

2. The RBC recommends that water utilities coordinate, to the extent practical, their drought response messaging. Drought messaging refers to both the content and the method or mechanism to deliver the message.

3. The RBC encourages water utilities in the basin to consider drought surcharges on water use during severe and/or extreme drought phases. Drought surcharges, when used, are typically only implemented if voluntary reductions are not successful in achieving the desired reduction in water use. In some cases, water utilities have already built into their response ordinance the ability to implement drought surcharges during the severe and/or extreme drought phases.

4. The RBC encourages water users and those with water interests to submit drought impact observations through the Condition Monitoring Observer Reports (CMOR). The CMOR system, maintained by the National Drought Mitigation Center (NDMC), provides supporting evidence in the form of on-the-ground information to help the authors of the U.S. Drought Monitor better understand local conditions. The USDA uses the Drought Monitor to trigger disaster declarations and determine eligibility for low-interest loans and some assistance programs. The SCO also reviews and uses the CMOR system in a variety of ways. CMORs can be submitted by clicking the "Submit a Report" button at the NDMC's Drought Impacts Toolkit website. The RBC also recommends that:

a. The SCO conduct outreach to make more stakeholders aware of the CMOR system and encourage its use to report drought conditions.

b. The NRCS promote the use of the CMOR system.

c. The South Carolina Adopt-a-Stream program promote use of the CMOR by its participants so that hydrologic conditions prior to and during drought may be documented.

5. To improve monitoring of conditions that may lead to drought, and to monitor changing conditions during drought, **the RBC recommends the funding and establishment of a mesoscale network of weather and climate monitoring stations in South Carolina.** Establishing a mesoscale network of weather and climate monitoring stations, known as a Mesonet, provides near real-time data at the local level to improve situational awareness and preparedness and support decision-makers and stakeholders, such as emergency management agencies, water resources managers, agricultural interests, transportation officials, energy providers, and the DRC. Currently, South Carolina is only one of 12 states in the United States without a Mesonet. A network of 46 weather stations (one per county) will provide an essential public service to the citizens of South Carolina.

8.2.3 Communication Plan

The Santee RBC recommends that each RBC have representation on the DRC. The RBC representative on the DRC may be the Chair, Vice Chair, or other RBC member. The Santee RBC will communicate drought conditions and responses within the basin to the DRC through this representative.

If any part of the basin is in a declared drought as determined by the DRC, the representative will solicit input from RBC members and other water managers and users regarding drought conditions and responses in their respective locations or interests. The representative is then responsible for communicating updates on drought conditions and responses within the basin to the DRC and/or the SCO. The DRC has existing mechanisms to communicate and coordinate drought response with stakeholders and the public. Under Section 49-23-70 of the Drought Response Act, SCDNR is responsible for disseminating public information concerning all aspects of the drought.

Chapter 9

Policy, Legislative, Regulatory, Technical, and Planning Process Recommendations

During the fourth and final phase of the planning process, the Santee RBC identified and discussed recommendations related to the river basin planning process; technical and program considerations; and policy, legislative, or regulatory considerations. Various recommendations were proposed by RBC members and discussed over the span of several meetings. They received broad RBC support and are to be taken as having consensus as defined by the River Basin Council Bylaws (SCDNR 2019a). Under these bylaws, consensus is achieved when all members can “live with” a decision, although some members may strongly endorse a solution while others may only accept it as a workable agreement.

The planning process recommendations are summarized in Chapter 9.1; the technical and program recommendations are summarized in Chapter 9.2; and the policy, legislative, and regulatory recommendations are summarized in Chapter 9.3.

These recommendations were approved by the RBC over the course of several meetings with nearly all members in attendance. While there were two members representing the Agriculture, Forestry, and Irrigation water interest category in attendance during the discussion of recommendations, the RBC member representating Four J Family Farms was not present.

9.1 River Basin Planning Process Recommendations

The following planning process recommendations should be taken as considerations for future phases of the river basin planning process. To implement these recommendations, the Santee RBC will need support from SCDES, other RBCs, technical experts, the South Carolina Legislature, and other organizations.

The Santee RBC proposed the following recommendations to improve communication among RBCs and other groups:

- **SCDES, the RBC Planning Teams, and the RBCs should conduct regular reviews of the RBC membership to make sure all interest categories are adequately represented and attendance across all interest categories meets the requirements of the RBC Bylaws.** Adequate representation of all water use groups may require intentional, targeted outreach to encourage potential members to apply to the RBC. Membership should also be reviewed when any member resigns from the council to ensure there is still sufficient representation of that member’s water interest category. Recognizing that RBC members invest significant time over the planning process in understanding the water resources of the river basin and the variety of issues, any appointments of RBC members after the river basin planning process is underway would need to be considered on a case-by-case basis. Appointments would be at the discretion of SCDES and would consider feedback from the RBC. In such instances, orientation would be necessary to bring new members up to speed.

- **SCDES should organize an annual state-wide meeting of RBCs and state agencies.** At least one or two statewide RBC meetings should be held annually. This meeting should have a clear agenda with action items summarized. RBCs should also be present at the Legislature's Water Day, occurring on the first Monday of March. Coordinated concerns or suggestions resulting from these meetings should be shared with the Legislative Surface Water Study Committee and with WaterSC for as long as these groups continue to convene during development of the State Water Plan.
- **SCDES should continue to designate staff to coordinate and support ongoing RBC activities.** Staff support is needed to assist with communication, identify meeting locations, help set agendas, keep the RBC focused, identify and bring in technical experts, and perform other activities. In order to fund the resources needed to support RBC activities, SCDES will require legislative support, which is outlined as a separate recommendation in Section 9.3.
- **RBC members should be encouraged to present observations and outcomes of the river basin planning process.** The RBC Chair and Vice Chair should approve the content.

9.2 Technical and Program Recommendations

The RBC chose to make several technical and program recommendations to address data gaps or information needs identified during the river basin planning process. The following recommendations should be taken as considerations for future phases of the river basin planning process. To implement these recommendations, the Santee RBC will need support from SCDES and other technical experts.

The Santee RBC identified the following recommendations pertaining to data needs:

- **Support for SCDES and USGS monitoring of groundwater levels.** Maintaining and collecting groundwater level data from existing wells in addition to installing deeper aquifer wells throughout the basin to collect data in areas where groundwater data is scarce will provide a better understanding of groundwater levels and trends throughout the basin. This additional data could be used to better understand the impacts of current groundwater use as well as the capacity of aquifers to sustain future demands.
- **Support continued efforts to maintain USGS streamflow gages.** The RBC recognizes that comprehensive, reliable, and long-term hydrologic data is critical to water planning and management. Additional partners and sponsors should be identified to help fund and maintain streamflow gages.

The Santee RBC developed the following recommendations for technical studies to improve knowledge of specific issues:

- **Incorporate future climate projections into modeling analyses.** As part of this effort, estimate the impact of increasing temperatures on evaporation and evaluate the potential impacts of increased evaporation on Lakes Marion and Moultrie.

- While the RBC should maintain its focus on the assessment of water quantity, **future planning efforts should include evaluation of surface water quality,** which is important to maintaining affordable public water supplies and the ecological health of the streams, rivers, and lakes. As part of future study and planning, the RBC could make recommendations to other planning bodies or departments of water quality parameters or stream segments requiring further study and impairment mitigation. Similarly, the RBC should be educated on other on-going water quality efforts such as §303(d) listings, watershed planning programs, and total maximum daily load (TMDL) development.
- **Work on the groundwater model developed by the USGS should be continued and completed.** The RBC would review results of the groundwater modeling to assess the ability of the basin's aquifers to sustain future demands, as part of the next update to the River Basin Plan.
- **The RBC endeavors to learn more about the Pinewood site including the regulation, consent orders, controls, and monitoring in place.** The Pinewood site was a hazardous waste landfill from 1978 to 2000, spanning 534 acres in Sumter County. In 2003, it became the Pinewood Site Custodial Trust (PSCT) under a settlement requiring post-closure care through 2103. The Trustees hold environmental permits, with SCDES providing regulatory oversight. Post-closure activities include maintaining landfill covers, operating leachate systems, and monitoring groundwater (SCDES, 2025f).
- **Study the impacts of land use changes on the supply of and demand for water resources.** The SWAM model does not account for potential changes in future land use that might impact the magnitude, timing, and frequency of flows. The recent climatic trend of more frequent and higher intensity rainfall events, coupled with development-driven increases in impervious surface and a reduction in recharge areas may result in shorter duration, higher flows. This not only effects the timing of flow but can exacerbate streambank scour and increase sediment transport and sediment loading to reservoirs. Models that simulate changes to rainfall, land use, and runoff can be used to evaluate this issue.
- **The State Water Plan should include reuse (recycled) water as a source of water for South Carolina and SCDES should implement regulations for its use that support water resilience in South Carolina.** Water recycling programs currently exist in South Carolina; however, there is opportunity to expand the use of reclaimed water. For example, indirect potable reuse, which is not currently allowed, involves discharging highly treated, reclaimed water to an environmental buffer, such as a surface water body or groundwater, before withdrawing the blended water and treating it at a drinking water treatment plant. Another application of this technology could be injection of reclaimed water to groundwater to create a groundwater barrier to prevent saltwater intrusion. Such use of reclaimed water for water recycling programs would require changes to South Carolina regulations. Current regulation (Regulation 61-9.505) allows for reclaimed water to be recycled for land application in areas with a high potential for contact.

9.3 Policy, Legislative, or Regulatory Recommendations

The Santee RBC engaged in discussion about issues and concerns with the existing policies, laws, and regulations governing water withdrawals and water use. Current (as of October 2025) regulations regarding surface water and groundwater withdrawals are summarized in Table 9-1 located at the end of this chapter. The Santee RBC developed the following recommendations for modifications to existing state or local laws, regulations, or ordinances:

- **The South Carolina Surface Water Withdrawal, Permitting, Use, and Reporting Act should allow for reasonable use criteria to be applied to all surface water withdrawals, like those that currently exist for groundwater withdrawals.** Under current regulation for surface water withdrawals, reasonable use criteria vary depending on the water use category and the time of permit application (pre- or post-2011, when SCDHEC's (now SCDES's) regulation, 61-119 Surface Water Withdrawal, Permitting, Use and Reporting, came into effect), as summarized below.
    - Existing (pre-2011) non-agricultural surface water withdrawers do not need to meet reasonable use criteria. The permitted withdrawal is based on the largest volume as determined by previously documented use, current treatment capacity, or designed capacity of the intake structure.
    - New (post-2011) or expanding non-agricultural surface water withdrawers must demonstrate that the requested water withdrawal amount meets the criteria for reasonable use.
    - Agricultural surface water withdrawals, all of which do not require a permit where there is remaining safe yield in a basin, do not need to satisfy reasonableness criteria for the requested withdrawal amount.

  Comparatively, under SCDES's regulation 61-113 Groundwater Use and Reporting, permittees of any use category seeking to withdraw greater than 3 million gallons in any month from groundwater must demonstrate to SCDES's satisfaction that groundwater withdrawal is reasonable and necessary and there are no unreasonable adverse effects on other water users. In parts of the Edisto and Pee Dee River basins, the absence of reasonable use as a criterion for issuing surface water registrations has resulted in large registrations being granted which have used up the remaining safe yield. Farmers seeking new registrations in these fully allocated portions of the Edisto and Pee Dee River basins must therefore apply for a permit and abide by permit conditions.

- **Improve the current laws that allow for regulation of water use so that they are enforceable and effective.** The current water law, which grandfathers most water users, needs to be improved to support effective management of the state's water resources. One approach to improve the effectiveness of the laws governing water use is to require sector-specific strategies to improve water use efficiency. The laws should also allow for the reallocation of water resources to where they are needed to support well-planned growth and development. This may require re-evaluation of existing users' permit limits, but only after carefully considering their long-term growth projections, water needs, and planned infrastructure investment.

  This recommendation was met with hesitancy from some RBC members because it could lead to some water users feeling a pinch of a finite resource during drought; however, consensus was reached in support of this recommendation because all RBC members saw the need for improvement in the laws and regulations which govern water use.

- **State and local governments should continue to develop/review/update/adopt and enforce laws, regulations, policies, and/or ordinances that improve the management of stormwater runoff, encourage infiltration, minimize streambank erosion, reduce sedimentation, and protect water resources.** Infiltration helps replenish groundwater aquifers, remove pollutants, and minimize erosion that causes sediment to appear in streams. Sedimentation is considered a threat to the water resources of the Santee River basin. Small impoundments (i.e., farm ponds) can become filled with sediment and lose their ability to store enough water and maintain irrigation during dry periods. Sediment loading also impacts water quality and habitat. The RBC encourages local governments and land managers to identify solutions specific to their needs and location.

- **Review periods for groundwater and surface water permit renewal should be re-evaluated, to facilitate long-term planning efforts, support bond issuance, protect withdrawers' investment in infrastructure, and protect the biological, physical and chemical integrity of groundwater and surface water.** Existing regulations should be amended to align users' renewal periods and permit requirements for surface water and groundwater withdrawals as much as reasonably possible. Review periods of 10 to 20 years were discussed, with some RBC members favoring 10 or more year periods to be more protective of water resources, while others preferred longer review periods, which better align with the necessary capital investment in infrastructure. While consensus was not reached on a specific recommended review period, there was support for increasing groundwater review periods beyond the current 5 years and aligning surface and groundwater review periods. The RBC continues to support SCDES's ongoing monitoring of groundwater resources and evaluation of conditions.
- **The Legislature should approve and adopt the State Water Plan and subsequent updates.** Legislative approval and adoption of the State Water Plan would not only recognize that significant time and money invested in water planning over the past decade but signal the importance of effective and continuous stakeholder-driven water planning that balances the state's economic and environmental interests and ensures the long-term protection of its water resources.
- **The Surface Water Withdrawal, Permitting, Use and Reporting Act (SC Code Sections 49-4-10 and the R. 61-119) should be amended to require all surface water withdrawals (existing, new, and registrants) over 3,000,000 gallons a month to be subject to permit requirements and review.** Under current laws and regulations non-agricultural withdrawers must apply for permits whereas agricultural water withdrawers register their use. Other differences between surface water and groundwater withdrawal regulations for various water user categories are summarized in Table 9-1. The RBC felt that consistency in permitting would support more equitable and effective management of the resource.

The Santee RBC discussed the need for future funding to continue water planning activities. The RBC made the following recommendations:

- **The South Carolina Legislature should authorize recurring funding as requested by SCDES for annual, ongoing water planning activities, including river basin planning**. Currently, nearly all the funding for the river basin planning process has come from the legislature. Funding should allow for RBCs to meet annually, at a minimum, and to work on implementation actions and Plan updates. The RBC noted that with increasing population in many counties in the basin, funding needs to be reviewed annually.
- **The South Carolina Legislature should establish a grant program to help support the implementation of the actions and strategies identified each RBC's River Basin Plan.** One example is Georgia's Regional Water Plan Seed Grant Program which supports and incentivizes local governments and other water users as they undertake their Regional Water Plan

implementation responsibilities. The RBC recommended a grant program be open to all sectors of water users, not just public water utilities.

- **A cost share program should be developed to drill deeper wells into aquifer units with less development pressure and operate them.** This recommendation would support agricultural users so they can withdraw from less used aquifers.
- **The State should support statewide water education programs through existing agencies such as Cooperative Extensions, Soil and Water Conservation Districts, etc., that include all sectors of water use and promote the types of water management strategies recommended in River Basin Plans.** The RBC can provide guidance on topics that are important.
- **Water users should continue to identify partnerships and alternative sources including interconnections to build resilience and ensure adequate quantity of water.** Interconnections with other water systems provides redundancy and improves resilience to drought and other unplanned disruptions.

The Santee RBC had in depth discussions on how safe yield is currently defined in the law and the need to update it to improve water availability characterization for permits and registrations. The RBC made the following recommendations:

- **The safe yield definition should be updated using median statistics (80% median rather than 80% mean or average) in recognition that median statistics more accurately characterize typical water availability in stream flows that are non-normally distributed**. 80% median (60+ % availability) is a “safer” safe yield compared to the current 80% mean (40+ % availability) and is a compromise in recognition that permittees may not utilize their entire permit allocation. The RBC wanted to make this recommendation actionable for the Legislature so specific details were included in the recommendation. Similarly, the RBC recommended that **minimum instream flows (MIF) and minimum water levels (MWL) should be based on median statistics**.
- **All permits and registrations requesting volumes above safe yield (80% median) should be required to develop and submit to SCDES, realistic contingency and/or conservation capabilities and plans commensurate with their requested volume which will trigger at minimum instream flow.** As is the case in the current law, withdrawers will be allowed to shift back to their primary withdrawal source once the contingency supply has been exhausted. The RBC noted that this recommendation is not intended to punish new withdrawers but to acknowledge there needs to be contingency and this recommendation would force users to review their withdrawal amounts.
- **When considering MIF and MWL criteria for new permits, SCDES should be allowed to use alternative hydrologic assessments and take into account water quality considerations due to complex hydrology, as is the case in coastal areas impacted by tides.** Furthermore, SCDNR and/or SCDES should review the science behind MIF standards to ensure they are based on best available science to adequately protect designated uses and recognize regional differences.
- **SCDES should require high use industrial water users (3 MGM) purchasing from a municipal supply to report their monthly water usage, aligning with existing SCDES water use reporting requirements.** To support effective management of the resource, more transparency in water use is needed for large water users that purchase from water utilities.

Table 9-1. Summary of regulations related to surface water and groundwater withdrawal.

Water Source	Use Type	User Type	Process	Applicability	Withdrawal Volume	Use Criteria	Low Flow Period Requirements	Review Period	Reporting
Surface Water	Agricultural	Existing (pre Jan 1, 2011)	Registration	Users withdrawing more than 3 MGM	Highest previous water usage	No criteria	No MIF obligations	No review, in perpetuity	Annual
		New (post Jan 1, 2011) or Expanding	Registration	Users withdrawing more than 3 MGM	Amount of water requested by the proposed withdrawer and availability of water at the point of withdrawal based on Safe Yield calculations.	Subject to safe yield assessment	No MIF obligations	No review, in perpetuity	Annual
	Hydropower	All	Exempt (non-consumptive use)						Annual
	All Other Use Types	Existing (pre Jan 1, 2011)	Permit	Users withdrawing more than 3 MGM	Largest volume as determined by previously documented use, current treatment capacity, or designed capacity of the intake structure	No criteria	Must address "appropriate industry standards for water conservation." Not subject to enforcement for MIF.	30 to 50 years[1]	Annual
		New (post Jan 1, 2011) or Expanding	Permit	Users withdrawing more than 3 MGM	Based on reasonableness, availability of water at point of withdrawal based on Safe Yield calculations.	Reasonable use criteria	Development of Contingency Plan for low flow periods, enforceable. Public water suppliers not subject to MIF[2]	20 to 50 years[1]	Annual

Table 9-1. Summary of regulations related to surface water and groundwater withdrawal. (Continued)

Water Source	Use Type	User Type	Process	Applicability	Withdrawal Volume	Use Criteria	Low Flow Period Requirements	Review Period	Reporting
Ground water	All Use Types	Withdrawals in Capacity Use Areas	Permit	Users withdrawing more than 3 MGM	Permit withdrawals based on reasonable use guidelines, which vary by water use sector.	Reasonable use criteria	Requires development of Best Management Plan that identifies water conservation measures, alternate sources of water, justification of water use, and description of beneficial use	Every 5 years	Annual
	All Use Types	Withdrawals Outside of Capacity Use Areas	Registration	Users withdrawing more than 3 MGM	Registrations do not have limits but require reporting.	No criteria	No MIF obligations	No review, in perpetuity	Annual

[1] New surface water permitees may receive permits of 20 years or up to 40 years as determined by department review.

Existing surface water permittees may receive permits of 30 years or up to 40 years as determined by department review.

Municipal or governmental bodies may receive permits of up to 50 years to retire a bond it issues to finance the construction of waterworks (SECTION 49-4-100).

[2] Public water suppliers not subject to MIF but are required to implement their contingency plan in accordance with drought declarations 49-4-150 6.

Chapter 10

River Basin Plan Implementation

10.1 Recommended Five-Year Implementation Plan

10.1.1 Implementation Objectives

The Santee RBC identified five implementation objectives for the Santee River Basin Plan. These five objectives were developed based on themes that emerged from the recommendations made and presented in previous chapters including water management strategies from Chapters 6 and 7; drought response strategies from Chapter 8; and policy, legislative, regulatory, technical, and planning process recommendations from Chapter 9. The objectives are as follows:

- **Objective 1.** Improve water use efficiency to conserve water resources.
- **Objective 2.** Communicate, coordinate, and promote findings and recommendations from the River Basin Plan.
- **Objective 3.** Improve technical understanding of water resource management issues.
- **Objective 4.** Protect water resources, enhance access to new sources, and build resilience.
- **Objective 5.** Improve drought management.

The RBC deemed objectives 2 and 3 to be the highest priority since they are supported mostly by actions and strategies that the RBC is responsible for. The other objectives were not prioritized.

The strategies and corresponding actions to achieve each objective are presented in Table 10-1. Table 10-1 also includes an outline of 5-year actions, responsible parties, budget, and potential funding sources to achieve each objective. The funding sources are further described in Chapter 10.1.2.

Table 10-1. Five Year Implementation Plan.

Strategy		Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 1. Improve water use efficiency to conserve water resources						
A. Municipal Conservation	Public Education of Water Conservation	Tool box of strategies. Applicability and priority will vary by utility.	1. RBC and SCDES identify funding opportunities and technical assistance (yrs 1-5). 2. RBC encourages water utilities to conduct a water loss/leak detection audit using AWWA M36 Method, establish a baseline, and continue to measure every 2-3 years (yrs 1-5). 3. RBC implements outreach and education program about recommended water management practices and funding opportunities (yrs 1-5). 4. Individual water users implement conservation practices (yrs 3-5). 5. RBC develops survey of practices implemented, funding issues, and funding sources utilized (beginning in yr 5 as part of 5-year Plan update).	RBC with support of SCDES and contractors: Identify funding opportunities and develop information to distribute. Conduct surveys and analyze results. Municipal Withdrawers: Implement appropriate strategies and seek funding from recommended sources as necessary.	Costs of implementation will vary by municipality according to current program capabilities and financial means. See Chapter 6.1.6 for discussion of cost-benefit of individual strategies. The cost of RBC support activities would be included in the budget for on-going RBC planning (if approved)	Individual strategies to be funded using outside funding opportunities or by evaluating existing rate structure. Possible outside funding sources include: Fed-1, 2, 5, 6, 7, and USDA-8 and 9.
	Conservation Pricing Structures/ Drought Surcharge					
	Leak Detection and Water Loss Control Program					
	AMI and AMR and district metering					
	Water Recycling					
	Landscape Irrigation Program and Codes / Time-of-Day Watering Limit					

[1] *See Tables 10-2 and 10-3 for funding source references.*

Table 10-1. Five-Year Implementation Plan (Continued).

Strategy		Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 1. Improve water use efficiency to conserve water resources						
B. Agricultural Conservation	Water Audits and Nozzle Retrofits	Tool box of strategies. Priority varies by operation. * Soil management and cover cropping are recognized as an important first steps to reap the maximum benefits from other strategies.	1. RBC and SCDES identify funding opportunities (yrs 1-5). 2. RBC implements outreach and education program about recommended water management practices and funding opportunities (yrs 1-5). 3. Individual water users implement conservation practices (yrs 3-5). 4. RBC develops survey of practices implemented, funding issues, and funding sources utilized (beginning in yr 5 as part of 5-year Plan update).	RBC with support of SCDES and contractors: Identify funding opportunities and develop information to distribute. Conduct surveys and analyze results. Farmers: Implement appropriate strategies and seek funding from recommended sources as necessary. The Farm Bureau may be able to assist with funding applications.	Costs of implementation will vary by agricultural operation according to size of operation, crops grown, current irrigation practices, and financial means. See Chapter 6.1.6 for discussion of cost-benefit of individual strategies. The cost of RBC support activities would be included in the budget for on-going RBC planning (if approved)	Possible funding sources include: USDA-7.
	Irrigation Equipment Changes					
	Soil Management and Cover Cropping*					
	Irrigation Scheduling					
	Crop Variety, Crop Type, and Crop Conversion					
	Moisture Sensors/ Smart Irrigation Systems					
	Wetting Agents (golf courses)					
	Water Recycling					
	Future technologies					

[1] *See Tables 10-2 and 10-3 for funding source references.*

Table 10-1. Five-Year Implementation Plan (Continued).

