

**RECOMMENDATIONS FOR A SURFACE WATER ALLOCATION SYSTEM
IN NORTH CAROLINA**

The Upper Tar River Basin Perspective

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ABSTRACT

North Carolina is a water-rich state, crisscrossed by more than 40,000 miles of rivers and streams and fed by an average of almost 50 inches of rain a year. Competition for the state's water resources is increasing, however, and recent droughts and lawsuits have highlighted the fact that there is a limit to this wealth. A more proactive and comprehensive approach to managing water withdrawals is needed. One management tool that has received attention at the General Assembly, but has not yet been implemented, is a statewide allocation system for surface water. My research is a prospective policy analysis, which explores the perspective of four groups of water professionals (primarily) within the Upper Tar River basin, in order to predict the implications and consequences of implementing a statewide surface water allocation policy.

Data was collected through a series of hour-long, semi-structured, in-person interviews. Informants included managers of municipal water systems in the Upper Tar River basin, water utility professionals from the private sector who work in the Upper Tar River basin, staff from state resource agencies, and environmental policy experts working on water issues in North Carolina. Data analysis, which drew from discourse analysis and grounded theory methods, explored the text of verbatim interview transcripts to identify the key themes in informants' discourse related to a surface water allocation policy. From these themes, I articulated a list of the fundamental objectives that an allocation program must meet and then developed a set of policy recommendations to guide development of such a program.

My analysis indicates that there is support for a statewide surface water allocation system, within the respondent group. In order to realize the potential benefits identified by informants and minimize their concerns, a successful surface water allocation program should (1) provide a fair process for determining allocations, (2) apply equitably to all user groups, (3) incorporate a comprehensive and integrated approach to understanding, managing, and regulating surface water use, (4) provide a broad planning and decision context, and (5) enable users to adequately plan and prepare for future water conditions.

This study provides insight to the perspectives of four stakeholder groups in the Upper Tar River basin and could serve as the basis for larger, perhaps quantitative studies. Future research is needed to investigate the transferability of these findings to other river basins in the state and to explore the perspectives of other important stakeholder groups, including agriculture and electric power generation.

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Table of Abbreviations

CUA	Capacity Use Area
CWFNC	Clean Water for North Carolina
DENR	Department of Environment and Natural Resources
DHEC	Department of Health and Environmental Control
DWQ	Division of Water Quality
DWR	Division of Water Resources
EPD	Environmental Protection Division
ERC	Environmental Review Commission
gpd	gallons per day
IBT	Interbasin Transfer
KLRWS	Kerr Lake Regional Water System
LWSP	Local Water Supply Plan
PTRF	Pamlico-Tar River Foundation
SGWASA	South Granville Water and Sewer Authority
USACE	U.S. Army Corps of Engineers
WAS	Water Allocation Study
WRC	Wildlife Resources Commission
WSRP	Water Shortage Response Plan
WWTR	Water Withdrawal and Transfer Registration

INTRODUCTION

North Carolina may be “one of the most hydrologically blessed places in the world.”¹ During a typical year, the state receives an average of almost 50 inches of rain, more than twice the amount of most states in the western half of the country (National Atlas 2011). More than 40,000 miles of rivers and streams crisscross the state, which itself covers less than 54,000 square miles (Nickens 2010). Due in part to that hydrologic abundance, North Carolina has limited regulations regarding water withdrawal and use. Demands on the state’s water resources are increasing, however, and recent lawsuits and droughts have highlighted the fact that there is a limit to this wealth. The state Division of Water Resources (DWR) acknowledges as much in its discussion of the impetus for the River Basin Water Supply Planning process (DWR 2011). In fact, DWR identified this issue ten years ago, observing that “North Carolina is beginning to see some water supply shortages and competition among water users... As North Carolina continues to grow, we will encounter water supply problems more frequently” (DWR 2001, 1-1). Since then, a number of new and revised policies have been implemented to help water planners and managers prepare to meet these anticipated water shortages.

One management tool that is being discussed, but has not yet been implemented, is a statewide allocation system for surface water. Many parties, including environmental policy experts, some state legislators, and some municipal water systems, see the need for an allocation system. There is also concern, however, about how an allocation system would be designed and operated. The goal of this research is to explore the potential usefulness of a statewide surface water allocation system from the perspective of four stakeholder groups, and to develop a set of resulting policy recommendations. In order to provide context for this discussion, I begin with a summary of relevant state water policies, a description of the main components of an allocation system, and a review of water allocation systems (or analogous frameworks) in nearby states.

Existing State Water Policies

Surface water law in North Carolina is grounded in the riparian rights framework. State law allows landowners along a river to make “reasonable use” of its water insofar as this use does not impair another riparian landowner’s ability to make reasonable use of the water flowing through his property.

¹ This quote comes from an interview I conducted as part of a class project investigating public awareness and opinions of instream flow in the Raleigh-Durham area. The speaker was one of the owners of a small, organic family farm.

