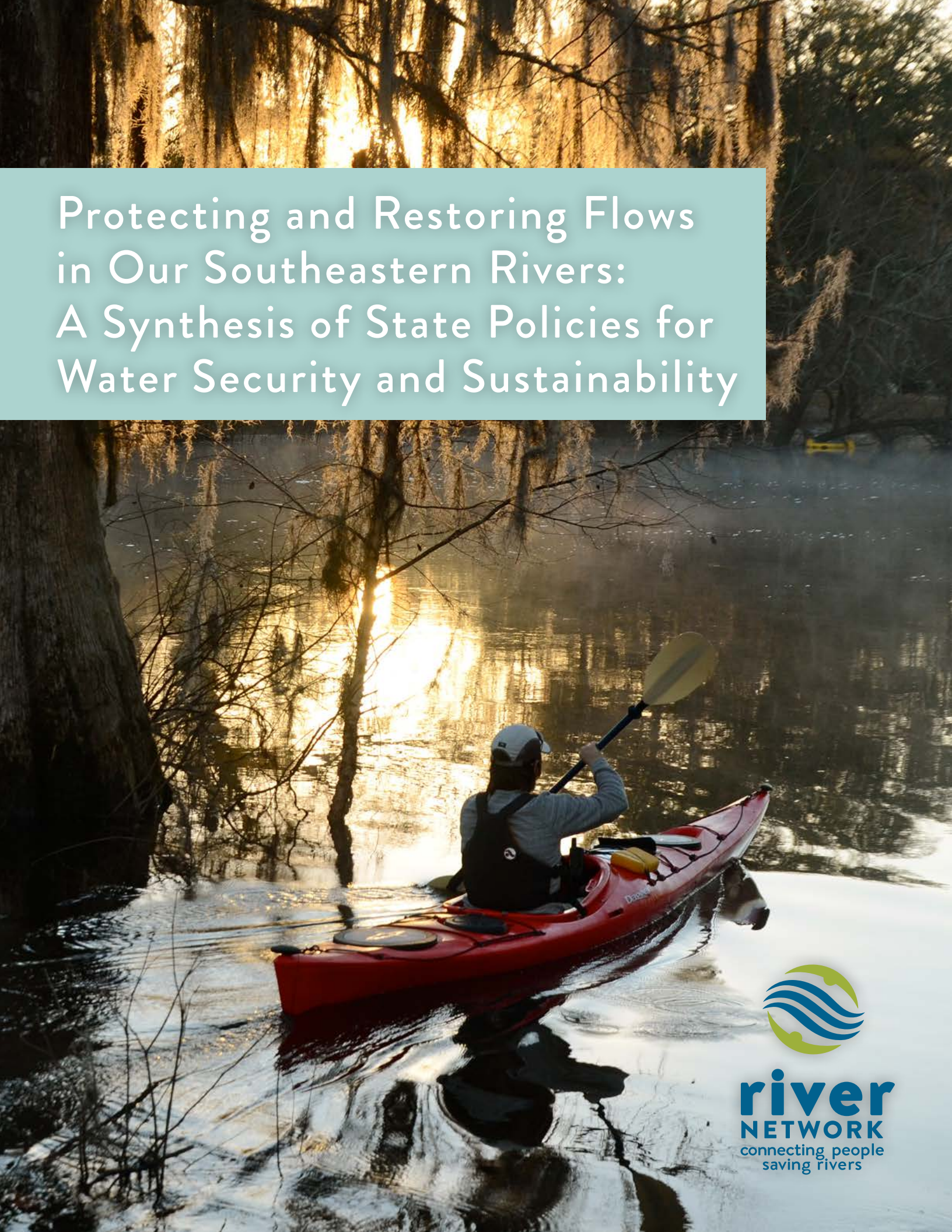
Protecting and Restoring Flows in Our Southeastern Rivers: A Synthesis of State Policies for Water Security and Sustainability



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WRITTEN BY KATHERINE BAER AND APRIL INGLE, RIVER NETWORK (2016)

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River Network empowers and unites people and communities to protect and restore rivers and other waters that sustain all life. We envision a future of clean and ample water for people and nature, where local caretakers are well equipped, effective and courageous champions for our rivers. Our three strategies for focused investment are strong champions, clean water, and ample water.

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EXECUTIVE SUMMARY

Southeastern rivers are places of grand beauty, world-class fisheries, unparalleled biodiversity, and outstanding canoeing and kayaking. The abundance of rainfall and water flowing in these rivers has also fueled phenomenal growth in the southeast. In addition to their beauty and fish, wildlife and recreation values, southeastern rivers are heavily relied upon to provide water for growing populations, industry and agriculture, as well assimilate the resulting wastewater. While water has been historically abundant in the southeast, the region is facing increasing water stress. Construction and operation of dams and reservoirs, water withdrawals, water transfers, wasteful water use, wastewater discharges, and increased development have placed southeastern rivers at risk, with rivers in some places running dry. Climate change creates additional pressure on water security and sustainability, making smart policy choices now even more important to protect and restore healthy rivers and communities.

Fortunately, the southeast is also home to many community and watershed groups dedicated to improving their local waterways and using a variety of approaches to protect and restore their rivers. Based on feedback from the watershed community, this report focuses on the important role of—and opportunity for—state-based policies to tackle these risks to ensure southeastern rivers with healthy flows for people and nature. To address the range of threats to river flows in the region, we selected a range of policies starting with the scientific foundations of water budgets and moving to supply management and flow protection and then demand management and finally the management of the built environment. While evaluated separately, these policies are clearly overlapping and should ideally be considered in an integrated manner.

Overall, there is much room for improvement of these southeastern state policies, but there are also a number of bright spots and opportunities to build on strong foundations. Georgia, for instance, has one of the strongest policies for reducing water loss, a key policy for reducing water demand, in the country. Tennessee makes strong use of Clean Water Act permitting to maintain healthy flows and South Carolina recently required surface water withdrawal permitting for the first time. All of these advances have been influenced by work of the watershed community in shaping policy and watchdogging implementation.

The scorecard on the next page is fully explained throughout this report, but highlights include:

UNDERLYING WATER LAW

Some southeastern states, like Alabama and North Carolina, are limited by their failure to move to "regulated riparianism," which allows states to authorize uses as part of a comprehensive process and to place restrictions on withdrawals and use based on amount, timing, environmental impact, and other factors as well as to allow all communities to access water supply **(see Water Law Box).**

WATER BUDGETS AND ENVIRONMENTAL FLOW CRITERIA

A core requirement for sustainable water management is knowing how much water is being used and returned and developing recommendations for environmental flows. Unfortunately, southeastern states have yet to fully undertake detailed water budgeting for their watersheds leaving a major gap in information and a huge opportunity to build a more substantial foundation for effective water supply planning and management. Only North Carolina has a strong and scientifically credible approach for determining environmental flows **(see sections on Water Budgeting and Flow Protection).**

MANAGING SUPPLY

Policies relating to supply of water that can affect flows include water withdrawal permitting and tracking, interbasin transfer evaluation and water planning. Most southeastern states have some sort program for tracking water withdrawals but only a few have programs to permit withdrawals with conditions or limits, mostly for surface waters. North Carolina and Alabama do not have a system for permitting water withdrawals. Interbasin transfers have resulted in significant net losses of water and flows in donor river basins in the region and the transfers are mostly only nominally addressed. North Carolina has the strongest interbasin transfer policies in the southeast, with the other states having some policy in place but with significant opportunities to strengthen and improve them. Water plans are another opportunity to sustainably manage water supplies and tie together and incorporate many of the policy opportunities highlighted in this report. While all southeastern states have done—or are in the process of doing—some level of water planning (notably Alabama's current water planning effort), all states have significant opportunities for improvement and especially tying plans to implementation **(see sections on Water Withdrawals, Interbasin Transfers and Water Plans)**.

FLOW PROTECTION

Strong environmental flow policies require both science-based environmental flow criteria as well as mechanisms or policies to apply the criteria. Water allocation and withdrawal permitting policy is one way to apply environmental flow protections, and water quality standards are another. Southeastern states generally don't have strong policies for flow protection although excellent models and technical resources exist. Of the states examined, Tennessee leads the way combining use of water quality standards and water withdrawal permitting that both consider flow criteria. The other southeastern states reviewed have made smaller steps that need significant improvements to effectively protect flows **(see section on Flow Protections)**.

REDUCING DEMAND

Water conservation and efficiency can be the cheapest, most reliable, and sustainable water supply source, and states can enact policy that make it the first option communities evaluate and pursue to meet their water supply needs. Although reduced water use doesn't automatically transfer to more water in our rivers, it is a prerequisite to a sustainable water management approach. If we hope to restore water to our depleted rivers and aquifers, we need to find ways to substantially reduce consumptive losses through conservation and efficiency. This report highlights five state policy opportunities for water conservation and efficiency including water loss, conservation and efficiency as part of drought planning, conservation planning, and permitting requirements, and state funding for conservation and efficiency. While there has been progress toward in reducing water use in the southeast, much of it has resulted from local or regional requirements, leaving room for advances in state policy. Georgia's water loss policy is an exception as it is considered one of the strongest in the country. Additionally, regional EPA guidelines for evaluating new water supply projects include thorough use of conservation and efficiency as part of the application process **(see section on Reducing Demand)**.

BUILT ENVIRONMENT

As the southeast continues to grow and sprawl, attention to the "built environment" can help reduce the demand for water and create more natural systems that contribute to and replenish our streams and rivers. The way buildings, roads, and landscapes are designed and developed greatly impacts the amount of water flowing in nearby waterways in at least two key ways. First, building

and appliance water efficiency affects the amount of water that has to be withdrawn and treated to meet water supply needs. States can go above and beyond the federal requirements and require fixtures and appliances to make buildings even more efficient, but Georgia is the only southeast state reviewed that has done so. Second, development and corresponding increases in impervious surfaces affects the way rainfall infiltrates and flows off the landscape, increasing storm flows and decreasing base flow to replenish nearby streams. Through stormwater permitting, states can encourage or require development to more closely mimic natural landscapes and hydrology by retaining certain amounts of water on-site. Although there are excellent examples from around the country, the southeast has yet to adopt this approach in any meaningful way and permit requirements are being weakened in some places **(see Section on Built Environment)**.

While there are sustainable water management successes to celebrate and emulate in the southeast, there are also significant opportunities to advance policies for water security and healthy river flows based on examples and ideas from a variety of places within and outside the region. Every place is governed by a different set of political, legal, environmental and institutional factors– we hope that this evaluation will help inspire and lay a strong foundation for change when the time is right.

State Policy Scorecard

	AL	GA	NC	SC	TN	OTHER MODELS
Water budgets (state and/or basinwide)	RED	YELLOW	YELLOW	YELLOW	RED	
Surface water and ground water withdrawals tracking, monitoring & permitting	RED	YELLOW	RED	YELLOW	YELLOW	Michigan
Flow protections	RED	YELLOW	YELLOW	YELLOW	GREEN	Florida, Mississippi, Connecticut
Interbasin transfer evaluations	RED	YELLOW	GREEN	YELLOW	YELLOW	Massachusetts, Georgia Policy proposal
State water plans	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW	
Water loss	RED	GREEN	YELLOW	YELLOW	YELLOW	
Drought planning	RED	YELLOW	YELLOW	RED	RED	Texas
Water conservation & efficiency planning & assessment	RED	YELLOW	RED	RED	RED	Rhode Island
Permitting requirements for water conservation & efficiency	RED	YELLOW	RED	RED	RED	Massachusetts, EPA Region 4
Funding for water conservation & efficiency	YELLOW	GREEN	YELLOW	YELLOW	YELLOW	
State building appliance standards	RED	GREEN	RED	RED	RED	
State stormwater permits require on-site retention	RED	RED	YELLOW	GREEN	YELLOW	West Virginia

KEY

GREEN
Strong policy in place and being implemented.

YELLOW
Weak policy in place or strong policy in place but lacking on implementation.

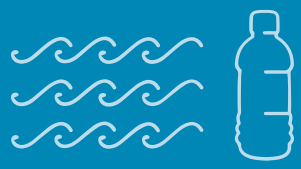
RED
No policy in place.

INTRODUCTION

Rivers of the Southeast are home to unparalleled freshwater biodiversity and provide drinking water to almost two-thirds of the population. These rivers link our communities together, providing places for paddling, swimming, fishing, and gathering, as well as a strong economic base. Historically an area of relative water abundance, the Southeast has experienced rapid expansion of water stress over the past decades from a variety of sources, including population growth, increased development and corresponding impervious cover, reservoir construction and dam management, and water withdrawals and transfers. These actions alter the flows in our rivers, often leaving them depleted or dry, or facing high flows that cause erosion and flood communities. With almost two-thirds of all U.S. fish species and over 90% of all mussel species found in Southeastern rivers, flow alterations impact the diverse heritage of our region and also create uncertainty for people downstream relying on water for drinking, recreation, agriculture, industry, and energy production. Climate change creates additional pressure on water security and sustainability, with some parts of the region predicted to become wetter and other parts drier, and floods and droughts becoming more intense. The stress on water availability and river flows across the region is already reflected in a series of legal battles over water allocation in several key basins.

There are solutions. Ranging from the local to national levels, communities are successfully working to protect and restore healthy rivers for people and nature. The goal of this report is to provide resources, analyses, and case studies to inform further policy developments at the state level. There are also important opportunities to advance policies for healthy flows at the federal and local levels, and as part of specific permit and legal negotiations, multi-state compacts and as part of individual voluntary and incentive-based transactions. The focus of this report, however, is on state-level policies, identified as a resource gap by our watershed and community group members and partners.

For methodology, we selected five southeastern states—Tennessee, Alabama, Georgia, North Carolina and South Carolina—to do a comparative analysis of their state water supply policies. We interviewed a number of practitioners across the region and surveyed our members to determine policies on which to focus. Once selected, River Network staff and graduate students at the University of Georgia's River Basin Center researched each policy in all five of the focus states through analysis of the states' legal and regulatory documents, and state government information, as well as white papers and



Rivers of the Southeast provide drinking water to almost ***two-thirds*** of the population.

existing analysis by organizations including the Southern Instream Flow Network and the Alliance for Water Efficiency. Once the initial findings were documented, we interviewed watershed groups in each of the five states and followed up with outreach and questions to relevant state agency staff. The report draft was reviewed in part or whole by 16 individuals followed by further fact checking, outreach and synthesis.

We alter flows in our Southeastern rivers by factors including: 1) dam operations and evaporative losses from large and small impoundments; 2) impervious surfaces, like roads and rooftops, that increase runoff and decrease baseflow; and 3) consumptive use of surface water—either the cumulative impacts of a number of small users or localized impacts caused by larger withdrawals.[1] Because of the diverse nature of these threats, the policies to protect and restore our rivers must comprehensively span these problems. As a result, the policies we selected to evaluate include specific flow protections, as well as water withdrawal permitting, water conservation and efficiency measures, and policies to reduce impervious surfaces (dam reoperations are also an important tool that is outside the scope of this report). The Southeast is already home to an abundance of reservoirs, but making the case against further unnecessary reservoir development will depend on good planning, reducing current water loss rates, and increasing water efficiency. Similarly, with the expected growth in the region, preventing, reducing, or removing impervious surfaces is an important strategy to protect streams and rivers. While these policies are presented in separate sections, they are overlapping and ideally should be considered as inherently integrated.

As part of River Network's work to engage citizens to take a stand for their waters, this policy synthesis is intended as a resource to provide context for these issues, evaluate and analyze a range of state policy opportunities, provide highlights and models, and suggest next steps communities can take as they chart policy priorities. Watershed advocates work in a variety of different political and social settings, and strategic opportunities to move policy forward present themselves in different ways and at different times. We hope that this compendium helps citizens to be prepared to make those changes happen when the time is right.

Water Law and Your River

State law generally governs how water rights are allocated and assigned, except when otherwise reserved for federal purposes (e.g., federal lands and rights associated with sovereign nations/tribes). There are two basic, and different, systems of water law in the United States, which determine how water rights are allocated and assigned and underpin state water supply policies. States in the Western U.S. use a "prior appropriation" system, while Eastern U.S. states use a "riparian rights" system, further divided into "traditional riparian rights" and "regulated riparianism."

The *prior appropriation doctrine* is largely followed by states west of the Mississippi River and has historical roots in the need to divert water for mining activities and in some areas, scarcity. Prior appropriation water law says the first person to put water from a waterbody to beneficial use has "Senior Rights" and has a priority right to that water for that use on an ongoing basis. Others who later use water from that waterbody have "Junior Rights" and only have rights to the water after the needs of the person with senior rights are fully satisfied. These senior and junior rights are transferable and land ownership is not required to obtain a water right. When there is a shortage of water, later users lose the right to water first; other rights holders are not required to reduce water use to ensure water for those with less junior rights.

States east of the Mississippi River traditionally follow the *riparian doctrine*, whereby the owner of land that borders a waterbody, river, or lake has the right to a "reasonable use" of that water. This right is shared by other riparian land owners, cannot be lost by nonuse, and generally cannot be separated from the land. When there is a shortage of water, all landowners with rights share in the loss. Under the riparian doctrine, defining "reasonable use" falls to the courts when there is a dispute, which can lead to lengthy litigation, uncertainty, and a large body of precedent in each state. For instance, in North Carolina, which still largely operates under this doctrine, the City of Greensboro recently was sued and forced to pay downstream hydroelectric plants for damages caused by the diversion of water for a

public water supply reservoir because the hydroelectric plants were riparian users and the City was not.[2]

Over the last several decades, as pressure on water resources has grown, many Eastern states have found the litigation-dependent riparian rights doctrine increasingly unworkable, and have modified their water law by statute to create an administrative system of permitting and allocation. This system, referred to as "regulated riparianism," is typically codified in state statutes, and moves away from judicially determined standards of reasonableness, replacing them with permit systems that protect legislatively enacted priorities.[3] This approach allows states to authorize uses as part of a comprehensive process and to place restrictions on withdrawals and use based on amount, timing, environmental impact, and other factors, as well as to allow communities to access water supply.[4]

The American Society of Civil Engineers publishes a Regulated Riparian Model Water Code with provisions for states to adopt. However, states typically have moved toward regulated riparianism in a more incremental manner, leading to a patchwork of approaches detailed throughout this report.[5]

The following chart indicates Southeastern states that have adopted some form of regulated riparianism:[6]

	Riparian	Regulated Riparian	
ALABAMA	X		Register water use
ArKANSAS		X	
FLORIDA		X	
GEORGIA		X	
KENTUCKY	X		
LOUISIANA		X	
MISSISSIPPI		X	
NORTH CAROLINA	X		Report water use
SOUTH CAROLINA		X	
TENNESSEE		X	

RESOURCES–LEARN MORE:

Water Law in a Nutshell, 5th ed. by David H. Getches, Sandra B. Zellmer & Adell L. Amos. (2015).

STATE POLICIES for Water Budgets

Water Budget Policy Scorecard	AL	GA	NC	SC	TN
Water budgets (state and/or basinwide)					

Introduction

As a first step in effectively understanding and managing our rivers, a state agency, watershed group or other entity needs to understand that particular resource's *water budget*: how much water is flowing, raining, or seeping into and out of the system, and how the water is used—the withdrawals, return flows, and consumptive losses **(see figure 1)**. Water budgets are quantitative descriptions of all the water resources available and the demands on them in a defined hydrologic system. Water budgets may be conducted at the reservoir or aquifer scale, but usually are conducted at the watershed—or river basin—scale. Water budgets are generally constructed based on currently observed data and therefore are not useful in determining how constraints and demands have changed resources historically, but instead in providing a foundation for effective planning and management moving forward.[7] For example, a water budget developed for the Ipswich River Basin in Massachusetts enabled decision-makers to pinpoint groundwater withdrawals as the cause of recurrent riverbed drying, and craft a targeted, science-based policy response that includes groundwater withdrawal limits for water-supply wells.[8]

A comprehensive water budget will include all water inputs and outputs, as well as fluxes of water between different components, for a defined hydrologic system. The water budget breaks the system down into the following basic components: precipitation, surface water and groundwater inflows and outflows, evapotranspiration, change in storage (surface water, groundwater, snow, and ice), interbasin transfers, and withdrawals. The U.S. Geological Survey (USGS) is developing water budget best practices, which aim to address some of the uncertainties that previously hindered the development of water budgets. Pilot studies (in the Southwest and Great Lakes) and focus area studies (in

KEY

GREEN

Full existence of water budgets created for entire state (either one for state or comprehensive combination of basin budgets) and water budget information is used in policy and management decisions (no states met these criteria).

YELLOW

Partial or negligible existence of water budgets and implementation of water budget through management and policies (e.g. some water budgets created but policies guiding process lacking, water budgets created for only certain basins and not others, water budget policies created but not implemented).

RED

No existing water budgets or policies to guide their creation.

the Apalachicola-Chattahoochee-Flint, Colorado, and Delaware River Basins) are helping USGS scientists overcome the challenges of data integration, understand the role of water in supporting ecological systems, and address validity and uncertainty issues associated with water budget development.[9]

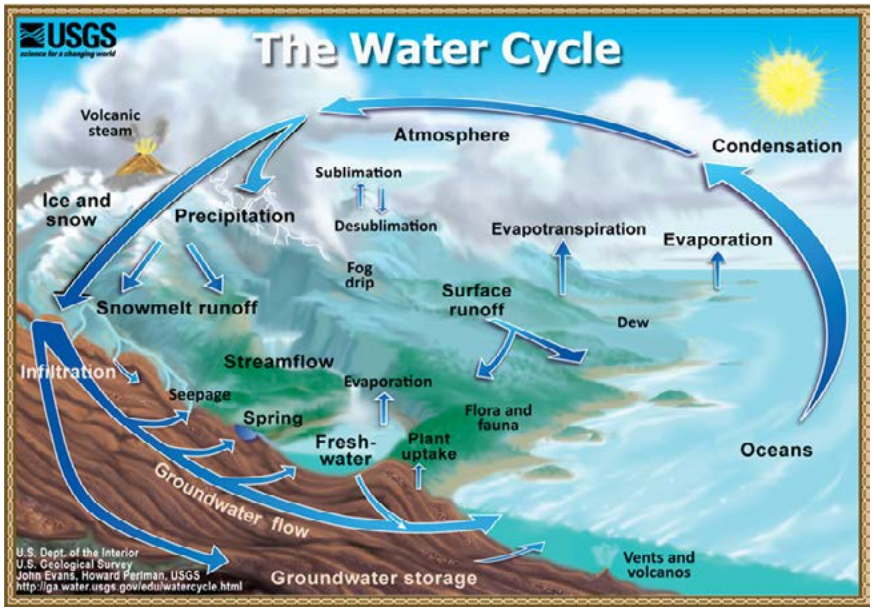


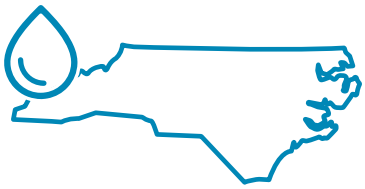
FIGURE 1–The Water Cycle (USGS)

This analysis of state policies relating to the formation or support of water budgets reveals that Southeastern states are largely lacking in this area, resulting in a lack of baseline accounting for river systems. However, some individual basins may have detailed water budgets due to other drivers like interstate water disputes. Of the states we reviewed, North Carolina has a detailed approach to developing water budgets in place but lacks broad implementation. Georgia has a process to develop consumptive use assessments tied to state water plan requirements that provides some elements of a water budget. South Carolina is in the process of developing modeling that can inform water budgets. Alabama and Tennessee do not have policies supporting water budget development.

LEARN MORE

To learn more about water budgets and how they are created, including how to use the USGS Water Census, please see River Network's online science module on **Environmental Flows and Water Security** with several components focused on understanding and developing water budgets.

Analysis of State Policies



NORTH CAROLINA

Starting in 2010, North Carolina law required the North Carolina Department of Environmental Quality (NCDEQ) to develop basin-wide hydrologic models for the state's 17 river basins.[10] Each model should include both surface water and groundwater resources within the river basin, transfers, withdrawals, ecological flow, instream flow requirements, projections of future withdrawals, estimates of return flows, inflow data, local water supply plans, and any other relevant scientific and technical information.[11] The model must be designed to simulate the flows of surface water resources to allow evaluation of proposed water transfers on source waters, and be designed to predict when yield may be inadequate and ecological flow may be adversely affected.[12]

After the model is complete, NCDEQ must submit the model to the N.C. Environmental Management Commission for approval, publication and a 60-day comment period.[13] The NCDEQ Division of Water Resources (DWR) includes an interactive map indicating hydrological unit assignments for particular areas of the state.[14] While North Carolina does not specifically refer to hydrologic models as a water budget, the method for hydrologic modeling is comprehensive and includes public participation through notice and comment procedures. Thus far, only five out of the 17 planned basins' models have been completed.[15] The state's process to establish an approach to identifying ecological flows is covered in the section on instream flow policies.

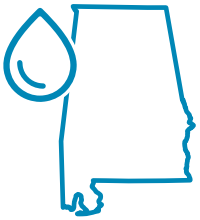
GEORGIA

While Georgia does not require the development of water budgets, per se, it does require consumptive use assessments and demand forecasts for each of the state's major river basins.[16] The consumptive use assessment quantifies the amount of water readily available during dry years for consumptive use, from both rivers and aquifers, after accounting for in-aquifer needs and flow regime requirements. In most cases this is only 7Q10 (the 7Q10 flow measure provides a conservative, minimum measure to determine chemical limits for Clean Water Act pollution discharge permits, but is not intended to indicate the range of flows needed to sustain a healthy river system—**see section on flow policies**). However, consumptive use in excess of the assessed availability is still allowed during normal and wet years. These consumptive use assessments are compared against forecasted water demands in the development of Water Resource Development and Conservation Plans.

The Georgia Environmental Protection Division (GAEPD) is the lead agency for implementing the state water planning process **(see water plan section)**, which includes water resource assessments for each of the state's 10 water-planning regions to identify gaps between water supply and demand for their regions.[17] Water resource assessments include: surface water availability,

groundwater availability, and surface water quality (assimilative capacity). Model forecasting includes water and wastewater demands across energy, agriculture, municipal, and industrial water use sectors.[18] The water resource assessments are compared to the forecasts to identify basins where demand forecasts can outstrip assessed resources, which are then targeted to develop regional Water Resource Development and Conservation Plans.[19]

Consumptive use assessments are complete for all of Georgia's major river basins. However, consumptive use assessments for aquifers lag behind as they are considered "extraordinarily expensive" and "time consuming."[20] Moreover, water efficiency is not taken into account by demand forecasts, thus overstating the water needed into the future.[21] In addition, the instream flow needs in this planning exercise were determined by using the State's interim instream flow policy that most often protects only very low instream flows (7Q10 flows). Finally, these consumptive use assessments are themselves only a portion of what is included in a water budget, which would also incorporate measures of inflows and non-consumptive uses.