Strategy		Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 1. Improve water use efficiency to conserve water resources						
C. Industrial and Energy Conservation	Water Audits and Leak Detection	Tool box of strategies. Priority varies by operation.	1. RBC develops and implements outreach and education programs about recommended water management practices (yrs 1-5). 2. Individual water users implement conservation practices (yrs 3-5). 3. RBC develops survey of practices implemented, funding issues, and funding sources utilized (beginning in yr 5 as part of 5-year Plan update). 4. RBC reviews and analyzes water usage to improve understanding of water savings of strategies (beginning in yr 5 as part of 5-year Plan update).	RBC with support of SCDES and contractors: Identify funding opportunities and develop and implement outreach program. Conduct surveys and analyze results. Industrial operators: Implement appropriate strategies and seek funding from recommended sources as necessary.	Costs of implementation will vary by industrial operation. See Chapter 6.1.6 for discussion of cost-benefit of individual strategies. The cost of RBC support activities would be included in the budget for on-going RBC planning (if approved)	Funding comes from industry.
	Rebates on Energy Efficiency Appliances					
	Water Recycling and Rainwater Capture and Harvesting					
	Water Saving Equipment and Efficient Water Systems					
	Installing Water Saving Fixtures and Toilets					
	Educating Employees					

[1] *See Tables 10-2 and 10-3 for funding source references.*

Table 10-1. Five-Year Implementation Plan (Continued).

Strategy	Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 2. Communicate, coordinate, and promote findings and recommendations from the River Basin Plan.					
A. The South Carolina Legislature authorize recurring funding as requested by SCDES for annual, ongoing water planning activities, including river basin planning.	No priority established	1. SCDES identifies funding needs and communicates with Legislature (yrs 1-5).	SCDES identifies the scope. SC Legislature approves the funding.	Existing SCDES budget can be used to develop the scope. The budget for planning is to be determined.	If approved, funding would come from SC Legislature.
B. The South Carolina Legislature should establish a grant program to help support the implementation of the actions and strategies identified each RBC's River Basin Plan.		1. SCDES identifies funding needs, outlines program requirements, and communicates with Legislature (yrs 1-5) on the need.	SCDES establishes grant program rules and administers the funding. SC Legislature approves the funding.	An initial "seed" grant program could start with a modest $500,000 to $1M for implementation actions statewide.	If approved, funding would come from SC Legislature.
C. The State should support statewide water education programs through existing agencies such as Cooperative Extensions, (etc.) that include all sectors of water use and promote the types of water management strategies recommended in River Basin Plans.		1. RBCs and SCDES to determine education topics of importance and target audience for education program (yr 1) 2. RBCs and SCDES to meet with organizations (e.g., Clemson Extension, Soil & Water Conservation Districts, and non-profits) that already conduct water-related education and outreach, to discuss opportunities for collaboration (yr 1). 3. RBCs and SCDES to identify what education programs exist to meet these needs and promote them (yrs 2-5). 4. With support of SCDES and/or contractors, RBCs to develop new education and outreach program to fill gaps (yrs 3-5).	RBC to provide guidance on education to SCDES. Legislature to approve funding.	Cost of RBC activities are included in on-going RBC meeting and support budgets. Budget for education programs be determined based on recommendations.	No direct cost for RBC meetings. Legislature approval required for additional state funding of education programs

[1] *See Tables 10-2 and 10-3 for funding source references.*

Table 10-1. Five-Year Implementation Plan (Continued).

Strategy	Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 2. Communicate, coordinate, and promote findings and recommendations from the River Basin Plan.					
D. SCDES, the RBC Planning Teams, and the RBCs should conduct regular reviews of the RBC membership to make sure all interest categories are adequately represented and attendance across all interest categories meets the requirements of the RBC Bylaws.	No priority established	1. SCDES, RBC Planning Team, and RBC conduct reviews of membership every 6 months (yrs 1-5). 2. SCDES and RBC conduct outreach to promote membership for under-represented groups as necessary (yrs 1-5).	SCDES, RBC Planning Team, and RBC jointly conduct reviews.	The cost of RBC activities are included in on-going RBC meeting budgets.	There is no direct cost.
E. SCDES should organize an annual state-wide meeting of RBCs and State agencies.		1. SCDES gages interest from all active RBCs (yr 1). 2. If other RBCs concur with the recommendation, SCDES plans first annual meeting location, agenda, and invitees. SCDES will also identify cost and assess availability of funding, if needed (yr 1-2). 3.SCDES executes annual meeting (yrs 1-5).	SCDES leads the coordination effort. RBC members attend meetings.	If contractor led, RBC meetings may range between $5,000 and $15,000 per meeting, depending on effort needed to prepare for, conduct, and document each meeting.	Funding would come from SC Legislature, if approved, and Fed-7.
F. SCDES should continue to designate staff to coordinate and support ongoing RBC activities.		1. SCDES identifies staff and funding needs to coordinate and support on-going RBC activities (yrs 1-5).	SCDES to identify staffing needs. SC Legislature approves continued funding.	The existing SCDES budget covers current activities. The budget for continued planning is to be determined.	Funding would come from existing SCDES budget. Additional funding, if approved, would come from SC Legislature.

[1] *See Tables 10-2 and 10-3 for funding source references.*

Table 10-1. Five-Year Implementation Plan (Continued).

Strategy	Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 2. Communicate, coordinate, and promote findings and recommendations from the River Basin Plan.					
G. RBC members should be encouraged to present observations and outcomes of the river basin planning process.	No priority established	1. RBC to develop outreach sub-committee to help identify opportunities to present observations and outcomes of the river basin planning process and advocate for the recommendations and strategies contained in the Santee River basin (yr 1). 2. Present to local organizations and at local and state conferences regarding the river basin plan and process (yrs 2-5).	RBC with support of SCDES and contractors.	Cost of RBC activities are included in on-going RBC meeting budgets.	There is no direct cost.

[1] *See Tables 10-2 and 10-3 for funding source references.*

Table 10-1. Five-Year Implementation Plan (Continued).

Strategy	Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 3. Improve technical understanding of water resource management issues.					
A. Incorporate future climate projections into modeling analyses. As part of this effort, estimate the impact of increasing temperatures on evaporation and evaluate the potential impacts of increased evaporation on Lakes Marion and Moultrie.	No priority established	1. Contractor to perform analysis and present results to the RBC (yr 1-3). 2. RBC to assess results of analysis and incorporate findings into the next Plan update (yrs 2-3).	Santee RBC with support from SCDES and contractors	Cost of RBC activities are included in on-going RBC meeting and support budgets. Cost for this analyses could range from $5,000-$20,000, depending on the level of detail.	Funding would come from existing SCDES budget for water planning, as available, and Fed-9.
B. The RBC endeavors to learn more about the Pinewood site including the regulation, consent orders, controls, and monitoring in place.		1. RBC Members review information available at the Pinewood Site Custodial Trust webpage (https://www.thepinewoodsite.com) and the SCDES webpage (https://des.sc.gov/community/environmental-sites-projects/pinewood-site) (yr 1). 2. If additional information is needed, SCDES to coordinate SCDES or other speaker(s) familiar with management of the site to present to the RBC (yr 1).	SCDES to coordinate.	The cost of RBC activities are included in on-going RBC meeting budgets.	There is no direct cost.
C. Future RBC planning efforts should address water quality.		1. RBC identifies specific water quality issues and concerns in the basin (yrs 3-5). 2. RBC develops approach to further address those water quality issues and concerns, including the need for development of a watershed plan under SCDES's Watershed Program (yrs 4-5).	RBC evaluates water quality with support from SCDES, SCDNR, and contractors.	The cost of RBC activities are included in on-going RBC meeting and support budgets. Development of watershed plans would come from SCDES's existing Watershed Program budget.	Funding would come from existing SCDES budget for water planning, as available, and Fed-9.

[1] See Tables 10-2 and 10-3 for funding source references.

Table 10-1. Five-Year Implementation Plan (Continued).

Strategy	Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 3. Improve technical understanding of water resource management issues.					
D. Support continued efforts to maintain USGS streamflow gages.	No priority established	1. Develop communication strategy for speaking with USGS and other entities funding stream gages (yr 1-2). 2. Outreach to USGS and current funding entities on the importance of streamflow data to the river basin planning process. RBC to support search for additional funding sources as needed (yr 3-5).	Santee RBC with support from SCDES, SCDNR, and contractors	Costs of monitoring and processing data for existing streamflow gages are in USGS existing budget. Some gages are maintained by other entities. A stream gauge suitable for inclusion in the USGS system cost between $20,000 and $35,000 to install, depending on the site, and $16,000 a year to operate (Gardner-Smith 2021).	USGS, SCDNR, and co-sponsors
E. Work on the groundwater model developed by the USGS should be continued/completed.		1. USGS completes updates to the South Atlantic Coastal Plain Groundwater model (yrs 1-2). 2. USGS simulates current and future conditions and shares findings with RBC (yrs 1-2). 3. RBC recommends additional scenarios for modeling, and USGS completes and reports findings (yrs 2-3). 4. RBC incorporates findings into the next Plan update (yrs 4-5).	USGS completes modeling. RBC recommends scenarios for modeling with SCDES and contractor support.	The SCDES existing budget (covered under the current contract between the SCDES and USGS) covers modeling.	Funding comes from existing SCDES budget and contract with the USGS.
F. Support for SCDES and USGS monitoring of groundwater levels.		1. SCDES seeks funding and drills new monitoring wells in groundwater areas of concern, as needed (yrs 1–5). 2.SCDES analyzes collected water level data (yrs 1–5).	SCDES develops additional monitoring wells with potential support from USGS.	New monitoring wells and monitoring equipment may range from $15,000 to $100,000 depending on depth.	Funding comes from SCDES and potential USGS budgets, as available.

[1] See Tables 10-2 and 10-3 for funding source references.

Table 10-1. Five-Year Implementation Plan (Continued).

Strategy	Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 3. Improve technical understanding of water resource management issues.					
G. Study the impacts of land use changes on the supply of and demand for water resources	No priority established	1. Invite RTI to educate the RBC on the CWWMG's land consevation modeling and/or explore other methods suitable to evaluating land use changes (yr 1-2). 2. Consider performing similar land conservation modeling to identify how land use changes may impact water resources (yrs 3-5).	Santee RBC with support from SCDES, SCDNR, and contractors.	Basinwide modeling focused on determining impacts of land use changes on water quantity and quality could range from $100,000 to $250,000.	Funded by SCDNR budget as available.
H. SCDES performs studies and analyses in support of a recycled water statute in South Carolina.		1. SCDES develops scope of study based on input from the WateReuseSC and RBCs and examples from other states (yr 2). 2. SCDES conducts study and reports findings to RBCs (yrs 3-5).	SCDES conducts study.	Funding for a study could come from existing SCDES budget, or by special appropriation from the legilsature. Actual funding amount to be determined.	Funding would come from existing SCDES budget.

[1] *See Tables 10-2 and 10-3 for funding source references.*

Table 10-1. Five-Year Implementation Plan (Continued).

Strategy	Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 4. Protect water resources, enhance access to new sources, and build resilience.					
A. Water users should continue to identify partnerships and alternative sources including interconnections to build resilience and ensure adequate quantity of water.	No priority established	1. RBC shares findings of potential future user shortages from modeling analysis with water users in the basin (yr 1). 2. RBC recommends water management strategies in the River Basin Plan to implement to reduce potential shortages, including development of partnerships (e.g., interconnections) and alternative sources where feasible (yrs 2-5).	Santee RBC with support from SCDES.	Development of interconnections and alternative sources can vary significantly depending on numerous factors.	FED-1, -2, -3, -4, -5 and -8.
B. State and local governments should continue to develop/review/update/ adopt and enforce laws, regulations, policies, and/or ordinances that improve the management of stormwater runoff, encourage infiltration, minimize streambank erosion, reduce sedimentation, and protect water resources.		1. Work with local governments and Councils of Government (COGs) to incorporate strategies into land use, planning, zoning, and permitting processes (yrs 1-5).	Santee RBC with support of SCDES to perform outreach.	Cost of RBC activities are included in on-going RBC meeting budgets.	There is no direct cost.
C. A cost share program should be developed (1) to drill deeper wells into aquifer units with less development pressure and (2) operate them.		1. Coastal RBCs work together to encourage the legislature to approve a cost share program that promotes installation of deeper production wells, where development pressure occurs (yrs 1–5). 2. With support from the Legislature, SCDES develop and administer the cost share program.	Coastal RBCs and SCDES.	New production wells may range from $100,000 to over $500,000 depending on depth and size. A cost share program might initially help defray the cost of the deeper wells.	Funding would come from SC Legislature, if approved.

[1] *See Tables 10-2 and 10-3 for funding source references.*

Table 10-1. Five-Year Implementation Plan (Continued).

Strategy	Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 5. Improve drought management					
A. Water utilities review their drought management plan and response ordinance every 5 years and review and update every 10 years, or more frequently if conditions change. Once updated, the plans are submitted to the SCO for review.	No priority established	1. Public suppliers on the RBC review and update their drought management plans and send them to the SCO (yrs 1-5). 2. Public suppliers on the RBC consider ways to incorporate RBC drought management recommendations into their drought plans (yrs 1-5). 3. Public suppliers shared updates to drought management plans with the SCO (e-mail to drought@dnr.sc.gov).	Public suppliers review and updates their drought management plans.	Drought planning activities occur within public suppliers' annual budgets.	Possible funding sources include: Fed-6.
B. SCDES and SCDNR lobby for state funding to support the review and update of drought management plans by water utilities, especially small utilities with less financial and technical resources.		1. RBC works with SCDES and SCDNR to determine the level of funding needed to support small utilities that wish to update their plans and ordinances (yrs 1-2). 2. SCDES and SCDNR communicates funding needs to Legislature (yr 1-5).	SCDES identifies the funding needs. SC legislature approves the funding.	The budget for implementation to be determined.	Funded would come from SC Legislature, if approved.

[1] *See Tables 10-2 and 10-3 for funding source references.*

Table 10-1. Five-Year Implementation Plan (Continued).

Strategy		Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 5. Improve drought management						
C. The RBC develops materials and an outreach strategy to public suppliers in the basin to implement the RBC's drought management recommendations (see Chapter 8.2.3)	1. The RBC encourages water utilities in the basin to consider drought surcharges on water use during severe and/or extreme drought phases.	No priority established	1. RBC develops materials on the benefits and implementation of RBC drought management recommendations (yr 1). 2. RBC develops outreach strategy to communicate with public suppliers and distribute materials (yr 2). 3. RBC executes outreach strategy and updates materials as necessary (yrs 3-5). 4. RBC develops approach to track updates to drought management plans in the basin (yrs 3-5).	RBC conducts outreach with support of SCDES and contractors.	There is no direct cost, other than ongoing contractor support, if needed. Cost of RBC activities are included in on-going RBC meeting budgets.	Possible funding sources include: Fed-6.
	2. The RBC encourages water users and those with water interests to submit drought impact observations through CMORs.					

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[1] *See Tables 10-2 and 10-3 for funding source references.*

10.1.2 Funding Opportunities

Existing external funding sources may be leveraged to promote implementation of the objectives outlined in Chapter 10.1.1. For example, the U.S. Environmental Protection Agency's (EPA's) Water Infrastructure Finance and Information Act program offers funding to support eligible water and wastewater infrastructure projects including those related to drought prevention, reduction, and mitigation. Other funding to support drought mitigation efforts may be available through the Federal Emergency Management Agency's (FEMA's) Hazard Mitigation Grant Program (HMGP). Table 10-2 summarizes federal funding sources for public suppliers that were available at the time this Plan was prepared in October 2025.

The USDA offers numerous programs for farmers and ranchers to reduce risk from drought or to restore land impacted by drought. The Farm Bill has authorized several programs to provide relief to farms and ranches experiencing drought, including the Federal Crop Insurance Program; the Emergency Conservation Program; the Pasture, Rangeland, and Forage Program; and the Livestock Forage Disaster Program. In addition, the Environmental Quality Incentives Program (EQIP) provides assistance to farm operations to conserve water and for other conservation measures. Some EQIP assistance is targeted toward water-conserving efforts in drought-prone regions through the WaterSMART Initiative, a collaboration between the USDA and the U.S. Department of the Interior's Bureau of Reclamation. Table 10-3 summarizes these and other existing USDA funding sources that were available at the time this Plan was prepared in October 2025.

In 2022 Congress passed the Inflation Reduction Act (IRA), which may provide additional funding to programs related to agricultural conservation for fiscal years 2023 through 2026. For example, of the $20 billion allotted to the USDA, Section 21001 of the IRA assigned $8.5 billion in addition to amounts otherwise available to an existing USDA program, EQIP. EQIP pays for ecosystem restoration and emissions reduction projects on farmland and may be used for activities such as the purchase of cover crops (one of the agricultural conservation strategies discussed in this plan). Annual obligations from the EQIP program have been approximately $1.8 to $1.9 billion from 2018 through 2021, with between $36 to $45 million allotted for projects in South Carolina in these years. Additionally, $3.25 billion was allotted to the federal Conservation Stewardship Program, $1.4 million to the Agricultural Conservation Easement Program, and $4.95 billion to the Regional Conservation Partnership Program. The IRA indicates that activities funded by these programs must "directly improve soil carbon, reduce nitrogen losses, or reduce, capture, avoid, or sequester carbon dioxide, methane, or nitrous oxide emissions, associated with agricultural production" (IRA 2022). Projects that provide water efficiency benefits in addition to these climate benefits may be eligible for funding under these programs. Section 30002 of the IRA also designated $837.5 million in funding to the Secretary of Housing and Urban Affairs for projects that improve energy or water efficiency for affordable housing (IRA 2022). On January 20, 2025, an Executive Order was issued requiring all agencies to immediately pause the disbursement of funds appropriated through the IRA and for agency heads to review the IRA to enhance their alignment with the administration's new policies. On February 20, 2025, $20 million in contracts for the EQIP, Conservation Stewardship Program, and Agricultural Conservation Easement Programs was released. At the time this Plan was prepared in October 2025, it is unknown if the IRA funding described above will be continued or eliminated.

In September 2022, $70 million in USDA "Partnerships for Climate-Smart Commodities" funding was invested in South Carolina's two land-grant universities, Clemson University and South Carolina State

University, to promote "climate-smart" agricultural practices in South Carolina. The project will utilize a coalition of 27 entities to promote the program to farmers, with a focus on peanuts, leafy greens, beef cattle, and forestry. Most of the funding will go directly to growers to offset the costs of implementing conservation practices. There may be opportunities to leverage this new funding source to implement the agricultural conservation strategies recommended in this plan. Although enrollment is currently closed as of the drafting of this plan in March 2025, interested parties are encouraged to sign up to learn about future opportunities. At the time this Plan was prepared in October 2025, funding disbursements for the program were frozen and it is unknown if funding will be continued or eliminated.

Table 10-2. Federal funding sources.

Funding Source Index[1]	Program	Agency	Grant/Loan Funds Available	Description
Fed-1	U.S. Economic Development Administration (EDA) Grants	EDA	No limit (subject to federal appropriation)	EDA's Public Works Program and Economic Adjustment Assistance Program aids distressed communities by providing funding for existing physical infrastructure improvements and expansions.
Fed-2	Water Infrastructure Finance and Information Act	U.S. EPA	Up to 49 percent of eligible project costs (minimum project size is $20 million for large communities and $5 million for small communities)	A federal credit program administered by EPA for eligible water and wastewater infrastructure projects, including drought prevention, reduction, and mitigation.
Fed-3	Section 502 Direct Loan Program	USDA Rural Development	Loans based on individual county mortgage limits	Loans are available for wells and water connections in rural communities. Availability is based on community income.
Fed-4	National Rural Water Association Revolving Loan Fund	USDA Rural Utilities Service	$100,000 or 75% of the total project	Provides loans for predevelopment costs associated with water and wastewater projects and for existing systems in need of small-scale capital improvements.
Fed-5	Emergency Community Water Assistance Grants	USDA Rural Development	Up to $100,000 or $1,000,000 depending on the type of project	Offers grants to rural areas and towns with populations of 10,000 or less to construct waterline extensions; repair breaks or leaks; address maintenance necessary to replenish the water supply; or construct a water source, intake, or treatment facility.
Fed-6	HMGP	FEMA	Variable	Provides funds to states, territories, tribal governments, and communities for hazard mitigation planning and the implementation of mitigation projects following a presidentially declared disaster event
Fed-7	Planning Assistance to States	USACE	Variable – funding is 50% federal and 50% nonfederal	USACE can provide states, local governments, and other nonfederal entities assistance in the development of comprehensive plans for the development, use, and conservation of water resources.

[1] As referenced in the "Funding Sources" column of Table 10-1.

Table 10-2. Federal funding sources (Continued).

Funding Source Index[1]	Program	Agency	Grant/Loan Funds Available	Description
Fed-8	Drinking Water State Revolving Fund	SCDES and SC Rural Infrastructure Authority	Congress appropriates funding for the Drinking Water State Revolving Fund that is then awarded to states by EPA based on results of the most recent Drinking Water Infrastructure Needs Survey and Assessment.	This program is a federal-state partnership aimed at ensuring that communities have safe drinking water by providing low-interest loans and grants to eligible recipients for drinking water infrastructure projects.
Fed-9	Clean Water State Revolving Fund	SCDES, SC Rural Infrastructure Authority	Congress appropriates funding for the Clean Water State Revolving Fund that is then awarded to states by EPA.	This program is a federal-state partnership that provides funding for water quality infrastructure projects including wastewater treatment facilities, nonpoint source pollution control, stormwater runoff mitigation, and water reuse.

[1] As referenced in the "Funding Sources" column of Table 10-1.

Table 10-3. USDA disaster assistance programs.

Funding Source Index[1]	Program	Agency	Description
USDA-1	Crop Insurance	Risk Management Agency (RMA)	Provides indemnity payments to growers who purchased crop insurance for production and quality losses related to drought, including losses from an inability to plant caused by an insured cause of loss.
USDA-2	Conservation Reserve Program Haying and Grazing	Farm Service Agency (FSA)	Provides for emergency haying and grazing on certain Conservation Reserve Program practices in a county designated as D2 or higher on the United States Drought Monitor, or in a county where there is at least a 40% loss in forage production.
USDA-3	Emergency Assistance for Livestock, Honeybees, and Farm-Raised Fish Program	FSA	Provides assistance to eligible owners of livestock and producers of honeybees and farm-raised fish for losses.
USDA-4	Emergency Conservation Program	FSA	Provides funding and technical assistance for farmers and ranchers to restore farmland damaged by natural disasters and for emergency water conservation measures in severe droughts.
USDA-5	Emergency Forest Restoration Program	FSA	Provides funding to restore privately owned forests damaged by natural disasters. Assistance helps landowners carry out emergency measures to restore forest health on land damaged by drought disasters.
USDA-6	Farm Loans	FSA	Provides emergency and operating loans to help producers recover from production and physical losses due to natural disasters and can pay for farm operating and family living expenses.

[1] As referenced in the "Funding Sources" column of Table 10-1.

Table 10-3. USDA disaster assistance programs (Continued).

Funding Source Index[1]	Program	Agency	Description
USDA-7	EQIP	FSA	Provides agricultural producers with financial resources and assistance to plan and implement improvements on the land in support of disaster recovery and repair and can help mitigate loss from future natural disasters. Assistance may also be available for emergency animal mortality disposal from natural disasters.
USDA-8	Emergency Watershed Program (Recovery)	NRCS	Offers vital recovery options for local communities to help people reduce hazards to life and property caused by droughts.
USDA-9	Emergency Community Water Assistance Grants	Rural Development	Offers grants to rural areas and towns with populations of 10,000 or less to construct waterline extensions; repair breaks or leaks; address maintenance necessary to replenish the water supply; or construct a water source, intake, or treatment facility.
USDA-10	Pasture, Rangeland, and Forage Program	RMA	Offers farmers and ranchers financial support to replace lost income due to forage losses caused by lower-than-average rainfall.
USDA-11	Livestock Forage Disaster Program	FSA	Offers financial support to livestock producers who experience grazing losses due to qualifying drought conditions or fire on federally managed lands. Payments compensate for lost grazing opportunities and additional feed costs incurred due to the disaster.