The meaning of “reasonable use” is not clearly defined in North Carolina law; it is determined chiefly through case law. If a riparian landowner feels her use is being impaired by an upstream user, her only recourse is to sue the upstream user, providing she can identify the appropriate party and can prove that this user has made more than “reasonable” use of the water.

This approach is typical of the eastern U.S. and contrasts with the western part of the country which operates under the “prior appropriation” doctrine which gives senior water right holders priority over more recently-arrived water users (Getches 2009). A prior appropriation structure necessitates a system for allocating water in order to document who has a senior water right and how much water is associated with that right. Riparian right states have traditionally not had detailed structures for assigning surface water rights, since the right to use water from a stream travels with ownership of the land adjacent to the stream. North Carolina’s water law is consistent with this history. Beyond the directive for “reasonable use,” North Carolina has six primary regulations related to surface water withdrawals.

Water Withdrawal and Transfer Registration (WWTR). The WWTR statute (North Carolina G.S. §143-215.22H) requires non-agricultural water users who expect to withdraw (or transfer to another river basin) more than 100,000 gallons per day (gpd) and agricultural water users who expect to withdraw (or transfer to another river basin) more than 1,000,000 gpd to register their use with the state ahead of time. This registration must be updated every five years. Registered users must also submit annual reports on their actual water use to DWR, but do not need authorization from the agency to make the registered withdrawals.

Interbasin Transfers (IBT). The Regulation of Surface Water Transfers Act (codified under North Carolina G.S. §143-215.22L) requires that any user who wishes to transfer more than 2,000,000 gpd of surface water from one river basin to another must first obtain a certificate from the Environmental Review Commission. This regulation was expanded in 2007 to include more public involvement and increased analysis of environmental impacts. The process to obtain a certificate has thus far proven to be lengthy and conflict-laden.

Dam Safety Law of 1967. Among other things, this regulation covers the timing and quantity of withdrawals and discharges from impoundments, in order to establish minimum instream flow conditions below dams. (North Carolina G.S. §143-215.25 (4))

Capacity Use Areas (CUA). The Water Use Act of 1967 (North Carolina G.S. §143-215.11 through .22) is the only state law that directly regulates withdrawals. In areas designated as CUAs, where cumulative

surface water and/or groundwater use have expanded to such a degree that use is unsustainable and additional regulation is needed, a permit (not simply registration) is mandated for water withdrawal or use over a certain volume. Mandatory reductions in groundwater and/or surface water withdrawals can also be established in CUAs, if needed.

Water Supply Plans. Under North Carolina G.S. §143-355(m), DWR prepares a State Water Supply Plan, “in order to assure the availability of adequate supplies of good quality water to protect the public health and to support desirable economic growth.” In large part, this plan is constructed around the Local Water Supply Plans (LWSP) that are required of (1) units of local government that provide public water supply and (2) community water systems that serve more than 3,000 individuals (or 1,000 connections), per North Carolina G.S. §143-355(l). The LWSPs, which must be updated every five years, ask water managers to report current water use, surface water and groundwater sources, and wastewater discharges, and to project their future supplies and demands of water for the next 50 years. Systems are also required to submit an annual update of their actual water use and system conditions for the preceding year to DWR.

Water Shortage Response Plans (WSRP). In accordance with North Carolina G.S. §143-355.2, water systems must prepare a WSRP containing conservation measures that would be implemented under drought conditions. If DWR determines that these measures are insufficient, it may require that the water system undertake additional measures as DWR deems necessary. During extreme or exceptional drought, water systems must report their actual water use to DWR weekly.

Water resource management has received an increased focus over the last decade, but policies have been created piecemeal and the result is fragmented governance of water resources (Holman et al 2007). These limited regulations do not enable policymakers and resource managers to track how much water is being withdrawn statewide, when, by whom, or what effect these withdrawals may have on other users or the overall health of the state’s natural systems. During the last legislative session (2010), DWR was directed to conduct basinwide hydrologic modeling of each of the state’s 17 major river basins (North Carolina G.S. §143-355(o)). This is the first statute to seek to quantify the complex relationship between surface water and groundwater in the state and the first to establish ecological flow needs for North Carolina’s major river basins. The modeling results should provide a fuller, more integrated understanding of North Carolina’s water resources. If so, the models could prove a valuable tool in water resource planning. Planning, though, is not sufficient. The state also needs a more comprehensive approach to managing and monitoring water use.

Fundamental Components of an Allocation System

At its most basic, a surface water allocation system is based on an understanding of how much water is available and includes mechanisms for proportioning water to various users, monitoring their use, and enforcing the allocations. Enforcement is usually handled by way of a permitting system.

It is a straightforward recipe for an allocation system. But each of these steps is complex and there is no single correct answer to questions of how to enforce an allocation, for example, or how to define “available water.” From scientific and legal perspectives, there are multiple possible approaches, although some are certainly better than others. In crafting policy, however, social (values) and political (power) considerations are often just as important as scientific and legal considerations.