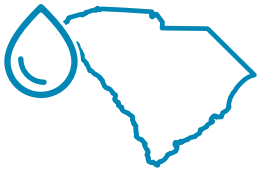
ALABAMA

In Alabama, there is no official statewide water budget, nor any requirement to create one, although there are plans to start this process. Historically, the Alabama Office of Water Resources (OWR) has conducted assessments of water resource availability and demands in a piecemeal fashion for disputed interstate river basins (e.g. Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa River Basins) and large or unregulated smaller streams. The OWR created a quick screening tool, called the Water Use Index, to identify basins that will potentially be water-stressed in the future. This tool, which broadly compares regional water demands and availability, identified several basins for further assessment.

As part of Alabama's work to develop a statewide water plan **(see water plan section)**, a comprehensive and integrative assessment of surface and groundwater resources is being developed.[22] Currently, surface water budgets cannot be calculated because baseflows for all of the state's river basins (and quantitative withdrawals from different sources) are not known. Following a pilot study, several state agencies are attempting to "establish the integrated process, methodologies, and timeline for the statewide assessment of water availability."[23] Once the pilot study is complete, the assessment process will be refined and, pending funding, may be extended to the entire state. However, recent budget cuts make this unlikely in the near future.

While this assessment process will be used to "graphically depict" water availability, it falls short of creating effective water budgets. The assessment process will report "how much water remains to meet instream flow needs

as well as other downstream and future needs," but does not address consumptive losses.[24] Moreover, water availability will be expressed in terms of Average Annual Daily Flow, instead of a more detailed measure like average daily flow, which is better for understanding many important management issues.[25] While Alabama has taken modest steps towards a better understanding of water availability statewide, there is a great need for continued funding and political support to ensure the assessment process is extended to the entire state, and that consumptive losses are identified.



SOUTH CAROLINA

Currently, there are no statewide or localized water budgets in South Carolina. The South Carolina Department of Natural Resources (SCDNR) has periodically released an assessment of the state's water resources and use via the South Carolina Water Assessment (last updated in 2009), and the corresponding South Carolina Water Plan **(see planning section below)**. However, both of these documents are now dated and are not used for decision-making.

The 2009 South Carolina State Water Assessment, based on 2006 data, provides a general overview of surface and groundwater sources in the state (e.g. major river basins and sub-basins), describes streamflow monitoring methods and monitoring station locations; includes average streamflow data for the state's major river basins and corresponding sub-basins; and provides descriptions of the different factors affecting those streamflows.[26] The State Water Assessment also provides a general overview of water use in the state, and for each major river basin and corresponding sub-basins, and it identifies the major categories of water users plus estimated quantities used by registered withdrawers from each category.[27] Further, the assessment distinguishes between instream and off-stream uses and includes specific data on consumptive water use for each use category in the corresponding sub-basin.[28]

South Carolina is currently developing mass-balance surface water models for each of the state's eight major river basins to better determine its available surface water. The impact of groundwater withdrawals on surface water is not included in this phase.[29] The modeling process includes withdrawers who are required to report use—those who withdraw three million gallons a month (100,000 gallons per day) or more **(see withdrawal permitting section)**. Separate surface water and groundwater modeling and availability assessments will be conducted which, along with future demand forecasts, will provide a basis for development of more comprehensive and detailed statewide and regional water plans and budgets, but until modeling is complete, South Carolina will be missing a key component necessary for the creation of workable water budgets.[30] The modeling will be integrated into an update of the comprehensive State Water Plan, which was last published in 2004.[31]

Tennessee has no statewide water budget. Two pilot regional water plans published in 2011 evaluated water uses and reservoir yields for their respective regions using water budgeting software.[32] More recently, as part of a 2014 report, the Tennessee Water Resource Technical Advisory Committee proposed a statewide system for reporting, maintaining, and accessing state hydrologic and water system data.[33] The report also contains some preliminary analyses of surface water and ground water resources, but does not explicitly identify a state or regional water budget as a desired outcome per se (although most of the listed outcomes require a thorough evaluation of water availability and projected use). For example, the proposed statewide system has the objective of determining "the immediate and long-term estimated water needs in areas most often impacted by drought or high growth" through modeling population growth and areas susceptible to drought, and determining current and projected water use in the areas of likely water stress or demand.[34]

TENNESSEE

Summary

A water budget is simply the accounting of water into and out of a system (river, reservoir, aquifer, etc.) and how water is used (the withdrawals, return flows and consumptive losses). As part of an overall plan to restore river flows, an accounting of the water is needed to accurately target and reduce consumptive losses (water that is withdrawn and not immediately returned). Not all water budgets use the correct methods needed to accurately account for water into and out of a system. An understanding, and correct application, of water budgets can provide needed information and the foundation for effective planning and management. Unfortunately, Southeastern states are largely lacking in correct baseline accounting for river systems, leaving a major gap in information and a weak foundation for effective planning and management.

Recommendations and What You Can Do

Ask your state to fund and implement a systematic, science-based approach to develop water budgets for each major river basin in your state. For trans-boundary watersheds, ask your state to cooperate with neighboring states to develop shared, equitable water budgets.

LEARN MORE

River Network's online science module on **Environmental Flows and Water Security**—(see components on Water Budgets)

U.S. Geological Survey website on Water Budgets

U.S. Geological Survey National Water Census website

U.S. Geological Survey National Water Census Data Portal

U.S. Geological Survey's **Water Budgets: Foundations for Effective Water-Resources and Environmental Management**

State Monitoring and Reporting for Hydrologically Impaired Waters

How can we better understand the impacts of hydrologic impairment on our waterways and focus attention on the need to restore them? Under the Clean Water Act, states are required to report on the health of all waters every two years, including the identification of waters not meeting water quality standards due to impairments from pollution (CWA §305(b) and §303(d)). For waters not achieving water quality standards, states must prioritize those impaired waters for restoration and develop a pollution cleanup budget, known as a Total Maximum Daily Load (TMDL) for the highest priority waters. While required cleanup plans are limited to impairments due to a "pollutant" (which includes solid waste; dredge spoil; chemical, municipal and industrial waste; rock; and sand (CWA §502(6)), states must also use their monitoring and assessment programs to identify impairments from "pollution," defined as "the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water" (CWA §502(19)).

Because flow alteration and hydromodification—including surface and ground water withdrawals, dams and impoundments, diversions or extreme low or high flows, and impervious surfaces that increase runoff and decrease baseflow—affect the chemical, physical, and biological integrity of our waters, they are considered pollution and should be identified and listed as a cause of impairment of state water quality standards where appropriate. In EPA's 2015 guidance to states on how to monitor and report on the status of their waters, the Agency made clear that states should consider how to "more fully understand the impacts and causes of all types of pollution on our nation's waters," with an emphasis on hydrologic impairment.[35]

EPA further detailed how states could apply biological narrative or numeric flow criteria or, in the absence of such, collect and assess additional data and information that may indicate a designated use is not being fully supported. EPA emphasized greater use of external datasets such as USGS gage data, StreamStats, or dam inventories, and the greater use of field personnel's visual observations and qualitative evaluations of flow levels and habitat alteration resulting from altered flows. They also suggested that sites experiencing extreme flow conditions during scheduled survey events, such as flood or no-flow situations, may result in a survey not being completed and

relevant information not being recorded. EPA provides an example of how this non-traditional information may instead be incorporated:

> *"EPA recognizes that it is possible to have an impaired or threatened designated use that may not be determined through the assessment of available numeric and narrative criteria alone… if a perennial stream is dry or has no flow and field staff are not able to collect a sample, then assessment of the designated use based solely on the sample results of an evaluation of narrative or numeric criteria may not be possible. However, data or information based on visual observations of no water in a perennial stream would be information on the physical condition of the stream, and would demonstrate the aquatic life or recreational use is most likely not being attained and a State may conclude that the designated use is impaired…. Thus data and/or information documenting significant hydrologic alteration could be used to make a use attainment decision for an impairment due to pollution not caused by a pollutant and should be collected, evaluated, and reported as appropriate."*[36]

While actual data from gauged streams or other scientific ways to monitor flows are more accurate and preferable, in many cases this type of data is not available. Lack of such data should no longer be used as an excuse not to report anything in this category.

Many states include qualitative measurements of flow in their rapid habitat assessment methods. Texas already provides a good example of using a visual assessment for flow, its physical stream monitoring requiring an assessment of flow on a scale from 1–6 representing a variety of flow severity levels,[37] including no flow and dry, plus a visual guide to accompany the flow severity levels. Such an approach can help provide data on flow impairment for the many ungauged small streams.

Collection of these data is a step forward in recognizing and documenting streams and rivers that are threatened by hydrologic alteration. Identifying these types of impairments will allow states, advocates, and other stakeholders to fully understand the extent of these impairments and to develop restoration policies and strategies for them.

LEARN MORE/WHAT YOU CAN DO

U.S. EPA's **2016 Integrated Reporting Guidance**

River Network, **The Clean Water Act Owner's Manual:** Identifying Problems and Restoring Watersheds (chapter 3)

U.S. EPA and USGS Draft Technical Report **Protecting Aquatic Life from Effects of Hydrologic Alteration**

Several on-line data and data resource portals listed below can also provide users with both observed and modeled hydrologic data and resulting calculated flow statistics:

USGS Water Census Data Portal

Freshwater Network Mapping Portal

- How and when does your state monitor and collect data for its 305(b) and 303(d) reports?
- Are you on the state mailing list to receive public notices about 305(b) and 303(d) list development?
- Is your state aware of EPA's new guidance encouraging the identification and reporting of hydrologically impaired waters?
- Based on EPA's guidance, do you have examples or information about hydrologically impaired waters in your watershed that could be submitted to the state?

STATE POLICIES

for Water Withdrawals

Introduction

The tracking of water withdrawals is vital as states implement strategies to meet the future water quantity and quality needs of their populations and keep enough water in rivers to meet any environmental flow targets. For a state to sustainably manage its water resources, it must have a way to monitor timing, size, and location of withdrawals, and must have authority to make allocation decisions, including limiting withdrawals when and where necessary. In this section we discuss permitting, monitoring, and reporting of water withdrawals from surface and groundwater resources.

Although a majority of states reviewed here have some sort of water withdrawal tracking program, only some states have a permitting agency with authority to condition or limit withdrawals for state designated purposes, such as public health and the environment. Even the states that have transitioned to a form of regulated riparianism **(see box Water Law and Your River)** take a greatly varied approach on how to manage water withdrawals. Groundwater management varies greatly (as does its impact on rivers) amongst the states, with many offering little oversight of groundwater use.

A strong water withdrawal permitting program must be supported by enabling legislation to cover all significant withdrawals from surface water and ground water; provide authority to limit or condition new and existing permits to protect rivers, downstream uses, and plan for water shortages; account for cumulative impacts; have limited permit duration to allow for adaptive management; require metering and usage reporting for all significant water users; and adaptably manage permitting decisions Across the states we reviewed, some states do not have any permitting program. Of those that do, there are gaps in the types of withdrawals that require permits, with agriculture often omitted entirely. Additionally, the threshold triggering a permit varies greatly **(see Tables 1 & 2)**. At the end of this section, several other states with strong programs are examined.

KEY

GREEN

State water permitting program exists and is used consistently to monitor, track, and address a variety of uses, including environmental flows (no states met these criteria).

YELLOW

A water withdrawal permitting program exists, but is either not fully implemented or is limited by major exclusions.

RED

Little to no authority for water withdrawal permitting and tracking.

Withdrawal Policies Scorecard	AL	GA	NC	SC	TN	MODEL POLICIES
Surface water withdrawals tracking, monitoring & permitting						Michigan, Florida
Groundwater withdrawals tracking, monitoring, and permitting						Michigan

Surface Water Withdrawals

For surface water withdrawals, Georgia and Tennessee have the most developed programs, requiring permits for a range of withdrawals. Georgia's program requires permits for most withdrawals over 100,000 gallons per day (GPD) and Tennessee requires permits for withdrawals that alter the stream from which the water is withdrawn, although exempts agriculture. South Carolina's permitting requirements are still relatively new and exempt agriculture, while neither North Carolina nor Alabama has a permitting system **(see Table 1)**.

State	Minimum Registered Withdrawal	Minimum Permit Withdrawal	Exceptions to Registering/ Permitting	Withdrawal Monitoring Requirements
ALABAMA	100,000 GPD	NA	Impoundments on private land, in-stream uses	5–10 year duration
GEORGIA		100,000 GPD	Reduction in flow from construction of impoundments	10–50 year duration
NORTH CAROLINA	100,000 GPD	NA	Agriculture must register only if withdrawal more than 1 MGD; encourage below that amount	Renewal every 5 years; annual water usage reports required
SOUTH CAROLINA	100,000 GPD (3 MGM agricultural use only)	100,000 GPD (3 MGM)	Agriculture is exempt from permitting (only must register)	Annual water use reports
TENNESSEE	10,000 GPD	Withdrawals that alter the source stream (ARAP)	Emergency uses involving human health/safety and agricultural purposes	Annual registry required; monthly compliance report required

TABLE 1
Surface Water Withdrawal Requirements–Minimum thresholds for registering a withdrawal amount or applying for a withdrawal permit. Registered withdrawals are typically only recorded, whereas permitted withdrawals have to be applied for and can be rejected or modified [MGD = million gallons per day, MGM = million gallons per month, GPD = gallons per day.]

Regulation of Georgia's surface water withdrawals is relatively rigorous among Southeastern states. Georgia shifted to regulated riparianism in 1977 through amendments to the state's Water Quality Control Act (after beginning to regulate groundwater withdrawals in 1972), which have since been supplemented by additional legislative changes including the Metropolitan North Georgia Water Planning District Act, the Georgia Comprehensive Statewide Water Management Planning Act, and the Georgia Water Stewardship Act.[38] The Georgia Environmental Protection Division (GAEPD) requires withdrawal permits for any surface water withdrawal, diversion, or impoundment greater than 100,000 GPD on monthly average with some exemptions.[39] These requirements apply to large agricultural operations, and to municipal and industrial withdrawals. When there are two or more competing permits, GAEPD may grant both applications if sufficient water is available, or modify existing permits to accommodate for

the proposed water use, also taking into account other factors including public health and the environment.[40] However, GAEPD does give preference to existing permits. Permits are issued for durations between 10-50 years, a length of time determined by GAEPD, with the exception of the Flint River Basin farm use permits that are issued for a duration of 25 years.[41]

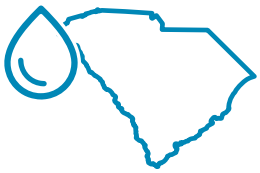
Water used for farm purposes may be exempt from many permitting conditions. For more recent farm water withdrawals, GAEPD evaluates and classifies applications and issues a permit accordingly. The Georgia Water Stewardship Act authorizes GAEPD to revoke unused permits in certain circumstances and preclude the transfer of unused or inactive permits.

TENNESSEE

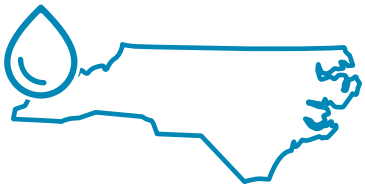
In Tennessee, water withdrawals fall under two main programs: permitting through the Aquatic Resource Alteration Permit (ARAP) and registration of certain withdrawals through Tennessee's Water Information Act.[42] Certain withdrawals of surface water are regulated through Tennessee's Water Quality Control Act, which requires an ARAP for alteration to any of the "physical, chemical, radiological, biological, or bacteriological" characteristics of a stream.[43] This includes taking out a portion of the stream's flow, and thus an individual ARAP is "required for water withdrawals which will or will likely result in alterations of the properties of the source stream."[44] In practice, this covers almost all new or expanded non-agricultural withdrawals.

ARAP applications are made to the Tennessee Department of Environment and Conservation (TDEC) and include proposed withdrawal rates, volume, and schedule, and the flow data of the source stream. TDEC must issue a permit that is protective of the stream, and may prohibit the withdrawal at certain levels and establish maximum withdrawal rates.[45] Agricultural and forestry activities are exempt, and withdrawals existing prior to 2000, when the regulations were promulgated, are exempt unless an increased withdrawal is requested.[46] This ARAP approach is unique among the states surveyed in that it recognizes the connection between clean water and water availability and uses clean water authorities to regulate withdrawals. It allows each permit to be individually assessed and incorporate the latest scientific information. For example, a recent water withdrawal permit issued for the Harpeth River incorporated provisions for low flow and water quality protections based on a USGS study following local advocacy efforts.[47]

Additionally, the 2002 Tennessee Water Information Act requires annual registration with TDEC of any recurring withdrawals of either surface water or ground water over 10,000 GPD to better document demand on water resources.[48] The two exceptions to registration are for emergency uses involving human health and safety and for agricultural purposes, creating a data gap for a large portion of the state's water use.[49] Though it is not an explicit exception, public water supply systems have not historically registered through the Water Information Act because they submit information under the Tennessee Safe Drinking Water Act and the Tennessee Water Quality Control Act.[50]



The current status of surface water withdrawal regulation in South Carolina is relatively complex and is a point of contention among a coalition of citizens and river users due to loopholes and the lack of enforcement, authority, and tools for scientific decision-making at the state agency.[51] Surface water withdrawal in South Carolina is governed by the Surface Water Withdrawal, Permitting, Use, and Reporting Act of 2011, which went into effect in 2012.[52] This law marked the first permitting requirements for surface water withdrawals in the state. The Act and its implementing regulations are carried out primarily by the South Carolina Department of Health and Environmental Control (SCDHEC), and require any non-agricultural withdrawer who extracts three million gallons or more in any one month to apply for and receive a permit.[53] These permitting requirements do not apply to agricultural users, who are only required to register their use of 3,000,000 gallons during any one month.[54] A registered withdrawer must register with SCDHEC and follow reporting requirements.[55] Additionally, all new or expanding registered and permitted users must report their anticipated withdrawal quantity to SCDHEC who will determine whether that quantity is within the safe yield for that water source.[56] If the Department determines that the quantity to be withdrawn is not within the safe yield, then the withdrawer is not allowed to go forward until it modifies its request. The safe yield concept is discussed further in the section on flow protection policy, however, the state's approach to this concept has led to conflicting definitions and over-allocation of a stream's available water.[57]



Permitting is not required in North Carolina. Instead, certain withdrawals are required to register while others are encouraged to do so but are otherwise exempt. Withdrawals or transfers of 100,000 gallons of water per day from surface water or ground water are required to register the withdrawal and to update the registration every five years.[58] Agriculture users are only required to register if they withdraw or transfer more than 1,000,000 gallons per day.[59] The North Carolina Department of Agriculture also collects information on withdrawals down to 10,000 gallons per day, but this data is aggregated and individual farm withdrawal is confidential.[60] These reported withdrawals can be used as evidence of use under any future allocation, and non-agriculture users that fall below the usage-reporting threshold can report their usage as "evidence of historic water use" in the case that an allocation and permitting system is established in the future.[61] Further, a local government with a revised and updated water supply plan is not required to register an additional water withdrawal.[62] Rules that went into effect in 2007 instruct registrants to also report their water usage annually to the Department of Environment and Natural Resources, facilitated by the use of an online reporting system.[63]

North Carolina's Water Use Act provides state authority to limit or prohibit withdrawals in "capacity use areas."[64] Although only two have ever been designated, they provide the basis for more widespread future use. The North Carolina Environmental Management Commission can designate a capacity use area where the cumulative uses of groundwater or surface water threaten their

sustainability.[65] To do so, the Environmental Management Commission first directs the North Carolina Department of Environmental Quality to investigate the area and write a report indicating the scope of water use problems in the area, including a consideration of water use and conservation, and suggested boundaries.[66] If the report indicates designation should be declared, the Environmental Management Commission may then adopt a rule declaring the specific area a capacity use area (following a public hearing).[67] As part of the rule, the Environmental Management Commission has the authority to prohibit withdrawals within the capacity use area of over 100,000 GPD from increasing their withdrawals over a certain amount, to prohibit creation of a new well or withdrawal facility in excess of a specific amount, and to limit the amount of water withdrawals from any new state-issued permit.[68]

After the Commission declares a capacity use area, it may also propose rules requiring water users in the area to report water withdrawal quantities, water sources, and the nature of water use at least every 30 days.[69] Regulations may also contain provisions to regulate the timing of withdrawals, or to protect against or abate salt water encroachment or unreasonable adverse effects on other users within the area.[70] Notably, individuals are prohibited from withdrawing, obtaining, or using surface water or groundwater in capacity use areas without obtaining a permit if the amount is greater than 100,000 gallons per day.[71] To decide whether to issue, modify, revoke, or deny a permit, the Commission considers a number of factors including the impairment to the stream or aquifer and related impacts on health and safety.[72] Permits last 10 years, and permit holders must monitor and report on withdrawals.[73] Existing uses can be grandfathered in if the withdrawal is found to be "reasonably necessary" and does not have unreasonably adverse effects on other water users.[74]

Even water users in a capacity use area who are not required to obtain a permit are still required to follow area policies created to protect and manage the area's water resources.[75] An example of this is the 15-county Central Coastal Plain Capacity Use Area.[76] The area was designated due to declining aquifer levels and requires permitting for withdrawals over 100,000 GPD and reporting and monitoring for withdrawals greater than 10,000 GPD, and the reduction in use over time.[77] Although the statutory authority allows the Commission to create a capacity use area for surface or groundwater, the authority has only been used twice, both times to address groundwater withdrawals.

Water withdrawals in Alabama are overseen by the state through a self-registration and reporting process. The 1993 Alabama Water Resources Act initiated state oversight of withdrawals, but the basic requirements for registration and reporting amount to little more than a declaration of intent to use water rather than a formal application for its use.[78] While the Alabama Office of Water Resources (OWR) does have the power to condition or deny water withdrawal permits in "Capacity Stress Areas," no such areas have yet to be designated and no regulations governing the process have been promulgated.[79]

ALABAMA

Registration for water withdrawals in Alabama is required for public water systems; self-supplied users of ground water or surface water; and users, including irrigators, who have the capacity to withdraw greater than 100,000 gallons per day (GPD).[80] Once a party has submitted a "Declaration of Beneficial Use," which involves identifying the source of water and the estimated amount of water withdrawn from—and returned to—the source, a "Certificate of Use" is more or less automatically issued and is valid for five to 10 years.[81] Certificate of Use holders are required to submit water use reports to OWR with the estimated amount of water withdrawn, diverted, or consumed for average daily use per month and peak day use per month.[82] Given that Alabama is still a riparian rights state, the legal ability to issue Certificates of Use to non-riparian users has been called into question.[83]

Given Alabama's significant limitations in measuring, tracking and permitting water withdrawals, the 2013 Alabama Water Agencies Working Group (AWAWG) report recommended enhancements to the Certificate of Use program to increase certainty for current water users in times of shortage.[84] Environmental organizations have advocated strongly for the state to adopt a permitting system, and as part of the state's current water planning process, there is a Use, Permitting, and Interbasin Transfer Focus Panel that will address these issues.[85]

Groundwater

State	Minimum Registered Withdrawal	Minimum Withdrawal to Trigger Permit Requirement	Exceptions to Registering/ Permitting	Permit Monitoring Requirements
ALABAMA	100,000 GPD and 50 GPM (only coastal)	NA		
GEORGIA		100,000 GPD on a monthly average		
NORTH CAROLINA	100,000 GPD	NA	Agriculture must register only if withdraw more than 1 MGD	
SOUTH CAROLINA	3 MGM outside of Capacity Use Area	100,000 GPD (3 MGM) in a Capacity Use Area		Annual water use reports
TENNESSEE	10,000 GPD	Withdrawals that alter the source stream (ARAP)		

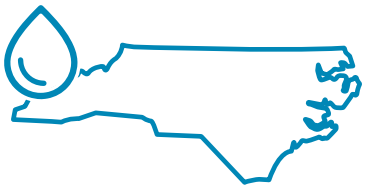
TABLE 2

Minimum thresholds for registering for a groundwater withdrawal amount or applying for a withdrawal permit. Registered withdrawals are typically only recorded, whereas permitted withdrawals have to be applied for and can be rejected or modified. Acronyms are defined as follows: GPM (gallons per minute), MGD (million gallons per day), MGM (million gallons per month), GPD (gallons per day).

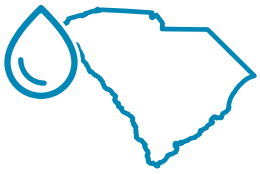
In Georgia, the Groundwater Use Act of 1972 gave the Environmental Protection Division (GAEPD) the authority to issue permits to prevent adverse impacts on other permitted aquifer users.[86] The Act currently applies to municipal, industrial, and agricultural uses greater than 100,000 GPD on a monthly average statewide. Generally, groundwater use permits are issued for no longer than 10 years, though there are exceptions.[87] All groundwater permits not used for two years, with the exception of those for farm use, will expire. The Georgia Water Stewardship Act grants the GAEPD some authority to revoke farm use permits for non-use.[88]

For consumptive uses without unreasonable adverse effects, GAEPD must issue a permit for all withdrawal applications.[89] However, the permit shall also contain as many conditions as GAEPD deems necessary, including well depth, amount of water to be withdrawn or used, or required installation of monitoring wells. For non-consumptive uses, GAEPD must issue permits for all applications to withdraw groundwater without any conditions. Only in 1988 were agricultural water users required to get groundwater use permits, and even then the permits contain no quantity limits, do not require annual reporting by the permit holder, do not expire (except in the Flint River basin with a 25-year term), and can be transferred with the sale of land without GAEPD approval.[90] The Georgia Water Stewardship Act removed some, but far from all, farm use exemptions. However, meters are required on permitted agricultural groundwater withdrawals and are monitored, and use reported in aggregate, by the Georgia Soil and Water Conservation Commission.[91]

Groundwater withdrawals in Tennessee are regulated through the Aquatic Resource Alteration Permits (ARAPs) if the withdrawal impacts the flow of surface water.[92] The same registration requirements and agricultural exemptions that apply to surface water also apply to groundwater with the Tennessee Water Information Act requiring any recurring withdrawals of groundwater over 10,000 GPD be annually registered with TDEC.[93] Similarly, in North Carolina, the same rules for surface water also apply to groundwater. Withdrawals or transfers of 100,000 gallons of water per day from ground water are required to register the withdrawal and update the registration every five years, and agricultural users are only required to register if they withdraw or transfer more than 1,000,000 gallons per day.[94] Groundwater information is focused on identifying aquifer depletion and has not been integrated into modeling impacts on surface waters.