[1] As referenced in the "Funding Sources" column of Table 10-1.

10.1.3 Implementation Considerations

To effectively implement the recommended strategies of the River Basin Plan, the RBC must continue to meet as a planning body. The implementation plan presented in this chapter assumes that the RBC has funding and staffing support from SCDES to continue to meet and work through implementation. The Planning Framework states that the River Basin Plan should not be perceived as a static document and the RBC should not be a stagnant planning body between successive updates. Rather, the RBC is to be "actively engaged in promoting the implementation of the recommendations proposed" and "will continue to meet on a periodic basis to pursue River Basin Plan implementation activities as needed" (SCDNR 2019a, p. 90). The Santee RBC may meet quarterly in the first year after publication of the River Basin Plan to pursue funding and implementation. After the first year, meetings may be held less frequently as needed, but at least once per year. To support continued river basin planning, the RBC included recommendations to continue funding of the planning process, to have SCDES designate staff to continue supporting RBC activities, and to promote coordination with other RBCs. Additional RBCs, including the Upper Savannah RBC, Broad RBC, and Saluda RBC, have recommended joint meetings of multiple RBCs, suggesting there is broad support for this recommendation.

The Santee RBC may encounter additional challenges in the implementation of the identified strategies. One such challenge is the identification of sufficient funding. For the implementation of Objective 1, water withdrawers may have limited financial capacity to pursue the recommended water management strategies. A municipal water utility's budget is limited by its customer base and rate structure. The increases to water rates necessary to fund implementation of the actions associated with these objectives may not be feasible for some communities. Agricultural water withdrawers may have limited financial resources to invest in new and potentially expensive water conservation or augmentation strategies. Although some outside funding sources exist, applications for such programs may present a technical or resource barrier to many water withdrawers. Any new funding sources pursued by the RBC with SCDES support may take time to develop, leading to delays in implementation. The identification of immediately available funding opportunities, the provision of support in funding applications, and the investigation of new funding sources are vital to implementation of the recommended strategies under Objective 1. The Santee RBC included a recommendation of establishing a grant program to support implementation of River Basin Plan recommendations. This strategy is included under Objective 2, communicate, coordinate, and promote findings and recommendations from the River Basin Plan.

Another challenge in the implementation of the River Basin Plan is stakeholder acceptance. The RBC itself has no authority to enforce recommendations in the basin. Therefore, implementation of these strategies is dependent upon effective communication of RBC findings and recommendations to stakeholders. For example, stakeholder acceptance is vital for achieving Objectives 1 and 5, as these strategies rely on individual water withdrawers reducing their demands or modifying their drought management plans. To gain acceptance, water withdrawers must understand the need for and goals of the recommended strategies as well as have assurance that they are viable and effective in improving equitable access to the basin's water resources. Additional strategies, including those under Objectives 2, 3, and 4, require action on the part of SCDES, USGS, and the state Legislature with the RBC playing a role in recommending and supporting the strategy. These strategies include outreach components as part of their 5-year actions in the implementation table. Outreach may include direct communication or the development of print or online materials to describe the recommendation, benefits, funding sources, and how these strategies relate to findings from the planning process.

As the RBC makes decisions related to implementation, the RBC should aim to build consensus where possible and consider documenting alternative points of view when consensus is not possible. Documenting alternative points of view can be equally valuable to officials who have a role implementing water management strategies and/or recommendations made by a portion of the RBC. Full consensus on every issue is an unrealistic goal, but the RBC should continue to discuss, revisit, and document issues from this and later planning phases that are marked by alternative or opposing points of view.

10.2 Long-term Planning Objectives

The Santee RBC's objectives described in Chapter 10.1 represent both short-term, 5-year actions and long-term objectives. For each objective, the 5-year actions are discussed in Chapter 10.1 and long-term strategies are presented below in Table 10-4.

Table 10-4. Long-term planning objectives.

Strategy	Long-Term Goals & Objectives
Objective 1. Improve water use efficiency to conserve water resources	
A. Municipal Conservation	Continue short term goals. Adjust recommended actions based on water savings realized. Seek additional funding sources.
B. Agricultural Conservation	Continue short term goals. Adjust recommended actions based on water savings realized. Seek additional funding sources. Explore new technologies and incorporate into recommendations as appropriate.
C. Industrial and Energy Conservation	Continue short term goals. Adjust recommended actions based on water savings realized. Seek additional funding sources. Explore new technologies and incorporate into recommendations as appropriate.
Objective 2. Communicate, coordinate, and promote findings and recommendations from the River Basin Plan.	
A. The South Carolina Legislature authorize recurring funding as requested by SCDES for annual, ongoing water planning activities, including river basin planning.	Continue funding river basin and state water planning activities.
B. The South Carolina Legislature should establish a grant program to help support the implementation of the actions and strategies identified each RBC's River Basin Plan.	Develop funding to support implementation of river basin and state water planning activities.
C. The State should support statewide water education programs through existing agencies such as Cooperative Extensions, (etc.) that include all sectors of water use and promote the types of water management strategies recommended in River Basin Plans.	Continue 5-year actions.
D. SCDES, the RBC Planning Teams, and the RBCs should conduct regular reviews of the RBC membership to make sure all interest categories are adequately represented and attendance across all interest categories meets the requirements of the RBC Bylaws.	Maintain RBC membership and engagement in water planning processes in the state.
E. SCDES should organize an annual state-wide meeting of RBCs and State agencies.	Coordinate efforts and recommendations among RBCs.
F. SCDES should continue to designate staff to coordinate and support ongoing RBC activities.	RBC activities will be coordinated and supported by SCDES.
G. RBC members should be encouraged to present observations and outcomes of the river basin planning process.	Continue to present outcomes of the planning process as river basin planning activities continue.

Table 10-4. Long-term planning objectives (Continued)

Strategy	Long-Term Goals & Objectives
Objective 3. Improve technical understanding of water resource management issues.	
A. Incorporate future climate projections into modeling analyses. As part of this effort, estimate the impact of increasing temperatures on evaporation and evaluate the potential impacts of increased evaporation on Lakes Marion and Moultrie.	Consider the findings of uncertainty analysis and include recommendations in next 5-yr Plan update.
B. The RBC endeavors to learn more about the Pinewood site including the regulation, consent orders, controls, and monitoring in place.	Continue 5-year actions.
C. Future RBC planning efforts should address water quality.	Consider findings of water quality analysis and include recommendations in next 5-yr Plan update.
D. Support continued efforts to maintain USGS streamflow gages.	Continue short-term goals. Monitor number of active gages in the basin.
E. Work on the groundwater model developed by the USGS should be continued/completed.	Understand the capacity of aquifers and sustainability of groundwater use in the Santee basins.
F. Support for SCDES and USGS monitoring of groundwater levels.	Consider findings of collected groundwater level data and include recommendations in next 5-yr Plan update.
G. Study the impacts of land use changes on the supply of and demand for water resources	Incorporate land use projections and recharge impacts into future modeling efforts.
H. SCDES performs studies and analyses in support of a recycled water statute in South Carolina.	Explore expanded use of reclaimed water for recycled water programs in South Carolina.
Objective 4. Protect water resources, enhance access to new sources, and build resilience.	
A. Water users should continue to identify partnerships and alternative sources including interconnections to build resilience and ensure adequate quantity of water.	Monitor user shortages identified and implement strategies to reduce the projected shortages.
B. State and local governments should continue to develop/review/update/ adopt and enforce laws, regulations, policies, and/or ordinances that improve the management of stormwater runoff, encourage infiltration, minimize streambank erosion, reduce sedimentation, and protect water resources.	Continue 5-year actions.
C. A cost share program should be developed (1) to drill deeper wells into aquifer units with less development pressure and (2) operate them.	The Legislature approves the cost-share program, and it is implemented.

Table 10-4. Long-term planning objectives (Continued)

Strategy		Long-Term Goals & Objectives
Objective 5. Improve drought management		
A. Water utilities review their drought management plan and response ordinance every 5 years and review and update every 10 years or more frequently if conditions change. Once updated, the plans are submitted to the SCO for review.		Public suppliers maintain up-to-date drought management plans that are consistent (where possible) with the recommendations of the RBC.
B. SCDES and SCDNR lobby for state funding to support the review and update of drought management plans by water utilities, especially small utilities with less financial and technical resources.		Public suppliers with financial constraints are supported in maintaining up-to-date drought management plans.
C. The RBC develops materials and an outreach strategy to public suppliers in the basin to implement the RBC's drought management recommendations (see Chapter 8.2.3)	1. The RBC encourages water utilities in the basin to consider drought surcharges on water use during severe and/or extreme drought phases.	Continue short-term goals.
	2. The RBC encourages water users and those with water interests to submit drought impact observations through CMORs.	

[1] See Tables 10-3 and 10-4 for funding source references.

10.3 Progress on River Basin Plan Implementation

To assess the performance of and quality of actions taken by the RBC, the Framework proposes the development of progress metrics. A progress metric is a "*benchmark used to monitor the success or failure of an action taken by an RBC*" (SCDNR 2009). Noting that the ultimate value and impact of the river basin planning process is the dissemination of its findings and implementation of its recommendations, the following progress metrics were proposed to address each of the seven implementation objectives defined at the beginning of this chapter. Successful tracking of metrics is dependent on RBCs continuing to meet after the River Basin Plans are published and having support from SCDES and contractors to track progress. The proposed progress metrics are:

1. Improve water use efficiency to conserve water resources.
    a. **Metric 1a:** Water utilities establish a baseline water loss/leak detection measure and improvement is seen over 5 years in subsequent surveys.
    b. **Metric 1b:** Funding opportunities are identified and used to implement conservation strategies.
2. Communicate, coordinate, and promote fundings and recommendations from the River Basin Plan.
    a. **Metric 2a**: The South Carolina State Water Plan incorporates the Santee River Basin Plan's recommendations.
    b. **Metric 2b:** The RBC meets at least bi-annually with support of SCDES.
    c. **Metric 2c:** Outreach leads to local, legislative or federal actions, decisions, and funding that support implementation strategies and actions.
3. Improve technical understanding of water resources management issues.
    a. **Metric 3a**: USGS streamflow gages and groundwater monitoring wells in the basin are maintained and increased.
    b. **Metric 3c:** Water quality issues and concerns in the basin are identified and a strategy to study approaches to address them is developed.
4. Protect water resources, enhance access to new sources, and build resilience.
    a. **Metric 4a**: Partnerships and alternate sources are identified.
    b. **Metric 4b:** The Legislature approves a cost-share program is developed and deeper wells are drilled and in operation.
5. Improve drought management.

a. **Metric 5a:** One hundred percent of public water supplier's drought management plans are updated within the last 10 years and submitted to the SCO for review.

This 2025 publication is the first Santee River Basin Plan publication. Future 5-year updates will evaluate the Santee RBC's performance relative to the progress metrics.

As noted throughout this plan, communication and the development of stakeholder buy-in is key to successful plan implementation. To develop stakeholder acceptance, RBC members, who are the ambassadors of the River Basin Plan, must have confidence in the planning process and outcomes. A key responsibility of RBC members, as defined in the Framework, is to regularly communicate with stakeholders to maintain a current understanding of RBC activities, the River Basin Plan, and emerging issues. To assess each RBC member's confidence in the plan, the plan approval process dictates that there will first be a test for consensus on the Draft Santee River Basin Plan. For the test of consensus, each member rates their concurrence with the plan using a five-point scale, as shown below:

1. Full Endorsement (i.e., member likes it).
2. Endorsement but with minor points of contention (i.e., basically member likes it).
3. Endorsement but with major points of contention (i.e., member can live with it).
4. Stand aside with major reservations (i.e., member cannot live with it in its current state and can only support it if changes are made).
5. Withdraw - Member will not support the draft river basin plan. The Planning Framework indicates that if a member votes 5 they will not continue working within the RBC's process and will leave the RBC. In practice, if a member votes 5 but wishes to remain engaged in future work of the RBC, the RBC has the discretion to vote on whether the member may remain on the RBC.

For the Final River Basin Plan, each RBC member votes simply to support or not support the plan. By indicating support, the member would be acknowledging his/her concurrence with the Final River Basin Plan and their commitment to support implementation of the plan. The results of the test for consensus on the Draft River Basin Plan and the RBC's votes on the Final River Basin Plan are shown in Table 10-5. The full results are included in Appendix B.

Table 10-5. Test of consensus results.

Test of Consensus Result	Number of RBC Members*
Draft River Basin Plan	
1. Full Endorsement (i.e., Member likes it).	**7**
2. Endorsement but with Minor Points of Contention (i.e., basically Member likes it).	**2**
3. Endorsement but with Major Points of Contention (i.e., Member can live with it).	**1**
4. Stand aside with Major Reservations (i.e., Member cannot live with it in its current state and can only support it if changes are made).	
5. Withdraw – Member will not support the Draft River Basin Plan and will not continue working within the RBC's process. Member has decided to leave the RBC.	
Final River Basin Plan	
Support	
Does Not Support	

** Three original RBC members were not active on the RBC when the Draft River Basin Plan was developed and did not vote. One RBC member was active but did not vote.*

Chapter 11
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Appendix A
Current Use and Demand Projections for Individual Water Users

Table A-1. Current Water Demands, Consumptive Use, and Returns.

User	Use Category	Source	Withdrawal (MGD)	Consumptive Use (%)	Consumptive Use (MGD)	Return (MGD)
Archie Stukes	Agriculture	Groundwater	0.04	100%	0.04	0.00
Bickley Farms	Agriculture	Groundwater	0.04	100%	0.04	0.00
Bookhart Farms 3 LLC	Agriculture	Groundwater	0.19	100%	0.19	0.00
Bookhart Farms 3 LLC - Community Club	Agriculture	Groundwater	0.17	100%	0.17	0.00
Brakefield	Agriculture	Groundwater	0.21	100%	0.21	0.00
Calhoun Trading Co. - Sunny	Agriculture	Groundwater	0.07	100%	0.07	0.00
Carolina Park Riverside Association, LLC	Agriculture	Groundwater	0.02	100%	0.02	0.00
Carson Farms	Agriculture	Groundwater	0.27	100%	0.27	0.00
Carter Farms	Agriculture	Groundwater	0.03	100%	0.03	0.00
Carter Farms - Cedar Creek Farm	Agriculture	Groundwater	0.04	100%	0.04	0.00
City Roots	Agriculture	Groundwater	0.00	100%	0.00	0.00
Clayton Rawl	Agriculture	Surface Water	0.06	100%	0.06	0.00
Clayton Rawl Farms Inc.	Agriculture	Groundwater	0.07	100%	0.07	0.00
Cogdill Family Farms	Agriculture	Groundwater	0.15	100%	0.15	0.00
Cottle Strawberry Farm	Agriculture	Groundwater	0.01	100%	0.01	0.00
Cypress Creek Farm	Agriculture	Groundwater	0.02	100%	0.02	0.00
Daniel W. Jordan Farms	Agriculture	Groundwater	0.05	100%	0.05	0.00
Dargan Culclasure	Agriculture	Surface Water	0.13	100%	0.13	0.00
Dargan Culclasure Farm	Agriculture	Groundwater	0.07	100%	0.07	0.00
Edward M. Rast Jr. Farms - Belleville	Agriculture	Groundwater	0.13	100%	0.13	0.00
Edward M. Rast Jr. Farms - Longview	Agriculture	Groundwater	0.04	100%	0.04	0.00
Everett Farms	Agriculture	Groundwater	0.36	100%	0.36	0.00

User	Use Category	Source	Withdrawal (MGD)	Consumptive Use (%)	Consumptive Use (MGD)	Return (MGD)
Finlay/Tucker LLC Beckham Swamp	Agriculture	Groundwater	0.06	100%	0.06	0.00
Flowers Farm, LLC	Agriculture	Groundwater	0.84	100%	0.84	0.00
Four J Family Farms	Agriculture	Groundwater	0.12	100%	0.12	0.00
FPI Properties, LLC - Harvin Farm	Agriculture	Groundwater	0.06	100%	0.06	0.00
H. Heath Hill & Son Farm	Agriculture	Groundwater	0.09	100%	0.09	0.00
Haigler Farms	Agriculture	Groundwater	0.78	100%	0.78	0.00
Haigler Farms Partnership	Agriculture	Groundwater	0.60	100%	0.60	0.00
Holman Farms	Agriculture	Groundwater	0.17	100%	0.17	0.00
Inabinet Farms	Agriculture	Groundwater	0.42	100%	0.42	0.00
J & G Farms	Agriculture	Groundwater	0.19	100%	0.19	0.00
Jeff D. Wiggins Farm	Agriculture	Groundwater	0.31	100%	0.31	0.00
Jeff Reeves Farm	Agriculture	Groundwater	0.13	100%	0.13	0.00
John Horton Farms	Agriculture	Groundwater	0.07	100%	0.07	0.00
John Olson Farm	Agriculture	Groundwater	0.14	100%	0.14	0.00
K & R Farms LLC	Agriculture	Groundwater	2.94	100%	2.94	0.00
KDW Farms, LLC	Agriculture	Groundwater	0.10	100%	0.10	0.00
Kendall Wannamaker Farm	Agriculture	Groundwater	0.73	100%	0.73	0.00
LB Wannamaker Seed	Agriculture	Groundwater	0.04	100%	0.04	0.00
Longstreet Farms Inc	Agriculture	Groundwater	0.03	100%	0.03	0.00
Low Falls Wholesale Nursery	Agriculture	Groundwater	0.04	100%	0.04	0.00
Low Falls Wholesale Nursey	Agriculture	Groundwater	0.23	100%	0.23	0.00
Lyons Bros	Agriculture	Surface Water	0.03	100%	0.03	0.00
Lyons Bros. Farm	Agriculture	Groundwater	0.04	100%	0.04	0.00
LYONS BROTHERS FARM	Agriculture	Groundwater	0.35	100%	0.35	0.00

User	Use Category	Source	Withdrawal (MGD)	Consumptive Use (%)	Consumptive Use (MGD)	Return (MGD)
Michael Shirer Farms	Agriculture	Groundwater	0.11	100%	0.11	0.00
Moore Farms	Agriculture	Groundwater	0.05	100%	0.05	0.00
Oak III Farms	Agriculture	Groundwater	0.20	100%	0.20	0.00
Oak III Farms/Cantey Bay	Agriculture	Groundwater	0.28	100%	0.28	0.00
Palmetto	Agriculture	Surface Water	0.13	100%	0.13	0.00
Palmetto Farm	Agriculture	Groundwater	1.60	100%	1.60	0.00
Prospect Hill of Edisto Island, LLC	Agriculture	Groundwater	0.09	100%	0.09	0.00
Ray Hill Farms	Agriculture	Groundwater	0.14	100%	0.14	0.00
Ricard	Agriculture	Surface Water	0.07	100%	0.07	0.00
Sikes Farm	Agriculture	Groundwater	0.43	100%	0.43	0.00
Spring Oak Plantation, LLC	Agriculture	Groundwater	0.04	100%	0.04	0.00
ST JULIAN PLANTATION	Agriculture	Groundwater	0.02	100%	0.02	0.00
St. Julian	Agriculture	Surface Water	0.02	100%	0.02	0.00
Strock Farms Partnership	Agriculture	Groundwater	0.20	100%	0.20	0.00
The Beach Company	Agriculture	Groundwater	0.21	100%	0.21	0.00
Tindal Farms, LLC	Agriculture	Groundwater	0.08	100%	0.08	0.00
Titan Farms	Agriculture	Groundwater	0.04	100%	0.04	0.00
Travis Avent Farm	Agriculture	Groundwater	0.19	100%	0.19	0.00
Tryon Farm, LLC (Buy Sod)	Agriculture	Groundwater	0.07	100%	0.07	0.00
Two Tell LLC	Agriculture	Groundwater	0.04	100%	0.04	0.00
W. H. Bull Farms	Agriculture	Groundwater	0.01	100%	0.01	0.00
Walker Farm	Agriculture	Surface Water	0.00	100%	0.00	0.00
Wiles	Agriculture	Surface Water	0.05	100%	0.05	0.00
ZZ Real Estate	Agriculture	Surface Water	0.00	100%	0.00	0.00
Southland Fisheries	Aquaculture	Surface Water	0.08	100%	0.08	0.00

User	Use Category	Source	Withdrawal (MGD)	Consumptive Use (%)	Consumptive Use (MGD)	Return (MGD)
SOUTHLAND FISHERIES CORPORATION	Aquaculture	Groundwater	0.04	100%	0.04	0.00
Berkeley Country Club	Golf Course	Groundwater	0.01	100%	0.01	0.00
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Golf Course	Groundwater	0.02	100%	0.02	0.00
Calhoun Hills Golf Complex	Golf Course	Groundwater	0.02	100%	0.02	0.00
Charwood Golf Club	Golf Course	Groundwater	0.06	100%	0.06	0.00
City of Goose Creek/ Crowfield Golf and Country Club	Golf Course	Groundwater	0.03	100%	0.03	0.00
City of North Charleston/ The Golf Club at Wescott Plantation	Golf Course	Groundwater	0.04	100%	0.04	0.00
Forest Lake	Golf Course	Surface Water	0.13	100%	0.13	0.00
Joint Base Charleston/ Red Bank Plantation GC	Golf Course	Groundwater	0.01	100%	0.01	0.00
Kiawah Island Inn Company, LLC/The Ocean Course	Golf Course	Groundwater	0.30	100%	0.30	0.00
Kiawah Island Utility Inc. - GC	Golf Course	Groundwater	0.20	100%	0.20	0.00
Kiawah Resort Associates, LP/Cassique GC	Golf Course	Groundwater	0.40	100%	0.40	0.00
Kiawah Resort/Osprey Point GC	Golf Course	Groundwater	0.20	100%	0.20	0.00
Legend Oaks Golf Operations, LLC	Golf Course	Groundwater	0.05	100%	0.05	0.00
LRA Charleston PP Golf, LLC	Golf Course	Groundwater	0.03	100%	0.03	0.00
Santee National at Chapel Creek Plantation	Golf Course	Groundwater	0.00	100%	0.00	0.00
Santee-Cooper Resort	Golf Course	Surface Water	0.05	100%	0.05	0.00

User	Use Category	Source	Withdrawal (MGD)	Consumptive Use (%)	Consumptive Use (MGD)	Return (MGD)
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Golf Course	Groundwater	0.05	100%	0.05	0.00
SPRING VALLEY COUNTRY CLUB	Golf Course	Groundwater	0.06	100%	0.06	0.00
The Links at Stono Ferry	Golf Course	Groundwater	0.09	100%	0.09	0.00
The Members	Golf Course	Surface Water	0.12	100%	0.12	0.00
WYBOO GOLF COURSE	Golf Course	Groundwater	0.02	100%	0.02	0.00
Albany International Corporation, Press Fabrics	Manufacturing	Groundwater	0.08	100%	0.08	0.00
AMC/Lanier Sand Operation	Manufacturing	Groundwater	0.03	100%	0.03	0.00
Aplek (DAK Congaree)	Manufacturing	Surface Water	54.22	0%	0.00	54.22
Celanese (DAK)	Manufacturing	Surface Water	1.07	22%	0.24	0.84
Chargeurs	Manufacturing	Surface Water	0.07	2%	0.00	0.07
China Jushi USA Corporation	Manufacturing	Groundwater	0.06	100%	0.06	0.00
CMC Steel	Manufacturing	Surface Water	0.23	100%	0.23	0.00
CR Bard	Manufacturing	Groundwater	0.20	3%	0.01	0.19
Devro, Inc.	Manufacturing	Groundwater	0.04	100%	0.04	0.00
INEOS (BP Amoco)	Manufacturing	Surface Water	5.25	17%	0.90	4.35
Ingevity (Kapstone)	Manufacturing	Surface Water	3.35	0%	0.00	3.35
Ingevity South Carolina, LLC/Charleston Chemical Plant	Manufacturing	Groundwater	0.14	100%	0.14	0.00
Maguro Enterprises, LLC	Manufacturing	Groundwater	0.09	100%	0.09	0.00
Michelin North America	Manufacturing	Groundwater	0.08	100%	0.08	0.00
Nephron Nitrile, LLC	Manufacturing	Groundwater	0.00	100%	0.00	0.00
Nucor	Manufacturing	Groundwater	2.87	33%	0.94	1.94