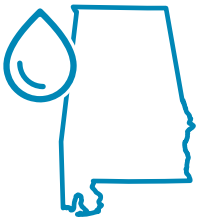


South Carolina groundwater withdrawal is governed by the Groundwater Use and Reporting Act and corresponding regulations.[95] The permitting requirements apply only in capacity use areas, to any groundwater withdrawal in excess of three million gallons during any one month from a single well or from multiple wells under common ownership within a one-mile radius from any existing or proposed well.[96] A capacity use area is an area designated by the South Carolina Department of Health and Environmental Control (SCDHEC) as being especially vulnerable, and there are currently only four such areas, all near the coast.[97] Those groundwater withdrawers



outside of capacity use areas are not required to obtain a permit, but must register any new well with the SCDHEC. All groundwater withdrawers, both permitted and registered, must submit yearly reports containing information on the use of withdrawn groundwater and monthly quantities withdrawn.[98]

In Alabama, registration is required for ground water users who have the capacity to withdraw greater than 100,000 gallons per day (GPD). Additionally, there are water withdrawal requirements for groundwater related to preventing saltwater intrusion that apply to new or renovated wells in coastal areas and adjacent areas in the 50-year capture zone.[99] The Alabama Water Agencies Working Group (AWAWG) report made recommendations, including identifying priority groundwater uses and determining maximum water withdrawals for aquifers that could be incorporated into the state's current water planning process.[100]



Michigan provides one example of linking water withdrawals to environmental impacts on stream flows. To fulfill the intent of the Great Lakes Compact to protect the region's water resources, Michigan passed legislation that prohibits new, large water withdrawals from causing an "adverse resource impact" on state waters.[101] Using a scientific approach with stakeholder collaboration, the state developed an assessment process based on ecological response curves to determine the impact of proposed water withdrawals on streams.[102] From there, streams were classified by zones A-D reflecting different degrees of sensitivity to flow reduction; zone A stream withdrawals are allowed, while withdrawals from zone D streams are not allowed due to predictions of adverse impact. In intermediate zones, water conservation or other measures may be required. Potential water withdrawal applicants can easily determine whether their proposed withdrawal location and amount will negatively impact the local stream by using the Water Withdrawal Assessment Process and Internet Screening Tool.[103]

Florida law requires the state's water management districts or the Florida Department of Environmental Protection to establish minimum flows and levels (MFLs) for aquifers, surface watercourses, and other surface water bodies, to identify the limits at which further withdrawals would be significantly harmful to the water resources or ecology of the area.[104] Waterbodies and their adopted minimum flows and levels, as well as those that are currently being developed or planning to be developed, are put on a **Minimum Flows and Levels Priority List and Schedule**. Waterbodies are placed on the list based upon their importance to the state or region and the potential for adverse impacts associated with water use. Peer review and stakeholder input are utilized to establish minimum flows and levels and to define what would constitute "significant harm." If flows or levels are, or are expected to be, below established minimum flows or levels, the water management district develops and implements a **recovery or prevention strategy**.[105]

Virginia also has broad authority to regulate water withdrawals. A Virginia Water Protection Permit is required for new or expanded withdrawals after 1989 and

conditions can restrict volume or timing to protect beneficial uses, including fish and wildlife habitat.[106] Because decisions regarding flow impacts are made on a case by case basis, Virginia is working with USGS and TNC to develop a comprehensive decision support tool that will allow a cumulative impacts analysis for each proposed withdrawal.

Summary

The tracking of water withdrawals is vital as states implement strategies to meet future water quantity and quality needs as well as keep enough water in rivers to provide environmental flows. For a state to sustainably manage its water resources there must be a way to know how much water is withdrawn from a river basin and/or aquifer, including withdrawal location and timing, as well as from where and when it's being withdrawn, and the ability to make allocation decisions via a permitting process.

Although a majority of Southeastern states have some sort of water withdrawal tracking program, only some have a permitting program where withdrawals can be conditioned or limited for state-designated purposes such as public health and the environment. Even the states that have transitioned to regulated riparianism take a greatly varied approach on how to manage water withdrawals; groundwater management is even more varied, with most states providing little oversight of groundwater use. Nonetheless, within the region strong building blocks exist that could be strengthened and replicated. Tennessee's approach recognizes the connection between clean water and water availability and builds on clean water authorities to regulate withdrawals. Both North and South Carolina have provisions on the books for "capacity use areas" that authorize stronger protections following a vulnerability analysis. While rarely used now, this approach could find broader application and lay the groundwork for statewide approaches. Finally, Michigan and Florida both provide examples of strong state frameworks for permitting withdrawals.

Recommendations and What You Can Do

- Ask your state to implement a strong water withdrawal permitting program that:
  - Is supported by enabling legislation;
  - Covers all significant withdrawals of surface water and ground water;
  - Provides the state with the authority to limit or condition new and existing permits to protect rivers and downstream uses, and to plan for water shortages;
  - Accounts for cumulative impacts; and
  - Limits permit duration and allows for adaptive management.

- Can your state include water withdrawals as part of Clean Water Act permitting to protect habitat and biological integrity?

- Does your state have a process to petition for designation of capacity-limited areas that require rigorous withdrawal permits?

LEARN MORE

The Nature Conservancy's **A Practical Guide to Environmental Flows for Policy and Planning**

Determining Environmental Limits to Streamflow Depletion Across Michigan

North Carolina Ecological Flow Science Advisory Board. 2013. **Recommendations for Estimating Flows to Maintain Ecological Integrity in Streams and Rivers in North Carolina**. A report submitted to the N.C. Department of Environment and Natural Resources

The Instream Flow Council's **Integrated Approaches to Riverine Resource Stewardship: Case Studies, Science, Law, People, and Policy**, 2009

The Instream Flow **Council's Instream Flows for Riverine Resource Stewardship (revised edition)**, 2004

Texas Parks and Wildlife Department Rivers Studies Program website

Florida Department of Environmental Protection's Water Management District minimum flows and levels website

STATE POLICIES

for Flow Protection

Introduction

States have a range of opportunities to protect environmental flows, defined as the quantity, timing, and quality of water flow required to sustain freshwater and estuarine ecosystems and the human well-being and livelihoods that depend on these ecosystems. These opportunities often intersect with federal policies and permits, like the Endangered Species Act and hydropower relicensing; however, this report focuses on state implementation opportunities.

Southern Instream Flow Network Recommendations for Comprehensive State Instream Flow Program

The Southern Instream Flow Network was developed as part of the Southeast Aquatic Resources Partnership to share and leverage resources on the technical, scientific, and policy aspects of instream flow protection in 15 states. As part of these resources, the Southern Instream Flow Network has identified 12 responsibilities for a comprehensive state instream flow program.[107]

1. Develop rules and regulations to administer state laws for instream flow protection;

2. Select appropriate methods to determine instream flow criteria;

3. Obtain and evaluate information on instream flow requirements;

4. Set instream flow criteria;

5. Assist planning agencies with incorporation of instream flow criteria into water management plans;

6. Use water allocation guidelines or limits from water management plans to inform permitting decisions;

7. Issue water use permits;

8. Enforce permit instream flow limits;

9. Monitor and evaluate program effectiveness;

10. Manage adaptively;

11. Advise on development of water conservation, drought, and other water management plans; and

12. Inform the public and build awareness about instream flow issues.

While many of these are covered in this report, to learn more about state agency program management and related research visit the **Southern Instream Flow Network**.

This section focuses on the state policy mechanisms by which environmental flow criteria can be applied. Conceptually, we are considering that strong environmental flow policy requires both science-based environmental flow criteria and mechanisms or policies to apply those criteria, which are shaped by the prevailing legal doctrine **(Figure 2)**.[108] Two specific policy approaches for states to take to protect environmental flows, water allocation, and permitting and/or adoption of water quality standards are addressed here.

LEGAL DOCTRINE

SCIENCE-BASED ENVIRONMENTAL FLOW CRITERIA + MECHANISMS TO APPLY FLOW CRITERIA = ENVIRONMENTAL FLOW POLICY

Forms of Instream Flow Criteria (in order of increasing level of flow protection)	Statewide Criteria	Percent Low Flow (set the minimum amount of water that should remain in the river)	Increasing Level of Flow Protection
		Seasonal Thresholds (set the minimum amount of water that should remain in the river seasonally)	
		Percent of Flow (limit the amount of withdrawals to a percentage of daily flow)	
	Criteria for Specific Waterways/ Segments	Limiting Habitat (minimum flow conditions that must be maintained for protection of aquatic habitat in that specific waterway)	
		Percent of Flow (limit the amount of withdrawals to a percentage of daily flow in that specific waterway)	
Information Needed for Science-Based Environmental Flow Criteria	Science–how should 'flows' be defined? What flows are needed to protect river health?		
	Data collection–what information do we regularly collect on flows and uses, and how robustly?		
	Modeling–can we tell what is currently happening/predict how flows will respond to hypothetical withdrawals?		
	Planning–what do we expect to happen with rainfall, groundwater inputs & outputs, and demand for various uses?		
Legal Doctrine	Prior appropriation		
	Riparian rights (common law)		
	Regulated riparian (statutory/administrative)		
How to Apply Instream Flow Criteria (i.e. Instream Flow Policy)	Water allocation guidelines in water management plans		
	Withdrawal permitting		
	Clean Water Act water quality standards & point source permitting		
	Requirements for dam operations		
	Other		
Related Policies & Opportunities	Demand Management (i.e. conservation and efficiency) Stormwater permitting Dam reoperations Incentives and voluntary transactions for flow restoration		

FIGURE 2
Environmental Flow Policy (adapted from Instream Flow Council, 2008 and Grady McCallie, North Carolina Conservation Network, presentation at River Rally 2016)

The effectiveness of policy approach, water allocation and permitting, or adoption of water quality standards, is premised on knowing how much water a river needs and establishing corresponding flow criteria to support those goals, including a range of flows. The science behind establishing environmental flows is beyond the scope of this paper, but is addressed in River Network's **Water Security Science Module** and by the **Southern Instream Flow Network**, the **Instream Flow Council** and **the Nature Conservancy**.

Flow Terminology

ENVIRONMENTAL FLOWS–"describe the quantity, timing, variability, and quality of water flows required to sustain freshwater and estuarine ecosystems and the human well-being and livelihoods that depend on these ecosystems."[109]

NATURAL FLOW PARADIGM–"The full range of natural intra- and inter-annual variation in hydrologic regimes, and associated characteristics of timing, duration, frequency, and rate of change, are critical in sustaining the full native biodiversity and integrity of aquatic ecosystems."[110]

INSTREAM FLOW–"[a]ny quantity of water flowing in a natural stream channel at any time of year. The quantity may or may not be adequate to sustain natural ecological processes and may or may not be protected or administered under a permit, water right, or other legally recognized means."[111]

How Much Water Does Your River Need?[112]

This is a question that has been asked by river conservationists and scientists for more than 50 years. Thankfully, our ability to answer this question has improved greatly over that time. "Environmental flow" is the term used most commonly to describe the quantity, timing, and quality of water flow required to sustain freshwater and estuarine ecosystems and the human well-being and livelihoods that depend on these ecosystems. One of the great challenges of sustainable water management is to allocate or reserve water to meet environmental flow needs while also providing water supplies for drinking water and other domestic uses, crop production, industrial use, and energy generation.

Developing environmental flow recommendations requires a sound understanding of the relationship between specific flow characteristics (magnitude, frequency, duration, timing, and rate of change) necessary to sustain ecological health, and then articulating these needs in a manner that can be used to influence water management and regulation. Engaging scientists across disciplines (ecologists, hydrologists, social scientists, economists, etc.), water users and providers (e.g., farmers, corporations, utilities), and community members together in this process brings everyone along in understanding how rivers work, what they need to remain healthy, and policy decisions we must make as a society to improve. It's also worth noting that conducting environmental flow assessments takes significant amounts of time, money, and other resources, and coordinating, planning, and acquiring funding are important parts of the process as well.

The concept of environmental flows has been evolving rapidly since the mid-1990s. Today's methodologies can be used to characterize environmental flow needs for specific reaches of a river as well for entire watersheds, regions, or states.

The science behind instream flow protection is addressed in River Network's **Water Security Science Module.**

For more information about environmental flows, check out:

- River Network **science module** on developing environmental flows
- "A Collaborative and Adaptive Process for Developing Environmental Flow Recommendations," by Richter et al.
- "The Ecological Limits of Hydrologic Alteration (ELOHA): A New Framework for Developing Regional Environmental Flow Standards," by Poff et al.
- Environmental Flows: A Practical Guide to Environmental Flows for Policy and Planning by TNC

Water Supply, Allocation, and Permitting vs. Water Quality Standards

States can support environmental flows through a water allocation and permitting system, where it exists, and/or through criteria supporting state water quality standards. Table 4 explains the advantages and disadvantages of both approaches. Under a water permitting system, states can limit withdrawals and set permit limits to achieve environmental flow goals. This approach can be based on "pass-by" flows where a permittee must allow a certain percentage of water to stay in the river or pass-by, which can be required to vary by season to better emulate natural flows.[113] Because the pass-by approach doesn't account for the cumulative impacts of withdrawals, the "pour-point" approach, where instream flow criteria are applied at points throughout a watershed, makes permit issuance contingent on the collective impacts of withdrawals.[114]

The Clean Water Act's goal is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Because river flows are integrally connected to maintaining these components, there are a number of Clean Water Act programs and provisions that affect these flows **(see box Opportunities to Protect Healthy Flows Under the Clean Water Act)**, including water quality standards. States are required to adopt water quality standards, which include designated uses of waterbodies, criteria to protect these uses, and an antidegradation policy to ensure that water doesn't degrade past certain levels. Criteria should address the chemical, physical, and biological integrity of waterways, which are integrally related to hydrologic factors.[115] As a result, 10 states (including Tennessee, Kentucky, and Virginia) and six tribes have adopted various narrative flow criteria into their water quality standards.[116] Water quality standards form the backbone of the Clean Water Act and having flow criteria can affect a range of provisions, including state water quality certifications for things like federal hydropower licenses, impaired waterway designations, antidegradation, and pollution discharge permits.

It is important to note that the minimum flow statistic, the "7Q10" (the seven consecutive days of lowest flow over a 10 year period), provides a conservative, minimum measure to determine chemical limits for Clean Water Act pollution discharge permits, but is not intended to indicate the flows (low flows and high flows) needed to sustain a healthy river system.[117] The 7Q10 measure is protective of water quality only insofar as it is used to model the potential chemical concentrations resulting from a discharge during low flow conditions, thereby allowing the permitting agency to establish appropriate discharge limits. Unfortunately, the 7Q10 flow has also been improperly used as a surrogate for instream flow protection, which the Instream Flow Council likens to "recommending the sickest day of your life as a satisfactory level for future well-being."[118]

	Water allocation or permitting under water supply program	Clean Water Act water quality standards
ADVANTAGES	• Permit limits can support instream flow criteria and prevent undesirable cumulative impacts • Allows for reporting of water use and enforcement of permits • Allows for adaptive management • Mitigation can be required	• Permit limits can support instream flow criteria and prevent undesirable cumulative impacts • Permitting and process to adopt criteria in place • Legislative action usually not necessary • Supports Clean Water Act provisions • Can require water use reporting as a result of basic compliance monitoring and reporting • Adaptive management of permitted uses can happen during permit renewals
DISADVANTAGES	• Requires permitting program for water allocation • May require legislative action to mandate instream flow protection	• Usually applies only when Clean Water Act provisions are triggered • Doesn't apply to those exempt from Clean Water Act (e.g. agriculture)

TABLE 3

Advantages and Disadvantages of Two Different Approaches States Can Use to Apply Instream Flow Policy (adapted from Southeastern Aquatic Resources Partnership)[119]

Flow Protection Policies Scorecard

	AL	GA	NC	SC	TN	MODEL POLICIES
Instream Flow Protections						Florida, Mississippi, Connecticut

Of the states surveyed here, Tennessee has perhaps the most comprehensive approach, addressing instream flow criteria from both the water quality and withdrawal sides, although permit requirements addressing flow are still negotiated on an individual basis. South Carolina and Georgia both have provisions to protect flow through their water withdrawal permitting processes but both are limited in effectiveness. In South Carolina, the implementation is hindered by an underlying safe yield concept that allows over-allocation of the resource. Georgia's long-term interim policy is based on a modified version of the 7Q10 or a mean annual flow approach that protects only seasonal low flows, and, as described in the water withdrawal permitting section, exemptions in permitting requirements limit the application of flow protections using this approach. Meanwhile, North Carolina developed a scientifically sound approach to protecting instream flows but has not implemented it. Alabama offers little protection but the Alabama Department of Conservation and Natural Resources does have an internal instream flow policy that states they will advocate for the protection of instream flow requirements in all water allocation decisions.[120] Approaches from Florida, Mississippi, and Connecticut provide possible models and are described at the end of this section.

KEY

GREEN

Strong environmental flow policy exists with requisite science-based environmental flow criteria and mechanisms or policies to apply those criteria.

YELLOW

An environmental flow policy exists but with insufficient criteria and/or mechanisms or policies to apply those criteria.

ORANGE

No environmental flow policy exists but other regulations may provide an opportunity for instream flow protections.

RED

No environmental flow policy exists (no states met this criteria).

TABLE 4

State Components of Flow Protection Policy

	Scientific process to determine environmental flow criteria	Water withdrawal provisions for flow protection	Water quality standards for criteria flow
ALABAMA	No	No	No
GEORGIA	No	Yes	No
NORTH CAROLINA	Yes	No	No
SOUTH CAROLINA	No	Yes–minimums based on mean annual daily flow	No
TENNESSEE	Yes	Possible	Yes

TENNESSEE

Tennessee addresses flow protections both through water quality standards and water withdrawal permitting. Tennessee is one of the only Southeastern states with narrative criteria for flow as part of state water quality standards. Flow is specifically included as a criterion to support fish and aquatic life as well as recreation uses.[121] Under the criteria for Fish and Aquatic Life, stream habitat must meet regionally-based biological integrity goals and must be supported by stream flows.

Other water quality criteria for fish, aquatic life, and livestock watering are based on 7-day minima at a 10-year recurrence interval (7Q10) while all other criteria is based on 30-day minima at a 5-year recurrence interval. The habitat criteria are considered "independent of a specified minimum flow duration and recurrence."[122]

Additionally, as described in the water withdrawal section above, under Tennessee's Water Quality Control Act physical alterations to streams, including almost all new or expanded non-agricultural water withdrawals, require an Aquatic Resource Alteration Permit (ARAP). The state has the authority to require minimum stream flows as a condition for individual ARAPs.[123] The Tennessee Department of Environment and Conservation must issue a permit that is protective of the stream, and can include conditions to prohibit the withdrawals at certain levels and "establish a maximum withdrawal rate in order to maintain the natural flow fluctuation characteristics of the source stream."[124] Thus, these withdrawal permits can include flow protections on a case by case basis, as occurred on a permit for the Harpeth River.[125]

To make the application of ecological flows more consistent, the state's Water Resources Technical Advisory Committee (WRTAC) highlighted the importance of in-stream flows, and recommended the establishment of a standardized approach for determining ecological flows required by streams and rivers.[126] USGS and several other agencies and nonprofits have started research in this area.[127]

Georgia does not have flow-based criteria as part of its water quality standards, and instream flow requirements are primarily associated with minimum standards necessary to meet CWA requirements in pollutant discharge permits.[128] Historically, Georgia employed an annual 7Q10 minimum instream flow standard to comply with water quality statutes. Mounting evidence that 7Q10 inadequately protects stream and ecosystem health led the Georgia Department of Natural Resources to release an Interim Instream Flow Policy in 2001.[129] This policy allows for new non-agricultural withdrawal permit applicants to choose between three methods for determining minimum instream flows. One minimum is a modified version of the 7Q10 methods, which is calculated on a monthly rather than annual basis. Partitioning the minimum flow by month makes the Georgia version of the 7Q10 more similar to a natural flow regime, albeit with the same complications associated with providing only for minimum flows without regard for peak flows or changes in flow rates.

A second option is the site-specific minimum, which is based on a permittee study and approved by DNR; it addresses what instream flows are needed to protect aquatic habitat. The third option is based on mean annual flows, where a certain percentage of the mean constitutes the minimum. For unregulated streams, it is 30% of the mean annual flow, whereas in regulated streams it is 30% July–November, 60% January–April, or 40% during May, June, and December. For all three options, if there is insufficient water to meet the minimum, a reservoir or withdrawal point must pass all of the inflowing water. The vast majority of permits in Georgia incorporate the monthly 7Q10 option.

Georgia's "Interim" Instream Flow Policy is still being applied to new permits more than a decade later.[130] Many permits are also grandfathered and don't incorporate the minimal standards in Georgia's instream flow policy, and some permits have no instream flow requirements at all. Georgia's regional water planning process also relied upon a monthly 7Q10 flow in lieu of the more protective options (such as a minimum based on percentages of mean annual flow). Additionally, a recent decision by the GAEPD to remove a longstanding 750 CFS minimum flow standard below Buford Dam on the Chattahoochee River—which had been in place for water quality purposes—is feared to lead to flow reductions downstream.[131]

Incentive-Based Approaches for Flow Protection

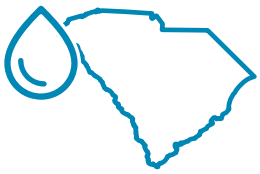
In addition to policies requiring flow protection, incentive approaches that encourage water saving behavior and transactions or agreements that restore water to rivers, lakes and groundwater can also be an option. Used here, "[i]ncentive-based instruments [are those] that use financial means, directly or indirectly, to motivate responsible parties to reallocate water, or reduce the health and environmental risks posed by their facilities, processes, or products.[132] Transactions are basically agreements between two parties to restore water to the environment. While these are more common in the western U.S. under the prior appropriation doctrine, examples in the East exist as well. Both these approaches can be useful to address water use not otherwise regulated, like agricultural use in most places.

Water efficiency and stormwater capture can be incentivized through sales tax exemptions for high-efficiency products, or reduction in stormwater utility fees for using green infrastructure, which can facilitate flow restoration. Tucson's Conserve to Enhance program, for example, allows people to track their water use and then donate their water bill savings to environmental restoration projects that improve habitat and flow.[133] Washington D.C.'s stormwater program combines a regulatory and incentive approach to reducing stormwater runoff and increasing green infrastructure. Developers must meet an on-site retention standard volume—half must be achieved on-site but the other half can be achieved on-site by buying stormwater retention credits or by paying into a bank. This incentivizes others to create green infrastructure credits and allows DC to target investments from the bank into areas that will benefit from green infrastructure but may be experiencing less development or redevelopment.[134]

Transactions or agreements between parties to restore water to rivers, lakes and groundwater can take many forms. In prior appropriation systems, these range from outright transfer of water rights for instream flow, to forbearance and fallowing agreements with farmers during periods of the year when water extraction leaves a system particularly out of balance. Even outside of prior appropriation systems, transactions can take the form of investment in farm-specific irrigation efficiency aimed at protecting or restoring flows. Willing parties must exist on both ends of the transaction for it to work—for example, a farmer willing to reduce their water use and a conservation organization or even downstream community willing to pay for the farmer's irrigation upgrades. In some places, when enough transaction opportunities and investors exist, a market can arise to encourage more efficient transfers or exchanges—however, markets are not necessary for water transactions.

One example of a transaction invests corporate funding from companies seeking to achieve or enhance water sustainability by offsetting their impact through local restoration projects. For instance, the Bonneville Environment Foundation worked with The Nature Conservancy and Georgia's Flint River Soil and Water Conservation District to retrofit irrigation technology to reduce groundwater withdrawals.[135] This is being replicated at a larger scale through the Change the Course initiative that certifies the flow benefits of water replenishment projects funded by corporate investments.[136]

A pure market for water where water is openly bought and sold it is problematic and unlikely in the Southeast where water use is governed by riparian or regulated riparian water law system, which lacks clearly defined water rights, as well as a cap on the total amount allowed to be withdrawn.[137] However, combining incentive, voluntary and transactional approaches within the regulated system does hold promise for finding more innovative ways to restore river flows.



SOUTH CAROLINA

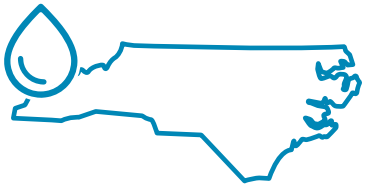
In South Carolina, consideration of instream flows is integrated into surface water withdrawal regulations but its efficacy suffers from unclear definition and inconsistent application. The S.C. Surface Water Withdrawal, Permitting, Use, and Reporting Act defines minimum instream flow as "the flow that provides an adequate supply of water at the surface water withdrawal point to maintain the biological, chemical, and physical integrity of the stream taking into account the needs of downstream users, recreation, and navigation." The definition then sets the specific minimum flows "at forty (40) percent of the mean annual daily flow for the months of January, February, March, and April; thirty (30) percent… for the months of May, June, and December; and twenty (20) percent… for the months of July through November…"[138] However, these do not apply to surface water withdrawal points located below a federally licensed impoundment.[139]

These minimum instream flows are incorporated into water withdrawal permitting in several ways. First, they are used as criteria for reviewing new or modified surface water withdrawal permit applications.[140] The S.C. Department of Health and Environmental Control is tasked with evaluating the reasonableness of the withdrawal proposed in the permit application, with evaluation of the minimum flow as a factor. This has limited application given that agricultural withdrawals must register but are not required to get a permit **(see withdrawal permitting section)**.

Second, South Carolina incorporates stream flows into the water source's "safe yield" determination, which is also a factor used under the permit evaluation criteria and for reviewing new agricultural registrants. Safe yield is defined as "the amount of water available for withdrawal from a particular surface water source in excess of the minimum instream flow or minimum water level for that surface water source," and is determined "by comparing the natural and artificial replenishment of the surface water to the existing or planned consumptive and nonconsumptive uses."[141] However, the method of calculation states that safe yield should be "calculated as the difference between the mean annual daily flow and twenty (20) percent of mean annual daily flow at the withdrawal point, taking into consideration natural and artificial replenishment of the surface water and affected downstream withdrawals."[142]

This results in conflicting "definitions" of how to calculate safe yield. Specifically, the method of calculation found in the body of the regulations does not mention minimum instream flow, meaning it does not trigger the seasonal variations dictated by the definition of minimum instream flow. Thus, the safe yield of a given unimpounded stream segment can be up to 80% of mean annual daily flow, regardless of the season or current level of flow. This became clear when a potato farm was approved for a registration that would have removed almost all of the river's summer flows. Although the registration was negotiated to a lower withdrawal level, it revealed the system's lack of protections for instream flow. Ultimately, efficacy and legality of the safe yield formula is on shaky ground,[143] resulting in safe yield flow calculations that were far in excess of the actual flows of a given surface water source, essentially over-allocating that source and threatening all downstream users.[144]

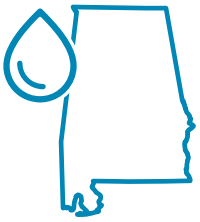
Third, instream flow is part of the South Carolina permit requirement for the creation and maintenance of contingency plans. Contingency plans go into effect "during times when the actual flow of the surface water is less than the minimum instream flow."[145] Contingency plans must be maintained on-site, must be available for inspection, and must list actions a permittee might take in case of minimum flow conditions. Such action plans might involve "water conservation, use of supplemental water supplies, use of off-stream water storage, operational changes."[146] These plans are not required for agricultural withdrawals, exempt from permit requirements.



While North Carolina does not protect instream flows through state policies, it went through the most scientifically rigorous process among the Southeastern states in developing recommendations for environmental flows. As part of the same state law directing the development of basinwide hydrologic modeling **(see section on Water Budgets)**, the Department of Environment and Natural Resources (now the Department of Environmental Quality) was tasked to characterize the "ecology [of] river basins and identify the flow necessary to maintain ecological integrity."[147] While this component of the law did not have a regulatory tie, it was intended to establish a foundation for better water planning in the future.[148]

The Department created a Science Advisory Board, with a variety of stakeholders, to characterize the natural ecology and identify flow requirements.[149] This Ecological Flows Scientific Advisory Board (EFSAB) worked for three years with input from a variety of scientific experts and other stakeholders to complete recommendations for estimating flows to maintain ecological integrity.[150] The EFSAB recommended that the state use a two-pronged strategy for establishing environmental flows, including: 1) percentage of flow–allow 80%–90% of instantaneous modeled baseline flow to remain in streams and also consider a strategy for mitigating harm during to-be-determined, critical low-flow events, and 2) biological response strategy–limit change in biological indices to 5–10%.[151] Both of these would be followed by further study and evaluation. North Carolina's Division of Water Resources subsequently derived from this a simpler "85% flow-by" rule of thumb: smaller withdrawals would receive standard review and approval, while larger proposed withdrawals would draw closer study.[152]

However, opposition to using ecological flow science led to attempts to dismiss the report.[153] A peer review report of the EFSAB Final Report was produced in 2015 by the Instream Flow Council that generally supported the work of the EFSAB but also recommended selected areas for clarification and further study.[154] Members of the state's Environmental Management Commission opposed further use of the EFSAB recommendations over concern that it could become a regulatory tool.[155] The EFSAB recommendations remain the state's best available science on flows.



Alabama does not have a narrative or numeric criteria for flow as part of its water quality standards, nor does the state evaluate the impacts of water withdrawals on instream flows. The only potential regulatory leverage point for instream flow protection in Alabama is through the National Pollutant

Discharge Elimination System (NPDES) pollution discharge permits.[156] For substances chronically toxic to aquatic life and those harmful for human health yet non-carcinogenic, the annual 7Q10 method is used to determine minimum receiving water flow. For substances acutely toxic to aquatic life an annual 1Q10 statistic is employed and for carcinogenic substances harmful to human health the mean annual flow is used to calculate minimum receiving flows.

Several states provide additional examples and models that could be applied elsewhere. Florida law clearly requires protection and restoration of instream flows. Each of the state's water management districts is required to develop a water management plan that includes minimum flows for all waterways that "shall be the limit at which further withdrawals would be significantly harmful to the water resources of the area."[157] The scientific calculations of these limits take place at the District level based on a priority schedule based on the importance of the water to the state and the potential for adverse impacts associated with water use, and the plan includes opportunity for public comment. For waterbodies where the designated flow levels are projected to fall below recommended levels, a recovery or prevention strategy must be developed as part of the state's regional water supply strategy.[158]

More recently, Mississippi has also adopted stronger protections for environmental flows. Starting in 1994, state law required the Mississippi Department of Environmental Quality to consult with the Mississippi Department of Fish, Wildlife, and Parks when making decisions regarding flow protection standards and opened up to approaches other than the 7Q10.[159] The Department of Fish, Wildlife, and Parks supported a conservative, presumptive approach limiting withdrawals to 20% of flow. In 2015, the Mississippi Department of Environmental Quality applied a permit limit on fracking industry withdrawals in the southwestern part of the state to use no more than 10% of median flow.[160] Although this currently has application only regionally within Mississippi, it marks the first time the state has applied a protective approach that could be used statewide.

Connecticut takes another approach to protecting environmental flows, focusing on those related to dam operations **(see box Dam Operations and Removal for Flow Protection)**.[161] The state classifies streams statewide by flow "condition class" from 1–4 —from unaltered to substantially altered—based on a number of factors. The classifications are based in part on maintaining "the natural variation in flow expected in Connecticut given seasonal climate and rainfall patterns and human use."[162] Each condition class then corresponds with regulations for releases from dams with an authorized consumptive diversion; these regulations prioritize ecological health for the more unaltered streams and human use for the more highly altered systems. For instance, for a minimally altered stream, 75% of the natural inflow must be released, whereas there is more balancing of human and natural requirements moving along the gradient to more highly altered systems.[163] The regulations do not apply to municipal water withdrawals or hydropower releases governed by federal permits, as well as other diversions. The state is currently in the process of classifying streams on a rotating basis by river basin.

Dam Operations and Removal for Flow Protection

All dams have multifaceted impacts on waterways, including significantly affecting instream flows by reducing the amount of water available through evaporative loss, storage, and releases. Hydropower dams in particular release water when they are generating power and release much smaller amounts when they are not. It's analogous to turning a water faucet on and off. The amounts of water released can vary vastly, creating unnatural highs and lows in the flow of water downstream.[164]

Dams regulated by the Federal Energy Regulatory Commission (FERC) must obtain licenses in order to generate hydroelectricity. These licenses are like rental contracts and they set conditions dam operators abide by in order to use rivers to produce and sell electricity. The licenses are good for 30-50 years, and many were granted before modern recognition of environmental and river flow protection needs. When these licenses expire, there is a once-in-a-generation opportunity to advocate for instream flow protections as part of the new permit.[165] For example, following advocacy efforts, in 2009 South Carolina denied a state 401 certification for FERC license renewal because the license did not provide sufficient flows to protect endangered species or reasonable assurances that downstream water quality standards would be met. As a result, negotiations were held and an agreement was reached to improve dam operations to provide necessary flows and floodplain inundation to mimic natural floods and slow-flow periods.[166]

Federal dam and hydropower projects are not required to have a license from FERC, but periodic updates of their dam operations are required and also offer opportunities to advocate for improved operations that will protect instream flows. For example, The Nature Conservancy's Sustainable Rivers Project brought together organizations; federal, state, and local agencies; and academic institutions to work with the Army Corps of Engineers to make modifications to their dam operations in order to improve the ecological health of the Savannah River.[167]

Removal of dams that have outlived their usefulness and pose environmental and public health threats is another option to restore river flows, and there are a number of examples from the Southeast.[168]

LEARN MORE

Dam Removal Resource Center by American Rivers

FERC Relicensing Process by American Whitewater

Resources about hydropower by Hydropower Reform Coalition

Environmental flows at US Army Corps of Engineers dams by The Nature Conservancy

DamNation

Opportunities to Protect Healthy Flows Under the Clean Water Act

As Justice O'Connor famously wrote for the Supreme Court, the distinction between water quality and water quantity under the Clean Water Act (CWA) is an "artificial" one.[169] While the CWA does not directly provide authority to regulate flow, there are several CWA tools that can be better used to drive protection and restoration of environmental flows.[170] Because flow alteration directly affects the physical, chemical, and biological integrity of rivers by changing water chemistry, temperature, habitat, and aquatic life cycles, there is an integral linkage between flows and the CWA. The joint EPA-USGS technical report, *Protecting Aquatic Life from Effects of Hydrologic Alteration*, as well as River Network's *Artificial Distinction* report, provide excellent compendiums of how CWA programs can incorporate and address flow alteration.[171]

SOME EXAMPLES INCLUDE:

• *Water quality standards criteria*–when establishing water quality standards, states and tribes adopt criteria to protect the chemical, physical and biological integrity, which can include narrative or numeric criteria for flow. While not prevalent, 10 states and six tribes have flow criteria as part of their water quality standards, including Virginia, Kentucky, and Tennessee.[172]

• *Water quality certification*–Section 401 of the CWA, water quality certification, allows states to review and veto or place conditions on activities requiring a federal permit or license that may result in a discharge—including hydropower licenses and wetland dredge and fill permits—to comply with state water quality standards.[173] Protecting flows through water quality certification may be clearest where a state has included specific flow criteria as part of their water quality standards, but 401 conditions can also be based on other information, such as that collected through the state monitoring and assessment process about the impact on water quality standards.[174]

• *Point source discharge permits*–under CWA Section 402, permits are required for the discharge of point source pollution (NPDES permits). To ensure that certain pollutants don't adversely impact aquatic life, permit writers make those calculations using the minimum flow statistic, the "7Q10" (the seven consecutive days of lowest flow over a 10 year period). When flows change—due to new withdrawals, climate change, or other factors—the 7Q10 and associated pollutant limits will also change. Ensuring that states revisit their flow calculations upon permit renewal may emphasize the need to protect river flows to avoid costly pollution treatment upgrades.

• *Monitoring and assessment of waters*–**see box State Monitoring and Reporting for Hydrologically Impaired Waters in Water Budgets section.**

Summary

States have a range of opportunities to protect environmental flows. Two key methods states can utilize to protect environmental flows are water allocation and permitting, and adoption of water quality standards that include flow criteria. To maximize the effectiveness of either approach, the best policies are premised on knowing how much water your river needs and establishing corresponding flow criteria to support those goals, including a range of flows.

Recommendations and What You Can Do

- Ask your state to incorporate effective environmental flow protections into its water withdrawal permitting program.
- Ask your state to incorporate environmental flow protections into water quality standards via the triennial review of water quality standards required by the Clean Water Act to happen every three years.
- Support development of a dam removal team in your state.

LEARN MORE

River Network's **Water Security Science Module**

River Network's issue of *River Voices* on **Water Security and Sustainability**

Southeastern Aquatic Resources Partnership and Southern Instream Flow Network's ***Instream Flow Protection Policy Overview***

EPA-USGS's draft **Technical Report: Protecting Aquatic Life from Effects of Hydrologic Alteration: U.S. Geological Survey Scientific Investigations Report 2015–5160**

Southern Instream Flow Network

Instream Flow Council

The Nature Conservancy's **Practical Guide to Environmental Flows for Policy and Planning**

Southeast Aquatic Resource Partnership

STATE POLICIES

for Interbasin Transfers

Introduction

An interbasin transfer (IBT) occurs when water is withdrawn from one basin, a "donor basin," and all or a portion of the water is returned to another basin, a "receiving basin." Interbasin transfers can happen for a number of reasons, including when a water system lies within two different river basins and the water system withdraws drinking water from one basin and discharges wastewater into another, or when a water system has to go to another river basin to get the amount—or quality—of water needed. Interbasin transfers can be harmful to the river system and downstream communities, so it is important to consider the impacts to the donor basin and the receiving basin and—preferably through enforceable policy—to ensure the transfer does not merely reallocate scarcity to another area or cause other water quality problems. In fact, some interbasin transfers have been instituted to avoid water quality problems in the donor basin, but have brought about water scarcity problems.[175] In Georgia, for instance, interbasin transfers adversely affect a number of rivers, including the Flint River, where seasonal low flows are 60% lower since the 1970s, with a little over a third of that attributable to interbasin transfers.[176]

CONSIDERATIONS FOR INTERBASIN TRANSFERS:

Potential benefits of interbasin transfers:

- May mitigate water scarcity in receiving basin for human and ecological needs
- May mitigate water quality impairments by diverting waste water discharges to less ecologically sensitive or impaired basins
- May reduce withdrawals from more ecologically sensitive basins
- May achieve regional economic or social goals
- May allow water systems to more economically or logistically discharge waste water when they are located within two river basins

Potential harm caused by interbasin transfers:

- May cause water scarcity in donor basin and associated ecological impacts
- May cause economic impacts in the donor basin due to lack of water for economic development
- May degrade water quality in either the donor and/or receiving basin (e.g. reduce assimilative capacity or transfer pollutants)
- May adversely change the hydrology in either the donor and/or receiving basin (e.g. change the flow regime, increase erosion)
- May allow receiving basin to avoid maximizing water efficiency
- May promote sprawl development in areas that would not otherwise have the water to support growth.

Interbasin Transfer Policies Scorecard	AL	GA	NC	SC	TN	OTHER MODELS
Interbasin Transfer Policies						Massachusetts, Georgia policy proposal

Of the states reviewed here, North Carolina has at times had the most extensive requirements for review of interbasin transfers (though some have been recently weakened), while Alabama currently has none (though Alabama does prohibit interbasin transfers out of the Tennessee River basin). Georgia, South Carolina, and Tennessee fall in between—all have policies in place with varying degrees of review and implementation.

Since 1993, North Carolina has required certification for new interbasin transfers that are more than an average of 2,000,000 gallons per day and for an increase in some existing transfers.[177] An exemption exists if the discharge point is situated upstream of the withdrawal point such that the water discharged will naturally flow past the withdrawal point, or if the discharge point is situated downstream of the withdrawal point and water flowing past the withdrawal point will naturally flow past the discharge point.[178]

The application process for an interbasin transfer certificate is extensive and can take three to five years. First, an applicant is required to file a notice of intent to file a petition and hold a public meeting in the source river basins both upstream and downstream from the proposed point of withdrawal, as well as in the receiving river basin.[179] The public meetings inform interested parties and the public about the nature and extent of the proposed transfer and provide opportunities for notice and comment on the scope of the environmental documents.[180]

In addition to notice and comment procedures for transfer certification, the N.C. Department of Environmental Quality (NCDEQ) studies and develops a statement covering the environmental impacts of any proposed transfer that requires a certificate.[181] An environmental impact statement must include an analysis of the certificate's potential impact on both the source and receiving river basin, an evaluation of alternatives to the proposed transfer, and a description of measures to mitigate any adverse impacts resulting from the proposed transfer.[182] After a draft environmental impact statement is created, the Environmental Management Commission initiates a notice and comment period and holds a public hearing on the draft.[183]

The petition requirements are relatively extensive and include: a description of the facilities to be used, all the proposed consumptive and nonconsumptive uses of the water to be transferred, the applicant's water conservation measures and water supply plan, all present and potential sources of water within the receiving

KEY

GREEN

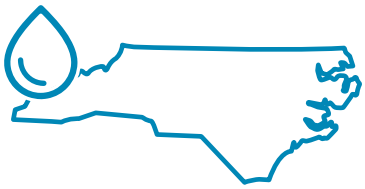
Interbasin Transfer Policy exists and provides sufficient protections to both the donor and receiving basins.

YELLOW

Interbasin Transfer Policy exists but is insufficient to protect the donor and/or receiving basin.

RED

Interbasin Transfer Policy does not exist.



NORTH CAROLINA

river basin, and a description of water transfers and withdrawals registered under state law or included in a local water supply plan.[184] The applicant must also demonstrate that the proposed transfer would not reduce the amount of water available for use in the source river basin to a degree that would impair existing uses pursuant to federal and statewide clean water antidegradation policies.[185] The petition includes a description of the water quality of the source river and receiving river, in-stream flow data for segments of the source and receiving rivers that may be affected by the transfer, and any waters that are failing to meet water quality standards under the Clean Water Act.[186] Finally, the petition must disclose the applicant's future water supply needs "and the present and reasonably foreseeable future water supply needs (including agricultural, recreational, and industrial uses, and electric power generation) for the public water systems with service areas located within the source river basin."[187]

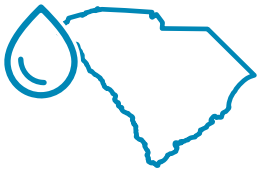
Once the environmental document is complete and the applicant submits a petition for a certificate, the Commission issues a draft decision on whether to grant the certificate.[188] Following the draft determination, the Commission holds a notice and comment period, as well as public hearings on the draft determination.[189] In making a final determination, the Commission considers a number of factors including benefits and impacts to both basins, fish and wildlife, and other water users.[190] While North Carolina's process is relatively strong, it has been weakened in recent years by decreasing opportunities for public input and fast tracking approvals for certain basins, and IBTs remain controversial.[191]

Georgia law encourages, as part of the water withdrawal permitting process, evaluation of interbasin transfers by the Georgia Environmental Protection Division (GAEPD) including consideration of the donor basin, receiving basin, and public input, with the exception of water transfers across basins as part of industrial operations.[192] Evaluation of the proposed interbasin transfers should consider existing and potential uses of water, in an attempt to "allocate a reasonable supply of surface waters to such users and applicants."[193] For a permit application to be considered reasonable, the receiving basin should show implementation of water conservation practices and achievement of "reasonable" water conservation goals.[194]

In evaluating interbasin transfer applications, GAEPD should consider characteristics of both the donor and receiving basin. Some of the notable donor basin characteristics include: the quantity requested in comparison to the stream flow during dry years and low flow conditions, the effect on both surface water and groundwater, and offsetting flow increases that may be arranged through permit conditions. Highlights of the receiving basin characteristics include: whether the applicant has implemented water conservation practices and has explored all other reasonable options (such as the use of reclaimed or recycled water), benefits of the transfer, and water treatment capacity. GAEPD should also consider the cost effectiveness and economic feasibility. Finally, GAEPD should consider the cumulative impacts of current and proposed interbasin transfers.[195]

Public participation is required prior to issuance of water withdrawal permits involving an interbasin transfer. GAEPD must notify the public and provide an opportunity for a public hearing via one or more of the following: a press release, publishing on a website, or direct contact with interested parties via email or other mechanisms.[196] The press release, notifying the public of a draft permit, must be distributed at least 30 days in advance to one or more newspapers circulated generally throughout all affected areas of the basin, followed by a 30-day public comment period. Given sufficient interest, GAEPD may hold a public hearing somewhere in the affected basin prior to the permit decision.

Unfortunately, there is evidence that GAEPD is not adequately evaluating the impact of interbasin transfers, and advocates have argued for required review of more comprehensive criteria to be adopted by statute.[197] Comprehensive criteria for interbasin transfer review (e.g. quantity of the proposed withdrawal and the stream flow of the donor basin, with special consideration for dry years and low flow conditions) are included in the state's comprehensive water planning process, but are only advisory.[198] Interbasin transfers are more strictly regulated in the Metropolitan North Georgia Water Planning District, where the District is prohibited from studying or planning for any interbasin transfers that would import water from outside of District boundaries.[199]



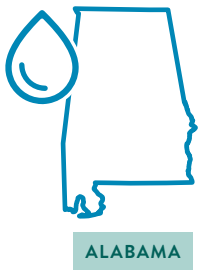
In South Carolina, interbasin transfers are regulated as surface water withdrawals under the Surface Water Withdrawal, Permitting, Use, and Reporting Act of 2011. An interbasin transfer is defined as "the transfer of three million (3,000,000) gallons or more of water in any one month from one of [a list of] USGS defined basins to a different basin such that the water is permanently lost from the basin of origin."[200] Any interbasin transfer permits that existed before this time remain in effect, subject to their individual expiration dates, and holders of such permits are considered existing surface water withdrawers for purposes of the Act **(see water permitting section above)**.[201] Any future attempts to renew existing interbasin transfer permits will be subject to permitting requirements imposed under the surface water withdrawal regulations.

The South Carolina Department of Health and Environmental Control (SCDHEC) is required to go through specific public notice process as part of the permit application that includes an interbasin transfer.[202] The public notice involves holding a mandatory public hearing and providing general notice on the Department's website, in a statewide newspaper, and directly to parties who hold withdrawal or Clean Water Act National Pollutant Discharge Elimination System (NPDES) permits in the donor basin, as well as to governing bodies of the local water supply in the donor basin.[203] Such notice must include certain details about the withdrawal including the amount to be withdrawn and transferred, a "non-technical description" of the requested withdrawal and transfer, the intended use of the transferred water, and details on the public hearing and comment period.[204]

Beyond these particular public notice requirements, the permit requirements for interbasin transfer withdrawals are no different than for any other new or expanding surface water withdrawer. Ideally, the considerations inherent in a permit application evaluation, such as minimum instream flow and safe yield, would address particular issues related to interbasin transfers and their effects on the health of the donor basin.

Tennessee's Inter-basin Water Transfer Act of 2000 regulates both surface water and ground water moved between basins.[205] The permitting process applies to public water supply entities, those directly or indirectly serving public water supply entities, or those granted power by the state through eminent domain or condemnation.[206] Private industry is excluded from this permitting process unless they are transferring or supplying water to a public system in another basin, either directly or indirectly.[207]

The Tennessee Department of Environmental Conservation must review and approve applications based upon the rules developed by the Board of Water Quality, Oil, and Gas.[208] The permit application must include, but is not limited to, the volume of the proposed withdrawal, any volume of water to be returned, and an assessment of hydrological and environmental impacts to the "losing river" (the source basin).[209] Further, in deciding whether to issue a permit, the state must address a number of criteria, including the quantity of the proposed withdrawal and stream flow of the donor basin with "special concern for low flow conditions," protection of water quality, and whether the project promotes water conservation.[210] These permits must be annually certified with the Tennessee Department of Environment and Conservation with accompanying flow and pump records.[211] However, monitoring of these transfers is unclear.



Currently, in Alabama, interbasin transfers are allowed de facto and are not regulated. The exception is the Tennessee River basin, where those counties along the river have adopted local legislation prohibiting transfers outside the basin. These laws would be superseded by a state water plan. Additionally, there are no monitoring or reporting requirements for interbasin transfers. As a result, while there are numerous examples of interbasin transfers in Alabama, particularly in the Birmingham area, the extent of their impacts is unknown. Recommendations for regulating interbasin transfers put forth in a 1990 report were never implemented, but as part of the current water planning process a panel has been formed to focus on Certificates of Use, Permitting, and Interbasin Transfers. The panel will: 1) determine how to evaluate and account for interbasin transfers, 2) identify and summarize current interbasin transfers, and 3) consider periodic reporting requirements, and establishment of a regulatory mechanism and criteria for new or expanded interbasin transfers.[212]

Two model policies, one enacted in Massachusetts and one proposed in Georgia, are described below for use in shaping future state policies.

The Massachusetts Interbasin Transfer Act applies to all transfers of water and wastewater that cross both a town line and a basin boundary, except those determined to be insignificant—if the withdrawal is less than 1 million gallons per day (MGD), or if the withdrawal is less than 5% of instantaneous flow, based upon consideration of the water-dependent uses, or based upon consideration of cumulative impacts of the transfer.[213]

IF THE IBT IS DETERMINED SIGNIFICANT, AN APPLICATION IS REQUIRED AND EIGHT CRITERIA MUST BE MET:

- Completion of the Massachusetts Environmental Policy Act (MEPA) process
- All viable in-basin sources must have been developed or ruled out as not viable
- All practical water conservation measures must have been implemented
- For existing surface water sources, a forestry management plan must have been implemented
- Reasonable in-stream flow in the donor basin must be maintained
- For groundwater transfers, a pumping test must be conducted and provided with the application
- The receiving community must have, or be developing, a local water resources management plan
- Cumulative impacts must be considered

Performance standards outline how each criterion should be addressed. Once completed applications have been received, the state has 60 days to hold two public hearings, one in the donor basin and one in the receiving community. State agency staff then makes a recommendation to approve or deny the transfer, and within two weeks an additional public hearing is held before a final decision is made. Although only two interbasin transfers have ever been rejected under this law, the regulations have demonstrably improved conservation and efficiency in the receiving basins.[214]

In 2010, the Georgia Water Coalition backed legislation that, while not adopted, can also serve as a model policy. In creating Georgia's Comprehensive Statewide Water Plan, stakeholders from across the state, in cooperation with GAEPD, developed a list of 22 specific criteria that should be considered by GAEPD when evaluating water withdrawal permits involving interbasin transfers. Vetted by stakeholders statewide through a three-year planning process and approved by the General Assembly and Governor, they provide the kind of analysis that would produce facts that will aid regulators in determining if a proposed transfer is

GEORGIA

harmful and, if so, if there are alternatives to such a transfer. The Georgia Water Coalition backed legislation would have enacted the interbasin transfer criteria outlined in the Water Plan and required GAEPD to consider these criteria when issuing permits involving interbasin transfers. As it stands, consideration of these criteria is merely discretionary within GAEPD.

THESE CRITERIA ARE LISTED BELOW AS THEY APPEAR IN THE GEORGIA 2008 WATER PLAN:[215]

DONOR BASIN CONSIDERATIONS

i. The quantity of the proposed withdrawal and the stream flow of the donor basin, with special consideration for dry years and low flow conditions

ii. The current and reasonably foreseeable future water needs of the donor basin, with special consideration for dry years and low flow conditions

iii. Protection of water quality in the donor basin, with special consideration for dry years and low flow conditions

iv. Any offsetting increases in flow in the donor basin that may be arranged through permit conditions

v. The number of downstream river miles from which water will be diverted as a result of the transfer

vi. The connection between surface water and groundwater in the donor basin, and the effect of the proposed transfer on either or both

RECEIVING BASIN CONSIDERATIONS

i. Determination of whether or not the applicant's proposed use is reasonable, including consideration of whether the applicant has implemented water conservation practices and achieved reasonable water conservation goals

ii. Assessment of the wastewater treatment capacity of the receiving basin

iii. The supply of water presently available to the receiving basin, as well as the estimates of overall current water demand and the reasonable foreseeable future water needs of the receiving basin

iv. The beneficial impact of any proposed transfer, and the demonstrated capability of the applicant to effectively implement its responsibilities under the requested permit

v. The impact of the proposed transfer on water conservation

vi. The applicant's efforts to explore all reasonable options for use of reclaimed water and recycling of available sources to meet the needs of the receiving basin

vii. Assessment of the adequacy of treatment capacity and current water quality conditions

CONSIDERATIONS AFFECTING BOTH BASINS

i. The economic feasibility, cost effectiveness, and environmental impacts of the proposed transfer in relation to alternative sources of water supply

ii. The cumulative impacts of the current and proposed interbasin transfers in the basin

iii. The requirements of the state and federal agencies with authority related to water resources

iv. The availability of water for responding to emergencies, including drought, in the donor basin and the receiving basin

v. The impact, whether beneficial or detrimental, on offstream and instream uses

vi. The quantity, quality, location, and timing of water returned to the basin of donor basin, receiving basin, and basins downstream

vii. Impact on interstate water use

viii. The cumulative effect on the donor basin and the receiving basin of any water transfer or consumptive use that is authorized or forecasted

ix. Such other factors as are reasonably necessary to carry out the purposes of Georgia law

Summary

An interbasin transfer occurs when water is withdrawn from one basin, a "donor basin," and all or a portion of the water is returned to another basin, a "receiving basin." When considering whether or not to allow interbasin transfers, it's important to consider the impacts to the donor basin and the receiving basin, and adopt policy to ensure the transfer does not merely reallocate scarcity to another area or cause water availability or water quality problems.

Recommendations and What You Can Do

- Are interbasin transfers adversely affecting flows in your state?