User	Use Category	Source	Withdrawal (MGD)	Consumptive Use (%)	Consumptive Use (MGD)	Return (MGD)
Shakespeare	Manufacturing	Groundwater	0.03	100%	0.03	0.00
Sun Chemical	Manufacturing	Surface Water	2.75	22%	0.60	2.15
United States Air Force, NNPTC - B.2409 Utility Plant	Manufacturing	Groundwater	0.02	100%	0.02	0.00
US Silica - Manufacturing	Manufacturing	Groundwater	1.22	100%	1.22	0.00
AMC/Dixiana	Mining	Groundwater	0.12	100%	0.12	0.00
Calhoun Sand Mine	Mining	Groundwater	0.25	100%	0.25	0.00
Edmund Sand Mine	Mining	Groundwater	1.01	100%	1.01	0.00
Martin Marietta	Mining	Surface Water	0.60	100%	0.60	0.00
Martin Marietta Quarry	Mining	Surface Water	0.00	50%	0.00	0.00
MCENTIRE AIR NATIONAL GUARD STATION	Other	Groundwater	0.01	100%	0.01	0.00
American Materials Co.- Dixiana Mine	Public Supply	Groundwater	0.00	100%	0.00	0.00
Calhoun County Municipal Water and Sewer - Belleville	Public Supply	Groundwater	0.19	100%	0.19	0.00
Calhoun County Municipal Water and Sewer - Sandy Run	Public Supply	Groundwater	0.66	100%	0.66	0.00
Cayce	Public Supply	Surface Water	3.26	3%	0.11	3.15
Charleston Water System	Public Supply	Surface Water	49.20	24%	12.05	37.14
Clarendon County Water & Sewer Department	Public Supply	Groundwater	0.06	100%	0.06	0.00
DCPW/EDISTO TRIBAL COUNCIL	Public Supply	Groundwater	0.07	100%	0.07	0.00
DCWA/KNIGHTSVILLE	Public Supply	Groundwater	0.61	100%	0.61	0.00
EASTOVER TOWN OF	Public Supply	Groundwater	0.07	100%	0.07	0.00
Elloree Water System	Public Supply	Groundwater	0.19	100%	0.19	0.00

User	Use Category	Source	Withdrawal (MGD)	Consumptive Use (%)	Consumptive Use (MGD)	Return (MGD)
Eutawville Town of	Public Supply	Groundwater	0.04	100%	0.04	0.00
GASTON RURAL COMMUNITY WATER DISTRICT	Public Supply	Groundwater	0.61	100%	0.61	0.00
GEORGETOWN COUNTY W&S DISTRICT	Public Supply	Groundwater	0.29	100%	0.29	0.00
Isle of Palms Water & Sewer Commission	Public Supply	Groundwater	0.33	100%	0.33	0.00
Kiawah Island Utility Inc. - WS	Public Supply	Groundwater	0.01	100%	0.01	0.00
Lake Marion Shores/ E&RPA	Public Supply	Groundwater	0.01	100%	0.01	0.00
Moncks Corner Water Works	Public Supply	Groundwater	0.03	100%	0.03	0.00
Mt Pleasant Waterworks	Public Supply	Groundwater	4.04	100%	4.04	0.00
North Shore	Public Supply	Groundwater	0.03	100%	0.03	0.00
PINEWOOD TOWN OF	Public Supply	Groundwater	0.06	100%	0.06	0.00
Santee Cooper - Lake Marion RWS	Public Supply	Surface Water	1.05	75%	0.79	0.26
Santee Cooper RWS	Public Supply	Surface Water	21.62	52%	11.27	10.35
SC Depart of Corrections Division of Facilities Management	Public Supply	Groundwater	0.20	100%	0.20	0.00
Seabrook Island Utility Commission	Public Supply	Groundwater	0.25	100%	0.25	0.00
Sigfield Water Co	Public Supply	Groundwater	0.04	100%	0.04	0.00
St. Matthews Town of	Public Supply	Groundwater	0.24	100%	0.24	0.00
SUMMERTON TOWN OF	Public Supply	Groundwater	0.21	100%	0.21	0.00
Summerville CPW	Public Supply	Groundwater	0.03	100%	0.03	0.00
Town of Sullivan Island Water & Sewer Department	Public Supply	Groundwater	0.00	100%	0.00	0.00

User	Use Category	Source	Withdrawal (MGD)	Consumptive Use (%)	Consumptive Use (MGD)	Return (MGD)
US Silica - Public Supply	Public Supply	Groundwater	0.02	100%	0.02	0.00
Cross Station	Thermoelectric	Surface Water	25.89	87%	22.42	3.47
Santee Cooper (formerly Jeffries)	Thermoelectric	Surface Water	0.00	100%	0.00	0.00
Williams Station	Thermoelectric	Surface Water	342.93	21%	72.02	270.91
Winyah Station	Thermoelectric	Surface Water	4.59	85%	3.90	0.69
Williamsburg Co		Discharge	0.45			
Pinewood Site		Discharge	1.04			
St. Stephen Power		Discharge	0.29			
SC Genco		Discharge	1.40			
Agg Discharge 1		Discharge	3.31			
Agg Discharge 2		Discharge	0.38			

*Groundwater consumptive use was not calculated and is listed as 100%

Table A-2. Permit and Registration Amounts for Current Water Users.

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
ZZ Real Estate	Agriculture	Surface Water	Registration	6.0	181.9	2183.2
Wiles	Agriculture	Surface Water	Registration	1.1	32.0	384.0
Dargan Culclasure	Agriculture	Surface Water	Registration	0.9	28.2	338.8
Palmetto	Agriculture	Surface Water	Registration	1.1	32.0	384.0
Lyons Bros	Agriculture	Surface Water	Registration	0.3	9.0	108.0
Clayton Rawl	Agriculture	Surface Water	Registration	1.3	40.0	480.0
Ricard	Agriculture	Surface Water	Registration	0.2	6.1	73.2
St. Julian	Agriculture	Surface Water	Registration	0.9	27.4	328.4
Walker Farm	Agriculture	Surface Water	Registration	0.1	3.0	36.0
Titan Farms	Agriculture	Groundwater	Permit	0.1	2.6	31.0
Dargan Culclasure Farm	Agriculture	Groundwater	Permit	0.1	2.5	30.5
Haigler Farms	Agriculture	Groundwater	Permit	1.3	38.4	460.3
Longstreet Farms Inc	Agriculture	Groundwater	Permit	0.2	4.6	55.4
Low Falls Wholesale Nursey	Agriculture	Groundwater	Permit	0.7	21.1	253.0
Low Falls Wholesale Nursery	Agriculture	Groundwater	Permit	0.1	1.9	23.0
Michael Shirer Farms	Agriculture	Groundwater	Permit	0.2	5.2	62.7
Palmetto Farm	Agriculture	Groundwater	Permit	2.2	66.7	800.0
Jeff Reeves Farm	Agriculture	Groundwater	Permit	0.1	4.1	49.0
John Olson Farm	Agriculture	Groundwater	Permit	0.3	7.9	94.7
J & G Farms	Agriculture	Groundwater	Permit	0.2	7.3	87.2
K & R Farms LLC	Agriculture	Groundwater	Permit	1.7	52.3	628.0
Moore Farms	Agriculture	Groundwater	Permit	0.1	3.6	43.2

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
LB Wannamaker Seed	Agriculture	Groundwater	Permit	0.1	3.2	38.4
Holman Farms	Agriculture	Groundwater	Permit	0.2	4.9	58.3
Edward M. Rast Jr. Farms - Longview	Agriculture	Groundwater	Permit	0.1	4.0	48.5
Edward M. Rast Jr. Farms - Belleville	Agriculture	Groundwater	Permit	0.4	11.3	136.0
LYONS BROTHERS FARM	Agriculture	Groundwater	Permit	1.2	35.8	429.0
Kendall Wannamaker Farm	Agriculture	Groundwater	Permit	1.6	48.9	586.5
Sikes Farm	Agriculture	Groundwater	Permit	0.5	14.4	173.0
Inabinet Farms	Agriculture	Groundwater	Permit	0.5	16.3	195.8
Carson Farms	Agriculture	Groundwater	Permit	1.2	37.9	455.0
Travis Avent Farm	Agriculture	Groundwater	Permit	0.6	18.8	225.8
Calhoun Trading Co. - Sunny	Agriculture	Groundwater	Permit	0.2	5.2	62.4
Bookhart Farms 3 LLC - Community Club	Agriculture	Groundwater	Permit	0.1	3.5	42.0
Carolina Park Riverside Association, LLC	Agriculture	Groundwater	Permit	0.03	1.1	12.7
Everett Farms	Agriculture	Groundwater	Permit	0.6	18.9	227.0
Tindal Farms, LLC	Agriculture	Groundwater	Permit	0.1	2.5	29.7
Oak III Farms/Cantey Bay	Agriculture	Groundwater	Permit	1.0	30.7	368.0
Four J Family Farms	Agriculture	Groundwater	Permit	0.5	14.3	172.0
Archie Stukes	Agriculture	Groundwater	Permit	0.1	2.8	33.6

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
Daniel W. Jordan Farms	Agriculture	Groundwater	Permit	0.1	1.7	20.0
Flowers Farm, LLC	Agriculture	Groundwater	Permit	1.9	57.6	691.0
Cogdill Family Farms	Agriculture	Groundwater	Permit	0.4	12.1	145.4
Cypress Creek Farm	Agriculture	Groundwater	Permit	0.2	5.6	67.0
Oak III Farms	Agriculture	Groundwater	Permit	1.0	31.1	373.0
John Horton Farms	Agriculture	Groundwater	Permit	0.2	6.3	76.0
Clayton Rawl Farms Inc.	Agriculture	Groundwater	Permit	0.1	3.3	40.0
Haigler Farms Partnership	Agriculture	Groundwater	Permit	0.8	25.8	309.5
Bickley Farms	Agriculture	Groundwater	Permit	0.2	6.7	80.0
ST JULIAN PLANTATION	Agriculture	Groundwater	Permit	0.1	1.6	19.0
Strock Farms Partnership	Agriculture	Groundwater	Permit	0.4	11.4	137.0
Lyons Bros. Farm	Agriculture	Groundwater	Permit	0.1	4.0	48.4
W. H. Bull Farms	Agriculture	Groundwater	Permit	0.1	2.9	34.5
Jeff D. Wiggins Farm	Agriculture	Groundwater	Permit	0.3	10.5	126.0
Bookhart Farms 3 LLC	Agriculture	Groundwater	Permit	0.2	6.2	73.8
Carter Farms	Agriculture	Groundwater	Permit	0.1	2.1	25.0
Prospect Hill of Edisto Island, LLC	Agriculture	Groundwater	Permit	0.4	12.6	151.1
Finlay/Tucker LLC Beckham Swamp	Agriculture	Groundwater	Permit	0.2	5.4	64.6
H. Heath Hill & Son Farm	Agriculture	Groundwater	Permit	0.2	6.4	77.0

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
FPI Properties, LLC - Harvin Farm	Agriculture	Groundwater	Permit	0.6	17.4	209.1
Ray Hill Farms	Agriculture	Groundwater	Permit	0.4	12.3	147.7
Carter Farms - Cedar Creek Farm	Agriculture	Groundwater	Permit	0.1	1.7	20.0
Tryon Farm, LLC (Buy Sod)	Agriculture	Groundwater	Permit	0.1	3.6	43.0
KDW Farms, LLC	Agriculture	Groundwater	Permit	0.1	3.6	43.4
Two Tell LLC	Agriculture	Groundwater	Permit	0.1	3.8	45.6
Spring Oak Plantation, LLC	Agriculture	Groundwater	Permit	0.1	1.6	19.0
Richard's Farms	Agriculture	Groundwater	Permit	0.2	5.0	60.0
Trackside Properties	Agriculture	Groundwater	Permit	0.2	4.8	58.0
City Roots	Agriculture	Groundwater	Registration	0.0	0.0	0.0
Cottle Strawberry Farm	Agriculture	Groundwater	Registration	0.01	0.3	3.0
Brakefield	Agriculture	Groundwater	Permit	0.0	0.0	0.0
The Beach Company	Agriculture	Groundwater	Permit	0.0	0.0	0.0
Southland Fisheries	Aquaculture	Surface Water	Registration	0.8	23.0	276.0
SOUTHLAND FISHERIES CORPORATION	Aquaculture	Groundwater	Registration	0.04	1.1	13.3
Santee-Cooper Resort	Golf Course	Surface Water	Permit	0.9	26.8	321.4
Forest Lake	Golf Course	Surface Water	Permit	0.4	11.3	135.6
The Members	Golf Course	Surface Water	Permit	0.7	19.8	237.8
Berkeley Country Club	Golf Course	Groundwater	Permit	0.04	1.4	16.2

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
Joint Base Charleston/ Red Bank Plantation GC	Golf Course	Groundwater	Permit	0.1	4.0	48.0
City of Goose Creek/ Crowfield Golf and Country Club	Golf Course	Groundwater	Permit	0.1	2.1	25.0
Calhoun Hills Golf Complex	Golf Course	Groundwater	Permit	0.03	1.0	12.0
Kiawah Island Utility Inc. - GC	Golf Course	Groundwater	Permit	0.3	8.8	106.0
LRA Charleston PP Golf, LLC	Golf Course	Groundwater	Permit	0.1	1.9	23.0
Kiawah Resort/Osprey Point GC	Golf Course	Groundwater	Permit	0.3	8.3	100.0
Kiawah Island Inn Company, LLC/The Ocean Course	Golf Course	Groundwater	Permit	0.3	9.4	113.0
Kiawah Resort Associates, LP/Cassique GC	Golf Course	Groundwater	Permit	0.6	19.0	227.4
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Golf Course	Groundwater	Permit	0.4	11.7	140.0
The Links at Stono Ferry	Golf Course	Groundwater	Permit	0.1	4.2	50.0
WYBOO GOLF COURSE	Golf Course	Groundwater	Permit	0.1	3.8	45.6
Legend Oaks Golf Operations, LLC	Golf Course	Groundwater	Permit	0.1	1.7	20.0

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
City of North Charleston/ The Golf Club at Wescott Plantation	Golf Course	Groundwater	Permit	0.1	4.2	50.0
Charwood Golf Club	Golf Course	Groundwater	Permit	0.1	2.4	28.5
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Golf Course	Groundwater	Permit	0.1	3.0	36.0
Santee National at Chapel Creek Plantation	Golf Course	Groundwater	Permit	0.1	2.5	30.4
SPRING VALLEY COUNTRY CLUB	Golf Course	Groundwater	Permit	0.3	9.8	118.0
Hidden Valley Golf Club	Golf Course	Groundwater	Permit	0.3	8.0	96.0
Old Sawmill Golf Club	Golf Course	Groundwater	Permit	2.1	63.5	762.0
Chargeurs	Manufacturing	Surface Water	Permit	0.5	15.6	187.2
Celanese (DAK)	Manufacturing	Surface Water	Permit	4.4	134.0	1608.0
INEOS (BP Amoco)	Manufacturing	Surface Water	Permit	76.5	2325.0	27900.0
Sun Chemical	Manufacturing	Surface Water	Permit	13.2	401.8	4821.1
Aplek (DAK Congaree)	Manufacturing	Surface Water	Permit	180.6	5491.0	65892.0
Ingevity (Kapstone)	Manufacturing	Surface Water	Permit	32.9	1000.0	12000.0
CMC Steel	Manufacturing	Surface Water	Permit	1.6	48.3	579.6
Albany International Corporation, Press Fabrics	Manufacturing	Groundwater	Permit	0.1	4.0	48.0
CR Bard	Manufacturing	Groundwater	Permit	0.3	8.6	103.0

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
Nucor	Manufacturing	Groundwater	Permit	3.6	108.3	1300.0
Maguro Enterprises, LLC	Manufacturing	Groundwater	Permit	1.5	45.8	549.0
United States Air Force, NNPTC - B.2409 Utility Plant	Manufacturing	Groundwater	Permit	0.1	2.5	30.0
Devro, Inc.	Manufacturing	Groundwater	Permit	0.01	0.4	4.5
Ingevity South Carolina, LLC/Charleston Chemical Plant	Manufacturing	Groundwater	Permit	0.2	5.9	71.0
Michelin North America	Manufacturing	Groundwater	Permit	0.1	2.8	33.3
US Silica	Manufacturing	Groundwater	Permit	4.5	138.3	1660.0
Nephron Nitrile, LLC	Manufacturing	Groundwater	Permit	0.4	12.6	151.8
AMC/Lanier Sand Operation	Manufacturing	Groundwater	Permit	0.9	28.2	337.9
China Jushi USA Corporation	Manufacturing	Groundwater	Permit	0.1	3.1	37.2
Shakespeare	Manufacturing	Groundwater	Registration	0.03	0.8	10.0
Martin Marietta	Mining	Surface Water	Permit	2.2	67.0	803.5
Martin Marietta Quarry	Mining	Surface Water	Permit	2.2	67.0	803.5
Calhoun Sand Mine	Mining	Groundwater	Permit	0.8	25.5	306.2
Edmund Sand Mine	Mining	Groundwater	Permit	1.9	56.7	680.3
AMC/Dixiana	Mining	Groundwater	Permit	0.2	6.3	75.0
Columbia Sand Mine	Mining	Groundwater	Permit	0.2	7.6	90.8

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
MCENTIRE AIR NATIONAL GUARD STATION	Other	Groundwater	Permit	0.1	4.2	50.0
Santee Cooper RWS	Public Supply	Surface Water	Permit	153.0	4650.0	55800.0
Charleston Water System	Public Supply	Surface Water	Permit	160.1	4866.7	58399.9
Cayce	Public Supply	Surface Water	Permit	23.8	722.3	8667.6
Santee Cooper - Lake Marion RWS	Public Supply	Surface Water	Permit	25.5	775.0	9300.0
St. Matthews Town of	Public Supply	Groundwater	Permit	0.3	10.4	125.0
Calhoun County Municipal Water and Sewer - Belleville	Public Supply	Groundwater	Permit	0.3	8.7	104.0
Calhoun County Municipal Water and Sewer - Sandy Run	Public Supply	Groundwater	Permit	0.8	25.8	309.0
Kiawah Island Utility Inc. - WS	Public Supply	Groundwater	Registration	0.01	0.2	2.0
Seabrook Island Utility Commission	Public Supply	Groundwater	Permit	0.5	14.2	170.0
Mt Pleasant Waterworks	Public Supply	Groundwater	Permit	6.6	200.8	2409.0
Town of Sullivan Island Water & Sewer Department	Public Supply	Groundwater	Permit	0.3	9.0	108.0
Isle of Palms Water & Sewer Commission	Public Supply	Groundwater	Permit	0.5	16.7	200.0

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
SUMMERTON TOWN OF	Public Supply	Groundwater	Permit	0.4	11.0	132.0
Clarendon County Water & Sewer Department	Public Supply	Groundwater	Permit	0.2	7.2	86.4
Summerville CPW	Public Supply	Groundwater	Permit	3.3	100.8	1210.0
DCWA/KNIGHTSVILLE	Public Supply	Groundwater	Permit	0.9	26.7	320.0
DCPW/EDISTO TRIBAL COUNCIL	Public Supply	Groundwater	Permit	0.1	4.0	48.0
SC Depart of Corrections Division of Facilities Management	Public Supply	Groundwater	Permit	0.3	8.1	97.0
GEORGETOWN COUNTY W&S DISTRICT	Public Supply	Groundwater	Permit	0.2	5.3	63.3
GASTON RURAL COMMUNITY WATER DISTRICT	Public Supply	Groundwater	Permit	0.9	25.9	310.5
Gilbert Summit	Public Supply	Groundwater	Permit	0.1	3.4	41.4
Elloree Water System	Public Supply	Groundwater	Permit	0.3	8.3	100.0
Eutawville Town of	Public Supply	Groundwater	Permit	0.03	0.8	10.0
EASTOVER TOWN OF	Public Supply	Groundwater	Permit	0.4	11.1	133.0
PINEWOOD TOWN OF	Public Supply	Groundwater	Permit	0.1	2.3	28.0
Sigfield Water Co	Public Supply	Groundwater	Permit	0.1	4.3	51.0
Moncks Corner Water Works	Public Supply	Groundwater	Registration	0.03	0.9	10.9

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
American Materials Co.- Dixiana Mine	Public Supply	Groundwater	Registration	0.004	0.1	1.4
North Shore	Public Supply	Groundwater	Registration	0.03	0.9	10.7
Lake Marion Shores/ E&RPA	Public Supply	Groundwater	Permit	0.0	0.0	0.0
Williams Station	Thermoelectric	Surface Water	Permit	596.2	18124.0	217488.0
Santee Cooper (formerly Jeffries)	Thermoelectric	Surface Water	Permit	177.6	5400.0	64800.0
Cross Station	Thermoelectric	Surface Water	Permit	94.5	2872.6	34471.0
Winyah Station	Thermoelectric	Surface Water	Permit	128.5	3906.0	46872.0

Table A-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Southland Fisheries	Surface Water	AQ	Moderate	2025	0.07
Southland Fisheries	Surface Water	AQ	Moderate	2030	0.07
Southland Fisheries	Surface Water	AQ	Moderate	2035	0.07
Southland Fisheries	Surface Water	AQ	Moderate	2040	0.07
Southland Fisheries	Surface Water	AQ	Moderate	2050	0.07
Southland Fisheries	Surface Water	AQ	Moderate	2060	0.07
Southland Fisheries	Surface Water	AQ	Moderate	2070	0.07
SOUTHLAND FISHERIES CORPORATION	Groundwater	AQ	Moderate	2025	0.04
SOUTHLAND FISHERIES CORPORATION	Groundwater	AQ	Moderate	2030	0.04
SOUTHLAND FISHERIES CORPORATION	Groundwater	AQ	Moderate	2035	0.04
SOUTHLAND FISHERIES CORPORATION	Groundwater	AQ	Moderate	2040	0.04
SOUTHLAND FISHERIES CORPORATION	Groundwater	AQ	Moderate	2050	0.04
SOUTHLAND FISHERIES CORPORATION	Groundwater	AQ	Moderate	2060	0.04
SOUTHLAND FISHERIES CORPORATION	Groundwater	AQ	Moderate	2070	0.04
Forest Lake	Surface Water	GC	Moderate	2025	0.13
Forest Lake	Surface Water	GC	Moderate	2030	0.13
Forest Lake	Surface Water	GC	Moderate	2035	0.13
Forest Lake	Surface Water	GC	Moderate	2040	0.13
Forest Lake	Surface Water	GC	Moderate	2050	0.13
Forest Lake	Surface Water	GC	Moderate	2060	0.13
Forest Lake	Surface Water	GC	Moderate	2070	0.13
Santee-Cooper Resort	Surface Water	GC	Moderate	2025	0.03
Santee-Cooper Resort	Surface Water	GC	Moderate	2030	0.03
Santee-Cooper Resort	Surface Water	GC	Moderate	2035	0.03
Santee-Cooper Resort	Surface Water	GC	Moderate	2040	0.03
Santee-Cooper Resort	Surface Water	GC	Moderate	2050	0.03
Santee-Cooper Resort	Surface Water	GC	Moderate	2060	0.03
Santee-Cooper Resort	Surface Water	GC	Moderate	2070	0.03
The Members	Surface Water	GC	Moderate	2025	0.12
The Members	Surface Water	GC	Moderate	2030	0.12