- If so, ask your state to develop an interbasin transfer policy that evaluates the factors mentioned in the Massachusetts and Georgia examples.

LEARN MORE

Massachusetts Office of Energy and Environmental Affairs **Interbasin Transfer Act**

Georgia Statewide Water Management Plan's **Interbasin Transfer Policy** (pg. 26)

Georgia Water Coalition's **Interbasin Transfers Briefing Document**

Water Planning

Introduction

Water planning is a broad umbrella and may involve a variety of activities related to assessment, forecasting, and management of both water quality and water quantity. While this report focuses on the ways Southeastern states plan management of water in our rivers, it is important to note that water quality and quantity are inextricably linked, making integrated planning preferable to planning for each separately. Water plans most commonly apply to rivers, lakes or reservoirs, and groundwater resources, but they may also include wetlands, estuaries, and floodplains. Water plans are crafted for achieving both short- and long-term goals, generally with a planning horizon of 25 or 50 years. Components of a strong water plan include state legislation that mandates planning and establishes criteria, public participation, integration of water quality and quantity, planning for critical areas, and funding for both planning and plan implementation **(see Table 5)**.[216]

Each state was reviewed for whether a state water management plan has been, or is being, developed; the scope of the plan or planning effort; how the plan is being implemented; and the provisions for public participation. Each state's approach to water supply planning is significantly different. Alabama is in the process of creating a state water plan and South Carolina has a rather outdated state water management plan, in the process of being updated. Georgia has a comprehensive state water management plan and regional water plans that lack implementation mechanisms, and North Carolina has a series of nested water supply plans. Tennessee has optional regional water planning.

KEY

GREEN

Existence and full implementation of water plan and corresponding policies and strong public participation (no states met these criteria).

YELLOW

Partial existence and implementation of water plan and corresponding policies (e.g. water planning process underway, policies exist but not yet fully implemented because shortages in funding or authority); some mechanisms for public participation.

RED

Negligible existence and/or implementation of water plan and corresponding policies (i.e. negligible implementation because water planning has not commenced, there is insufficient authority to implement the plan, or there is inadequate funding to implement the plan); no opportunities for meaningful public engagement (no states met these criteria).

Water Planning Policy Scorecard	AL	GA	NC	SC	TN
State Water Plan					

TABLE 5

Recommended Components of State Water Plans (adapted from Statewide Water Resources Planning study)[217]

	AL	GA	NC	SC	TN
State legislation that mandates planning take place, criteria for how the planning process will take place, and funding to fully undertake the process	No	Legislation–yes, Criteria–yes, Funding–yes	Yes/? (Legislation– yes, Criteria–yes, Funding–no)	Legislation–yes, Criteria–yes, Funding–no	No
Research, collect and use the best available scientifically sound data as a basis of planning	No (recommended by AWAWG)	Yes	Yes	Yes	Yes (for 2 existing regional water plans)
Maintain transparency and public engagement in the planning process	No (recommended by AWAWG)	State Water Plan–Yes, Regional Water Plans–No	Yes	Yes	Yes (for 2 existing regional water plans)
Substantively include state government, federal agencies, regional entities, local government, and the public in planning	No (recommended by AWAWG)	Yes/No (State Water Plan–Yes, Regional Water Plans–No)	Yes	Yes	Yes (for 2 existing regional water plans)
Base planning on watersheds, river basins, and aquifers, not political boundaries	TBD	No	Yes	Water Plan–No (includes only state-level recommendations); Assessments–Yes	Yes
Integrate surface water and groundwater planning	TBD	No	Yes	Yes	Yes (for 2 existing regional water plans)
Link water quantity and water quality	TBD	Yes	Yes	Yes	Yes
Incorporate uniform, consistently applied, and enforceable standards to manage water use	TBD	No	No	No	No
Incorporate implementation that includes enforcement of standards, rigorous evaluation and adaptive management	TBD	No	No	No	No
Plan for critical areas (i.e. capacity strained areas, rapidly increasing use areas, threatened or high ecological value areas, impaired areas (i.e. salt water intrusion), etc.)	TBD	Yes	Yes	No	Yes
Focus on decreasing demand as well as increasing supplies	TBD	Yes	Yes	Yes	Yes

Alabama's State Water Plan

Alabama currently does not have a plan; however, development of a statewide comprehensive water resources management plan is currently underway and seen as critical for the state, especially as it relates to ongoing interstate water allocation disputes with Georgia and Florida.[218] Momentum toward a state water plan accelerated in 2011 after repeated efforts by the Alabama Rivers Alliance and others, when Governor Robert Bentley created the Alabama Water Agencies Working Group (AWAWG) from several key state agencies. The AWAWG was formed to examine water resource programs and policies and to recommend how to improve planning and management activities for water resources.[219]

This effort led to the 2012 AWAWG report *Water Management Issues in Alabama*, which resulted in a formal charge to the AWAWG to reconvene and create a comprehensive database of Alabama's water resources, meet with stakeholders, and recommend a statewide water management action plan and timeline.[220] This effort culminated with the 2013 AWAWG report, and a discussion of 12 water focus areas (identified from stakeholder comments and previous reports).

The 2013 AWAWG report recommends conducting statewide water management planning with a process it called the "Water MAP" (Monitor, Assess, and Plan). The Water MAP Process involves three phases: 1) *monitoring:* water quality, water use, surface and groundwater in real-time, rainfall and soil moisture, biological conditions, and monitoring program review; 2) *assessing:* water quality, surface and ground water capacities and availability, biological and instream flow information, water availability and needs forecasts, and assessment program review; and 3) *planning:* water plan development, implementation, and updates; identify water management practices, implement regulatory programs, and review regulatory programs. Currently, there is a series of issue-based Focus Area Panels working to develop recommendations for the plan that will be synthesized into a master report by the AWAWG.

The success of the Water MAP Process may be hindered by state budget constraints. A limited amount of funding is dedicated solely to the Water MAP process, and funding has been cut numerous times; there are no funds for predictive or proactive modeling. It is uncertain whether sufficient funds will be invested in future implementation and enforcement.

PUBLIC PARTICIPATION IN ALABAMA WATER PLANNING

The Alabama Water Resources Act, which serves as the legislative foundation for state water-planning efforts, does not define mechanisms for public participation by citizens or local or regional entities, although the AWAWG recommended passing legislation during the Water MAP process.[221] Furthermore, the Water MAP Process suggests an outreach track to inform and engage stakeholders in the development of the statewide water management plan. It is not clear, however, how outreach will be implemented. While Governor Bentley has indicated that stakeholder inclusion is critical to the success of a state water plan and has charged the AWAWG with reaching out to stakeholders (leading to the inclusion of a separate stakeholder outreach track in the Water MAP Process), stakeholder outreach activities in general have been lacking. Stakeholder outreach meetings, led by the AWAWG, thus far included only those identified as "key stakeholders;" few public forums have been held. To help fill this gap and increase stakeholder engagement, the Alabama Rivers Alliance held public water policy symposia around the state.[222] State representatives were also invited and attended these symposia.[223] While there are a number of conservation groups who were appointed to the issue-based Focus Area Panels working to develop recommendations for the plan, the Panels have been less open to public input generally.[224]

Georgia's State Water Plan

In 2001, the Georgia Senate created the Joint Comprehensive Water Plan Study Committee and Water Plan Advisory Committee to develop the guidelines for future comprehensive state water planning efforts.[225] The Final Report of the Joint Comprehensive Water Plan Study Committee, released in 2002, proposed a framework for the state water plan.[226] As a result, Georgia's 2004 Comprehensive Statewide Water Management Planning Act mandated the development of a statewide water plan with the goal of Georgia managing water resources in a "sustainable manner to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens."[227]

The Georgia Environmental Protection Division (GAEPD) was charged with developing the Comprehensive Statewide Water Management Plan (Water Plan). A Water Council comprised of agency heads and legislators, and chaired by the GAEPD Director, provided oversight, input, review and approval before the Water Plan was presented to the Georgia General Assembly for adoption. The final plan was adopted in 2008. It required water quantity and water quality assessments and water and wastewater demand forecasts for the municipal, industrial, agricultural, and energy sectors.[228] The Water Plan also called for (but did not require) potential policy, management practices, and implementation actions to manage water quantity and water quality, and management practices and implementation actions for managing water demand, water return, and water supply.[229] Further, the Water Plan required the development of Regional Water Plans by Regional Water Councils covering 11 Water Planning Regions, which were configured primarily on county boundaries instead of watershed boundaries. This configuration of the Regions substantially limits the ability of Councils to create comprehensive water management plans and causes river basins to be dissected into multiple Regions and have disjointed Regional Water Plans covering them. In particular, several watersheds have their headwaters or significant land area within the Metropolitan North Georgia Water Planning District disconnected from the remainder of the river basin in their respective water planning Regions.

In the area of water conservation, the Water Plan required development of a Water Conservation Implementation Plan to provide guidance to Georgia's seven major water use sectors (agricultural irrigation, electric generation, golf courses, industrial and commercial, landscape irrigation, domestic and non-industrial public uses, and state agencies) on effective practices for water conservation. Each chapter of the water conservation implementation plan detailed sector-specific water conservation goals, benchmarks, best practices, and implementation actions designed to reduce water waste, water loss, and where necessary, water use.[230] The lack of enforceability of this conservation plan (and for much of the Water Plan generally) was always a concern among many in the environmental community. However, many of the items in the Water Conservation Implementation were included in Georgia's Water Stewardship Act (detailed in the Conservation Section of this report).

The Regional Water Councils used the Water Plan, the water quantity and water quality assessments, the water and wastewater demand forecasts, and the water conservation implementation plan to develop regional water plans that identified expected water needs plus water management practices to meet those future water needs. Stakeholders raised a number of issues of concern regarding the process and methodology used to develop the plans. First, the timing of the delivery of some of the assessments, forecasts, and water conservation implementation plan hindered the Councils' ability to fully use the information and make well-informed planning decisions. For example, information on the water use by thermoelectric power plants, the single largest user of water in Georgia at that time, was delayed until less than three months before drafts of the Regional Water Plans were due to be completed. Second, there were also concerns that the water use forecasts for electricity generation were arbitrary and failed to address less water intensive methods of electricity generation. Third, some forecasts were based upon unrealistic, high-growth population projections. There were concerns that instream flow modeling should have used more appropriate data points, that water quantity assessments used improper minimum instream flow standards (relying on the outdated 7Q10), and that groundwater modeling was based on incorrect assumptions.[231] Nonetheless, Regional Water Plans were finalized and adopted in 2011 and a five-year review of the Regional Water Plans is taking place in 2016.[232]

The 2001 Metropolitan North Georgia Water Planning District Act also required the creation of water management plans (Water Supply and Water Conservation Management Plan, Watershed Management Plan, and Wastewater Management Plan) and rules for regional water planning in the 15-county Metropolitan North Georgia Water Planning District (Metro District), which encompasses the metropolitan Atlanta area—the most populous area of the state.[233] These plans were developed separate from, and prior to, the statewide Regional Water Planning effort. Water planning in the Metro District is now consistent with the statewide rules and regulations that guide the Regional Water Planning effort, although the Metro District planning efforts remain better-funded than those across the rest of the state.

The actual impact of the Water Plan and Regional Water Plans on the management of Georgia's resources is unclear. In 2014, each Regional Water Council developed a report that summarized progress on implementation of regional water plan management practices and recommendations,[235] but it is unclear if, or to what degree, regional water planning actually impacted the actions that were highlighted. A major drawback of both the State Water Plan and Regional Water Plans is that they do not have the force of law and thus contain no enforceable water management mandates, only recommendations. While GAEPD and other state agencies are encouraged to take actions outlined in the Water Plan, and make water management decisions based on the Regional Water Plans, there are no requirements to do so. As such, it is challenging to assess if actions resulted from water plans or other factors.[236]

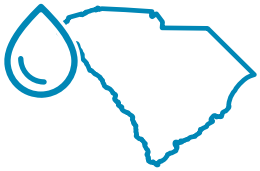
PUBLIC PARTICIPATION IN GEORGIA WATER PLANNING

Development of the Statewide Water Plan included multiple forms of stakeholder input. The Water Planning process included Basin Advisory Committees, Technical Advisory Committees, a Statewide Advisory Committee, as well as public meetings and town hall meetings.[237] Regional Water Council members were appointed by the Governor, Lt. Governor, and Speaker of the House, but their appointees did not represent the broad spectrum of water interests and expertise in the Region; additionally, women and minorities

were largely left out of the appointments.[238] Regional Water Council meetings often included a public comment period at the end of meetings, which was not conducive to Council members responding to questions or requests or including public input in their decision making.

A public comment period on the draft Regional Water Plans was also offered prior to adoption of those plans. The Georgia Water Coalition recommended that future regional water planning efforts incorporate one or more public meetings solely for the purpose of allowing non-Council members to present information and ask questions and get answers, and for each Regional Water Council to accept public input.[239]

South Carolina's State Water Plan



The South Carolina Water Resources Planning and Coordination Act of 1967 gives the South Carolina Department of Natural Resources (SCDNR) responsibility for developing comprehensive water policy for the state, including coordination of policies and activities among departments and agencies.[240] The Water Plan itself is intended to be "a guide for managing the State's surface and ground water in order to maximize the use of this resource while protecting it for future use."[241]

Initial development of South Carolina's water resources policy plan was done in two phases. Phase I, the South Carolina State Water Assessment (Assessment), provided an overall assessment of the state's water resources; described stream, lake, and aquifer systems; and provided information on the amount and availability of water. The Assessment is a comprehensive reference guide on many topics related to the state's water resources, as well as an overview of water quantity, quality, availability, and use in the state **(described in the section on Water Budgets)**.

Phase II, the South Carolina Water Plan (Water Plan), outlined guidelines and procedures for managing the State's water resources, and was published in 1998. The Water Plan was revised and updated in 2004, and this "Second Edition" of the Water Plan incorporated knowledge gained and lessons learned from a severe drought in the state from 1998–2002.[242] The Second Edition identified 12 water management goals, provided an overview of the state's hydrology and water usage, identified potential water management practices, and cataloged existing water quality regulations and programs. The Water Plan also identified several needs, including the need to regulate surface and groundwater withdrawals, establish instream flow requirements, develop a water-sharing strategy related to lake in-flows and out-flows, establish a statewide "water-table monitoring network" to assess and monitor hydrologic conditions, and establish mechanisms to negotiate equitable apportionment of water resources shared with neighboring states. However, the Water Plan did not establish any specific program or process to actually manage the state's water resources. The Water Plan is primarily a report of conditions and recommendations, and is not a specific and actionable plan for how the state's water resources will be managed.[243]

The State Water Plan is currently being updated. In 2014, the state began the process and hired a contractor to develop surface water quantity models for eight major watersheds in the state to accurately assess the location and quantity of water resources to support effective water planning and management.[244] As described in the section on Water Budgets, the current modeling process is still limited in that the water use data collected relies only on those withdrawers who are required to report use (those who withdraw three million gallons or more a month **[see withdrawal permitting section]**). The modeling will provide surface water and groundwater availability assessments, which along with future demand forecasts will provide a basis for development of more comprehensive and detailed statewide and regional water plans and budgets.[245]

In 2015, the state hired the S.C. Water Resources Center at Clemson University to assist the state agencies and their consultant in the implementation of a stakeholder engagement process that establishes a dialogue on water use, current and future needs, and the water assessment process. A website on the modeling process was developed to share information and updates. Two stakeholder meetings will be held in each of the eight river basins—one at the beginning of the modeling process and one near the end to gather input and share outcomes. The intent of the stakeholder engagement process is to enable stakeholders to provide data towards model development, create an open dialogue, and improve assumptions used in the model.[246]

North Carolina

In 1989, North Carolina implemented requirements for a state and local water supply planning process; regional planning was discretionary. In recent years, however, the State has moved toward basin water supply planning.

LOCAL WATER SUPPLY PLANS

North Carolina law requires local government units that provide public water and large community water systems to prepare a local water supply plan.[247] Current and potential needs, the likelihood of meeting those needs, and an annual water use update based on water use and system conditions must be submitted every year.[248]

More specifically, local water supply plans in North Carolina must show present and projected population, industrial development, and water use in the service area.[249] Plans also should consider present and projected water supplies, technical assistance that may be needed to address predicted water needs, water conservation and reuse programs, and a description of how the unit will respond to drought and water shortage emergencies.[250] Current local plans can be accessed online at the North Carolina Department of Environment and Natural Resources Division of Water Resources website.[251]

N.C. STATE WATER SUPPLY PLAN

The North Carolina Department of Environmental Quality (NCDEQ) is required to develop a State water supply plan, which should include water supply information and projections.[252] The plan summarizes water conservation and water reuse programs described in local plans, the technical assistance needs indicated by local plans, and the extent to which the various local plans are compatible with one another.[253] The Department may assist the local government in identifying the preferred water supply alternative that alone or in combination with other water sources will provide for the long-term water supply needs documented in the local water supply plan.[254] In short, the State plan serves to assess water supply needs by compiling over 500 local water supply plans. North Carolina is currently developing river basin water supply plans for each major basin that will merge data submitted by water withdrawers with a computer-based hydrologic model **(see water budget section)** and these will be integrated into the state plan. At this point, however, only five out of 17 basin models are complete.

N.C. REGIONAL AND RIVER BASIN SUPPLY PLANS

In addition to state and local water plans, one or more water systems may establish a water supply planning organization to plan for and coordinate water resource supply and demand on a regional basis.[255] NCDEQ recently created the Basin Planning Branch in order to merge basin wide planning groups in the Division of Water Resources and Division of Water Quality.[256] The transition to basin supply plans allows the Department to analyze the cumulative effects of long- range projections of water withdrawals and returns on the surface waters of the basin being evaluated. Basin plans will also help local governments and other water users plan for future needs by providing reliable information. If funded and implemented, the recent basin-wide approach will provide aggressive analysis of existing and future needs on a more comprehensive basis than the previous planning effort. However, these plans are ultimately limited in practical effect given that North Carolina does not have a water permitting system.

According to the state, NCDEQ staff work with a variety of stakeholders to develop river basin water resources plans.[257] Stakeholders are asked to provide information on protecting and enhancing watershed water quality and issues associated with reliability of water supplies. Stakeholders typically include watershed associations, land trusts, water quality monitoring coalitions, soil and water conservation districts, public water systems, and other federal, state, and local agencies.[258] The Basin Planning Branch also provides a public listserv that sends e-mails regarding public comment periods and public meetings related to the development of Basin Plans.

Tennessee's Regional Water Supply Plans

Tennessee takes a regional voluntary approach to water planning. Regional water planning began in 2002 when Tennessee passed the Water Information Act (WIA), which recognizes that surface water and ground water withdrawals have the potential to impact Tennessee water use, and that a system for documenting current water demand and potential growth is necessary. To aid in the process, the WIA gave the state the authority to appoint a Water Resource Technical Advisory Committee[259] (WRTAC) comprised of representatives of federal, state, and local agencies and private organizations, including nonprofit organizations and industry.[260] This committee, which is no longer in existence, was funded temporarily to make recommendations on pressing water resource issues.[261]

While initially little was accomplished through the Water Information Act, Tennessee began prioritizing statewide water resource planning for both water quality and water supply following a severe drought in 2007–2008.[262] Following the WRTAC recommendations, the Tennessee Department of Environment and Conservation (TDEC) partnered with a number of entities to develop regional projects and model water plans for two areas that were especially vulnerable to droughts: the North Central Tennessee region and the Southern Cumberland region.[263] While the two study areas were unique, the same process was applied to both to determine the most cost-effective and sustainable way to meet current and projected water supply needs. The result of each study is a detailed and adaptive implementation plan to meet the region's water supply needs for the next 20 years. Each region appears to be voluntarily implementing their plans.[264]

In 2013, the WRTAC compiled information from both pilot plans to develop the Regional Water Resources Planning Guidelines for Tennessee.[265] The WRTAC also published the state's Regional Water Supply Plans Approval Process.[266] While regional water planning is encouraged by the state through incentives and by giving state agencies the authority to award funding based on criteria related to water planning, the state has not required regional water plans.[267] Currently, only the two pilot water plans exist, but as utility districts apply for water withdrawal increases via ARAPs, TDEC may require a water plan in support of the application.[268]

In addition to the WRTAC, the Regional Water Resource Planning studies also relied upon stakeholders in the study area to provide information through a series of meetings with local government officials, utility managers, and the public.[269]

Summary

Water planning may involve a variety of activities related to assessment, forecasting, and management of both water quality and water quantity. Water quality and quantity are inextricably linked and planning for both should be integrated. Surface water and groundwater resource planning should also be integrated where appropriate. The scope of water plans most commonly applies to rivers and lakes or reservoirs and groundwater resources, but may also include wetlands, estuaries, and floodplains. Water plans are crafted for achieving both short- and long-term goals, generally with a planning horizon of 25 or 50 years.

Recommendations and What You Can Do

Ask your state to incorporate the following into its water planning efforts:

1. Pass state legislation that mandates that planning take place as well as establish criteria for how the planning process will take place and funding to support it.

2. Gather and use the best available scientifically sound data as a basis of planning.

3. Maintain transparency and public engagement in the planning process.

4. Substantively include state government, regional entities, local government and the public in planning.

5. Base planning on watersheds, river basins, and aquifers, and not on political boundaries.

6. Integrate surface water and groundwater planning.

7. Link water quantity and water quality.

8. Incorporate uniform, consistently applied, and enforceable standards to manage water use.

9. Incorporate implementation that includes enforcement, rigorous evaluation and adaptive management.

10. Plan for critical areas (i.e. capacity strained areas, rapidly increasing use areas, threatened or high ecological value areas, impaired areas [e.g. salt water intrusion], etc.).

11. Focus on decreasing demand through water conservation and efficiency measures **(see section on Reducing Demand)**, before increasing supplies.

LEARN MORE

Institute for a Secure and Sustainable Environment's ***Statewide Water Resources Planning: A Nine-State Study*** report

Georgia Water Coalition's 2015 Report: Recommendations for a Healthy Water Future

REDUCING DEMAND

Water Conservation and Efficiency

Water Conservation and Efficiency Policy Scorecard	AL	GA	NC	SC	TN	OTHER MODELS
Water Loss						
Drought Planning						Texas
Planning and Assessment						Rhode Island
Permitting Requirements						Massachusetts, EPA Region 4 Water Efficiency Guidelines
Funding (SRF)						

Introduction

Reducing water use is one key component of keeping water in our rivers. Water conservation and efficiency can be thought of as the cheapest, most reliable, and environmentally beneficial new source of water supply and should be the first option that communities evaluate and pursue.[270] Such conservation and efficiency initiatives "can help sustain water supply from existing sources, postpone or eliminate the need to invest in expensive supply development projects, and return water to rivers and aquifers."[271] Although reduced water use doesn't automatically translate to more waters in our rivers, it is a prerequisite to a sustainable water management approach. This is especially critical in a region like the Southeast with a rapidly growing and sprawling population, and particularly in areas with insufficient water supplies to meet growing demand and continual threats of additional surface water withdrawals, interbasin transfers of water and construction of new dams and reservoirs.[272] Evaporation from existing reservoirs is a major source of flow alteration in the Southeast as well as dam operations, underscoring the need to rigorously evaluate any new reservoir proposal **(see box The High Cost of**

KEY

GREEN

Strong policy in place and being implemented.

YELLOW

Weak policy in place or strong policy in place but lacking on implementation.

RED

No policy in place.

Reservoirs).[273] And while conservation and efficiency can be driven at the local level by market mechanisms and utility rate structures, there is also an important role for state-level policies. If we hope to restore water to our depleted rivers and aquifers, we need to find ways to substantially reduce consumptive losses through conservation and efficiency.

Potential water savings in the Southeast remain a significant opportunity to reduce demand for new water withdrawals. Calculations show that by applying basic water efficiency policies, communities can secure reliable, new water supply while leaving more water in rivers to support healthy flows.[274] Water efficiency also saves money by reducing electricity use required for pumping and treating water and wastewater, and by postponing or eliminating the need for new infrastructure.[275] In North Carolina, for instance, adopting policies for reducing water loss and increasing water fixture efficiency is estimated to save 76 MGD of water (equal to 8% of water withdrawals for public water supply in 2005) and 176 gigawatts of electricity.[276]

The High Cost of Reservoirs: Making the Case for Water Efficiency

In the Southeast, water supply is too often addressed by looking at new reservoirs first. However, building new dams is the most expensive way to secure water, and there are many examples in the Southeast and elsewhere where local governments and water utilities are securing their future water needs for much less cost by investing in water efficiency.

American Rivers' *Hidden Reservoir* report shows that, per gallon of water secured, reservoirs cost up to 8,500 times more than water efficiency. Reservoirs also lose immense quantities of water through evaporation and their capacity to store water diminishes over time as they fill with sediment, adding expensive maintenance costs. For example, if the following Southeastern cities and metropolitan areas were to invest in water efficiency versus new dams to secure future water supplies, they would realize significant savings:

- Metro Atlanta: $300 million–$700 million saved
- Charlotte, N.C.: $75 million–$160 million saved
- Columbia, S.C.: $45 million–$100 million saved

To look at it another way, the proposed Lower Little Tallapoosa Dam in Georgia would cost $11.61 per gallon of capacity (this project is currently mothballed). In contrast, DeKalb County, Georgia's program to replace outdated fixtures with water efficient products costs only $1.17 per gallon of capacity.

Water supply reservoirs can also leave taxpayers and ratepayers burdened with debt as reservoir costs exceed initial cost estimates, or when new customers don't materialize as projected. One notable example is the Hickory Log Creek Reservoir in Canton, Georgia, which quintupled in price to $100 million, and increased water demand did not materialize as had been projected.[277]

Not only does water efficiency save taxpayers and utility customers money, it is effective in securing water supply relatively quickly. Through water efficiency, Cary, North Carolina increased its water supply by 15% in 11 years and Tampa, Florida increased its water supply by 26% over 12 years. Boston, Massachusetts grew its customer base by 2 million people while reducing water consumption by one-third and saving $500 million by investing in water efficiency instead of a new dam.

As states in the Southeast continue to plan and more carefully manage the use of their water resources, water efficiency not only makes sense as a way to manage use but also as a way to save taxpayers and utility customers money.[278]

LEARN MORE

American Rivers, **Money Pit: The High Cost & High Risk of Water Supply Reservoirs in the Southeast**

American Rivers, **Hidden Reservoir: Why Water Efficiency is the Best Solution for the Southeast**

When reviewing state water conservation policies, the Alliance for Water Efficiency assigned grades in the states in this study as ranging from B to D.[279] The good news is that a number of places in the Southeast are pursuing water conservation and efficiency with marked results. In Atlanta, for example, the demand forecast for the metropolitan region was recently significantly decreased. Partly as a result of successful water conservation and efficiency efforts between 2009 and 2015, the long-range demand forecasts for 2050 dropped by 25%, from a projected daily use of 1.2 billion gallons to between 862 and 898 million gallons and remain the same today.[280] Further, the Southeast also has a regional requirement for evaluation of water efficiency as part of the federal permit approval process for new water supply reservoirs **(see box *EPA's Water Efficiency Guidelines for Southeastern States* below)**.

In this section we evaluate five state policy opportunities for water conservation and efficiency: 1) water loss policies, 2) drought plans, 3) water conservation planning processes separate from drought plans, 4) state permitting requirements for water conservation, and 5) state revolving fund investments for water conservation and efficiency. Related policies on increasing water efficiency in buildings are included in the Built Environment section.

State water conservation and efficiency policies in the Southeast are still lacking, providing room for reform and improvement. However, a number of examples from the Southeast and beyond illustrate what can be achieved, and Georgia currently has one of the strongest state water loss policies nationwide. For an assessment of state conservation policies in all states, please see *The Water Efficiency and Conservation State Scorecard: An Assessment of Laws and Policies* by the Alliance for Water Efficiency and Environmental Law Institute.

Defining Water Conservation and Efficiency

While water conservation and efficiency have the same goal of reducing overall water use, and the terms are often used interchangeably, they are different approaches toward the same end. Water conservation is about using less water through "policies, programs and practices,"[281] whereas water efficiency is defined as the "[m]inimization of the amount of water used to accomplish a function, task or result."[282] In other words, water efficiency is more technology-driven, and water conservation is more behavior-driven: taking a short shower would be considered water conservation, while installing a low-flow high-efficiency showerhead would be considered water efficiency. Similarly, water conservation is planting native or drought-tolerant species to reduce outdoor water demand, while water efficiency is using moisture sensors or other irrigation technology to minimize the water used.

RESOURCES

The Difference Between Water Conservation and Efficiency, Grace Communications Foundation

Water Loss Reductions

Background

Due to leaking pipes, aging infrastructure, water theft, and inaccurate metering, a substantial amount of water is "lost" between the treatment plant and the customer.[283] This means that the utility loses money from unbilled, highly treated water (referred to as "non-revenue water"), and also unnecessarily increases the amount of water that must be withdrawn from the source. Nationally, estimates are that 14–18% of all treated water is lost, or approximately six billion gallons a day.[284] Not only does the water system lose money on the front end, but leaking and poorly maintained infrastructure can lead to lower bond ratings, usually resulting in higher costs for the utility and ratepayers.[285] Given a water system's need to reduce costs and improve system efficiency, water loss policies provide a good place for watershed groups to align their interests to reduce the demand for additional withdrawals.

Fortunately, there are a number of smart policies and practices to reduce water loss, usually starting with a water audit and then shifting to reducing leaks and improving metering and billing practices. Driven by increasing water scarcity and the need to control costs, more states are adopting water loss policies, including some leaders in the Southeast.[287] The Natural Resources Defense Council suggests the following factors are needed for an exemplary water loss policy:

- Annual water loss reporting with American Waterworks Association (AWWA) standard terminology;
- Annual use of AWWA Free Water Audit Software®;
- Validation of water loss data, and volume-based performance benchmarking.[288]

It is important that water utilities begin with the standardized audit methodology to most strategically address water loss in their systems, as well as increase transparency and accountability.[289]

Nationally, estimates are that ***14–18%*** of all treated water is lost, or approximately ***six billion gallons*** a day.[284]

Water Loss Examined

<table>
<tr><td rowspan="4">Volume from Own Sources (corrected for known errors)</td><td rowspan="8">System Input Volume</td><td>Water Exported (corrected for known errors)</td><td colspan="3">Billed Water Exported</td><td>Revenue Water</td></tr>
<tr><td rowspan="7">Water Supplied</td><td rowspan="3">Authorized Consumption</td><td rowspan="2">Billed Authorized Consumption</td><td>Billed Metered Consumption</td><td rowspan="2">Revenue Water</td></tr>
<tr><td>Billed Unmetered Consumption</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption</td><td>Unbilled Metered Consumption</td><td rowspan="7">Non-revenue Water</td></tr>
<tr><td rowspan="5">Water Imported (corrected for known errors)</td><td>Unbilled Unmetered Consumption</td></tr>
<tr><td rowspan="4">Water Losses</td><td rowspan="3">Apparent Losses</td><td>Systematic Data Handling Errors</td></tr>
<tr><td>Customer Metering Inaccuracies</td></tr>
<tr><td>Unauthorized Consumption</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transmission and Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections up to the point of Customer Metering</td></tr>
</table>

NOTE: All data in volume for the period of reference, typically one year.

SOURCE

Alliance for Water Efficiency and International Water Association

Water loss includes "real losses" such as leaks from water pipelines as well as "apparent losses," which refers to non-physical water loss such as inaccurate meters and billing problems. These together with unbilled authorized consumption, like that of a fire department, make up "non-revenue water." Given the need for water providers to reduce costs and recoup investment, the American Waterworks Association (AWWA), International Water Association (IWA), and other groups have been working to provide guidance and leadership in this area for many years.[290] This has led to the development of the AWWA water audit software used "to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery."[291]

Many water loss policies specifically refer to the AWWA audit. Although water loss auditing and control are largely system-specific practices, the water audit provides consistency and also includes performance indicators, such as "real losses as a percent of system input volume" and an "Infrastructure Leakage Index," allowing for some degree of comparison and benchmarking across the industry.[292] Finally, the AWWA water audit includes the capability to evaluate the validity of the data to provide a measure of the reliability of the data through a Data Validity Score.[293]

Water Loss Policy Scorecard

All of the states surveyed here, with the exception of Alabama, have at least a rudimentary water loss policy in place. Georgia's policy is currently considered the strongest policy in the country (along with California).

	AL	GA	NC	SC	TN
Water Loss					

Of the states surveyed, North Carolina and South Carolina have the most rudimentary water loss requirements. North Carolina requires local governments that provide public water service to 1,000 or more connections or 3,000 or more people to prepare a Local Water Supply Plan and report annually on their water use and water system conditions.[294] The component on water system conditions is minimal and asks whether the system has a leak detection program and for estimates of use from non-metered connections, but no comprehensive water loss audit programs or requirements exist.[295] South Carolina requires community water systems to "initiate and carry out a program aimed at detecting leaks in the distribution system" and any leaks found in the system "shall be repaired promptly."[296] "Promptly" is not specifically defined, although the state expects the water system to fix leaks as soon as they are able.[297] The state reviews these records as part of an annual sanitary survey inspection.[298] Neither of these programs requires use of the AWWA water audit or any verification that water loss is actually being reduced, although South Carolina encourages use of AWWA water loss methodology.

Tennessee's water loss policy is overseen by the state Comptroller's Office and was initiated in 2007, stemming from concerns that 40-50% of water was being lost.[299] Building on the requirement that all local governments must already submit financial audits to the Comptroller, the state added in utility water loss as an additional component of the audit.[300] Water loss audit requirements have changed over time and currently require use of the AWWA water Audit and set a schedule for decreasing water loss and increasing Data Validity Scores over time.[301] For instance, non-revenue water as a percentage of total operating costs is required to decrease from a maximum of 25% in 2016 to a maximum of 20% in 2018. Water loss greater than these set percentages is considered "excessive" and is subject to referral to the state Water and Wastewater Financing Board or the Utility Management Review Board for further action, including referral to the appropriate court.[302] Training and assistance is also available to utilities that are unable to meet the targets.[303] Tennessee's policy does not require data validity to be checked by a third party.

Georgia has a strong water loss policy, and implementation has been improved by technical support and training for local utilities. Spurred by a major drought

KEY

GREEN

State water loss program exists and uses AWWA terminology and software, validation of water loss data, performance benchmarking, and public reporting of water loss data.

YELLOW

Some components of the above water loss program in place.

RED

No water loss program in place.

and litigation with neighboring states over water use, the Georgia Water Stewardship Act of 2010 required a number of water conservation measures, including a provision that all water utilities serving 3,300 or more people submit an annual water loss audit to the state following AWWA methodology.[304] Water audit requirements were phased in, starting with utilities serving 10,000 people or more in 2012 before moving to smaller water systems in 2013.[305] The state distributed a free water loss manual and partnered with the Georgia Association of Water Professionals to host workshops as the requirements became applicable.[306] Data anomalies in the first round of audits led Georgia's Environmental Finance Authority (GEFA) to provide over $3 million in funding from the Drinking Water State Revolving Fund for technical assistance and training for water systems in how to do an audit.[307] Finally, water audits must be certified by a Qualified Water Loss Auditor (who can be part of the water utility) and are posted to the state website following review.[308]

To move from assessment to actually reducing water loss, Georgia requires "demonstrable progress" starting in 2016. By July 1, 2016, public water systems were required to "develop and conduct a water loss control program to investigate, assess, and implement efforts to improve water supply efficiency," and water loss programs must be updated, as needed. Each public water system must also establish individual goals for defining measures of water supply efficiency and how to improve water supply efficiency. The public water systems are supposed to make progress toward improving water supply efficiency and demonstrate it by standard performance measures, such as an improvement in Data Validity Score, implementation of a water loss control program, and others.[309] Demonstration of progress can then be evaluated by the state when reviewing new or modified water withdrawal permits for surface water or groundwater or increase in permitted service connections, and the state may (though is not obligated to) deny a permit for failure to show progress.[310]

Water loss policies offer a prime opportunity for watershed groups to work together with water utilities and state policymakers to find ways to save water and money as part of a smart business approach to water system management. Georgia's policy and the model policies and legislation from NRDC both provide strong examples from which to work.[311] With water industry associations supporting these approaches and the states' ability to use a portion of their federal water infrastructure funding to assist with training needs, implementing water loss reduction programs can yield the baseline from which to plan for and achieve reductions in demand for highly-treated water, thereby reducing new withdrawals from rivers.

Any water loss policy should ensure that audits are validated and that there is sufficient time to phase in the requirements before mandating universal improvements, so as to avoid gaming the system.[312] Additionally, advocates should work to ensure water loss policies and other state programs are aligned and don't work at cross purposes. For example, in Georgia, the Governor's Water Supply program provides funding to develop new water supplies—but does not include conservation or efficiency as water supplies. Despite Paulding County water system's 18% water loss rate, the state is providing millions of dollars of funding to build a new reservoir for future water supply.[313] Likewise, water withdrawal permits continue to be issued in many places despite high water losses.[314]

Summary

Due to leaking pipes, aging infrastructure, water theft, and inaccurate metering, a substantial amount of water is "lost" between the water treatment plant and the customer. Fortunately, there are a number of smart policies and practices to reduce water loss, usually starting with a water audit and then shifting to reducing leaks and improving metering and billing practices. These can be part of larger efforts to reduce demand and consumptive use of water.

Recommendations and What You Can Do

- Ask your state to develop a water loss policy that requires the following:
  - annual water loss auditing using American Water Works Association's (AWWA's) free water audit software,
  - annual water loss reporting using AWWA standard terminology,
  - validated water loss data and volume-based performance benchmarking,
  - publicly reported water loss audits,
  - aggressive water loss reduction, and
  - alignment of water loss policies with other state water policies and water supply funding programs.

- Work with industry associations and water utilities that can help support effective water loss policy.

LEARN MORE

Natural Resources Defense Council's ***Cutting Our Losses: State Policies to Track and Reduce Leakage from Public Water Systems*** report

Natural Resources Defense Council's **Cutting Our Losses, State Policies to Track and Reduce Leakage from Public Water Systems** website and **Model Water Loss legislation**

U.S. EPA's **Water Loss Webinar**

Alliance for Water Efficiency's **Water Loss Control webpage** and **Water Audit Case Studies**

Center for Neighborhood Technology's ***The Case for Fixing the Leaks: Protecting People While Saving Water in the Great Lakes Region*** report

AWWA **Free Water Audit Software**

IWA/AWWA **Water Audit Method**

GA Water System Audit and Water Loss Control Manual

Drought Planning, Water Conservation & Efficiency Planning and Permitting Requirements

Introduction

Water conservation planning refers to ongoing, long-term planning for conservation and efficiency; in contrast, drought plans are shorter-term measures that take effect only during water shortages. Because "[o]ne of the best ways to prepare for drought is simply to have an excellent on-going water conservation program," the two are certainly related.[315] Additionally, in the historically water-rich Southeast, it is often a drought that first spurs action on water conservation, and strong drought planning can have longer-term impacts to reduce demand. In North Carolina, for example, stronger drought response policies were one factor leading to decreasing water use over time.[316] Linking water conservation and efficiency requirements to withdrawal permitting is another option open to states that have water withdrawal permitting requirements.

Linking water conservation and efficiency requirements to withdrawal permitting is another option open to states that have water withdrawal permitting requirements.

Drought Planning

BACKGROUND

Drought planning is one part of water supply management that, when effective, can help alleviate short-term water shortages and ensure river flows are available for multiple uses. Drought planning is considered a "short-term curtailment" in water demand and should not replace ongoing and long-term efforts to reduce water demand.[317]

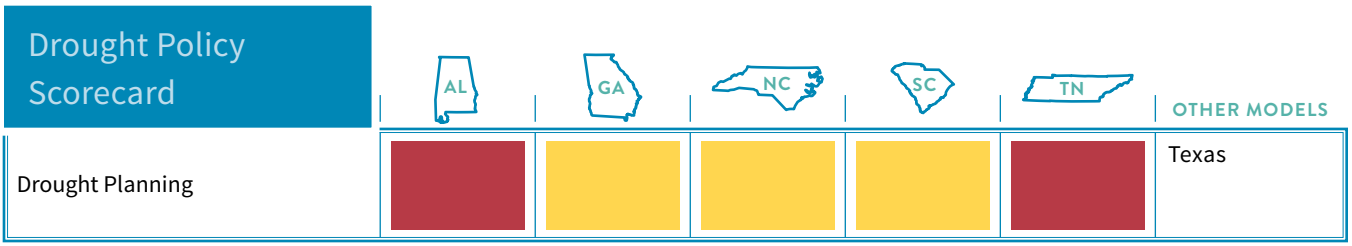
Many states in the Southeast developed water policies and created regulatory mechanisms to manage water withdrawals during a much wetter time without considering drought, while recent severe droughts are in fact more indicative of future conditions.[318] As a result, Southeastern states have developed drought plans with varying levels of rigor and effectiveness, starting in 1985. There are a wide variety of drought impacts ranging from economic losses to environmental degradation to public health impacts. For a thorough overview of drought impacts, see the American Planning Association's *Planning and Drought*.[319]

Drought plans typically focus on short-term response, although some states also take the opportunity to create longer-term drought mitigation plans. All of the Southeastern states have undertaken drought planning and, except for Mississippi, have a state drought plan **(see Figure 3, Chronology of Drought Planning in Southeast)**. According to the Alliance for Water Efficiency, criteria for strong state drought planning policies will require drought plans at the local, regional, or water system level; will include a clear framework with required elements; and will require regular updates.[320] The American Planning Association recommends that effective state drought plans include: community outreach process, proactive drought mitigation, accountable actions and timelines for implementation, and mechanisms to evaluate drought plan effectiveness. Moreover, best practices for drought planning include: common drought triggers and responses, continuous monitoring and data collection, diversifying the water supply, sharing data and tools with stakeholders, and undertaking drought exercises.[321]

FIGURE 3

Chronology of drought planning in the southeast

- **1985** Virginia, South Carolina
- **1988** Florida (delegates to local), Kentucky
- **1990** North Carolina
- **2003** Georgia
- **2004** West Virginia
- **2005** Alabama, Mississippi (delegates to local)
- **2009** Florida
- **2015** Kentucky, Tennessee



Across the states we evaluated, Georgia and North Carolina had the most robust drought plans, and Georgia has specific requirements in response to drought. While Georgia's conservation prescriptions are clearly laid out and apply across the board, drought determinations are left to the discretion of the state agency. Meanwhile, North Carolina allows water systems to set their own trigger and response levels but includes default conservation responses for communities without drought plans. Alabama and Tennessee have plans that emphasize coordination and do not prescribe any actions for local governments or water systems to take at different levels of drought. South Carolina's was similar, although it does allows a path for state-mandated action when critically needed.

Georgia adopted its most recent drought rules in 2015 to make the plan consistent with the statewide water management plan and the Georgia Water Stewardship Act.[322] Georgia's drought response plan applies to water withdrawal permit holders and includes: a set of factors to consider when issuing a drought declaration and a drought declaration process, defined roles for agencies and organizations, drought responses related to outdoor watering and a variance request process, and pre-drought mitigation strategies limiting outdoor watering between 10 a.m. and 4 p.m. consistent with existing law.[323] Drought response is divided into three response levels: level one requires public education; level two limits most outdoor watering to two days a week, and level three prohibits some types of outdoor irrigation,

KEY

GREEN

Strong drought policy exists with sufficient protections in place to protect both water users and environmental flows during droughts (no states met this criteria).

YELLOW

A drought policy exists but with insufficient protections for water users and/or environmental flows during droughts.

RED

Drought policy exists but with no action required in response to droughts.

and requires public water systems to develop a drought surcharge program plus a variety of other approaches, such as providing retrofit kits to customers.[324]

Georgia's plan, however, leaves drought declarations to the discretion of the Georgia Environmental Protection Division, making it unclear when different response levels will be triggered. Moreover, concrete drought mitigation actions aside from outdoor watering reductions are only required at the most severe drought levels.

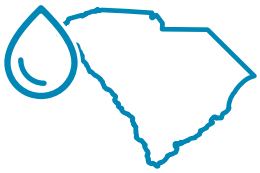
In addition to the statewide drought management plan, Georgia also has region-specific drought plans. For example, in response to acute drought impacts, especially those on endangered aquatic species caused by agricultural irrigation in the Flint River, the Flint River Drought Protection Act included special provisions for addressing drought in this basin.[325] However, lack of state funding has limited the effectiveness of this program.

Drought planning in North Carolina requires large community water systems and local governments that provide public water service to develop water shortage response plans for state drought designations. These plans must include conservation measures to manage different levels of drought. The North Carolina Drought Management Advisory Council issues advisories for each county, designating areas where drought conditions are imminent, areas where drought conditions exist, and the degree of severity of drought conditions.[326] In determining whether to issue a drought advisory, the Council relies primarily on the U.S. Drought Monitor for North Carolina but also considers stream flows, ground water levels, the amount of water stored in reservoirs, and weather forecasts.[327] The Drought Management Advisory Council was originally created by the state legislature in 2003 to monitor drought conditions, coordinate drought responses between local governments, and increase public awareness, and has since become responsible for making recommendations for improved coordination between government authorities, public water systems, and water users.[328]

In response to the 2007–2008 drought, when many water systems faced severe shortages, the state passed a Drought Bill that provided more state oversight of local plans and default requirements for communities without an approved plan.[329] Local water shortage response plans must establish specific tiered levels of water availability that trigger responses based on increased severity of drought or water shortage.[330] The response actions are not prescribed by the state but include voluntary, mandatory, and emergency response procedures,[331] and also public outreach, enforcement provisions and procedures to review the plan's effectiveness.[332] Systems without such an approved plan must implement standard conservation measures when the North Carolina Drought Management Advisory Council issues an "extreme" or "exceptional" drought designation.[333]

Further, the North Carolina Department of Environmental Quality may require the local government or large community water system to implement more stringent

measures of the plan if the county is in "severe, extreme, or exceptional drought," or if the local plan has been implemented at the appropriate tier for 30 days or more and that plan has not sufficiently reduced water use.[334] To determine whether a more stringent plan is necessary, the Department of Environmental Quality considers drought conditions, rainfall forecasts, reductions achieved through the current plan, the availability of other water supply sources, economic impacts, and conservation measures established by the U.S. Geological Survey.[335]



South Carolina passed the most recent version of the South Carolina Drought Response Act in 2000; the plan largely leaves drought planning to the local level with few state-based requirements.[336] The four stages of drought alert are incipient, moderate, severe, and extreme, determined by quantified drought indices.[337] Drought plans and ordinances are adopted at the local level based on a "Model Drought Management Plan and Response Ordinance" created by the South Carolina Department of Natural Resources (SCDNR).[338] The state models essentially provide a template for local governments to tailor to their particular needs and involve notice requirements and use restrictions based on certain drought conditions and characteristics of the locales' water source, but water reductions only become mandatory at the most severe stages of drought.

A Drought Response Committee made up of representatives statewide and from each of four regional drought management areas is tasked with evaluating drought conditions within drought management areas to determine whether any action should be taken beyond the local level.[339] If so, the committee formulates recommended actions for implementation by SCDNR.[340] In cases of severe or extreme drought conditions, the regulations allow SCDNR discretion to require mandatory reduction in non-essential water use in affected drought management areas, as recommended by the Drought Response Committee and evaluated based on factors including economic use of water and harm caused.[341] The jurisdiction of the drought regulations does not allow for restriction of water use, at any level of drought alert, for water stored in aquifer storage facilities or managed watershed impoundments, or water from ponds on private property.[342]

There have been multiple drought plans in Alabama, the most recent one adopted in 2013.[343] Alabama's drought plan is intended to coordinate the assessment of drought conditions and provide support for water conservation efforts. The plan relies on a regional approach to identifying and responding to drought conditions in nine drought management regions, for which drought conditions are assessed and responses are developed and administered individually. The plan uses drought triggers and indicators, but only to identify impacted regions and provide recommended guidance on responses for impacted sectors.[344]

The Alabama Office of Water Resources (OWR), the lead implementing agency, is responsible for coordinating monitoring and data collection needed to make

drought determinations, declare droughts, and administer a Drought Information Center. The OWR also develops the drought levels, in coordination with the Alabama Drought Assessment and Planning Team's Monitoring and Impact Group. Additionally, the Alabama Drought Assessment and Planning Team assists with the coordination of intergovernmental drought responses; provides support to local governments, water suppliers, and other affected parties through direct and online notifications; and reviews the drought plan every five years to recommend changes.

While Alabama's state and regional plans are necessary first steps towards effective drought management, they have significant limitations. The drought plans are essentially a codification of what the state was already doing during droughts, and these plans are better considered drought coordination plans, as they do not require action. In anticipation of the state water plan, the recent Drought Planning and Response Act requires that the state drought plan be made consistent with any water planning legislation.[345]

TENNESSEE

Following record droughts in 2007–2008, Tennessee's Water Resources Advisory Committee finalized the Tennessee Department of the Environment and Conservation (TDEC) Drought Management Plan, an update of a plan originally released in 1987.[346] The statewide plan does not outline any restrictions, but instead describes the roles and responsibilities of federal, state, and local governments, as well as private industries in conserving drinking water. The plan also identifies the state role, stemming from a variety of existing state laws, as determining drought intensity, communicating drought information, and requiring drought plans by community water systems.[347]

Local drought management plans are required under Tennessee's Safe Drinking Water Act,[348] and a state-developed guidance document assists communities to develop these management plans.[349] Community plans must include the identification of "trigger points," which are conditions or circumstances that call for "pre-determined action," but the trigger points do not require any specific conservation measures, instead leaving it to the locality to decide.

Texas provides a strong model for state drought planning requirements. In 1999, the state began requiring drought contingency plans for retail public water suppliers serving more than 3,300 connections and wholesale water suppliers.[350] Minimum requirements for the drought contingency plans are clearly laid out and include: public outreach, consistency with regional plans, specific criteria for designating drought stages, and specific strategies to curtail non-essential water use and use of alternate water sources, such as interconnections and reclaimed water.[351] Enforcement mechanisms and penalties must also be specified, and the plans for retail supplies must be updated every five years. The state provides detailed, model drought contingency plans that water suppliers can use.[352] Even with these robust requirements, however, lack of state oversight has hindered the effectiveness of this program.[353]

Water Conservation Planning and Assessment Requirements

Water conservation planning, in contrast to drought planning, applies at all times and provides states an opportunity to require local governments and water systems to promote water efficiency on a consistent basis.[354] When evaluating state water conservation planning requirements, the Alliance for Water Efficiency considers the following elements as key for a strong policy: state authority to approve plans, regular updates, comprehensive and detailed elements providing a standardized approach, and ability to enforce the plans.[355] Among the states reviewed here, Alabama, North Carolina, and Tennessee have no water conservation planning requirements outside of the drought planning process, while Georgia's conservation planning requirements are tied to permitting, described in the next section. South Carolina has limited requirements for a subsection of groundwater withdrawals in designated "capacity use areas," also described in the next section.

Water Conservation Planning Policy Scorecard	AL	GA	NC	SC	TN	OTHER MODELS
Water Conservation Planning Requirements						Rhode Island

Several good models exist outside the region that could be incorporated into state programs.[356] Rhode Island's Water Use and Efficiency Act, for instance, was successfully advanced by the Coalition for Water Security, an alliance of 16 environmental organizations concerned with water scarcity and supply issues.[357] Over a three-year period, the Coalition raised awareness about the threats to freshwater flows and need for more efficient water use, leading to the passage of the Act.[358] The law requires all public water suppliers of greater than 50 MGD to prepare a Demand Management Strategy to meet a residential average annual water use of 65 gallons per capita per day (GPCD), efficient indoor and outdoor water use, and a maximum of 10% water loss.[359]

Rhode Island's Demand Management Strategy must include the following elements: program for 100% metering, maintenance, and replacement of meters, and installation of automated meter reading; recording metered usage and quarterly billing; education; rate structures that encourage efficient use, cover costs, and are equitable; and use of a leak detection

KEY

GREEN

Strong water conservation policy exists that requires and enforces adherence to comprehensive water conservation and efficiency standards (no states met this criteria).

YELLOW

Water conservation policy exists but with limited requirements, limited enforcement, and/or limited or insufficient water conservation and efficiency standards.

RED

No water conservation policy exists. to droughts.

program. Other elements such as limits on outdoor water use, conservation pricing, and improved indoor use are all encouraged. Demand Management Strategies are included as part of a utility's water supply plan and are publicly available for review.[360] The Rhode Island Water Resources Board reviews and approves the Demand Management Strategies and requires an annual update on progress toward achieving the water efficiency targets.[361]

Given the minimal to no requirements for water conservation and efficiency in state policies in the Southeast, there is much room to advocate for improvement.

Net Blue: Making New Development Water Neutral

Adapted from Mary Ann Dickinson and Bill Christiansen, "Alliance for Water Efficiency," in *River Voices*, Spring 2016.

As population continues to grow in many communities, local planners and decision makers are challenged with the task of accommodating new water customers and new water-using developments with increasingly strained water supplies and limited water and wastewater infrastructure. To cope with this problem, several communities across the United States have adopted policies that aim for water neutrality by requiring the projected water demand associated with new construction to be "offset" via on-site and off-site water efficiency measures. This works as follows: On-site water demand offsets are achieved by outfitting the structures in a new development with water-efficient fixtures that exceed baseline legal codes, or incorporating the use of recycled water. Off-site water demand offsets require the developer to achieve water demand reductions on the properties of pre-existing customers, typically through the replacement of inefficient fixtures on their properties. The goal of the offsets is to make the new development water-neutral to the community, and thus reduce the need to take additional water from rivers and aquifers. Examples or pilots have been summarized in the report, *Water Offset Policies for Water-Neutral Community Growth* (available on **AWE's website**).