User	Water Source	Use Category	Projection	Year	Demand (MGD)
The Members	Surface Water	GC	Moderate	2035	0.12
The Members	Surface Water	GC	Moderate	2040	0.12
The Members	Surface Water	GC	Moderate	2050	0.12
The Members	Surface Water	GC	Moderate	2060	0.12
The Members	Surface Water	GC	Moderate	2070	0.12
Berkeley Country Club	Groundwater	GC	Moderate	2025	0.01
Berkeley Country Club	Groundwater	GC	Moderate	2030	0.01
Berkeley Country Club	Groundwater	GC	Moderate	2035	0.01
Berkeley Country Club	Groundwater	GC	Moderate	2040	0.01
Berkeley Country Club	Groundwater	GC	Moderate	2050	0.01
Berkeley Country Club	Groundwater	GC	Moderate	2060	0.01
Berkeley Country Club	Groundwater	GC	Moderate	2070	0.01
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Groundwater	GC	Moderate	2025	0.26
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Groundwater	GC	Moderate	2030	0.26
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Groundwater	GC	Moderate	2035	0.26
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Groundwater	GC	Moderate	2040	0.26
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Groundwater	GC	Moderate	2050	0.26
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Groundwater	GC	Moderate	2060	0.26
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Groundwater	GC	Moderate	2070	0.26
Calhoun Hills Golf Complex	Groundwater	GC	Moderate	2025	0.01
Calhoun Hills Golf Complex	Groundwater	GC	Moderate	2030	0.01
Calhoun Hills Golf Complex	Groundwater	GC	Moderate	2035	0.01
Calhoun Hills Golf Complex	Groundwater	GC	Moderate	2040	0.01

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Calhoun Hills Golf Complex	Groundwater	GC	Moderate	2050	0.01
Calhoun Hills Golf Complex	Groundwater	GC	Moderate	2060	0.01
Calhoun Hills Golf Complex	Groundwater	GC	Moderate	2070	0.01
Charwood Golf Club	Groundwater	GC	Moderate	2025	0.06
Charwood Golf Club	Groundwater	GC	Moderate	2030	0.06
Charwood Golf Club	Groundwater	GC	Moderate	2035	0.06
Charwood Golf Club	Groundwater	GC	Moderate	2040	0.06
Charwood Golf Club	Groundwater	GC	Moderate	2050	0.06
Charwood Golf Club	Groundwater	GC	Moderate	2060	0.06
Charwood Golf Club	Groundwater	GC	Moderate	2070	0.06
City of Goose Creek/ Crowfield Golf and Country Club	Groundwater	GC	Moderate	2025	0.03
City of Goose Creek/ Crowfield Golf and Country Club	Groundwater	GC	Moderate	2030	0.03
City of Goose Creek/ Crowfield Golf and Country Club	Groundwater	GC	Moderate	2035	0.03
City of Goose Creek/ Crowfield Golf and Country Club	Groundwater	GC	Moderate	2040	0.03
City of Goose Creek/ Crowfield Golf and Country Club	Groundwater	GC	Moderate	2050	0.03
City of Goose Creek/ Crowfield Golf and Country Club	Groundwater	GC	Moderate	2060	0.03
City of Goose Creek/ Crowfield Golf and Country Club	Groundwater	GC	Moderate	2070	0.03
City of North Charleston/ The Golf Club at Wescott Plantation	Groundwater	GC	Moderate	2025	0.00
City of North Charleston/ The Golf Club at Wescott Plantation	Groundwater	GC	Moderate	2030	0.00
City of North Charleston/ The Golf Club at Wescott Plantation	Groundwater	GC	Moderate	2035	0.00

User	Water Source	Use Category	Projection	Year	Demand (MGD)
City of North Charleston/ The Golf Club at Wescott Plantation	Groundwater	GC	Moderate	2040	0.00
City of North Charleston/ The Golf Club at Wescott Plantation	Groundwater	GC	Moderate	2050	0.00
City of North Charleston/ The Golf Club at Wescott Plantation	Groundwater	GC	Moderate	2060	0.00
City of North Charleston/ The Golf Club at Wescott Plantation	Groundwater	GC	Moderate	2070	0.00
Joint Base Charleston/ Red Bank Plantation GC	Groundwater	GC	Moderate	2025	0.01
Joint Base Charleston/ Red Bank Plantation GC	Groundwater	GC	Moderate	2030	0.01
Joint Base Charleston/ Red Bank Plantation GC	Groundwater	GC	Moderate	2035	0.01
Joint Base Charleston/ Red Bank Plantation GC	Groundwater	GC	Moderate	2040	0.01
Joint Base Charleston/ Red Bank Plantation GC	Groundwater	GC	Moderate	2050	0.01
Joint Base Charleston/ Red Bank Plantation GC	Groundwater	GC	Moderate	2060	0.01
Joint Base Charleston/ Red Bank Plantation GC	Groundwater	GC	Moderate	2070	0.01
Kiawah Island Inn Company, LLC/The Ocean Course	Groundwater	GC	Moderate	2025	0.29
Kiawah Island Inn Company, LLC/The Ocean Course	Groundwater	GC	Moderate	2030	0.29
Kiawah Island Inn Company, LLC/The Ocean Course	Groundwater	GC	Moderate	2035	0.29
Kiawah Island Inn Company, LLC/The Ocean Course	Groundwater	GC	Moderate	2040	0.29
Kiawah Island Inn Company, LLC/The Ocean Course	Groundwater	GC	Moderate	2050	0.29
Kiawah Island Inn Company, LLC/The Ocean Course	Groundwater	GC	Moderate	2060	0.29

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Kiawah Island Inn Company, LLC/The Ocean Course	Groundwater	GC	Moderate	2070	0.29
Kiawah Island Utility Inc. (GC)	Groundwater	GC	Moderate	2025	0.20
Kiawah Island Utility Inc. (GC)	Groundwater	GC	Moderate	2030	0.20
Kiawah Island Utility Inc. (GC)	Groundwater	GC	Moderate	2035	0.20
Kiawah Island Utility Inc. (GC)	Groundwater	GC	Moderate	2040	0.20
Kiawah Island Utility Inc. (GC)	Groundwater	GC	Moderate	2050	0.20
Kiawah Island Utility Inc. (GC)	Groundwater	GC	Moderate	2060	0.20
Kiawah Island Utility Inc. (GC)	Groundwater	GC	Moderate	2070	0.20
Kiawah Resort Associates, LP/Cassique GC	Groundwater	GC	Moderate	2025	0.38
Kiawah Resort Associates, LP/Cassique GC	Groundwater	GC	Moderate	2030	0.38
Kiawah Resort Associates, LP/Cassique GC	Groundwater	GC	Moderate	2035	0.38
Kiawah Resort Associates, LP/Cassique GC	Groundwater	GC	Moderate	2040	0.38
Kiawah Resort Associates, LP/Cassique GC	Groundwater	GC	Moderate	2050	0.38
Kiawah Resort Associates, LP/Cassique GC	Groundwater	GC	Moderate	2060	0.38
Kiawah Resort Associates, LP/Cassique GC	Groundwater	GC	Moderate	2070	0.38
Kiawah Resort/Osprey Point GC	Groundwater	GC	Moderate	2025	0.20
Kiawah Resort/Osprey Point GC	Groundwater	GC	Moderate	2030	0.20
Kiawah Resort/Osprey Point GC	Groundwater	GC	Moderate	2035	0.20

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Kiawah Resort/Osprey Point GC	Groundwater	GC	Moderate	2040	0.20
Kiawah Resort/Osprey Point GC	Groundwater	GC	Moderate	2050	0.20
Kiawah Resort/Osprey Point GC	Groundwater	GC	Moderate	2060	0.20
Kiawah Resort/Osprey Point GC	Groundwater	GC	Moderate	2070	0.20
Legend Oaks Golf Operations, LLC	Groundwater	GC	Moderate	2025	0.04
Legend Oaks Golf Operations, LLC	Groundwater	GC	Moderate	2030	0.04
Legend Oaks Golf Operations, LLC	Groundwater	GC	Moderate	2035	0.04
Legend Oaks Golf Operations, LLC	Groundwater	GC	Moderate	2040	0.04
Legend Oaks Golf Operations, LLC	Groundwater	GC	Moderate	2050	0.04
Legend Oaks Golf Operations, LLC	Groundwater	GC	Moderate	2060	0.04
Legend Oaks Golf Operations, LLC	Groundwater	GC	Moderate	2070	0.04
LRA Charleston PP Golf, LLC	Groundwater	GC	Moderate	2025	0.03
LRA Charleston PP Golf, LLC	Groundwater	GC	Moderate	2030	0.03
LRA Charleston PP Golf, LLC	Groundwater	GC	Moderate	2035	0.03
LRA Charleston PP Golf, LLC	Groundwater	GC	Moderate	2040	0.03
LRA Charleston PP Golf, LLC	Groundwater	GC	Moderate	2050	0.03
LRA Charleston PP Golf, LLC	Groundwater	GC	Moderate	2060	0.03
LRA Charleston PP Golf, LLC	Groundwater	GC	Moderate	2070	0.03
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Groundwater	GC	Moderate	2025	0.04
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Groundwater	GC	Moderate	2030	0.04

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Groundwater	GC	Moderate	2035	0.04
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Groundwater	GC	Moderate	2040	0.04
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Groundwater	GC	Moderate	2050	0.04
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Groundwater	GC	Moderate	2060	0.04
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Groundwater	GC	Moderate	2070	0.04
SPRING VALLEY COUNTRY CLUB	Groundwater	GC	Moderate	2025	0.03
SPRING VALLEY COUNTRY CLUB	Groundwater	GC	Moderate	2030	0.03
SPRING VALLEY COUNTRY CLUB	Groundwater	GC	Moderate	2035	0.03
SPRING VALLEY COUNTRY CLUB	Groundwater	GC	Moderate	2040	0.03
SPRING VALLEY COUNTRY CLUB	Groundwater	GC	Moderate	2050	0.03
SPRING VALLEY COUNTRY CLUB	Groundwater	GC	Moderate	2060	0.03
SPRING VALLEY COUNTRY CLUB	Groundwater	GC	Moderate	2070	0.03
The Links at Stono Ferry	Groundwater	GC	Moderate	2025	0.09
The Links at Stono Ferry	Groundwater	GC	Moderate	2030	0.09
The Links at Stono Ferry	Groundwater	GC	Moderate	2035	0.09
The Links at Stono Ferry	Groundwater	GC	Moderate	2040	0.09
The Links at Stono Ferry	Groundwater	GC	Moderate	2050	0.09
The Links at Stono Ferry	Groundwater	GC	Moderate	2060	0.09
The Links at Stono Ferry	Groundwater	GC	Moderate	2070	0.09
WYBOO GOLF COURSE	Groundwater	GC	Moderate	2025	0.02
WYBOO GOLF COURSE	Groundwater	GC	Moderate	2030	0.02
WYBOO GOLF COURSE	Groundwater	GC	Moderate	2035	0.02
WYBOO GOLF COURSE	Groundwater	GC	Moderate	2040	0.02
WYBOO GOLF COURSE	Groundwater	GC	Moderate	2050	0.02

User	Water Source	Use Category	Projection	Year	Demand (MGD)
WYBOO GOLF COURSE	Groundwater	GC	Moderate	2060	0.02
WYBOO GOLF COURSE	Groundwater	GC	Moderate	2070	0.02
Alpek (DAK Congaree)	Surface Water	IN	Moderate	2025	53.37
Alpek (DAK Congaree)	Surface Water	IN	Moderate	2030	59.69
Alpek (DAK Congaree)	Surface Water	IN	Moderate	2035	65.11
Alpek (DAK Congaree)	Surface Water	IN	Moderate	2040	70.11
Alpek (DAK Congaree)	Surface Water	IN	Moderate	2050	81.65
Alpek (DAK Congaree)	Surface Water	IN	Moderate	2060	93.61
Alpek (DAK Congaree)	Surface Water	IN	Moderate	2070	107.82
CMC Steel	Surface Water	IN	Moderate	2025	0.23
CMC Steel	Surface Water	IN	Moderate	2030	0.25
CMC Steel	Surface Water	IN	Moderate	2035	0.25
CMC Steel	Surface Water	IN	Moderate	2040	0.26
CMC Steel	Surface Water	IN	Moderate	2050	0.27
CMC Steel	Surface Water	IN	Moderate	2060	0.28
CMC Steel	Surface Water	IN	Moderate	2070	0.30
Chargeurs	Surface Water	IN	Moderate	2025	0.07
Chargeurs	Surface Water	IN	Moderate	2030	0.07
Chargeurs	Surface Water	IN	Moderate	2035	0.07
Chargeurs	Surface Water	IN	Moderate	2040	0.07
Chargeurs	Surface Water	IN	Moderate	2050	0.07
Chargeurs	Surface Water	IN	Moderate	2060	0.07
Chargeurs	Surface Water	IN	Moderate	2070	0.07
INEOS (BP Amoco)	Surface Water	IN	Moderate	2025	4.98
INEOS (BP Amoco)	Surface Water	IN	Moderate	2030	5.56
INEOS (BP Amoco)	Surface Water	IN	Moderate	2035	6.07
INEOS (BP Amoco)	Surface Water	IN	Moderate	2040	6.51
INEOS (BP Amoco)	Surface Water	IN	Moderate	2050	7.57
INEOS (BP Amoco)	Surface Water	IN	Moderate	2060	8.50
INEOS (BP Amoco)	Surface Water	IN	Moderate	2070	9.60
Celanese (DAK)	Surface Water	IN	Moderate	2025	1.19
Celanese (DAK)	Surface Water	IN	Moderate	2030	1.33
Celanese (DAK)	Surface Water	IN	Moderate	2035	1.45
Celanese (DAK)	Surface Water	IN	Moderate	2040	1.56

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Celanese (DAK)	Surface Water	IN	Moderate	2050	1.82
Celanese (DAK)	Surface Water	IN	Moderate	2060	2.09
Celanese (DAK)	Surface Water	IN	Moderate	2070	2.40
Ingevity (Kapstone)	Surface Water	IN	Moderate	2025	1.41
Ingevity (Kapstone)	Surface Water	IN	Moderate	2030	1.57
Ingevity (Kapstone)	Surface Water	IN	Moderate	2035	1.72
Ingevity (Kapstone)	Surface Water	IN	Moderate	2040	1.85
Ingevity (Kapstone)	Surface Water	IN	Moderate	2050	2.14
Ingevity (Kapstone)	Surface Water	IN	Moderate	2060	2.41
Ingevity (Kapstone)	Surface Water	IN	Moderate	2070	2.72
Martin Marietta	Surface Water	IN	Moderate	2025	0.68
Martin Marietta	Surface Water	IN	Moderate	2030	0.68
Martin Marietta	Surface Water	IN	Moderate	2035	0.68
Martin Marietta	Surface Water	IN	Moderate	2040	0.68
Martin Marietta	Surface Water	IN	Moderate	2050	0.68
Martin Marietta	Surface Water	IN	Moderate	2060	0.68
Martin Marietta	Surface Water	IN	Moderate	2070	0.68
Sun Chemical	Surface Water	IN	Moderate	2025	3.19
Sun Chemical	Surface Water	IN	Moderate	2030	3.26
Sun Chemical	Surface Water	IN	Moderate	2035	3.51
Sun Chemical	Surface Water	IN	Moderate	2040	3.75
Sun Chemical	Surface Water	IN	Moderate	2050	4.29
Sun Chemical	Surface Water	IN	Moderate	2060	4.68
Sun Chemical	Surface Water	IN	Moderate	2070	5.13
Nucor	Groundwater	IN	Moderate	2025	2.91
Nucor	Groundwater	IN	Moderate	2030	3.14
Nucor	Groundwater	IN	Moderate	2035	3.16
Nucor	Groundwater	IN	Moderate	2040	3.25
Nucor	Groundwater	IN	Moderate	2050	3.36
Nucor	Groundwater	IN	Moderate	2060	3.54
Nucor	Groundwater	IN	Moderate	2070	3.72
CR Bard	Groundwater	IN	Moderate	2025	0.20
CR Bard	Groundwater	IN	Moderate	2030	0.20
CR Bard	Groundwater	IN	Moderate	2035	0.22

User	Water Source	Use Category	Projection	Year	Demand (MGD)
CR Bard	Groundwater	IN	Moderate	2040	0.23
CR Bard	Groundwater	IN	Moderate	2050	0.26
CR Bard	Groundwater	IN	Moderate	2060	0.29
CR Bard	Groundwater	IN	Moderate	2070	0.31
Albany International Corporation, Press Fabrics	Groundwater	IN	Moderate	2025	0.08
Albany International Corporation, Press Fabrics	Groundwater	IN	Moderate	2030	0.08
Albany International Corporation, Press Fabrics	Groundwater	IN	Moderate	2035	0.09
Albany International Corporation, Press Fabrics	Groundwater	IN	Moderate	2040	0.09
Albany International Corporation, Press Fabrics	Groundwater	IN	Moderate	2050	0.09
Albany International Corporation, Press Fabrics	Groundwater	IN	Moderate	2060	0.10
Albany International Corporation, Press Fabrics	Groundwater	IN	Moderate	2070	0.10
AMC/Lanier Sand Operation	Groundwater	IN	Moderate	2025	0.03
AMC/Lanier Sand Operation	Groundwater	IN	Moderate	2030	0.03
AMC/Lanier Sand Operation	Groundwater	IN	Moderate	2035	0.03
AMC/Lanier Sand Operation	Groundwater	IN	Moderate	2040	0.03
AMC/Lanier Sand Operation	Groundwater	IN	Moderate	2050	0.03
AMC/Lanier Sand Operation	Groundwater	IN	Moderate	2060	0.03
AMC/Lanier Sand Operation	Groundwater	IN	Moderate	2070	0.03
Devro, Inc.	Groundwater	IN	Moderate	2025	0.00
Devro, Inc.	Groundwater	IN	Moderate	2030	0.00
Devro, Inc.	Groundwater	IN	Moderate	2035	0.00

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Devro, Inc.	Groundwater	IN	Moderate	2040	0.00
Devro, Inc.	Groundwater	IN	Moderate	2050	0.01
Devro, Inc.	Groundwater	IN	Moderate	2060	0.01
Devro, Inc.	Groundwater	IN	Moderate	2070	0.01
Ingevity South Carolina, LLC/Charleston Chemical Plant	Groundwater	IN	Moderate	2025	0.13
Ingevity South Carolina, LLC/Charleston Chemical Plant	Groundwater	IN	Moderate	2030	0.14
Ingevity South Carolina, LLC/Charleston Chemical Plant	Groundwater	IN	Moderate	2035	0.16
Ingevity South Carolina, LLC/Charleston Chemical Plant	Groundwater	IN	Moderate	2040	0.17
Ingevity South Carolina, LLC/Charleston Chemical Plant	Groundwater	IN	Moderate	2050	0.20
Ingevity South Carolina, LLC/Charleston Chemical Plant	Groundwater	IN	Moderate	2060	0.22
Ingevity South Carolina, LLC/Charleston Chemical Plant	Groundwater	IN	Moderate	2070	0.25
Maguro Enterprises, LLC	Groundwater	IN	Moderate	2025	0.01
Maguro Enterprises, LLC	Groundwater	IN	Moderate	2030	0.01
Maguro Enterprises, LLC	Groundwater	IN	Moderate	2035	0.01
Maguro Enterprises, LLC	Groundwater	IN	Moderate	2040	0.01
Maguro Enterprises, LLC	Groundwater	IN	Moderate	2050	0.01
Maguro Enterprises, LLC	Groundwater	IN	Moderate	2060	0.01
Maguro Enterprises, LLC	Groundwater	IN	Moderate	2070	0.02
Michelin North America	Groundwater	IN	Moderate	2025	0.07
Michelin North America	Groundwater	IN	Moderate	2030	0.08
Michelin North America	Groundwater	IN	Moderate	2035	0.08
Michelin North America	Groundwater	IN	Moderate	2040	0.09
Michelin North America	Groundwater	IN	Moderate	2050	0.11
Michelin North America	Groundwater	IN	Moderate	2060	0.13
Michelin North America	Groundwater	IN	Moderate	2070	0.15

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Shakespeare	Groundwater	IN	Moderate	2025	0.03
Shakespeare	Groundwater	IN	Moderate	2030	0.03
Shakespeare	Groundwater	IN	Moderate	2035	0.03
Shakespeare	Groundwater	IN	Moderate	2040	0.04
Shakespeare	Groundwater	IN	Moderate	2050	0.04
Shakespeare	Groundwater	IN	Moderate	2060	0.05
Shakespeare	Groundwater	IN	Moderate	2070	0.05
United States Air Force, NNPTC - B.2409 Utility Plant	Groundwater	IN	Moderate	2025	0.02
United States Air Force, NNPTC - B.2409 Utility Plant	Groundwater	IN	Moderate	2030	0.02
United States Air Force, NNPTC - B.2409 Utility Plant	Groundwater	IN	Moderate	2035	0.02
United States Air Force, NNPTC - B.2409 Utility Plant	Groundwater	IN	Moderate	2040	0.02
United States Air Force, NNPTC - B.2409 Utility Plant	Groundwater	IN	Moderate	2050	0.02
United States Air Force, NNPTC - B.2409 Utility Plant	Groundwater	IN	Moderate	2060	0.02
United States Air Force, NNPTC - B.2409 Utility Plant	Groundwater	IN	Moderate	2070	0.02
US Silica	Groundwater	IN	Moderate	2025	0.91
US Silica	Groundwater	IN	Moderate	2030	0.91
US Silica	Groundwater	IN	Moderate	2035	0.91
US Silica	Groundwater	IN	Moderate	2040	0.91
US Silica	Groundwater	IN	Moderate	2050	0.91
US Silica	Groundwater	IN	Moderate	2060	0.91
US Silica	Groundwater	IN	Moderate	2070	0.91
305011001	Surface Water	IR	Moderate	2025	0.00
305011001	Surface Water	IR	Moderate	2030	0.00
305011001	Surface Water	IR	Moderate	2035	0.01
305011001	Surface Water	IR	Moderate	2040	0.01

User	Water Source	Use Category	Projection	Year	Demand (MGD)
305011001	Surface Water	IR	Moderate	2050	0.01
305011001	Surface Water	IR	Moderate	2060	0.02
305011001	Surface Water	IR	Moderate	2070	0.02
305011003	Surface Water	IR	Moderate	2025	0.00
305011003	Surface Water	IR	Moderate	2030	0.00
305011003	Surface Water	IR	Moderate	2035	0.00
305011003	Surface Water	IR	Moderate	2040	0.00
305011003	Surface Water	IR	Moderate	2050	0.00
305011003	Surface Water	IR	Moderate	2060	0.00
305011003	Surface Water	IR	Moderate	2070	0.00
305011101	Surface Water	IR	Moderate	2025	0.00
305011101	Surface Water	IR	Moderate	2030	0.01
305011101	Surface Water	IR	Moderate	2035	0.02
305011101	Surface Water	IR	Moderate	2040	0.03
305011101	Surface Water	IR	Moderate	2050	0.06
305011101	Surface Water	IR	Moderate	2060	0.08
305011101	Surface Water	IR	Moderate	2070	0.11
Clayton Rawl	Surface Water	IR	Moderate	2025	0.02
Clayton Rawl	Surface Water	IR	Moderate	2030	0.02
Clayton Rawl	Surface Water	IR	Moderate	2035	0.02
Clayton Rawl	Surface Water	IR	Moderate	2040	0.02
Clayton Rawl	Surface Water	IR	Moderate	2050	0.02
Clayton Rawl	Surface Water	IR	Moderate	2060	0.02
Clayton Rawl	Surface Water	IR	Moderate	2070	0.02
Dargan Culclasure	Surface Water	IR	Moderate	2025	0.12
Dargan Culclasure	Surface Water	IR	Moderate	2030	0.12
Dargan Culclasure	Surface Water	IR	Moderate	2035	0.12
Dargan Culclasure	Surface Water	IR	Moderate	2040	0.12
Dargan Culclasure	Surface Water	IR	Moderate	2050	0.12
Dargan Culclasure	Surface Water	IR	Moderate	2060	0.12
Dargan Culclasure	Surface Water	IR	Moderate	2070	0.12
Lyons Bros	Surface Water	IR	Moderate	2025	0.01
Lyons Bros	Surface Water	IR	Moderate	2030	0.01
Lyons Bros	Surface Water	IR	Moderate	2035	0.01

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Lyons Bros	Surface Water	IR	Moderate	2040	0.01
Lyons Bros	Surface Water	IR	Moderate	2050	0.01
Lyons Bros	Surface Water	IR	Moderate	2060	0.01
Lyons Bros	Surface Water	IR	Moderate	2070	0.01
Palmetta	Surface Water	IR	Moderate	2025	0.10
Palmetta	Surface Water	IR	Moderate	2030	0.10
Palmetta	Surface Water	IR	Moderate	2035	0.10
Palmetta	Surface Water	IR	Moderate	2040	0.10
Palmetta	Surface Water	IR	Moderate	2050	0.10
Palmetta	Surface Water	IR	Moderate	2060	0.10
Palmetta	Surface Water	IR	Moderate	2070	0.10
Ricard	Surface Water	IR	Moderate	2025	0.05
Ricard	Surface Water	IR	Moderate	2030	0.05
Ricard	Surface Water	IR	Moderate	2035	0.05
Ricard	Surface Water	IR	Moderate	2040	0.05
Ricard	Surface Water	IR	Moderate	2050	0.05
Ricard	Surface Water	IR	Moderate	2060	0.05
Ricard	Surface Water	IR	Moderate	2070	0.05
St. Julian	Surface Water	IR	Moderate	2025	0.02
St. Julian	Surface Water	IR	Moderate	2030	0.02
St. Julian	Surface Water	IR	Moderate	2035	0.02
St. Julian	Surface Water	IR	Moderate	2040	0.02
St. Julian	Surface Water	IR	Moderate	2050	0.02
St. Julian	Surface Water	IR	Moderate	2060	0.02
St. Julian	Surface Water	IR	Moderate	2070	0.02
Walker Farm	Surface Water	IR	Moderate	2025	0.00
Walker Farm	Surface Water	IR	Moderate	2030	0.00
Walker Farm	Surface Water	IR	Moderate	2035	0.00
Walker Farm	Surface Water	IR	Moderate	2040	0.00
Walker Farm	Surface Water	IR	Moderate	2050	0.00
Walker Farm	Surface Water	IR	Moderate	2060	0.00
Walker Farm	Surface Water	IR	Moderate	2070	0.00
Wiles	Surface Water	IR	Moderate	2025	0.05
Wiles	Surface Water	IR	Moderate	2030	0.05

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Wiles	Surface Water	IR	Moderate	2035	0.05
Wiles	Surface Water	IR	Moderate	2040	0.05
Wiles	Surface Water	IR	Moderate	2050	0.05
Wiles	Surface Water	IR	Moderate	2060	0.05
Wiles	Surface Water	IR	Moderate	2070	0.05
Agricultural Totals	Groundwater	IR	Moderate	2025	10.11
Agricultural Totals	Groundwater	IR	Moderate	2030	10.44
Agricultural Totals	Groundwater	IR	Moderate	2035	10.78
Agricultural Totals	Groundwater	IR	Moderate	2040	11.14
Agricultural Totals	Groundwater	IR	Moderate	2050	11.89
Agricultural Totals	Groundwater	IR	Moderate	2060	12.68
Agricultural Totals	Groundwater	IR	Moderate	2070	13.53
Martin Marietta Quarry	Surface Water	MI	Moderate	2025	0.00
Martin Marietta Quarry	Surface Water	MI	Moderate	2030	0.00
Martin Marietta Quarry	Surface Water	MI	Moderate	2035	0.00
Martin Marietta Quarry	Surface Water	MI	Moderate	2040	0.00
Martin Marietta Quarry	Surface Water	MI	Moderate	2050	0.00
Martin Marietta Quarry	Surface Water	MI	Moderate	2060	0.00
Martin Marietta Quarry	Surface Water	MI	Moderate	2070	0.00
AMC/Dixiana	Groundwater	MI	Moderate	2025	0.11
AMC/Dixiana	Groundwater	MI	Moderate	2030	0.11
AMC/Dixiana	Groundwater	MI	Moderate	2035	0.11
AMC/Dixiana	Groundwater	MI	Moderate	2040	0.11
AMC/Dixiana	Groundwater	MI	Moderate	2050	0.11
AMC/Dixiana	Groundwater	MI	Moderate	2060	0.11
AMC/Dixiana	Groundwater	MI	Moderate	2070	0.11
Calhoun Sand Mine	Groundwater	MI	Moderate	2025	0.21
Calhoun Sand Mine	Groundwater	MI	Moderate	2030	0.21
Calhoun Sand Mine	Groundwater	MI	Moderate	2035	0.21
Calhoun Sand Mine	Groundwater	MI	Moderate	2040	0.21
Calhoun Sand Mine	Groundwater	MI	Moderate	2050	0.21
Calhoun Sand Mine	Groundwater	MI	Moderate	2060	0.21
Calhoun Sand Mine	Groundwater	MI	Moderate	2070	0.21
Edmund Sand Mine	Groundwater	MI	Moderate	2025	0.91

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Edmund Sand Mine	Groundwater	MI	Moderate	2030	0.91
Edmund Sand Mine	Groundwater	MI	Moderate	2035	0.91
Edmund Sand Mine	Groundwater	MI	Moderate	2040	0.91
Edmund Sand Mine	Groundwater	MI	Moderate	2050	0.91
Edmund Sand Mine	Groundwater	MI	Moderate	2060	0.91
Edmund Sand Mine	Groundwater	MI	Moderate	2070	0.91
Cross Station	Surface Water	PT	Moderate	2025	26.48
Cross Station	Surface Water	PT	Moderate	2030	26.48
Cross Station	Surface Water	PT	Moderate	2035	26.48
Cross Station	Surface Water	PT	Moderate	2040	26.48
Cross Station	Surface Water	PT	Moderate	2050	26.48
Cross Station	Surface Water	PT	Moderate	2060	26.48
Cross Station	Surface Water	PT	Moderate	2070	26.48
Santee Cooper (formerly Jeffries)	Surface Water	PT	Moderate	2025	0.00
Santee Cooper (formerly Jeffries)	Surface Water	PT	Moderate	2030	0.00
Santee Cooper (formerly Jeffries)	Surface Water	PT	Moderate	2035	0.00
Santee Cooper (formerly Jeffries)	Surface Water	PT	Moderate	2040	0.00
Santee Cooper (formerly Jeffries)	Surface Water	PT	Moderate	2050	0.00
Santee Cooper (formerly Jeffries)	Surface Water	PT	Moderate	2060	0.00
Santee Cooper (formerly Jeffries)	Surface Water	PT	Moderate	2070	0.00
Williams Station	Surface Water	PT	Moderate	2025	372.64
Williams Station	Surface Water	PT	Moderate	2030	372.64
Williams Station	Surface Water	PT	Moderate	2035	0.00
Williams Station	Surface Water	PT	Moderate	2040	0.00
Williams Station	Surface Water	PT	Moderate	2050	0.00
Williams Station	Surface Water	PT	Moderate	2060	0.00
Williams Station	Surface Water	PT	Moderate	2070	0.00
Winyah Station	Surface Water	PT	Moderate	2025	4.34
Winyah Station	Surface Water	PT	Moderate	2030	0.00
Winyah Station	Surface Water	PT	Moderate	2035	0.00

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Winyah Station	Surface Water	PT	Moderate	2040	0.00
Winyah Station	Surface Water	PT	Moderate	2050	0.00
Winyah Station	Surface Water	PT	Moderate	2060	0.00
Winyah Station	Surface Water	PT	Moderate	2070	0.00
Cayce	Surface Water	WS	Moderate	2025	3.50
Cayce	Surface Water	WS	Moderate	2030	3.61
Cayce	Surface Water	WS	Moderate	2035	3.70
Cayce	Surface Water	WS	Moderate	2040	3.79
Cayce	Surface Water	WS	Moderate	2050	4.00
Cayce	Surface Water	WS	Moderate	2060	4.22
Cayce	Surface Water	WS	Moderate	2070	4.43
Charleston Water System	Surface Water	WS	Moderate	2025	52.42
Charleston Water System	Surface Water	WS	Moderate	2030	56.99
Charleston Water System	Surface Water	WS	Moderate	2035	61.69
Charleston Water System	Surface Water	WS	Moderate	2040	66.46
Charleston Water System	Surface Water	WS	Moderate	2050	75.71
Charleston Water System	Surface Water	WS	Moderate	2060	84.97
Charleston Water System	Surface Water	WS	Moderate	2070	94.23
Santee Cooper - Lake Marion RWS	Surface Water	WS	Moderate	2025	1.67
Santee Cooper - Lake Marion RWS	Surface Water	WS	Moderate	2030	1.81
Santee Cooper - Lake Marion RWS	Surface Water	WS	Moderate	2035	1.95
Santee Cooper - Lake Marion RWS	Surface Water	WS	Moderate	2040	2.10
Santee Cooper - Lake Marion RWS	Surface Water	WS	Moderate	2050	2.38
Santee Cooper - Lake Marion RWS	Surface Water	WS	Moderate	2060	2.66
Santee Cooper - Lake Marion RWS	Surface Water	WS	Moderate	2070	2.95
Santee Cooper RWS	Surface Water	WS	Moderate	2025	25.71
Santee Cooper RWS	Surface Water	WS	Moderate	2030	27.89
Santee Cooper RWS	Surface Water	WS	Moderate	2035	30.09
Santee Cooper RWS	Surface Water	WS	Moderate	2040	32.30
Santee Cooper RWS	Surface Water	WS	Moderate	2050	36.67

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Santee Cooper RWS	Surface Water	WS	Moderate	2060	41.03
Santee Cooper RWS	Surface Water	WS	Moderate	2070	45.39
American Materials Co.- Dixiana Mine	Groundwater	WS	Moderate	2025	0.00
American Materials Co.- Dixiana Mine	Groundwater	WS	Moderate	2030	0.00
American Materials Co.- Dixiana Mine	Groundwater	WS	Moderate	2035	0.00
American Materials Co.- Dixiana Mine	Groundwater	WS	Moderate	2040	0.00
American Materials Co.- Dixiana Mine	Groundwater	WS	Moderate	2050	0.00
American Materials Co.- Dixiana Mine	Groundwater	WS	Moderate	2060	0.00
American Materials Co.- Dixiana Mine	Groundwater	WS	Moderate	2070	0.00
Calhoun County Municipal Water and Sewer	Groundwater	WS	Moderate	2025	0.72
Calhoun County Municipal Water and Sewer	Groundwater	WS	Moderate	2030	0.67
Calhoun County Municipal Water and Sewer	Groundwater	WS	Moderate	2035	0.62
Calhoun County Municipal Water and Sewer	Groundwater	WS	Moderate	2040	0.60
Calhoun County Municipal Water and Sewer	Groundwater	WS	Moderate	2050	0.60
Calhoun County Municipal Water and Sewer	Groundwater	WS	Moderate	2060	0.60
Calhoun County Municipal Water and Sewer	Groundwater	WS	Moderate	2070	0.60
Clarendon County Water & Sewer Department	Groundwater	WS	Moderate	2025	0.03
Clarendon County Water & Sewer Department	Groundwater	WS	Moderate	2030	0.03
Clarendon County Water & Sewer Department	Groundwater	WS	Moderate	2035	0.02

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Clarendon County Water & Sewer Department	Groundwater	WS	Moderate	2040	0.02
Clarendon County Water & Sewer Department	Groundwater	WS	Moderate	2050	0.02
Clarendon County Water & Sewer Department	Groundwater	WS	Moderate	2060	0.02
Clarendon County Water & Sewer Department	Groundwater	WS	Moderate	2070	0.02
DCPW	Groundwater	WS	Moderate	2025	0.08
DCPW	Groundwater	WS	Moderate	2030	0.08
DCPW	Groundwater	WS	Moderate	2035	0.09
DCPW	Groundwater	WS	Moderate	2040	0.09
DCPW	Groundwater	WS	Moderate	2050	0.10
DCPW	Groundwater	WS	Moderate	2060	0.10
DCPW	Groundwater	WS	Moderate	2070	0.11
DCWA	Groundwater	WS	Moderate	2025	0.73
DCWA	Groundwater	WS	Moderate	2030	0.79
DCWA	Groundwater	WS	Moderate	2035	0.85
DCWA	Groundwater	WS	Moderate	2040	0.92
DCWA	Groundwater	WS	Moderate	2050	1.04
DCWA	Groundwater	WS	Moderate	2060	1.17
DCWA	Groundwater	WS	Moderate	2070	1.29
EASTOVER TOWN OF	Groundwater	WS	Moderate	2025	0.07
EASTOVER TOWN OF	Groundwater	WS	Moderate	2030	0.07
EASTOVER TOWN OF	Groundwater	WS	Moderate	2035	0.07
EASTOVER TOWN OF	Groundwater	WS	Moderate	2040	0.08
EASTOVER TOWN OF	Groundwater	WS	Moderate	2050	0.08
EASTOVER TOWN OF	Groundwater	WS	Moderate	2060	0.08
EASTOVER TOWN OF	Groundwater	WS	Moderate	2070	0.08
Elloree Water System	Groundwater	WS	Moderate	2025	0.18
Elloree Water System	Groundwater	WS	Moderate	2030	0.17
Elloree Water System	Groundwater	WS	Moderate	2035	0.16
Elloree Water System	Groundwater	WS	Moderate	2040	0.15
Elloree Water System	Groundwater	WS	Moderate	2050	0.15
Elloree Water System	Groundwater	WS	Moderate	2060	0.15
Elloree Water System	Groundwater	WS	Moderate	2070	0.15

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Eutawville Town of	Groundwater	WS	Moderate	2025	0.05
Eutawville Town of	Groundwater	WS	Moderate	2030	0.04
Eutawville Town of	Groundwater	WS	Moderate	2035	0.04
Eutawville Town of	Groundwater	WS	Moderate	2040	0.04
Eutawville Town of	Groundwater	WS	Moderate	2050	0.04
Eutawville Town of	Groundwater	WS	Moderate	2060	0.04
Eutawville Town of	Groundwater	WS	Moderate	2070	0.04
GASTON RURAL COMMUNITY WATER DISTRICT	Groundwater	WS	Moderate	2025	0.60
GASTON RURAL COMMUNITY WATER DISTRICT	Groundwater	WS	Moderate	2030	0.62
GASTON RURAL COMMUNITY WATER DISTRICT	Groundwater	WS	Moderate	2035	0.64
GASTON RURAL COMMUNITY WATER DISTRICT	Groundwater	WS	Moderate	2040	0.65
GASTON RURAL COMMUNITY WATER DISTRICT	Groundwater	WS	Moderate	2050	0.69
GASTON RURAL COMMUNITY WATER DISTRICT	Groundwater	WS	Moderate	2060	0.73
GASTON RURAL COMMUNITY WATER DISTRICT	Groundwater	WS	Moderate	2070	0.76
GEORGETOWN COUNTY W&S DISTRICT	Groundwater	WS	Moderate	2025	0.33
GEORGETOWN COUNTY W&S DISTRICT	Groundwater	WS	Moderate	2030	0.37
GEORGETOWN COUNTY W&S DISTRICT	Groundwater	WS	Moderate	2035	0.41
GEORGETOWN COUNTY W&S DISTRICT	Groundwater	WS	Moderate	2040	0.45
GEORGETOWN COUNTY W&S DISTRICT	Groundwater	WS	Moderate	2050	0.52
GEORGETOWN COUNTY W&S DISTRICT	Groundwater	WS	Moderate	2060	0.60
GEORGETOWN COUNTY W&S DISTRICT	Groundwater	WS	Moderate	2070	0.68

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Isle of Palms Water and Sewer Commission	Groundwater	WS	Moderate	2025	0.38
Isle of Palms Water and Sewer Commission	Groundwater	WS	Moderate	2030	0.41
Isle of Palms Water and Sewer Commission	Groundwater	WS	Moderate	2035	0.45
Isle of Palms Water and Sewer Commission	Groundwater	WS	Moderate	2040	0.48
Isle of Palms Water and Sewer Commission	Groundwater	WS	Moderate	2050	0.55
Isle of Palms Water and Sewer Commission	Groundwater	WS	Moderate	2060	0.62
Isle of Palms Water and Sewer Commission	Groundwater	WS	Moderate	2070	0.68
Kiawah Island Utility Inc. (WS)	Groundwater	WS	Moderate	2025	0.01
Kiawah Island Utility Inc. (WS)	Groundwater	WS	Moderate	2030	0.01
Kiawah Island Utility Inc. (WS)	Groundwater	WS	Moderate	2035	0.01
Kiawah Island Utility Inc. (WS)	Groundwater	WS	Moderate	2040	0.01
Kiawah Island Utility Inc. (WS)	Groundwater	WS	Moderate	2050	0.02
Kiawah Island Utility Inc. (WS)	Groundwater	WS	Moderate	2060	0.02
Kiawah Island Utility Inc. (WS)	Groundwater	WS	Moderate	2070	0.02
Moncks Corner Water Works	Groundwater	WS	Moderate	2025	0.01
Moncks Corner Water Works	Groundwater	WS	Moderate	2030	0.02
Moncks Corner Water Works	Groundwater	WS	Moderate	2035	0.02
Moncks Corner Water Works	Groundwater	WS	Moderate	2040	0.02
Moncks Corner Water Works	Groundwater	WS	Moderate	2050	0.02
Moncks Corner Water Works	Groundwater	WS	Moderate	2060	0.02
Moncks Corner Water Works	Groundwater	WS	Moderate	2070	0.02
Mt Pleasant Waterworks	Groundwater	WS	Moderate	2025	4.51

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Mt Pleasant Waterworks	Groundwater	WS	Moderate	2030	4.91
Mt Pleasant Waterworks	Groundwater	WS	Moderate	2035	5.31
Mt Pleasant Waterworks	Groundwater	WS	Moderate	2040	5.74
Mt Pleasant Waterworks	Groundwater	WS	Moderate	2050	6.52
Mt Pleasant Waterworks	Groundwater	WS	Moderate	2060	7.33
Mt Pleasant Waterworks	Groundwater	WS	Moderate	2070	8.11
PINEWOOD TOWN OF	Groundwater	WS	Moderate	2025	0.05
PINEWOOD TOWN OF	Groundwater	WS	Moderate	2030	0.05
PINEWOOD TOWN OF	Groundwater	WS	Moderate	2035	0.05
PINEWOOD TOWN OF	Groundwater	WS	Moderate	2040	0.05
PINEWOOD TOWN OF	Groundwater	WS	Moderate	2050	0.05
PINEWOOD TOWN OF	Groundwater	WS	Moderate	2060	0.05
PINEWOOD TOWN OF	Groundwater	WS	Moderate	2070	0.05
SC Depart of Corrections Division of Facilities Management	Groundwater	WS	Moderate	2025	0.19
SC Depart of Corrections Division of Facilities Management	Groundwater	WS	Moderate	2030	0.19
SC Depart of Corrections Division of Facilities Management	Groundwater	WS	Moderate	2035	0.19
SC Depart of Corrections Division of Facilities Management	Groundwater	WS	Moderate	2040	0.19
SC Depart of Corrections Division of Facilities Management	Groundwater	WS	Moderate	2050	0.19
SC Depart of Corrections Division of Facilities Management	Groundwater	WS	Moderate	2060	0.19
SC Depart of Corrections Division of Facilities Management	Groundwater	WS	Moderate	2070	0.19
Seabrook Island Utility Commission	Groundwater	WS	Moderate	2025	0.38
Seabrook Island Utility Commission	Groundwater	WS	Moderate	2030	0.41
Seabrook Island Utility Commission	Groundwater	WS	Moderate	2035	0.44

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Seabrook Island Utility Commission	Groundwater	WS	Moderate	2040	0.48
Seabrook Island Utility Commission	Groundwater	WS	Moderate	2050	0.54
Seabrook Island Utility Commission	Groundwater	WS	Moderate	2060	0.61
Seabrook Island Utility Commission	Groundwater	WS	Moderate	2070	0.68
St. Matthews Town of	Groundwater	WS	Moderate	2025	0.23
St. Matthews Town of	Groundwater	WS	Moderate	2030	0.22
St. Matthews Town of	Groundwater	WS	Moderate	2035	0.20
St. Matthews Town of	Groundwater	WS	Moderate	2040	0.20
St. Matthews Town of	Groundwater	WS	Moderate	2050	0.20
St. Matthews Town of	Groundwater	WS	Moderate	2060	0.20
St. Matthews Town of	Groundwater	WS	Moderate	2070	0.20
SUMMERTON TOWN OF	Groundwater	WS	Moderate	2025	0.20
SUMMERTON TOWN OF	Groundwater	WS	Moderate	2030	0.18
SUMMERTON TOWN OF	Groundwater	WS	Moderate	2035	0.16
SUMMERTON TOWN OF	Groundwater	WS	Moderate	2040	0.15
SUMMERTON TOWN OF	Groundwater	WS	Moderate	2050	0.15
SUMMERTON TOWN OF	Groundwater	WS	Moderate	2060	0.15
SUMMERTON TOWN OF	Groundwater	WS	Moderate	2070	0.15
Summerville CPW	Groundwater	WS	Moderate	2025	0.03
Summerville CPW	Groundwater	WS	Moderate	2030	0.03
Summerville CPW	Groundwater	WS	Moderate	2035	0.03
Summerville CPW	Groundwater	WS	Moderate	2040	0.03
Summerville CPW	Groundwater	WS	Moderate	2050	0.04
Summerville CPW	Groundwater	WS	Moderate	2060	0.04
Summerville CPW	Groundwater	WS	Moderate	2070	0.05
Town of Sullivan Island Water & Sewer Department	Groundwater	WS	Moderate	2025	0.00
Town of Sullivan Island Water & Sewer Department	Groundwater	WS	Moderate	2030	0.00
Town of Sullivan Island Water & Sewer Department	Groundwater	WS	Moderate	2035	0.01

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Town of Sullivan Island Water & Sewer Department	Groundwater	WS	Moderate	2040	0.01
Town of Sullivan Island Water & Sewer Department	Groundwater	WS	Moderate	2050	0.01
Town of Sullivan Island Water & Sewer Department	Groundwater	WS	Moderate	2060	0.01
Town of Sullivan Island Water & Sewer Department	Groundwater	WS	Moderate	2070	0.01
Southland Fisheries	Surface Water	AQ	High Demand	2025	0.21
Southland Fisheries	Surface Water	AQ	High Demand	2030	0.21
Southland Fisheries	Surface Water	AQ	High Demand	2035	0.21
Southland Fisheries	Surface Water	AQ	High Demand	2040	0.21
Southland Fisheries	Surface Water	AQ	High Demand	2050	0.21
Southland Fisheries	Surface Water	AQ	High Demand	2060	0.21
Southland Fisheries	Surface Water	AQ	High Demand	2070	0.21
SOUTHLAND FISHERIES CORPORATION	Groundwater	AQ	High Demand	2025	0.11
SOUTHLAND FISHERIES CORPORATION	Groundwater	AQ	High Demand	2030	0.11
SOUTHLAND FISHERIES CORPORATION	Groundwater	AQ	High Demand	2035	0.11
SOUTHLAND FISHERIES CORPORATION	Groundwater	AQ	High Demand	2040	0.11
SOUTHLAND FISHERIES CORPORATION	Groundwater	AQ	High Demand	2050	0.11
SOUTHLAND FISHERIES CORPORATION	Groundwater	AQ	High Demand	2060	0.11
SOUTHLAND FISHERIES CORPORATION	Groundwater	AQ	High Demand	2070	0.11
Forest Lake	Surface Water	GC	High Demand	2025	0.23
Forest Lake	Surface Water	GC	High Demand	2030	0.23
Forest Lake	Surface Water	GC	High Demand	2035	0.23
Forest Lake	Surface Water	GC	High Demand	2040	0.23
Forest Lake	Surface Water	GC	High Demand	2050	0.23
Forest Lake	Surface Water	GC	High Demand	2060	0.23
Forest Lake	Surface Water	GC	High Demand	2070	0.23

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Santee-Cooper Resort	Surface Water	GC	High Demand	2025	0.16
Santee-Cooper Resort	Surface Water	GC	High Demand	2030	0.16
Santee-Cooper Resort	Surface Water	GC	High Demand	2035	0.16
Santee-Cooper Resort	Surface Water	GC	High Demand	2040	0.16
Santee-Cooper Resort	Surface Water	GC	High Demand	2050	0.16
Santee-Cooper Resort	Surface Water	GC	High Demand	2060	0.16
Santee-Cooper Resort	Surface Water	GC	High Demand	2070	0.16
The Members	Surface Water	GC	High Demand	2025	0.23
The Members	Surface Water	GC	High Demand	2030	0.23
The Members	Surface Water	GC	High Demand	2035	0.23
The Members	Surface Water	GC	High Demand	2040	0.23
The Members	Surface Water	GC	High Demand	2050	0.23
The Members	Surface Water	GC	High Demand	2060	0.23
The Members	Surface Water	GC	High Demand	2070	0.23
Berkeley Country Club	Groundwater	GC	High Demand	2025	0.03
Berkeley Country Club	Groundwater	GC	High Demand	2030	0.03
Berkeley Country Club	Groundwater	GC	High Demand	2035	0.03
Berkeley Country Club	Groundwater	GC	High Demand	2040	0.03
Berkeley Country Club	Groundwater	GC	High Demand	2050	0.03
Berkeley Country Club	Groundwater	GC	High Demand	2060	0.03
Berkeley Country Club	Groundwater	GC	High Demand	2070	0.03
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Groundwater	GC	High Demand	2025	0.27
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Groundwater	GC	High Demand	2030	0.27
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Groundwater	GC	High Demand	2035	0.27
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Groundwater	GC	High Demand	2040	0.27
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Groundwater	GC	High Demand	2050	0.27
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Groundwater	GC	High Demand	2060	0.27