The Alliance for Water Efficiency, River Network, and the Environmental Law Institute are working together in the Net Blue project to develop a national planning and zoning model ordinance template tool that communities can voluntarily adopt to make their new developments water-neutral. This template will be made publically available for use.

A water demand offset policy should have comprehensive legal requirements in place, along with sound methodologies for estimating the water demands of new developments and for calculating credits resulting from the savings of on-site and off-site water efficiency measures. Having an offset ratio greater than 1:1 can guard against uncertainty in both the projections for new demands and the demand reductions resulting from water efficiency measures. The offset ordinance can also include provisions that measure actual consumption once the development is constructed and occupied to ensure it is not exceeding the projected demand. It is also important to ensure that the off-site and on-site water efficiency measures are permanent and enforceable.

LEARN MORE

Alliance for Water Efficiency **Net Blue project**

Conservation and Efficiency Requirements as Part of State Permitting

Permitting for water withdrawals, where it exists **(see section on water withdrawals)**, provides an obvious opportunity to require conservation and efficiency planning, assessment, and/or implementation. Of the Southeastern states that we reviewed, Tennessee and Alabama have no such requirements. North Carolina and South Carolina have some narrow requirements with limited application. Georgia has the most requirements on the books, but implementation will be the key to making a real difference.

Water Conservation and Efficiency Requirements in Permits Scorecard	AL	GA	NC	SC	TN	OTHER MODELS
Water Conservation Planning Requirements						Massachusetts, EPA Region 4 Water Efficiency Guidelines

In North Carolina, the only conservation and efficiency requirements outside of droughts (see above) and eligibility for certain state funding **(see funding section)** is tied to applications for interbasin transfers (IBTs) between river basins **(see Interbasin Transfer section above)**. At several points in the evaluation and decision process, applicants requesting approval from the N.C. Environmental Management Commission for an IBT certificate must first evaluate water conservation as part of the environmental alternatives analysis,[362] and second, must describe the water conservation practices used and proposed to be used.[363] Finally, if the Environmental Management Commission grants approval, the certificate for the IBT must include a "water conservation plan that specifies the water conservation measures that will be implemented by the applicant in the receiving river basin to ensure the efficient use of the transferred water."[364] Unfortunately, this plan does not have to be any more stringent to offset the effects of the IBT (i.e., it would look no different from a conservation plan in the donor river basin), missing an opportunity to create meaningful and more consistent standards for reducing water use when managing regional water use.[365]

South Carolina has a limited provision that requires certain groundwater withdrawals to submit a "best management plan" to "protect water quality and reduce water consumption," but no requirements related to surface water withdrawals.[366] Implementation of this provision is unclear. Meanwhile, Tennessee and Alabama have no such requirements related to permitting at all at this time.

KEY

GREEN

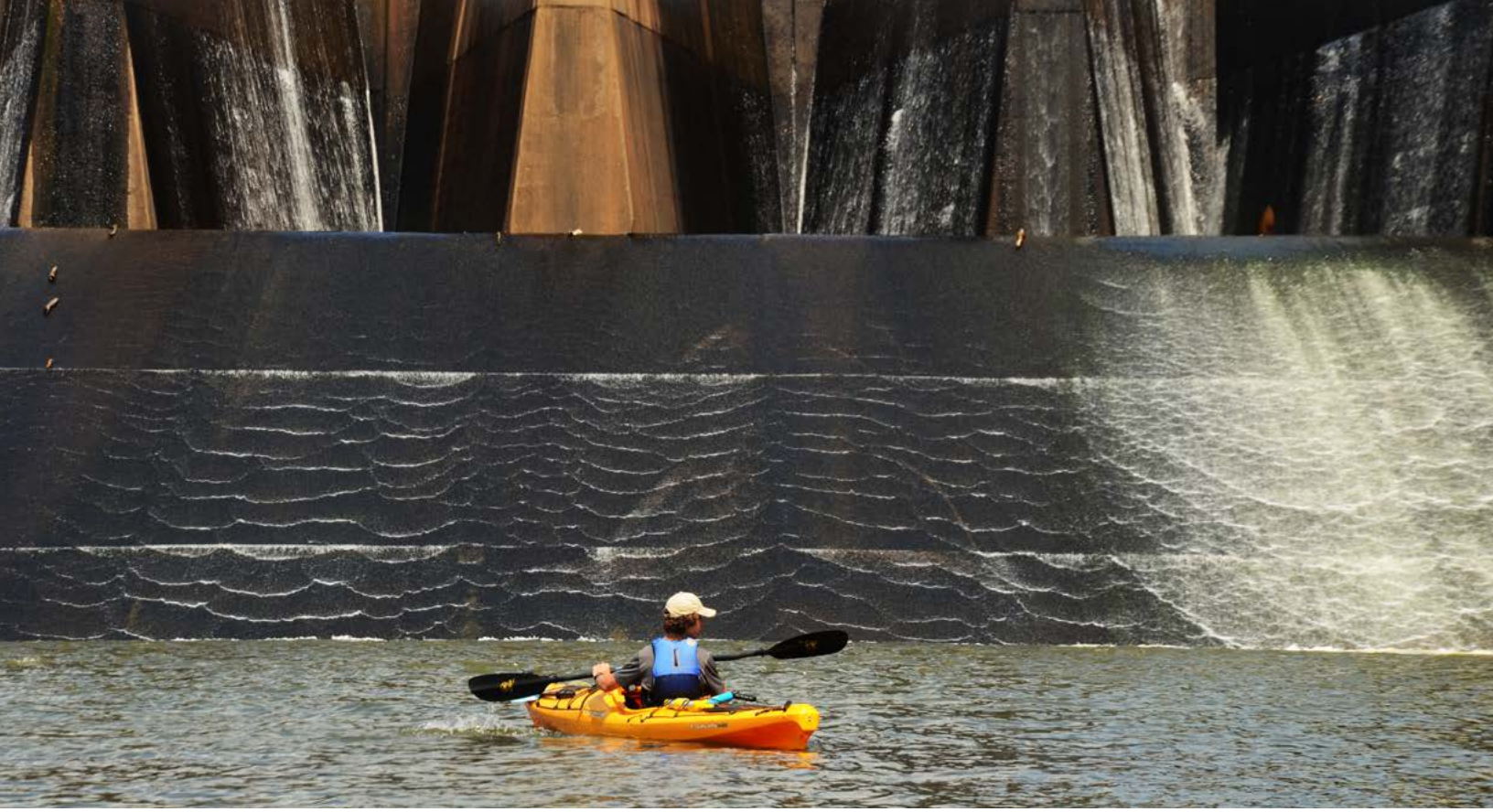
Comprehensive water conservation and efficiency planning, assessment, and implementation is required as a condition of new or renewed water withdrawal permits (no states met this criteria).

YELLOW

Some water conservation and efficiency planning, assessment, or implementation is required as a condition of new or renewed water withdrawal permits.

RED

No, or extremely limited, water conservation and efficiency planning, assessment, or implementation is required as a condition of new or renewed water withdrawal permits, OR the state does require permits to withdraw water.



In Georgia, entities applying for a water withdrawal permit, or an increase in their withdrawal permit, are required to submit a conservation plan that is prepared in accordance with guidelines detailed in the regulation.[367] The conservation plans must include details on system management, treatment plant management, rate-making policies, drought contingency plans, plumbing ordinances and/or codes, water recycling and reuse, and water conservation education programs. After five years, the permittee must submit a progress report on actions and improvements to conserve water and reduce water loss. While there are no requirements for the conservation plans or progress reports to meet certain standards in order to receive a permit, it is an opportunity for GAEPD to review and, if needed, make recommendations for conservation and efficiency improvements.

Also in Georgia, there are nominal connections between permitting and water conservation and efficiency requirements via water plans and water loss requirements (see above). The state's Comprehensive Statewide Water Plan was adopted in 2008, and called for the development of regional water plans **(described more fully in Water Plans section)**. Guidance provided to the Regional Water Planning Councils identified that management practices (including conservation) may be needed to fill forecasted water supply gaps and that the councils should consider practices that would decrease demand, including conservation and efficiency (but also practices that would "increase the capacity of the resource," i.e. new reservoirs).[368]

The Georgia Environmental Protection Division is required to make all water withdrawal permitting decisions in accordance with the state water plan and regional water plans. Any political subdivision or local water authority that is not in compliance with the plan is ineligible for state grants or loans for water projects, except for projects designed to bring the entity into compliance with the plan.[369] However, Georgia's statewide and regional water plans are more recommendations than regulations, making it highly unlikely for an entity to be "officially" out of compliance with the statewide or regional water plan.

Further, Georgia's state water plan integrated the Metropolitan North Georgia Water Planning District (Metro District) into the regional water planning effort by including it as one of the 11 regional water planning councils. The Metro District pre-dates the water plan and was created in 2001 to establish and implement long-term, comprehensive water supply and conservation, watershed, and wastewater management programs required and enforced for 15 counties in the metropolitan Atlanta area. Local governments and utilities are responsible for implementing the Metro District's water management plans. Compliance with the plans is necessary to obtain new or expanded water withdrawal permits from GAEPD, or to receive grants or loans from the Georgia Environmental Finance Authority.[370] Unlike the statewide water plan, the Metro District's legislative mandate is clearer and more legally enforceable.[371]

A strong example of how to link water permitting with conservation and efficiency is found in Massachusetts. There, water withdrawals for public water supplies are regulated and required to comply with a set of permit conditions for water conservation, including meeting a performance standard and restricting outdoor water use.[372] Specifically, all public water supply withdrawal permits must include conditions for 100% water metering and calibration per industry standards, a water pricing and revenue structure that covers total costs (and cannot be a declining block rate), plans to retrofit public buildings with high-efficiency fixtures, and authority to regulate outdoor water use.[373] Further, the state has set a performance standard of 65 residential gallons per capita per day (RGCPD) (the average RCPGD is 80–100) and a limit of 10% water loss that should be met within five years[374] (average water loss ranges from 14–18%).[375] Finally, the state requires standard outdoor watering restrictions that vary based on whether the permittee is meeting its performance standard.[376] Implementation has yet to be tested, as all permit renewals with these new conditions have been delayed since these regulations went into effect.[377]

EPA's Water Efficiency Guidelines for Southeastern States

In 2010 EPA issued water efficiency guidelines to review and evaluate proposed water supply projects in its Southeastern region (Region 4).[378] Development of new or expanded reservoirs for water supply requires a CWA section 404 permit for the dredge and fill of wetlands. Under section 404, EPA and the Corps of Engineers must ensure that "…no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem…" and that no permit shall be issued "unless the potential impacts to waters of the U.S. be minimized to the degree practicable."[379] As part of this analysis to reduce impacts on streams and rivers, EPA requires that project applicants use the water-efficiency guidelines when determining the water demand projections as part of the project's stated purpose and as part of the alternatives analysis. The guidelines clearly state that the project applicant "**must take actions to ensure** that, to the maximum extent practicable, they are implementing sustainable water management practices..."[380] The guidelines also apply to EPA review of Environmental Impact Statements or Environmental Assessments under the National Environmental Policy Act (NEPA).

THE SUSTAINABLE WATER MANAGEMENT PRACTICES INCLUDE:[381]

- Effective management–e.g. how the utility will work to reduce water consumption through public education and integrated water management;
- Pricing water to encourage efficiency and cover fixed costs;
- Ensuring efficient use–e.g. stopping leaks, metering water connections, and retrofitting buildings with efficient fixtures; and
- Watershed approaches–e.g. developing watershed water budgets, protecting source water and groundwater recharge.

These guidelines demonstrate the strong links between water quality and quantity and all proposed reservoir projects should now receive closer scrutiny as a result. They provide a basis for advocates to ensure that new, environmentally harmful reservoirs are not built without a rigorous evaluation of opportunities for water efficiency. It's important to inquire during the review process to ensure that applicants adequately use the guidelines to develop the project's stated purpose and alternatives analysis.

Related, it is also important that the needs analysis in the application uses up-to-date and realistic population projections. The stated purpose of new proposed reservoirs is often to meet the needs of new customers and increased population, but these projections must prove the need and should not be based on outdated data. The inability to demonstrate need, either by failing to fully implement water efficiency measures per EPA's water efficiency guidelines and/or demonstrating projected population growth, have led to the abandoning of a number of recent reservoir proposals.

Summary—Drought Planning, Water Conservation and Efficiency Planning and Permitting Requirements

Water conservation planning is ongoing, long-term planning for conservation and efficiency, whereas drought plans are shorter-term measures in response to water shortages. Because "[o]ne of the best ways to prepare for drought is simply to have an excellent on-going water conservation program," the two are certainly related. Linking water conservation and efficiency requirements to withdrawal permitting is another option open to states that have water withdrawal permitting requirements.

Overall, of the states reviewed, policies to achieve water conservation and efficiency through drought plans, conservation plans, and water permitting are fairly weak. Both EPA's Regional Water Efficiency Guidelines and policies in states outside the region provide good examples worth considering.

Recommendations and What You Can Do

- Ask your state to develop a drought plan that:
  - Applies widely and provides specific details about water conservation actions that must happen at the local level during drought,
  - Accounts for conserving necessary flows to support environmental functions and prevents water quality impairment, and
  - Is triggered before impairments of environmental flows and water quality occur.

- Ask your state to develop a water conservation planning policy or require a "demand management strategy" be implemented by water withdrawers and that the policy:
  - Has performance metrics that are enforceable;
  - Gives your state the authority to approve conservation plans;
  - Requires regular plan updates and measures of plan effectiveness;
  - Is comprehensive, with detailed elements, and provides a standard approach; and
  - Is enforceable.

- Ask your state to issue permits for water withdrawals and, as part of new or increased withdrawals, require:
  - Conservation and efficiency planning, assessment, and implementation; and
  - Compliance with conservation and efficiency performance standards.

- For water supply development projects that require a federal Clean Water Act 404 permit, ensure the applicant follows the region's **Water Efficiency Guidelines**.

LEARN MORE

Alliance for Water Efficiency's **Drought and Drought Response webpage**

American Planning Association's ***Planning and Drought*** report

National Drought Mitigation Center

U.S. EPA's **Drought Response and Planning Guide for Water Utilities**

Alliance for Water Efficiency and Environmental Law Institute's **The Water Efficiency and Conservation State Scorecard: An Assessment of Laws and Policies**

U.S. EPA's **Region 4 Guidelines on Water Efficiency Measures for Water Supply Projects in the Southeast** (note that this is being updated so be sure to check for any newer versions).

Drought Mitigation Center's website on **Types of State Drought Plans**

Rhode Island's Water Supply System Management Plans

Pacific Institute's **A Community Guide for Evaluating Future Urban Water Demand**

Funding Water Conservation and Efficiency

Aligning conservation and efficiency efforts with funding is important to ensure implementation of these approaches. While water conservation and efficiency measures often save water as well as money, states can further speed the process of adopting water-saving measures through their funding programs. This section evaluates funding for water conservation and efficiency with a focus on State Revolving Loan Funds. While the State Revolving Loan Funds are not a state's only source of funding, they have proven a long-term funding source that can be leveraged with other investments.

Water Conservation and Efficiency Funding Scorecard	AL	GA	NC	SC	TN
Funding water conservation and efficiency					

Background

The federally funded Clean Water and Drinking Water State Revolving Loan Funds provide states with annual appropriations to use for water infrastructure projects in the form of low-interest loans to recipients that then "revolve" back into the fund. Since the Clean Water State Revolving Loan Fund's (CWSRF's) inception in 1987 and the Drinking Water State Revolving Loan Fund's (DWSRF's) inception in 1996, billions of dollars have been provided to states and loaned out, primarily to water systems and local governments. States must provide a 20% match to this federal investment and manage the state program according to certain process and eligibility requirements, including creating a priority ranking system, an annual list of projects (the "intended use plan"), and opportunities for public participation.[382]

Beyond the basic procedural requirements, states have flexibility in how they structure their SRF programs and in deciding what types of projects to prioritize for funding within the broad federal project eligibility requirements. Water conservation and efficiency are eligible uses under both the CWSRF and the DWSRF **(see Table 6 below)**, and states can provide lower or even no-interest loans to recipients for a number of activities, including conservation and efficiency to further incentivize their use.[383]

KEY

GREEN

State has funded and/or subsidized demand reduction such as high efficiency appliance retrofits or metering unmetered areas.

YELLOW

State has funded water efficiency but limited to line replacements or updated metering that are good practice but don't substantively reduce water demand.

RED

State does not fund water conservation or efficiency practices as defined under the SRF (no states met this criteria).

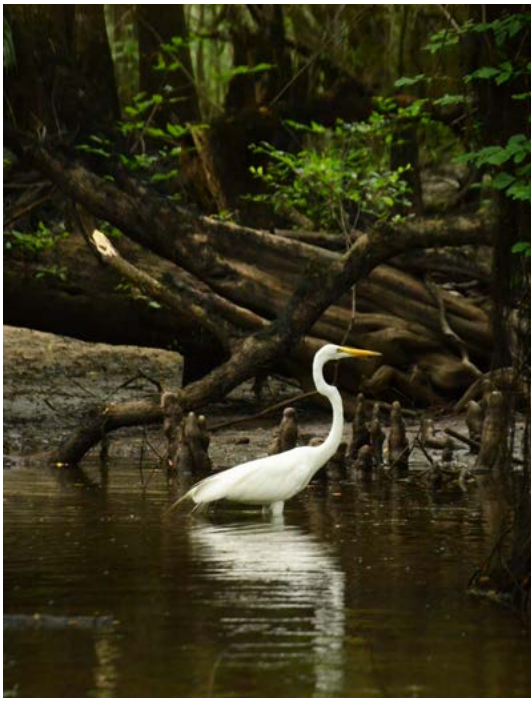
Finally, dedicated SRF funding for green infrastructure and water and energy efficiency that was included in the 2009 American Recovery and Reinvestment Act catalyzed increased spending for water efficiency in some places.[384] This funding, referred to as the "Green Project Reserve," has continued in varying degrees via the federal appropriations process and in some state programs. While Green Project Reserve funding for green infrastructure and water and energy efficiency has become optional under the DWSRF, at least 10% of a state's annual grant under the CWSRF must be spent on these projects if there are eligible projects.[385] Thus, advocates have an opportunity to increase spending in these categories by ensuring that projects—including water efficiency and green infrastructure—are submitted for CWSRF funding. On the DWSRF side, some states are opting to retain the 10% goal as well.

TABLE 6

Water conservation and efficiency projects eligible for SRF funding (adapted from U.S. EPA)[386]

Project type	Clean Water SRF	Drinking Water SRF
Measures to reduce, treat, and capture stormwater (e.g. rainwater harvesting, green roofs)	X	
Reusing or recycling stormwater or wastewater	X	
Water meters or automated meter reading systems	X	X
Retrofit or replacement of water fixtures, fittings, equipment, or appliances (can include rebate or grant programs); measures to reduce demand for publicly owned treatment works capacity through water conservation, efficiency, or reuse are allowed on publicly OR privately owned property under the CWSRF.	X	X
Efficient landscape or irrigation equipment	X	
Systems to recycle gray water	X	
Wastewater system leak detection devices and equipment	X	
Planning and design activities for water efficiency that are reasonably expected to result in a capital project	X	X
Drinking water distribution system leak detection		X
Direct potable reuse and rainwater harvesting	X	

Despite these opportunities, only some states have taken full advantage to fund water conservation and efficiency projects. Competing demands for traditional and important infrastructure uses, like upgrading wastewater and drinking water plants to meet water quality and drinking water standards, are often prioritized over water conservation and efficiency despite the latter's cost-effectiveness. Moreover, even under the Green Project Reserve, states can and have generally opted to fund water meter replacements and water line replacement and rehabilitation to meet spending targets. While these are worthy projects, they do not alone reduce the demand for water. Switching from manual to automated meters, for instance, provides more accurate and timely information regarding water use, allowing for quicker leak detection and identification of problems to reduce water loss.[387] However, metering unmetered areas or retrofitting inefficient fixtures does more to reduce water demand. Pushing states to better use infrastructure funding for innovative and integrated approaches to reduce consumptive use of water is another good option for advocates working to restore rivers.



Because water conservation and efficiency is an eligible activity for funding nationwide, for this report we assessed whether states were considering water conservation and efficiency by looking at a number of factors including whether they are: 1) offering additional subsidization (lower or zero interest loans or loan forgiveness [i.e. grants]) for these activities, 2) prioritizing such projects through the state priority ranking system, 3) funding these activities regularly, and 4) funding or providing any other incentives for any water efficiency retrofits or similar programs that directly reduce the demand for treated water.

Among Southeastern state policies, with the exception of Georgia to a degree, no states have used the SRF to fund water efficiency upgrades or retrofit programs. Most SRF funding categorized under water conservation and efficiency has gone to drinking water line upgrades, rehabilitation, and replacement, as well as meter installation or replacement. The use of additional subsidization to further incentivize these projects is variable and balanced with other state priorities such as meeting the needs of economically disadvantaged communities.

GEORGIA

Georgia administers the SRFs through the Georgia Environmental Finance Authority (GEFA), which provides clear guidance that a broad range of conservation and efficiency projects are eligible for funding from the CWSRF, the DWSRF, or both.[388] Additionally, the state chooses to provide a 1% interest rate reduction for conservation and efficiency projects.[389] Between 2001 and 2016, Georgia loaned over $85 million for water conservation projects in four categories, including approximately $32 million for water reuse, $30 million for water meter replacements, $22 million for line rehabilitation and replacement, and $300,000 for high efficiency fixture programs **(see box Innovative Uses of SRF)**.[390] In FY15, for example, Georgia committed to providing $108 million in assistance from the SRFs to local communities for a variety of projects, and approximately

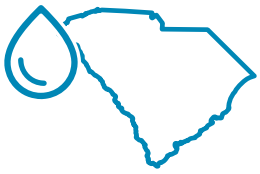
$17 million of that was for water line rehabilitation and replacement and water meter replacement.[391] As described in the section on water loss, Georgia has also made smart use of set-aside funding from the DWSRF to pay for technical training and support to implement state water loss policies. As an additional way to incentivize water conservation, Georgia has offered a "Sales Tax Holiday" that exempts Energy Star and Water Sense certified products—including dishwashers, clothes washers, refrigerators, air conditioners, ceiling fans, fluorescent light bulbs, programmable thermostats, toilets, urinals, showerheads, and faucets—from sales tax.[392] Nonetheless, in contrast, Georgia has tried to allocate $300 million into building new reservoirs and other heavy-infrastructure projects.

Innovative Uses of the SRF for Water Efficiency

In Georgia's Atlanta metropolitan region, Douglasville-Douglas County Water and Sewer Authority received $300,000 from the CWSRF to increase funding for its high-efficiency toilet rebate program, with each homeowner eligible for up to $200 in 2009.[393]

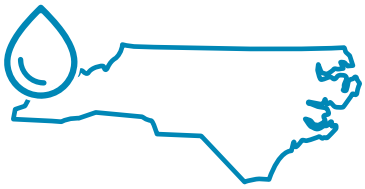
Former Authority Executive Director Pete Frost said: "'Not only does the program save our customers money but it saves us money in the long run because we won't have to expand facilities. There are also the added environmental benefits from eliminating the need to build and expand reservoirs and saving the energy no longer needed to pipe, treat, and pump the water.'"[394]

In South Carolina, the state has yet to fund any projects for reuse or high-efficiency fixtures, although funding continues to be used to rehabilitate leaking pipes, and metering projects were funded via the American Recovery and Reinvestment Act's Green Project Reserve. The state has not focused on promoting funding for water efficiency retrofits, as there does not seem to be the demand for them.[395] Further, there were not any projects eligible to receive funding for the FY15 CWSRF Green Project Reserve.[396]



SOUTH CAROLINA

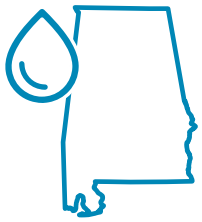
North Carolina's SRF program is managed through the state's Department of Environmental Quality Division of Water Infrastructure.[397] The most recent list of funded projects under the DWSRF included a number of drinking water line replacements.[398] In the past, North Carolina's program has been noted for its strong connection between infrastructure funding and sustainable water supply management approaches. The state requires, as a condition for receiving SRF or other state funding, that a water system or local government has a rate structure that encourages conservation and covers costs, has implemented a leak detection and repair program, and has metered all water use.[399] However, implementation of these requirements is unclear, as the current list includes funded projects that could not document all of these criteria.[400]



NORTH CAROLINA

In Tennessee, the state has chosen to retain the optional 10% goal for green projects as part of the DWSRF and the Tennessee Department of Environment and Conservation funded a number of water meter replacements as part of both SRF programs, and it was not clear whether these received additional subsidization.[401] The state has not yet funded any end-use water efficiency projects such as water efficiency rebates or retrofit programs.

Alabama's SRF program is managed via the same agency that provides oversight for other regulatory programs, the Alabama Department of Environmental Management. For FY15 the state planned to fund 24 water efficiency projects through the DWSRF and no projects via the CWSRF. All of the water efficiency projects were for upgrading or replacing manual water meters with those that can be read automatically, and it was unclear whether the state would provide additional subsidization for those projects.[402] The state has yet to fund any projects for reuse or high-efficiency fixtures.



Although all Southeastern states provide some regular funding for the water efficiency category, almost all of these projects are for projects like water line and meter replacement. To gain new and additional water savings, states should also fund water efficiency retrofits and installation of first-time meters. Thus advocates have a role in pushing states to advertise and look for projects in these categories. Additionally, recent changes to the CWSRF require states to condition assistance on the certification that a loan recipient has selected to "the maximum extent practicable, a project or activity that maximizes the potential for efficient water use, reuse, recapture, and conservation…"[403] States have the flexibility to develop guidance in how to implement this provision, providing the opportunity to maximize the effectiveness of this evaluation that includes conservation and efficiency.[404]

Summary

Aligning conservation and efficiency efforts with available funding is important to ensure implementation of water efficiency as one way to reduce consumptive water use. While water conservation and efficiency often save water as well as money, states can further speed the process of adopting water saving measures by offsetting costs through their funding programs. While the State Revolving Loan Funds are not a state's only source of funding for conservation and efficiency, they have proved to be a long-term funding source that can be leveraged with other investments. Despite these opportunities, only some states have taken full advantage to fund water conservation and efficiency projects.