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Briar's Creek Holdings, LLC/The Golf Club at Briar's Creek	Groundwater	GC	High Demand	2070	0.27
Calhoun Hills Golf Complex	Groundwater	GC	High Demand	2025	0.07
Calhoun Hills Golf Complex	Groundwater	GC	High Demand	2030	0.07
Calhoun Hills Golf Complex	Groundwater	GC	High Demand	2035	0.07
Calhoun Hills Golf Complex	Groundwater	GC	High Demand	2040	0.07
Calhoun Hills Golf Complex	Groundwater	GC	High Demand	2050	0.07
Calhoun Hills Golf Complex	Groundwater	GC	High Demand	2060	0.07
Calhoun Hills Golf Complex	Groundwater	GC	High Demand	2070	0.07
Charwood Golf Club	Groundwater	GC	High Demand	2025	0.10
Charwood Golf Club	Groundwater	GC	High Demand	2030	0.10
Charwood Golf Club	Groundwater	GC	High Demand	2035	0.10
Charwood Golf Club	Groundwater	GC	High Demand	2040	0.10
Charwood Golf Club	Groundwater	GC	High Demand	2050	0.10
Charwood Golf Club	Groundwater	GC	High Demand	2060	0.10
Charwood Golf Club	Groundwater	GC	High Demand	2070	0.10
City of Goose Creek/ Crowfield Golf and Country Club	Groundwater	GC	High Demand	2025	0.07
City of Goose Creek/ Crowfield Golf and Country Club	Groundwater	GC	High Demand	2030	0.07
City of Goose Creek/ Crowfield Golf and Country Club	Groundwater	GC	High Demand	2035	0.07
City of Goose Creek/ Crowfield Golf and Country Club	Groundwater	GC	High Demand	2040	0.07
City of Goose Creek/ Crowfield Golf and Country Club	Groundwater	GC	High Demand	2050	0.07
City of Goose Creek/ Crowfield Golf and Country Club	Groundwater	GC	High Demand	2060	0.07

User	Water Source	Use Category	Projection	Year	Demand (MGD)
City of Goose Creek/ Crowfield Golf and Country Club	Groundwater	GC	High Demand	2070	0.07
City of North Charleston/ The Golf Club at Wescott Plantation	Groundwater	GC	High Demand	2025	0.11
City of North Charleston/ The Golf Club at Wescott Plantation	Groundwater	GC	High Demand	2030	0.11
City of North Charleston/ The Golf Club at Wescott Plantation	Groundwater	GC	High Demand	2035	0.11
City of North Charleston/ The Golf Club at Wescott Plantation	Groundwater	GC	High Demand	2040	0.11
City of North Charleston/ The Golf Club at Wescott Plantation	Groundwater	GC	High Demand	2050	0.11
City of North Charleston/ The Golf Club at Wescott Plantation	Groundwater	GC	High Demand	2060	0.11
City of North Charleston/ The Golf Club at Wescott Plantation	Groundwater	GC	High Demand	2070	0.11
Joint Base Charleston/ Red Bank Plantation GC	Groundwater	GC	High Demand	2025	0.02
Joint Base Charleston/ Red Bank Plantation GC	Groundwater	GC	High Demand	2030	0.02
Joint Base Charleston/ Red Bank Plantation GC	Groundwater	GC	High Demand	2035	0.02
Joint Base Charleston/ Red Bank Plantation GC	Groundwater	GC	High Demand	2040	0.02
Joint Base Charleston/ Red Bank Plantation GC	Groundwater	GC	High Demand	2050	0.02
Joint Base Charleston/ Red Bank Plantation GC	Groundwater	GC	High Demand	2060	0.02
Joint Base Charleston/ Red Bank Plantation GC	Groundwater	GC	High Demand	2070	0.02
Kiawah Island Inn Company, LLC/The Ocean Course	Groundwater	GC	High Demand	2025	0.43
Kiawah Island Inn Company, LLC/The Ocean Course	Groundwater	GC	High Demand	2030	0.43

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Kiawah Island Inn Company, LLC/The Ocean Course	Groundwater	GC	High Demand	2035	0.43
Kiawah Island Inn Company, LLC/The Ocean Course	Groundwater	GC	High Demand	2040	0.43
Kiawah Island Inn Company, LLC/The Ocean Course	Groundwater	GC	High Demand	2050	0.43
Kiawah Island Inn Company, LLC/The Ocean Course	Groundwater	GC	High Demand	2060	0.43
Kiawah Island Inn Company, LLC/The Ocean Course	Groundwater	GC	High Demand	2070	0.43
Kiawah Island Utility Inc. (GC)	Groundwater	GC	High Demand	2025	0.41
Kiawah Island Utility Inc. (GC)	Groundwater	GC	High Demand	2030	0.41
Kiawah Island Utility Inc. (GC)	Groundwater	GC	High Demand	2035	0.41
Kiawah Island Utility Inc. (GC)	Groundwater	GC	High Demand	2040	0.41
Kiawah Island Utility Inc. (GC)	Groundwater	GC	High Demand	2050	0.41
Kiawah Island Utility Inc. (GC)	Groundwater	GC	High Demand	2060	0.41
Kiawah Island Utility Inc. (GC)	Groundwater	GC	High Demand	2070	0.41
Kiawah Resort Associates, LP/Cassique GC	Groundwater	GC	High Demand	2025	0.81
Kiawah Resort Associates, LP/Cassique GC	Groundwater	GC	High Demand	2030	0.81
Kiawah Resort Associates, LP/Cassique GC	Groundwater	GC	High Demand	2035	0.81
Kiawah Resort Associates, LP/Cassique GC	Groundwater	GC	High Demand	2040	0.81
Kiawah Resort Associates, LP/Cassique GC	Groundwater	GC	High Demand	2050	0.81

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Kiawah Resort Associates, LP/Cassique GC	Groundwater	GC	High Demand	2060	0.81
Kiawah Resort Associates, LP/Cassique GC	Groundwater	GC	High Demand	2070	0.81
Kiawah Resort/Osprey Point GC	Groundwater	GC	High Demand	2025	0.34
Kiawah Resort/Osprey Point GC	Groundwater	GC	High Demand	2030	0.34
Kiawah Resort/Osprey Point GC	Groundwater	GC	High Demand	2035	0.34
Kiawah Resort/Osprey Point GC	Groundwater	GC	High Demand	2040	0.34
Kiawah Resort/Osprey Point GC	Groundwater	GC	High Demand	2050	0.34
Kiawah Resort/Osprey Point GC	Groundwater	GC	High Demand	2060	0.34
Kiawah Resort/Osprey Point GC	Groundwater	GC	High Demand	2070	0.34
Legend Oaks Golf Operations, LLC	Groundwater	GC	High Demand	2025	0.20
Legend Oaks Golf Operations, LLC	Groundwater	GC	High Demand	2030	0.20
Legend Oaks Golf Operations, LLC	Groundwater	GC	High Demand	2035	0.20
Legend Oaks Golf Operations, LLC	Groundwater	GC	High Demand	2040	0.20
Legend Oaks Golf Operations, LLC	Groundwater	GC	High Demand	2050	0.20
Legend Oaks Golf Operations, LLC	Groundwater	GC	High Demand	2060	0.20
Legend Oaks Golf Operations, LLC	Groundwater	GC	High Demand	2070	0.20
LRA Charleston PP Golf, LLC	Groundwater	GC	High Demand	2025	0.06
LRA Charleston PP Golf, LLC	Groundwater	GC	High Demand	2030	0.06
LRA Charleston PP Golf, LLC	Groundwater	GC	High Demand	2035	0.06
LRA Charleston PP Golf, LLC	Groundwater	GC	High Demand	2040	0.06
LRA Charleston PP Golf, LLC	Groundwater	GC	High Demand	2050	0.06

User	Water Source	Use Category	Projection	Year	Demand (MGD)
LRA Charleston PP Golf, LLC	Groundwater	GC	High Demand	2060	0.06
LRA Charleston PP Golf, LLC	Groundwater	GC	High Demand	2070	0.06
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Groundwater	GC	High Demand	2025	0.14
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Groundwater	GC	High Demand	2030	0.14
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Groundwater	GC	High Demand	2035	0.14
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Groundwater	GC	High Demand	2040	0.14
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Groundwater	GC	High Demand	2050	0.14
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Groundwater	GC	High Demand	2060	0.14
Santee-Cooper Resort, Inc. - Lake Marion Golf Club	Groundwater	GC	High Demand	2070	0.14
SPRING VALLEY COUNTRY CLUB	Groundwater	GC	High Demand	2025	0.27
SPRING VALLEY COUNTRY CLUB	Groundwater	GC	High Demand	2030	0.27
SPRING VALLEY COUNTRY CLUB	Groundwater	GC	High Demand	2035	0.27
SPRING VALLEY COUNTRY CLUB	Groundwater	GC	High Demand	2040	0.27
SPRING VALLEY COUNTRY CLUB	Groundwater	GC	High Demand	2050	0.27
SPRING VALLEY COUNTRY CLUB	Groundwater	GC	High Demand	2060	0.27
SPRING VALLEY COUNTRY CLUB	Groundwater	GC	High Demand	2070	0.27
The Links at Stono Ferry	Groundwater	GC	High Demand	2025	0.12
The Links at Stono Ferry	Groundwater	GC	High Demand	2030	0.12
The Links at Stono Ferry	Groundwater	GC	High Demand	2035	0.12
The Links at Stono Ferry	Groundwater	GC	High Demand	2040	0.12

User	Water Source	Use Category	Projection	Year	Demand (MGD)
The Links at Stono Ferry	Groundwater	GC	High Demand	2050	0.12
The Links at Stono Ferry	Groundwater	GC	High Demand	2060	0.12
The Links at Stono Ferry	Groundwater	GC	High Demand	2070	0.12
WYBOO GOLF COURSE	Groundwater	GC	High Demand	2025	0.07
WYBOO GOLF COURSE	Groundwater	GC	High Demand	2030	0.07
WYBOO GOLF COURSE	Groundwater	GC	High Demand	2035	0.07
WYBOO GOLF COURSE	Groundwater	GC	High Demand	2040	0.07
WYBOO GOLF COURSE	Groundwater	GC	High Demand	2050	0.07
WYBOO GOLF COURSE	Groundwater	GC	High Demand	2060	0.07
WYBOO GOLF COURSE	Groundwater	GC	High Demand	2070	0.07
Alpek (DAK Congaree)	Surface Water	IN	High Demand	2025	66.07
Alpek (DAK Congaree)	Surface Water	IN	High Demand	2030	73.31
Alpek (DAK Congaree)	Surface Water	IN	High Demand	2035	81.34
Alpek (DAK Congaree)	Surface Water	IN	High Demand	2040	90.03
Alpek (DAK Congaree)	Surface Water	IN	High Demand	2050	111.09
Alpek (DAK Congaree)	Surface Water	IN	High Demand	2060	136.42
Alpek (DAK Congaree)	Surface Water	IN	High Demand	2070	168.34
CMC Steel	Surface Water	IN	High Demand	2025	0.38
CMC Steel	Surface Water	IN	High Demand	2030	0.43
CMC Steel	Surface Water	IN	High Demand	2035	0.47
CMC Steel	Surface Water	IN	High Demand	2040	0.52
CMC Steel	Surface Water	IN	High Demand	2050	0.64
CMC Steel	Surface Water	IN	High Demand	2060	0.79
CMC Steel	Surface Water	IN	High Demand	2070	0.98
Chargeurs	Surface Water	IN	High Demand	2025	0.19
Chargeurs	Surface Water	IN	High Demand	2030	0.21
Chargeurs	Surface Water	IN	High Demand	2035	0.23
Chargeurs	Surface Water	IN	High Demand	2040	0.25
Chargeurs	Surface Water	IN	High Demand	2050	0.31
Chargeurs	Surface Water	IN	High Demand	2060	0.38
Chargeurs	Surface Water	IN	High Demand	2070	0.47
INEOS (BP Amoco)	Surface Water	IN	High Demand	2025	7.99
INEOS (BP Amoco)	Surface Water	IN	High Demand	2030	8.87
INEOS (BP Amoco)	Surface Water	IN	High Demand	2035	9.84

User	Water Source	Use Category	Projection	Year	Demand (MGD)
INEOS (BP Amoco)	Surface Water	IN	High Demand	2040	10.88
INEOS (BP Amoco)	Surface Water	IN	High Demand	2050	13.44
INEOS (BP Amoco)	Surface Water	IN	High Demand	2060	16.49
INEOS (BP Amoco)	Surface Water	IN	High Demand	2070	20.36
Celanese (DAK)	Surface Water	IN	High Demand	2025	1.78
Celanese (DAK)	Surface Water	IN	High Demand	2030	1.97
Celanese (DAK)	Surface Water	IN	High Demand	2035	2.19
Celanese (DAK)	Surface Water	IN	High Demand	2040	2.42
Celanese (DAK)	Surface Water	IN	High Demand	2050	2.99
Celanese (DAK)	Surface Water	IN	High Demand	2060	3.67
Celanese (DAK)	Surface Water	IN	High Demand	2070	4.53
Ingevity (Kapstone)	Surface Water	IN	High Demand	2025	11.31
Ingevity (Kapstone)	Surface Water	IN	High Demand	2030	12.55
Ingevity (Kapstone)	Surface Water	IN	High Demand	2035	13.93
Ingevity (Kapstone)	Surface Water	IN	High Demand	2040	15.38
Ingevity (Kapstone)	Surface Water	IN	High Demand	2050	19.02
Ingevity (Kapstone)	Surface Water	IN	High Demand	2060	23.31
Ingevity (Kapstone)	Surface Water	IN	High Demand	2070	28.82
Martin Marietta	Surface Water	IN	High Demand	2025	0.79
Martin Marietta	Surface Water	IN	High Demand	2030	0.79
Martin Marietta	Surface Water	IN	High Demand	2035	0.79
Martin Marietta	Surface Water	IN	High Demand	2040	0.79
Martin Marietta	Surface Water	IN	High Demand	2050	0.79
Martin Marietta	Surface Water	IN	High Demand	2060	0.79
Martin Marietta	Surface Water	IN	High Demand	2070	0.79
Sun Chemical	Surface Water	IN	High Demand	2025	4.13
Sun Chemical	Surface Water	IN	High Demand	2030	4.59
Sun Chemical	Surface Water	IN	High Demand	2035	5.09
Sun Chemical	Surface Water	IN	High Demand	2040	5.63
Sun Chemical	Surface Water	IN	High Demand	2050	6.95
Sun Chemical	Surface Water	IN	High Demand	2060	8.54
Sun Chemical	Surface Water	IN	High Demand	2070	10.54
Nucor	Groundwater	IN	High Demand	2025	3.70
Nucor	Groundwater	IN	High Demand	2030	4.10

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Nucor	Groundwater	IN	High Demand	2035	4.55
Nucor	Groundwater	IN	High Demand	2040	5.05
Nucor	Groundwater	IN	High Demand	2050	6.21
Nucor	Groundwater	IN	High Demand	2060	7.65
Nucor	Groundwater	IN	High Demand	2070	9.42
CR Bard	Groundwater	IN	High Demand	2025	0.26
CR Bard	Groundwater	IN	High Demand	2030	0.29
CR Bard	Groundwater	IN	High Demand	2035	0.32
CR Bard	Groundwater	IN	High Demand	2040	0.36
CR Bard	Groundwater	IN	High Demand	2050	0.44
CR Bard	Groundwater	IN	High Demand	2060	0.54
CR Bard	Groundwater	IN	High Demand	2070	0.66
Albany International Corporation, Press Fabrics	Groundwater	IN	High Demand	2025	0.13
Albany International Corporation, Press Fabrics	Groundwater	IN	High Demand	2030	0.14
Albany International Corporation, Press Fabrics	Groundwater	IN	High Demand	2035	0.16
Albany International Corporation, Press Fabrics	Groundwater	IN	High Demand	2040	0.18
Albany International Corporation, Press Fabrics	Groundwater	IN	High Demand	2050	0.22
Albany International Corporation, Press Fabrics	Groundwater	IN	High Demand	2060	0.27
Albany International Corporation, Press Fabrics	Groundwater	IN	High Demand	2070	0.33
AMC/Lanier Sand Operation	Groundwater	IN	High Demand	2025	0.06
AMC/Lanier Sand Operation	Groundwater	IN	High Demand	2030	0.06
AMC/Lanier Sand Operation	Groundwater	IN	High Demand	2035	0.06
AMC/Lanier Sand Operation	Groundwater	IN	High Demand	2040	0.06

User	Water Source	Use Category	Projection	Year	Demand (MGD)
AMC/Lanier Sand Operation	Groundwater	IN	High Demand	2050	0.06
AMC/Lanier Sand Operation	Groundwater	IN	High Demand	2060	0.06
AMC/Lanier Sand Operation	Groundwater	IN	High Demand	2070	0.06
Devro, Inc.	Groundwater	IN	High Demand	2025	0.57
Devro, Inc.	Groundwater	IN	High Demand	2030	0.63
Devro, Inc.	Groundwater	IN	High Demand	2035	0.70
Devro, Inc.	Groundwater	IN	High Demand	2040	0.77
Devro, Inc.	Groundwater	IN	High Demand	2050	0.95
Devro, Inc.	Groundwater	IN	High Demand	2060	1.17
Devro, Inc.	Groundwater	IN	High Demand	2070	1.44
Ingevity South Carolina, LLC/Charleston Chemical Plant	Groundwater	IN	High Demand	2025	0.22
Ingevity South Carolina, LLC/Charleston Chemical Plant	Groundwater	IN	High Demand	2030	0.25
Ingevity South Carolina, LLC/Charleston Chemical Plant	Groundwater	IN	High Demand	2035	0.27
Ingevity South Carolina, LLC/Charleston Chemical Plant	Groundwater	IN	High Demand	2040	0.30
Ingevity South Carolina, LLC/Charleston Chemical Plant	Groundwater	IN	High Demand	2050	0.37
Ingevity South Carolina, LLC/Charleston Chemical Plant	Groundwater	IN	High Demand	2060	0.46
Ingevity South Carolina, LLC/Charleston Chemical Plant	Groundwater	IN	High Demand	2070	0.56
Maguro Enterprises, LLC	Groundwater	IN	High Demand	2025	0.49
Maguro Enterprises, LLC	Groundwater	IN	High Demand	2030	0.56
Maguro Enterprises, LLC	Groundwater	IN	High Demand	2035	0.64
Maguro Enterprises, LLC	Groundwater	IN	High Demand	2040	0.73
Maguro Enterprises, LLC	Groundwater	IN	High Demand	2050	0.95
Maguro Enterprises, LLC	Groundwater	IN	High Demand	2060	1.23
Maguro Enterprises, LLC	Groundwater	IN	High Demand	2070	1.59

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Michelin North America	Groundwater	IN	High Demand	2025	0.11
Michelin North America	Groundwater	IN	High Demand	2030	0.12
Michelin North America	Groundwater	IN	High Demand	2035	0.14
Michelin North America	Groundwater	IN	High Demand	2040	0.15
Michelin North America	Groundwater	IN	High Demand	2050	0.19
Michelin North America	Groundwater	IN	High Demand	2060	0.23
Michelin North America	Groundwater	IN	High Demand	2070	0.28
Shakespeare	Groundwater	IN	High Demand	2025	0.03
Shakespeare	Groundwater	IN	High Demand	2030	0.03
Shakespeare	Groundwater	IN	High Demand	2035	0.04
Shakespeare	Groundwater	IN	High Demand	2040	0.04
Shakespeare	Groundwater	IN	High Demand	2050	0.05
Shakespeare	Groundwater	IN	High Demand	2060	0.06
Shakespeare	Groundwater	IN	High Demand	2070	0.08
United States Air Force, NNPTC - B.2409 Utility Plant	Groundwater	IN	High Demand	2025	0.03
United States Air Force, NNPTC - B.2409 Utility Plant	Groundwater	IN	High Demand	2030	0.03
United States Air Force, NNPTC - B.2409 Utility Plant	Groundwater	IN	High Demand	2035	0.03
United States Air Force, NNPTC - B.2409 Utility Plant	Groundwater	IN	High Demand	2040	0.03
United States Air Force, NNPTC - B.2409 Utility Plant	Groundwater	IN	High Demand	2050	0.03
United States Air Force, NNPTC - B.2409 Utility Plant	Groundwater	IN	High Demand	2060	0.03
United States Air Force, NNPTC - B.2409 Utility Plant	Groundwater	IN	High Demand	2070	0.03
US Silica	Groundwater	IN	High Demand	2025	1.76
US Silica	Groundwater	IN	High Demand	2030	1.76
US Silica	Groundwater	IN	High Demand	2035	1.76
US Silica	Groundwater	IN	High Demand	2040	1.76

User	Water Source	Use Category	Projection	Year	Demand (MGD)
US Silica	Groundwater	IN	High Demand	2050	1.76
US Silica	Groundwater	IN	High Demand	2060	1.76
US Silica	Groundwater	IN	High Demand	2070	1.76
305011001	Surface Water	IR	High Demand	2025	0.00
305011001	Surface Water	IR	High Demand	2030	0.02
305011001	Surface Water	IR	High Demand	2035	0.03
305011001	Surface Water	IR	High Demand	2040	0.04
305011001	Surface Water	IR	High Demand	2050	0.07
305011001	Surface Water	IR	High Demand	2060	0.10
305011001	Surface Water	IR	High Demand	2070	0.14
305011003	Surface Water	IR	High Demand	2025	0.00
305011003	Surface Water	IR	High Demand	2030	0.00
305011003	Surface Water	IR	High Demand	2035	0.00
305011003	Surface Water	IR	High Demand	2040	0.00
305011003	Surface Water	IR	High Demand	2050	0.00
305011003	Surface Water	IR	High Demand	2060	0.00
305011003	Surface Water	IR	High Demand	2070	0.00
305011101	Surface Water	IR	High Demand	2025	0.01
305011101	Surface Water	IR	High Demand	2030	0.03
305011101	Surface Water	IR	High Demand	2035	0.05
305011101	Surface Water	IR	High Demand	2040	0.08
305011101	Surface Water	IR	High Demand	2050	0.13
305011101	Surface Water	IR	High Demand	2060	0.19
305011101	Surface Water	IR	High Demand	2070	0.25
Clayton Rawl	Surface Water	IR	High Demand	2025	0.25
Clayton Rawl	Surface Water	IR	High Demand	2030	0.25
Clayton Rawl	Surface Water	IR	High Demand	2035	0.25
Clayton Rawl	Surface Water	IR	High Demand	2040	0.25
Clayton Rawl	Surface Water	IR	High Demand	2050	0.25
Clayton Rawl	Surface Water	IR	High Demand	2060	0.25
Clayton Rawl	Surface Water	IR	High Demand	2070	0.25
Dargan Culclasure	Surface Water	IR	High Demand	2025	0.23
Dargan Culclasure	Surface Water	IR	High Demand	2030	0.23
Dargan Culclasure	Surface Water	IR	High Demand	2035	0.23