Recommendations and What You Can Do

- Identify the agency that administers the SRF in your state for **drinking water** and **clean water**.
- Ask your state to prioritize, or have ranking criteria, that favor funding conservation and efficiency projects above other types of new water supply projects.
- Ask your state to dedicate a certain percentage of funds for conservation and efficiency projects.
- Ask your state to require investment in conservation and efficiency before funding other types of new water supply projects.
- Ask your state to incentivize water conservation and efficiency projects by providing low- or no-interest loans, or principal forgiveness, for those projects.
- Ask your state to fund water conservation and efficiency projects that result in lowering demand for water.
- Ask your state to develop a priority list for ranking projects that includes funding for water conservation and efficiency.
- Ask your state to clarify and provide outreach about the funding eligibility of a range of water conservation and efficiency projects.

LEARN MORE

U.S. EPA's **Learn About the Clean Water SRF**

U.S. EPA's **How the Drinking Water State Revolving Fund Works**

Pricing Water Right

Water rates can incentivize conservation and efficiency when priced right. Although rate structures and water system financing are outside the scope of this report, it's important to remember that water utilities have to balance the need to cover the costs of their fixed infrastructure—operating and maintaining the pipes and treatment plants that treat and deliver water—with the need conserve water and provide access to all customers. Careful planning and financing, coupled with targeted affordability strategies can result in water rates that cover costs, reward conservation and ensure equitable access to drinking water.

LEARN MORE

Water Research Foundation–**New Business Models for the Water Industry**

UNC Environmental Finance Center–**Innovative Alternative Pricing Models for Utilities**

American Rivers–**Drinking Water Infrastructure: Who Pays and How**

Alliance for Water Efficiency–**Financing Sustainable Water**

U.S. EPA–**Compendium of Drinking Water and Wastewater Customer Assistance Programs**

Built Environment and Flow Protection

Introduction

Increasingly, our cities (or the "built environment") are recognized as a source of water supply that can help reduce the demand for water and create more natural systems that contribute to and replenish our streams and rivers. The way buildings, roads, housing and commercial areas, and landscapes are designed and developed greatly impacts the amount of water flowing in nearby waterways in at least two key ways. First, building efficiency affects the amount of water that has to be withdrawn and treated to meet water supply needs. Second, development and corresponding increases in impervious surfaces affects the way rainfall infiltrates and flows off the landscape, increasing storm flows and decreasing base flow to replenish nearby streams. Impervious surfaces are one of the leading causes of flow problems in the Southeast and one likely to increase as the region continues to grow.[405]

Within our buildings, the ways water is used can make a big difference in how much water is left for healthy stream flows. While increased water efficiency must be coupled with flow protections, reducing demand is a key part of a sustainable water management strategy. Everything from toilets, faucets, clothes and dish washers, and showerheads in residences, and bathrooms, dish and clothes washing in businesses, impacts the amount of water that needs to be withdrawn from rivers to meet a community's water supply needs. By using water-efficient appliances and fixtures, communities—even ones that are growing—can maintain, or even reduce, the amount of water they need to withdraw from waterways. An estimated seven billion gallons of water per day (bgd) has been saved in the U.S. since 1994 due to federal policy requiring water-efficient fixtures—enough water to supply seven New York Cities per day.[406] Now many communities are going beyond these requirements, triggering use of new, even more efficient products to reduce demand even further.

Outside these buildings, the way land is developed and used, and the way landscapes are managed, greatly impacts how rainfall affects waterways and stream flows. Typical urban development creates large amounts of impervious surfaces, resulting in too much rain running off too quickly into waterways, adversely impacting water quality and wildlife habitat and causing flooding. This water is also "lost" and unavailable to infiltrate naturally, which replenishes waterways and provides important base flows during dry periods for many streams. For instance, over a five-year period, Nashville lost an estimated 17–40 billion gallons and Greenville, S.C. lost an estimated 12–29 billion gallons from failing to effectively capture, reuse, and infiltrate stormwater runoff.[407] However, using the right practices allows urban landscapes to more closely mimic natural landscapes, leading to more natural runoff patterns that can help protect and replenish healthy stream flows. Also, reducing outdoor water use, which is often a consumptive use of water, by conserving water and using water-efficient irrigation tools for watering landscapes can significantly decrease the demand for highly treated water.

In addition to many effective local efforts, there are state-level policies that can address both parts of this equation. In the Southeast, there are examples of state-level policies that require water-efficient fixtures and appliances in homes and businesses that exceed the federal minimum, and require management of stormwater in ways that more closely mimic natural runoff patterns. This section of the report will explore both.

State Building and Plumbing Regulations Requiring Water-Efficient Fixtures

State Building and Plumbing Regulations Scorecard	AL	GA	NC	SC	TN
Have building and plumbing efficiency standards more stringent than federal minimum					

Background

The use of water-efficient fixtures was initially driven by federal requirements via the Energy Policy Act of 1992 (EPAct) that went into effect in 1994 and mandated the maximum amount of water certain fixtures and appliances could use **(see Table 7)**. The impact of these requirements has been steady and has grown over time as old appliances and fixtures are replaced and new homes are built using appliances with higher efficiency. Over time, some of the efficiency standards have been updated to be even more stringent, and since 1980 the efficiency of the regulated fixtures and appliances has improved 43–86%, depending on the fixture or appliance.[408]

In addition to the national standards set by the EPAct, state and local governments can adopt water efficient requirements that are more stringent than the federal requirements (assuming local governments are not specifically prohibited from doing so by state law). Many states have done this since 2010, when states were no longer prohibited from adopting lower water use thresholds due to preemption by the federal government.[409] EPA's WaterSense rating and labeling program, akin to Energy Star, has criteria more stringent than required by the EPAct **(see Table 7)**.[410] While the WaterSense program is voluntary, the criteria have been adopted into some local and state requirements and green certifications.[411]

KEY

GREEN

Have building and plumbing efficiency standards more stringent than federal minimum.

RED

Do not have building or plumbing efficiency standards beyond federal standards.

Nationwide, however, installation of WaterSense fixtures and appliances remains low; on average, WaterSense adoption rates are 6.7% for toilets, 25.4% for faucets, and 28.7% for showerheads. Adoption rates are even lower in the Southeast, with Alabama, Kentucky, Tennessee, and Mississippi having the lowest installation rates, averaging 5.1%.[412] Nationally, there are also seven recognized voluntary "green" building codes, standards, and rating systems, and all but one contain water efficiency provisions.[413] Cumulatively, water-efficient fixtures and appliances have significant impacts on our water supplies, and it is estimated that water savings due to the Energy Policy Act and WaterSense will grow to 10 bgd by 2020. These water savings help water utilities delay, and in some cases forego altogether, the development of new water supplies, keeping more water in our rivers.[414]

Water Efficiency Standards	Federal Regulation[415]	EPA's WaterSense[416]	Georgia Water Stewardship Act[417]	Other State Requirements
Residential				
Toilets	1.6 gpf	1.28 gpf	1.28 gpf	
Showerheads	2.5 gpm–80 psi	2.0 gpm	NA	2.0 gpm–CA, 7/1/16 1.8 gpm–CA 7/1/18 WaterSense labeled–CO, 9/1/16[418]
Bathroom Faucets	2.2 gpm–60 psi	NA	1.5 gpm–60 psi	
Kitchen Faucets	2.2 gpm–60 psi	1.5 gpm	2.0 gpm–60 psi	
Clothes Washers	26 gallons/load		NA*	
Dishwashers	6.5 gallons/cycle		NA*	
Commercial				
Urinals	1.0 gpf	0.5 gpf	0.5 gpf	
Toilet	1.6 gpf	1.6 gpf	1.28 gpf	
Bathroom Faucets	2.2 gpm	0.5 gpm	1.5 gpm–60 psi	
Pre-Rinse Spray Valve (dishwashing)	1.6 gpm		NA	

gpf: Gallon per Flush (gpf)/gpm: Gallons per Minute/psi: Pounds per Square Inch

*Georgia does have a "Sales Tax Holiday" that exempts Energy Star and WaterSense certified products, including dishwashers, clothes washers, refrigerators, air conditioners, ceiling fans, fluorescent light bulbs, programmable thermostats, toilets, urinals, showerheads, and faucets from sales tax.[419]

TABLE 7

Comparison of Water Efficiency Standards (adapted from Alliance for Water Efficiency)

Analysis of State Policies

The Alliance for Water Efficiency's *Water Efficiency and Conservation State Scorecard* report provides a framework to assess which states have fixture efficiency requirements that exceed the federal requirements. With the exception of Georgia, no state in the Southeast has state building or plumbing codes that require water efficient fixtures beyond the federal standards set by the federal Energy Policy Act **(Table 8)**.[420] North Carolina does have a requirement for construction and renovations of public agencies that includes a reduction in indoor and outdoor potable water use.[421] Georgia has one of the country's most comprehensive state building and plumbing codes, however, it does not have requirements for showerheads, clothes washers, or pre-rinse spray valves (PRSV) that go beyond the federal requirements. Georgia's comprehensive state building and plumbing codes are the result of the **Georgia Water Stewardship Act** adopted in 2010, which requires all new construction after July 1, 2012 to install high-efficiency plumbing fixtures, including toilets, bathroom and kitchen faucets, and urinals. The law also requires retail sales of toilets to meet these standards.[422]

Efficiency standards more stringent than federal minimum	AL	GA	NC	SC	TN
Toilet Regulations	No	Yes	No	No	No
Showerhead Regulations	No	No	No	No	No
Urinal Regulations	No	Yes	No	No	No
Clothes Washer Regulations	No	No	No	No	No
Pre-Rinse Spray Valves (PRSV) Regulations	No	No	No	No	No
Building or Plumbing Codes	No	Yes	No	No	No

TABLE 8

Water Efficiency Standards for specific appliances in Southeastern states

In addition to the requirements listed above, the Georgia Water Stewardship Act requires all new multi-tenant residential, commercial, and industrial buildings to install sub-meters and bill tenants according to their individual water use. The intent of sub-meters is to decrease water use by making tenants in multi-unit buildings aware of, and pay for, their individual water use. The law also requires all new construction to install high-efficiency cooling towers (i.e. building heat removal devices that cool equipment) that meet the minimum standards prescribed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers.

As noted in the section of this report on drought requirements, outdoor watering can also comprise a considerable amount of residential water use and as a "consumptive use" is especially important to curtail when considering how to keep water in our rivers. Some states restrict water use for outdoor watering during times of drought, but it is rare to find such consistent requirements outside of droughts. However, the Georgia Water Stewardship Act mandates a permanent outdoor watering schedule that restricts outdoor watering statewide—with significant exceptions—between the hours of 10:00 a.m. and 4:00 p.m. In addition to conserving water, a permanent restriction makes compliance easier by keeping the requirement consistent and in place at all times.

Given that only Georgia has gone beyond federal minimums, there are immense opportunities for other states in the Southeast (as well as further opportunities in Georgia) to set requirements for higher water efficiency standards.

Summary

Within buildings, the ways water is used can make a big difference in how much water is left for healthy stream flows. Everything from toilets, faucets, clothes and dish washers, and showerheads in residences, and bathrooms, dish and clothes washing in businesses, impacts the amount of water that needs to be withdrawn from rivers to meet a community's water supply needs. By using water-efficient appliances and fixtures, communities—even ones that are growing—can maintain, or even reduce, the amount of water they need to withdraw from our waterways.

Recommendations and What You Can Do

- Ask your state to adopt stringent plumbing codes.
- Require plumbing codes match or exceed WaterSense specifications.
- Require WaterSense labeling to ensure 3rd party verification of fixture efficiency.
- Partner with industries that also benefit from more stringent plumbing codes. See Chattahoochee Riverkeeper's case study on Toto in their ***Filling the Water Gap* report**.
- Partner with utilities who support more stringent plumbing codes to help reduce their demand. See **this article** describing Denver Water's leadership on the Colorado law requiring sale of WaterSense fixtures.

LEARN MORE

U.S. EPA's **Water Sense program**

Alliance for Water Efficiency's **Background on Codes and Standards**

Alliance for Water Efficiency and Environmental Law Institute's **Water Efficiency and Conservation State Scorecard: An Assessment of Laws and Policies**

American Water Works Association **Article: "Low-Volume Plumbing Fixtures Achieve Water Savings"**

National Conference on State Legislatures' **Water Efficient Plumbing webpage**

State Stormwater Permit Requirements That Facilitate and Increase Infiltration, Capture and Reuse

State Stormwater Permit Requirements That Facilitate and Increase Infiltration, Capture and Reuse Scorecard

	AL	GA	NC	SC	TN	OTHER MODELS
Stormwater permits require on-site water retention						West Virginia

Background

Polluted stormwater runoff is a major source of streams failing to meet water quality standards nationwide. As forests, fields, and other natural surfaces are replaced with streets, parking lots, buildings, and homes, rain is prevented from soaking into the ground to be absorbed and released slowly back into streams and taken up via trees and plants. Instead, when it rains, water falls on impervious surfaces—like pavement—that water can't soak into; rather, water collects and carries sediment, bacteria, oils, metals, and other pollutants into the stormwater system, combined storm/sanitary system, or nearby waterways.

This urban stormwater runoff either flows into a stormwater drain and is discharged directly to waterways, flows into the sewer system and is released to nearby streams after treatment at a wastewater facility, or, when there is too much rain flowing into the sewer system, can cause sewer overflows and discharges of untreated sewage and stormwater into nearby streams. Excessive stormwater discharge contributes to habitat degradation (scouring and erosion) and unnatural hydrology in local streams by increasing peak flows and decreasing baseflows.[423] This runoff can also cause flash flooding.

Using management practices that cause urban landscapes to more closely mimic natural landscapes and hydrology to "harvest, infiltrate, and evapotranspire stormwater" leads to more natural runoff patterns and healthier stream flows.[424] In recent years, the scientific and technical understanding of how to control stormwater has evolved toward "volume-based" controls that attempt to keep more water on-site to better

KEY

GREEN

Stormwater MS4 permits have some requirements for on-site water retention.

RED

Stormwater MS4 permits have no requirements on-site water retention.

protect, restore, and replicate natural hydrology. To achieve this goal, many communities across the country have incorporated stormwater requirements using performance-based standards that require the retention of a certain amount of water on-site.[425]

These standards also serve to drive the use of so-called "green infrastructure" approaches—including rain gardens, green roofs, permeable pavement and tree planting as cost-effective methods of compliance, while also providing multiple community benefits.[426] Green infrastructure can help reduce polluted stormwater runoff while also replenishing base flows, while at the same time providing energy savings, flood reduction, and cooler temperatures. Additionally, stormwater capture and on-site reuse can help diversify a community's water supply portfolio.[427] Calculations for a medium-density area in Birmingham, Alabama, for instance, estimate that demand for potable water could be reduced by as much as 24% simply by capturing rainwater for use in flushing toilets and outdoor irrigation.[428]

Urban stormwater runoff is regulated by the Clean Water Act's National Pollutant Discharge Elimination System (NPDES) program for stormwater discharges from Municipal Separate Storm Sewer Systems (MS4) that has different requirements for small and large communities.[429] The regulations are intended to reduce stormwater pollution and water quality degradation, but they have proven to be too vague. Instead of actually reducing the volume of stormwater, MS4 permits have more commonly required that it merely be conveyed or detained.[430] Permits are issued by the state permitting agency or EPA depending on the state, providing opportunities to create more protective permits.

Analysis of State Policies

Across the Southeast, several states have or have had stormwater permits that incorporate retention standards or associated state stormwater manuals that recognize green infrastructure practices. While Alabama's, Georgia's, and North Carolina's MS4 permits have no standards for on-site retention or volume control, South Carolina's permits include some standards of this type. Tennessee had a permit that relied heavily on Low Impact Development until recent rollbacks.

Until recently, Tennessee had some of the best stormwater requirements in the Southeast. Tennessee's Phase II MS4 permit for smaller communities required stormwater discharges from new development and redevelopment sites be managed so "post-development hydrology [did] not exceed the pre-development hydrology at the site, in accordance with the performance standards." The performance standards also required that the first inch of rainfall be 100% managed on-site through runoff reduction or harvesting techniques. MS4s were permitted to allow off-site compliance where meeting the standard was not possible through alternatives such as an in-lieu fee program or off-site runoff reduction within the same sub-watershed, or by achieving other objectives such as increased density, brownfield redevelopment, or incorporating transit.[431] Unfortunately, a legislative rollback of late prohibits the permit from being any more stringent than federal minimum requirements, and the post-development hydrology language has been removed in the revised draft permit.[432]

South Carolina's Phase II MS4 permit also requires the first inch of rainfall be 100% managed on-site and lists the ways

MS4s can meet that standard in their local stormwater management plans and codes. The South Carolina permit specifies a limited set of regulatory approaches that MS4s can use in their stormwater management plans and standards. The permit requires "either one, combination, or equivalent combination of design strategies, control measures, practices or provisions such as infiltration, evapotranspiration, rain harvesting, and stormwater reuse and recharge that demonstrate the runoff reduction and pollutant removal necessary to maintain predevelopment conditions and to protect water quality to the MEP (maximum extent practicable)." Further, the permit provides examples of specific standards for retention and recharge that could be adopted.[433]

North Carolina's stormwater permits do not have retention standards. However, there has been increasing acceptance of low-impact development and green infrastructure practices that involve on-site retention. For instance, the state's Best Management Practices Manual has been updated to include sections on bioretention, permeable paving, and rainwater capture, and the state has committed to promote low impact development as a voluntary option.[434]

West Virginia has a strong phase II MS4 permit that uses an objective performance standard expressed as a volume of rain to be managed on-site. Specifically, the permit requires that the volume from the first inch of rainfall in a 24-hour storm on development and redevelopment sites is managed "by canopy interception, soil amendments, evaporation, rainfall harvesting, engineered infiltration, extended filtration and/or evapotranspiration, and any combination of the above mentioned practices."[435] The permittee must implement and enforce via an ordinance and/or other enforceable mechanism(s). Additionally, the permit encourages smart growth and brownfield redevelopment by reducing requirements for those projects.[436]

Green Streets: Restoring Rivers, Revitalizing Neighborhoods, and Making Streets Safer

Streets represent a significant percentage, sometimes the greatest percentage, of the overall impervious cover in a city and a corresponding amount of stormwater runoff that alters stream flows. One way to slow, absorb and treat the stormwater that flows off of streets is a method called "Green Streets." Green Streets incorporate green infrastructure practices, such as vegetated swales, rain gardens and permeable pavement, by placing them on or adjacent to the street to collect stormwater, treat it with a combination of soils and plant material, and allow it let it sink back into the earth and slowly discharge into nearby storm drains, streams, or be taken up by plants.

Green street infrastructure can provide multiple benefits including treatment of stormwater, beautification, calming traffic, providing buffers for cyclists and pedestrians, and reducing air pollution and temperatures with street trees. Several related concepts incorporate green streets and other community, quality of life, and environmental goals. "Complete Streets" are designed and operated to enable safe access for all users, regardless of age, ability, or mode of transportation. "Safe Routes to School" are designed to improve the health and well-being of children by enabling and encouraging them to walk and bicycle to school.

LEARN MORE

Promoting Green Streets – A Recipe for Integrating Water and Transportation Infrastructure Investment by River Network

Municipal Green Streets Projects and Resources Guide by River Network

Green Streets: Filtering and Slowing Stormwater, Revitalizing Neighborhoods and Making Streets Safer Webinar by River Network/Urban Waters Learning Network

River Rally 2016 Session: Promoting Green Streets–A Recipe for Integrating Water and Transportation Infrastructure Investment by River Network

Turning Pavement into Green Space

Parking lots and other types of paved lots significantly contribute to the amount of impervious surface in communities and watersheds. To reduce the amount of pavement, stormwater pollution, rapid runoff and decreased infiltration, and increase the amount of green space, communities have begun working together to remove unwanted and unneeded pavement in their neighborhoods and watersheds.

The Portland, OR-based organization, **Depave**, recruits and trains community members to safely remove pavement and create new public green space. Since 2008, Depave has removed more than 135,000 square feet of pavement with the help of over 2,750 volunteers from various Portland communities. As a result of this work, each year more than 3.25 million gallons of rainwater is diverted from the over-burdened storm drain system and infiltrated into soils to sustain stream flows, urban trees, community gardens, and more than 50 community green spaces.

River Network worked with Depave to expand their model to the cities of Tacoma and Puyallup, WA. Four Depave events were completed in Tacoma and Puyallup and River Network has continued to promote the Depave model nationally through River Rally and stormwater-related work. Conversations about establishing Depave programs in other locations are taking place and de-paving unwanted and unneeded pavement in the southeast could be another method to reduce stormwater pollution and replenish southeastern rivers.

Summary

Outside our buildings, the way land is developed and used and the way landscapes are managed greatly impacts how rainfall affects waterways and stream flows. Impervious surfaces are a top cause of stream flow alteration in the Southeast. Typical urban development creates large amounts of impervious surfaces; too much rain runs off too quickly into waterways, adversely impacting water quality and wildlife habitat and causing flooding. This water is also "lost," or unable to naturally infiltrate into the ground, which replenishes groundwater and provides important base flows during dry periods for many waterways. However, using the right practices allows urban landscapes to more closely mimic natural landscapes, leading to more natural runoff patterns that can help protect and replenish healthy stream flows. Also, reusing stormwater for outdoor water can significantly decrease the demand for highly-treated water.

Recommendations and What You Can Do

• Know when your state MS4 General NPDES permit is up for renewal (covering lots of jurisdictions) or when your individual MS4 permit is up for renewal (applied to larger jurisdictions >100K population).

• Ask your state to include a retention standard and/or require green infrastructure practices in their definition of "Maximum Extent Practicable" (MEP).

• Identify local governments already taking this approach and use them as examples of how these approaches are "practicable" (one of the key terms for Phase II MS4 permits for smaller urbanized areas). See for example, the **City of Atlanta's green infrastructure stormwater ordinance.**

LEARN MORE

River Network's **Clean Water Act and NPDES regulations for stormwater**

River Network's Green Streets webpage

American Rivers, NRDC and Smart Growth America's ***Paving Our Way to Water Shortages: How Sprawl Aggravates the Effects of Drought*** report

American Rivers' ***Permitting Green Infrastructure: A Guide to Improving Municipal Stormwater Permits and Protecting Water Quality*** report

U.S. EPA's **Green Infrastructure website**

Water Environment Federation **Stormwater Institute**

CONCLUSIONS

There are many sustainable water management successes and examples to celebrate and emulate in the southeast and there also significant opportunities to advance sustainable water management policy. To ensure a future of healthy rivers with water flowing for people and nature upstream and down, we can and must do more. Our objective with this report is to compare state approaches, identify state policy opportunities and provide information, examples and resources to support river conservation organizations in their efforts to advocate for sustainable water management policies in the southeast.

THERE ARE A NUMBER OF FINDINGS AND THEMES THROUGHOUT THIS REPORT THAT CAN HELP FRAME WAYS TO CONSIDER THESE IDEAS:

• *Create strong scientific foundations for protecting flows but also work with what you have*–A core requirement for sustainable water management is understanding how much water is being used and returned, and developing sound recommendations for environmental flows. North Carolina for example, followed an exemplary process for establishing environmental flow targets. Advocating for state policies to fund and require monitoring and modeling can have big benefits. However, where there is not the funding or mechanism to conduct detailed scientific analyses, there are surrogate approaches, like presumptive standards for instream flow that can be used. Mississippi, for example, applied such an approach to fracking permits in part of the state, limiting withdrawals to no more than 10% of median flow. Work with state contacts from the **Instream Flow Council** and the **Southern Instream Flow Network** to help identify resources, and submit specific requests for scientific assistance to **River Network's River Science Connection**.

• *Good fortune comes to the well-prepared*–Crises and conflict often offer the opportunity to make change. Georgia's Water Stewardship Act that spurred many of the state's advances in conservation and efficiency and South Carolina's Water Withdrawal, Permitting, Use and Reporting Act both followed times of increasing tension over water caused by drought, growing water demand and legal battles. Both were strongly influenced by coalitions of watershed and community groups. Legal battles, major droughts and big changes in water use provide similar opportunities. Further, even some short term actions can have long term impact. Water conservation required during drought can change long term water use behavior. So be ready to respond with your best policy

To ensure a future of healthy rivers with water flowing for people and nature upstream and down,

we can and must do more.

solutions at these change points (for more, see the article in ***River Voices*** by David Lillard with the West Virginia Rivers Coalition on Transforming Crisis to Opportunity).

• *Clean water and healthy flows are connected (as you know…)*–Often the policies governing clean water and water supply are separate, but there are a number of policy connections between the Clean Water Act and water quantity. Tennessee provides a clear example of how to link the impacts of flow alteration to CWA requirements through assessment of water withdrawals. Other examples include EPA Region 4 Water Efficiency Guidelines for reviewing new water supply projects and the attention to monitoring for hydrologic impairment. Some of these options may provide opportunities where a direct approach to flow protection is less viable. Further, some communities are looking to use Integrated Water Management to reduce costs and maximize social, environmental and economic benefits, providing an opportunity to address clean water and water supply issues together.

• *Work in Coalitions*–The Rhode Island Coalition for Water Security provides a good example of a coalition that successfully achieved major advances in reducing water demand statewide. Many coalitions exist throughout the southeast as well, such as the North Carolina Conservation Network, the Georgia Water Coalition and South Carolina Rivers Forever that are all raising awareness and pushing for better policies. For instance, in the absence of an official public participation process for their state's water plan, the Alabama Rivers Alliance hosted their own set of public engagement opportunities. Working with diverse partners like water utilities and farmers provides a broader base to try out new practical solutions. Efforts of the **Upper Flint River Working Group** is one example. Consider starting with issues like water loss that can attract the support of water utilities or other non-traditional partners.

• *Legal doctrine matters*–States that have moved to regulated riparianism have the ability to regulate and set conditions for water withdrawals and can balance uses and upstream and downstream needs. States still working under the riparian doctrine may need to use other approaches that are tied to specific conditions. Two states, North Carolina and South Carolina both have provisions for "capacity use areas" that authorize withdrawal limitations under certain conditions. While not proactive planning tools, these could be used more extensively.

• *Growth will continue*–the southeast is projected to continue growing, and in a sprawling manner. The need to develop using less impervious surfaces, like roads and parking lots, and reducing stormwater runoff will help keep stream flows more natural. At the same time, some communities will look to new water supply reservoirs before maximizing water conservation and efficiency. Scrutinize population projections and water demand forecasts to evaluate whether more reservoirs are truly needed and advocate for stormwater permits and programs that use retention standards and green infrastructure to reduce impervious surfaces and their impacts to streams and rivers.

State governments have an important role to play in mitigating the risks that threaten healthy river flows and river advocates can urge them to take a number of actions that will lead to more sustainable management of southeastern rivers. Many other excellent opportunities for protecting and restoring our rivers including dam removal, local ordinances, hydropower relicensing and voluntary or incentive-based transaction exist as well. We hope that watershed and community groups and others are ready to use some combination of these policies and practices to achieve a sustainable water future for our southeastern rivers.

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