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Dargan Culclasure	Surface Water	IR	High Demand	2040	0.23
Dargan Culclasure	Surface Water	IR	High Demand	2050	0.23
Dargan Culclasure	Surface Water	IR	High Demand	2060	0.23
Dargan Culclasure	Surface Water	IR	High Demand	2070	0.23
Lyons Bros	Surface Water	IR	High Demand	2025	0.04
Lyons Bros	Surface Water	IR	High Demand	2030	0.04
Lyons Bros	Surface Water	IR	High Demand	2035	0.04
Lyons Bros	Surface Water	IR	High Demand	2040	0.04
Lyons Bros	Surface Water	IR	High Demand	2050	0.04
Lyons Bros	Surface Water	IR	High Demand	2060	0.04
Lyons Bros	Surface Water	IR	High Demand	2070	0.04
Palmetta	Surface Water	IR	High Demand	2025	0.18
Palmetta	Surface Water	IR	High Demand	2030	0.18
Palmetta	Surface Water	IR	High Demand	2035	0.18
Palmetta	Surface Water	IR	High Demand	2040	0.18
Palmetta	Surface Water	IR	High Demand	2050	0.18
Palmetta	Surface Water	IR	High Demand	2060	0.18
Palmetta	Surface Water	IR	High Demand	2070	0.18
Ricard	Surface Water	IR	High Demand	2025	0.11
Ricard	Surface Water	IR	High Demand	2030	0.11
Ricard	Surface Water	IR	High Demand	2035	0.11
Ricard	Surface Water	IR	High Demand	2040	0.11
Ricard	Surface Water	IR	High Demand	2050	0.11
Ricard	Surface Water	IR	High Demand	2060	0.11
Ricard	Surface Water	IR	High Demand	2070	0.11
St. Julian	Surface Water	IR	High Demand	2025	0.11
St. Julian	Surface Water	IR	High Demand	2030	0.11
St. Julian	Surface Water	IR	High Demand	2035	0.11
St. Julian	Surface Water	IR	High Demand	2040	0.11
St. Julian	Surface Water	IR	High Demand	2050	0.11
St. Julian	Surface Water	IR	High Demand	2060	0.11
St. Julian	Surface Water	IR	High Demand	2070	0.11
Walker Farm	Surface Water	IR	High Demand	2025	0.01
Walker Farm	Surface Water	IR	High Demand	2030	0.01

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Walker Farm	Surface Water	IR	High Demand	2035	0.01
Walker Farm	Surface Water	IR	High Demand	2040	0.01
Walker Farm	Surface Water	IR	High Demand	2050	0.01
Walker Farm	Surface Water	IR	High Demand	2060	0.01
Walker Farm	Surface Water	IR	High Demand	2070	0.01
Wiles	Surface Water	IR	High Demand	2025	0.05
Wiles	Surface Water	IR	High Demand	2030	0.05
Wiles	Surface Water	IR	High Demand	2035	0.05
Wiles	Surface Water	IR	High Demand	2040	0.05
Wiles	Surface Water	IR	High Demand	2050	0.05
Wiles	Surface Water	IR	High Demand	2060	0.05
Wiles	Surface Water	IR	High Demand	2070	0.05
Agricultural Totals	Groundwater	IR	High Demand	2025	34.07
Agricultural Totals	Groundwater	IR	High Demand	2030	35.33
Agricultural Totals	Groundwater	IR	High Demand	2035	36.64
Agricultural Totals	Groundwater	IR	High Demand	2040	37.99
Agricultural Totals	Groundwater	IR	High Demand	2050	40.86
Agricultural Totals	Groundwater	IR	High Demand	2060	43.94
Agricultural Totals	Groundwater	IR	High Demand	2070	47.26
Martin Marietta Quarry	Surface Water	MI	High Demand	2025	0.00
Martin Marietta Quarry	Surface Water	MI	High Demand	2030	0.00
Martin Marietta Quarry	Surface Water	MI	High Demand	2035	0.00
Martin Marietta Quarry	Surface Water	MI	High Demand	2040	0.00
Martin Marietta Quarry	Surface Water	MI	High Demand	2050	0.00
Martin Marietta Quarry	Surface Water	MI	High Demand	2060	0.00
Martin Marietta Quarry	Surface Water	MI	High Demand	2070	0.00
AMC/Dixiana	Groundwater	MI	High Demand	2025	0.18
AMC/Dixiana	Groundwater	MI	High Demand	2030	0.18
AMC/Dixiana	Groundwater	MI	High Demand	2035	0.18
AMC/Dixiana	Groundwater	MI	High Demand	2040	0.18
AMC/Dixiana	Groundwater	MI	High Demand	2050	0.18
AMC/Dixiana	Groundwater	MI	High Demand	2060	0.18
AMC/Dixiana	Groundwater	MI	High Demand	2070	0.18
Calhoun Sand Mine	Groundwater	MI	High Demand	2025	0.44

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Calhoun Sand Mine	Groundwater	MI	High Demand	2030	0.44
Calhoun Sand Mine	Groundwater	MI	High Demand	2035	0.44
Calhoun Sand Mine	Groundwater	MI	High Demand	2040	0.44
Calhoun Sand Mine	Groundwater	MI	High Demand	2050	0.44
Calhoun Sand Mine	Groundwater	MI	High Demand	2060	0.44
Calhoun Sand Mine	Groundwater	MI	High Demand	2070	0.44
Edmund Sand Mine	Groundwater	MI	High Demand	2025	1.63
Edmund Sand Mine	Groundwater	MI	High Demand	2030	1.63
Edmund Sand Mine	Groundwater	MI	High Demand	2035	1.63
Edmund Sand Mine	Groundwater	MI	High Demand	2040	1.63
Edmund Sand Mine	Groundwater	MI	High Demand	2050	1.63
Edmund Sand Mine	Groundwater	MI	High Demand	2060	1.63
Edmund Sand Mine	Groundwater	MI	High Demand	2070	1.63
Cross Station	Surface Water	PT	High Demand	2025	30.62
Cross Station	Surface Water	PT	High Demand	2030	30.62
Cross Station	Surface Water	PT	High Demand	2035	30.62
Cross Station	Surface Water	PT	High Demand	2040	30.54
Cross Station	Surface Water	PT	High Demand	2050	30.62
Cross Station	Surface Water	PT	High Demand	2060	30.54
Cross Station	Surface Water	PT	High Demand	2070	30.62
Santee Cooper (formerly Jeffries)	Surface Water	PT	High Demand	2025	0.00
Santee Cooper (formerly Jeffries)	Surface Water	PT	High Demand	2030	0.00
Santee Cooper (formerly Jeffries)	Surface Water	PT	High Demand	2035	0.00
Santee Cooper (formerly Jeffries)	Surface Water	PT	High Demand	2040	0.00
Santee Cooper (formerly Jeffries)	Surface Water	PT	High Demand	2050	0.00
Santee Cooper (formerly Jeffries)	Surface Water	PT	High Demand	2060	0.00
Santee Cooper (formerly Jeffries)	Surface Water	PT	High Demand	2070	0.00
Williams Station	Surface Water	PT	High Demand	2025	559.53
Williams Station	Surface Water	PT	High Demand	2030	559.53
Williams Station	Surface Water	PT	High Demand	2035	0.00

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Williams Station	Surface Water	PT	High Demand	2040	0.00
Williams Station	Surface Water	PT	High Demand	2050	0.00
Williams Station	Surface Water	PT	High Demand	2060	0.00
Williams Station	Surface Water	PT	High Demand	2070	0.00
Winyah Station	Surface Water	PT	High Demand	2025	8.47
Winyah Station	Surface Water	PT	High Demand	2030	0.00
Winyah Station	Surface Water	PT	High Demand	2035	0.00
Winyah Station	Surface Water	PT	High Demand	2040	0.00
Winyah Station	Surface Water	PT	High Demand	2050	0.00
Winyah Station	Surface Water	PT	High Demand	2060	0.00
Winyah Station	Surface Water	PT	High Demand	2070	0.00
Cayce	Surface Water	WS	High Demand	2025	4.17
Cayce	Surface Water	WS	High Demand	2030	4.36
Cayce	Surface Water	WS	High Demand	2035	4.57
Cayce	Surface Water	WS	High Demand	2040	4.78
Cayce	Surface Water	WS	High Demand	2050	5.24
Cayce	Surface Water	WS	High Demand	2060	5.74
Cayce	Surface Water	WS	High Demand	2070	6.28
Charleston Water System	Surface Water	WS	High Demand	2025	63.58
Charleston Water System	Surface Water	WS	High Demand	2030	69.87
Charleston Water System	Surface Water	WS	High Demand	2035	76.91
Charleston Water System	Surface Water	WS	High Demand	2040	84.77
Charleston Water System	Surface Water	WS	High Demand	2050	103.40
Charleston Water System	Surface Water	WS	High Demand	2060	126.78
Charleston Water System	Surface Water	WS	High Demand	2070	156.21
Santee Cooper - Lake Marion RWS	Surface Water	WS	High Demand	2025	1.91
Santee Cooper - Lake Marion RWS	Surface Water	WS	High Demand	2030	2.08
Santee Cooper - Lake Marion RWS	Surface Water	WS	High Demand	2035	2.28
Santee Cooper - Lake Marion RWS	Surface Water	WS	High Demand	2040	2.50
Santee Cooper - Lake Marion RWS	Surface Water	WS	High Demand	2050	3.01
Santee Cooper - Lake Marion RWS	Surface Water	WS	High Demand	2060	3.64

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Santee Cooper - Lake Marion RWS	Surface Water	WS	High Demand	2070	4.44
Santee Cooper RWS	Surface Water	WS	High Demand	2025	29.39
Santee Cooper RWS	Surface Water	WS	High Demand	2030	32.09
Santee Cooper RWS	Surface Water	WS	High Demand	2035	35.10
Santee Cooper RWS	Surface Water	WS	High Demand	2040	38.44
Santee Cooper RWS	Surface Water	WS	High Demand	2050	46.32
Santee Cooper RWS	Surface Water	WS	High Demand	2060	56.13
Santee Cooper RWS	Surface Water	WS	High Demand	2070	68.40
American Materials Co.-Dixiana Mine	Groundwater	WS	High Demand	2025	0.01
American Materials Co.-Dixiana Mine	Groundwater	WS	High Demand	2030	0.01
American Materials Co.-Dixiana Mine	Groundwater	WS	High Demand	2035	0.01
American Materials Co.-Dixiana Mine	Groundwater	WS	High Demand	2040	0.01
American Materials Co.-Dixiana Mine	Groundwater	WS	High Demand	2050	0.01
American Materials Co.-Dixiana Mine	Groundwater	WS	High Demand	2060	0.01
American Materials Co.-Dixiana Mine	Groundwater	WS	High Demand	2070	0.01
Calhoun County Municipal Water and Sewer	Groundwater	WS	High Demand	2025	1.01
Calhoun County Municipal Water and Sewer	Groundwater	WS	High Demand	2030	1.06
Calhoun County Municipal Water and Sewer	Groundwater	WS	High Demand	2035	1.11
Calhoun County Municipal Water and Sewer	Groundwater	WS	High Demand	2040	1.16
Calhoun County Municipal Water and Sewer	Groundwater	WS	High Demand	2050	1.27
Calhoun County Municipal Water and Sewer	Groundwater	WS	High Demand	2060	1.39

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Calhoun County Municipal Water and Sewer	Groundwater	WS	High Demand	2070	1.52
Clarendon County Water & Sewer Department	Groundwater	WS	High Demand	2025	0.06
Clarendon County Water & Sewer Department	Groundwater	WS	High Demand	2030	0.07
Clarendon County Water & Sewer Department	Groundwater	WS	High Demand	2035	0.07
Clarendon County Water & Sewer Department	Groundwater	WS	High Demand	2040	0.07
Clarendon County Water & Sewer Department	Groundwater	WS	High Demand	2050	0.08
Clarendon County Water & Sewer Department	Groundwater	WS	High Demand	2060	0.09
Clarendon County Water & Sewer Department	Groundwater	WS	High Demand	2070	0.10
DCPW	Groundwater	WS	High Demand	2025	0.12
DCPW	Groundwater	WS	High Demand	2030	0.12
DCPW	Groundwater	WS	High Demand	2035	0.13
DCPW	Groundwater	WS	High Demand	2040	0.14
DCPW	Groundwater	WS	High Demand	2050	0.15
DCPW	Groundwater	WS	High Demand	2060	0.16
DCPW	Groundwater	WS	High Demand	2070	0.18
DCWA	Groundwater	WS	High Demand	2025	0.83
DCWA	Groundwater	WS	High Demand	2030	0.91
DCWA	Groundwater	WS	High Demand	2035	1.00
DCWA	Groundwater	WS	High Demand	2040	1.09
DCWA	Groundwater	WS	High Demand	2050	1.32
DCWA	Groundwater	WS	High Demand	2060	1.60
DCWA	Groundwater	WS	High Demand	2070	1.94
EASTOVER TOWN OF	Groundwater	WS	High Demand	2025	0.12
EASTOVER TOWN OF	Groundwater	WS	High Demand	2030	0.13
EASTOVER TOWN OF	Groundwater	WS	High Demand	2035	0.14
EASTOVER TOWN OF	Groundwater	WS	High Demand	2040	0.14
EASTOVER TOWN OF	Groundwater	WS	High Demand	2050	0.16
EASTOVER TOWN OF	Groundwater	WS	High Demand	2060	0.17
EASTOVER TOWN OF	Groundwater	WS	High Demand	2070	0.19

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Elloree Water System	Groundwater	WS	High Demand	2025	0.28
Elloree Water System	Groundwater	WS	High Demand	2030	0.30
Elloree Water System	Groundwater	WS	High Demand	2035	0.31
Elloree Water System	Groundwater	WS	High Demand	2040	0.32
Elloree Water System	Groundwater	WS	High Demand	2050	0.35
Elloree Water System	Groundwater	WS	High Demand	2060	0.39
Elloree Water System	Groundwater	WS	High Demand	2070	0.43
Eutawville Town of	Groundwater	WS	High Demand	2025	0.07
Eutawville Town of	Groundwater	WS	High Demand	2030	0.07
Eutawville Town of	Groundwater	WS	High Demand	2035	0.07
Eutawville Town of	Groundwater	WS	High Demand	2040	0.08
Eutawville Town of	Groundwater	WS	High Demand	2050	0.09
Eutawville Town of	Groundwater	WS	High Demand	2060	0.09
Eutawville Town of	Groundwater	WS	High Demand	2070	0.10
GASTON RURAL COMMUNITY WATER DISTRICT	Groundwater	WS	High Demand	2025	0.72
GASTON RURAL COMMUNITY WATER DISTRICT	Groundwater	WS	High Demand	2030	0.75
GASTON RURAL COMMUNITY WATER DISTRICT	Groundwater	WS	High Demand	2035	0.79
GASTON RURAL COMMUNITY WATER DISTRICT	Groundwater	WS	High Demand	2040	0.83
GASTON RURAL COMMUNITY WATER DISTRICT	Groundwater	WS	High Demand	2050	0.90
GASTON RURAL COMMUNITY WATER DISTRICT	Groundwater	WS	High Demand	2060	0.99
GASTON RURAL COMMUNITY WATER DISTRICT	Groundwater	WS	High Demand	2070	1.09
GEORGETOWN COUNTY W&S DISTRICT	Groundwater	WS	High Demand	2025	0.37
GEORGETOWN COUNTY W&S DISTRICT	Groundwater	WS	High Demand	2030	0.41
GEORGETOWN COUNTY W&S DISTRICT	Groundwater	WS	High Demand	2035	0.47

User	Water Source	Use Category	Projection	Year	Demand (MGD)
GEORGETOWN COUNTY W&S DISTRICT	Groundwater	WS	High Demand	2040	0.53
GEORGETOWN COUNTY W&S DISTRICT	Groundwater	WS	High Demand	2050	0.67
GEORGETOWN COUNTY W&S DISTRICT	Groundwater	WS	High Demand	2060	0.85
GEORGETOWN COUNTY W&S DISTRICT	Groundwater	WS	High Demand	2070	1.09
Isle of Palms Water and Sewer Commission	Groundwater	WS	High Demand	2025	0.46
Isle of Palms Water and Sewer Commission	Groundwater	WS	High Demand	2030	0.51
Isle of Palms Water and Sewer Commission	Groundwater	WS	High Demand	2035	0.56
Isle of Palms Water and Sewer Commission	Groundwater	WS	High Demand	2040	0.62
Isle of Palms Water and Sewer Commission	Groundwater	WS	High Demand	2050	0.75
Isle of Palms Water and Sewer Commission	Groundwater	WS	High Demand	2060	0.92
Isle of Palms Water and Sewer Commission	Groundwater	WS	High Demand	2070	1.13
Kiawah Island Utility Inc. (WS)	Groundwater	WS	High Demand	2025	0.01
Kiawah Island Utility Inc. (WS)	Groundwater	WS	High Demand	2030	0.01
Kiawah Island Utility Inc. (WS)	Groundwater	WS	High Demand	2035	0.02
Kiawah Island Utility Inc. (WS)	Groundwater	WS	High Demand	2040	0.02
Kiawah Island Utility Inc. (WS)	Groundwater	WS	High Demand	2050	0.02
Kiawah Island Utility Inc. (WS)	Groundwater	WS	High Demand	2060	0.03
Kiawah Island Utility Inc. (WS)	Groundwater	WS	High Demand	2070	0.03
Moncks Corner Water Works	Groundwater	WS	High Demand	2025	0.02
Moncks Corner Water Works	Groundwater	WS	High Demand	2030	0.02
Moncks Corner Water Works	Groundwater	WS	High Demand	2035	0.02

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Moncks Corner Water Works	Groundwater	WS	High Demand	2040	0.02
Moncks Corner Water Works	Groundwater	WS	High Demand	2050	0.03
Moncks Corner Water Works	Groundwater	WS	High Demand	2060	0.03
Moncks Corner Water Works	Groundwater	WS	High Demand	2070	0.04
Mt Pleasant Waterworks	Groundwater	WS	High Demand	2025	5.47
Mt Pleasant Waterworks	Groundwater	WS	High Demand	2030	6.02
Mt Pleasant Waterworks	Groundwater	WS	High Demand	2035	6.62
Mt Pleasant Waterworks	Groundwater	WS	High Demand	2040	7.32
Mt Pleasant Waterworks	Groundwater	WS	High Demand	2050	8.90
Mt Pleasant Waterworks	Groundwater	WS	High Demand	2060	10.95
Mt Pleasant Waterworks	Groundwater	WS	High Demand	2070	13.45
PINEWOOD TOWN OF	Groundwater	WS	High Demand	2025	0.08
PINEWOOD TOWN OF	Groundwater	WS	High Demand	2030	0.09
PINEWOOD TOWN OF	Groundwater	WS	High Demand	2035	0.09
PINEWOOD TOWN OF	Groundwater	WS	High Demand	2040	0.09
PINEWOOD TOWN OF	Groundwater	WS	High Demand	2050	0.10
PINEWOOD TOWN OF	Groundwater	WS	High Demand	2060	0.11
PINEWOOD TOWN OF	Groundwater	WS	High Demand	2070	0.12
SC Depart of Corrections Division of Facilities Management	Groundwater	WS	High Demand	2025	0.24
SC Depart of Corrections Division of Facilities Management	Groundwater	WS	High Demand	2030	0.24
SC Depart of Corrections Division of Facilities Management	Groundwater	WS	High Demand	2035	0.24
SC Depart of Corrections Division of Facilities Management	Groundwater	WS	High Demand	2040	0.24
SC Depart of Corrections Division of Facilities Management	Groundwater	WS	High Demand	2050	0.24
SC Depart of Corrections Division of Facilities Management	Groundwater	WS	High Demand	2060	0.24

User	Water Source	Use Category	Projection	Year	Demand (MGD)
SC Depart of Corrections Division of Facilities Management	Groundwater	WS	High Demand	2070	0.24
Seabrook Island Utility Commission	Groundwater	WS	High Demand	2025	0.46
Seabrook Island Utility Commission	Groundwater	WS	High Demand	2030	0.50
Seabrook Island Utility Commission	Groundwater	WS	High Demand	2035	0.55
Seabrook Island Utility Commission	Groundwater	WS	High Demand	2040	0.61
Seabrook Island Utility Commission	Groundwater	WS	High Demand	2050	0.74
Seabrook Island Utility Commission	Groundwater	WS	High Demand	2060	0.91
Seabrook Island Utility Commission	Groundwater	WS	High Demand	2070	1.12
St. Matthews Town of	Groundwater	WS	High Demand	2025	0.34
St. Matthews Town of	Groundwater	WS	High Demand	2030	0.35
St. Matthews Town of	Groundwater	WS	High Demand	2035	0.37
St. Matthews Town of	Groundwater	WS	High Demand	2040	0.39
St. Matthews Town of	Groundwater	WS	High Demand	2050	0.42
St. Matthews Town of	Groundwater	WS	High Demand	2060	0.46
St. Matthews Town of	Groundwater	WS	High Demand	2070	0.51
SUMMERTON TOWN OF	Groundwater	WS	High Demand	2025	0.33
SUMMERTON TOWN OF	Groundwater	WS	High Demand	2030	0.34
SUMMERTON TOWN OF	Groundwater	WS	High Demand	2035	0.36
SUMMERTON TOWN OF	Groundwater	WS	High Demand	2040	0.38
SUMMERTON TOWN OF	Groundwater	WS	High Demand	2050	0.41
SUMMERTON TOWN OF	Groundwater	WS	High Demand	2060	0.45
SUMMERTON TOWN OF	Groundwater	WS	High Demand	2070	0.50
Summerville CPW	Groundwater	WS	High Demand	2025	0.03
Summerville CPW	Groundwater	WS	High Demand	2030	0.03
Summerville CPW	Groundwater	WS	High Demand	2035	0.04
Summerville CPW	Groundwater	WS	High Demand	2040	0.04
Summerville CPW	Groundwater	WS	High Demand	2050	0.05
Summerville CPW	Groundwater	WS	High Demand	2060	0.06
Summerville CPW	Groundwater	WS	High Demand	2070	0.07

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Town of Sullivan Island Water & Sewer Department	Groundwater	WS	High Demand	2025	0.01
Town of Sullivan Island Water & Sewer Department	Groundwater	WS	High Demand	2030	0.01
Town of Sullivan Island Water & Sewer Department	Groundwater	WS	High Demand	2035	0.01
Town of Sullivan Island Water & Sewer Department	Groundwater	WS	High Demand	2040	0.01
Town of Sullivan Island Water & Sewer Department	Groundwater	WS	High Demand	2050	0.01
Town of Sullivan Island Water & Sewer Department	Groundwater	WS	High Demand	2060	0.01
Town of Sullivan Island Water & Sewer Department	Groundwater	WS	High Demand	2070	0.01

Appendix B

Draft and Final Plan Survey Consensus Results

To assess each RBC member's confidence in the plan, the plan approval process dictates that there will be a test for consensus on the Draft River Basin Plan and a vote of support or disagreement on the Final River Basin Plan. For the test of consensus on the Draft Plan, each member rates their concurrence with the plan using a five-point scale, as shown below:

1. Full Endorsement (i.e., member likes it).
2. Endorsement but with minor points of contention (i.e., basically member likes it).
3. Endorsement but with major points of contention (i.e., member can live with it).
4. Stand aside with major reservations (i.e., member cannot live with it in its current state and can only support it if changes are made).
5. Withdraw - Member will not support the draft river basin plan and will not continue working within the RBC's process. Member has decided to leave the RBC.

For the Final River Basin Plan, each RBC member votes simply to support or disagree with the plan. By indicating support, the member would be acknowledging his/her concurrence with the Final River Basin Plan and their commitment to support implementation of the plan. The RBC member's votes on the Draft and Final River Basin Plans are listed below.

Table B-1. Level of consensus for the Draft and Final River Basin Plan.

RBC Member	Draft Plan Level of Endorsement	Final Plan Support or Disagree
Todd Biegger	**1**	
Allan Clum	**1**	
Hixon Copp	**1**	
Riley Egger*	*Not active/did not vote*	
John Grego	**2**	
W.E. Mickey Johnson, Jr.*	*Not active/did not vote*	
Michael Melchers	**2**	
Jeff Ruble*	*Not active/did not vote*	
Brandon Stutts	*Did not vote*	
Jason Thompson	**3**	
David Wielicki	**1****	
Sarah Wiggins	**1**	
Alicia Wilson	**1**	
Mike Wooten	**1**	

** Member was not active at the time this River Basin Plan was prepared and did not vote on the Plan.*

*** Member voted "Yes".*

Appendix C
Public Comments and Responses