Designers of environmental policies typically employ scientific and technical data which add a degree of complexity and uncertainty to the decision making process. For example, in order to determine how much surface water is available for use in a river basin, scientists would use a model that incorporates historic stream flow patterns with geography, climate, land use, and existing and estimated future use volumes. The modeler must decide which data sources to use and how much weight to give to various factors influencing flow, among other decisions. Each of the steps taken to build the model incorporates more complexity (in order to better mimic the complex natural system at hand) and some measure of uncertainty (insofar as we do not understand natural systems perfectly and cannot perfectly predict the future). Even if stakeholders are able to integrate all the complexity and uncertainty and reach agreement on what future stream flow patterns would likely be, there can still be important disagreements over how that stream should best be managed (e.g. how much instream flow should be preserved, which users should have priority during a drought), since stakeholders may have different values, priorities, and attitudes toward risk (Bacow & Wheeler 1984). These disagreements cannot be settled solely with scientific or legal expertise.

Policies regulating the use of shared resources are value-laden. DeBell (2006) outlines three reasons for this. First, people value resources differently and consequently place different values on various uses of the resource. For example, is a river first and foremost a natural ecosystem or a conduit for moving water to cities and industries? Secondly, people affected by environmental policies are not all affected similarly. Consider the differing impacts of water quality regulations on a hog farmer and a fisherman. Third, people may have divergent assessments of the risk of possible policy outcomes. How likely are businesses to locate elsewhere if a county raises its water rates? At what point does declining quality of life outweigh low tax rates in relocation decisions? Individuals also have different sensitivities

to risk. The result of these disparate values, priorities, and risk attitudes is that stakeholders and policymakers debating the appropriate use of natural resources may come to the discussion with very different worldviews (Costanza et al 2000). These variations also help to explain why similar policies are designed and implemented differently in different locations.

A discussion of values is especially relevant when considering the potential for implementing an allocation system. As we will see below, some states have opted to promulgate water withdrawal permits without an allocation system. Permits provide the benefit of protecting permitted users from lawsuits claiming their water use is not “reasonable,” since in authorizing the permit, the state has made the determination that the use is reasonable. However, a system that only permits withdrawals, without an overarching allocation structure, operates on a first-come-first-served basis, in essence making allocation decisions by default. Such a system lacks a long-term vision of how water will be proportioned among various classes of users (e.g. agriculture, public water supply, and industry) and provides no certainty for future expansions of existing users (e.g. for growing cities). Avoiding a discussion of the political and value judgments inherent in water allocation decisions may be easier in the short-term, but it does not avoid value decisions – it merely hides them.

Considering the values involved in an allocation policy from the outset has practical ramifications, as well. Allocation decisions that are seen as fair are more durable over the long term (Smith 1994). Stakeholders’ determinations of fairness relate not just to the distribution of water allocations themselves, but also to the process by which allocation decisions are reached. There are multiple ways of distributing allocations which could be considered fair, such as basing allocations on users’ current usage, the intensity of users’ needs, or the priority of types of uses (e.g. drinking water vs. lawn watering). This complexity makes the determination of a “fair” allocation difficult, and consequently increases the importance of using a fair process to reach those decisions. Some research has shown procedural justice to be more important in allocation decisions than other factors unrelated to fairness, even such fundamental issues as factuality and feasibility (Barrett-Howard and Tyler 1986). These findings reinforce the central role that values play in regulating the use of shared resources. Successful allocation policies must balance political and social priorities, as well as scientific and legal constraints.

Allocation Systems in Nearby States

Western states, which operate under a prior appropriation framework for water rights, have utilized water allocation and permitting systems for many years. Southeastern states have begun integrating these mechanisms into their legal frameworks more recently. In the Southeast, six states (Florida,

Georgia, Kentucky, North and South Carolina, and Virginia) have regulations governing surface water withdrawal permitting. None have explicit water allocation programs. This section will review the approaches taken by South Carolina and Georgia. Key provisions of both states' legislation are highlighted in Table 1, below.

South Carolina's Surface Water Withdrawal, Permitting, Use and Reporting Act was passed very recently, in July 2010 (SC ST SEC 49-4-10 to -180). The state Department of Health and Environmental Control (DHEC) is currently in the process of promulgating regulations to implement the act. All existing users will be grandfathered. For new users, the state calculates a minimum instream flow level for each proposed withdrawal point and mandates this minimum is maintained. Beyond this, however, new withdrawals can be authorized until the point there is insufficient water in the stream ("safe yield") to supply new withdrawals. The statute mandates that renewed permits be issued for at least the same amount of water as a user's expiring permit, but provides no guarantee that new users will be able to obtain a withdrawal permit or that existing users will be able to expand their withdrawal in the future. Instead, if the safe yield is inadequate to accommodate a new or expanding user, the state can meet with other permitted withdrawers in the basin and attempt to reach mutually agreed upon permit reductions, sufficient to supply the new applicant. To discourage permit seekers from overstating their water needs (e.g. as a hedge against the uncertainty of future expansions), the state will evaluate requests for expanded withdrawal volumes and can deny the expansion if it determines that quantity is not necessary to meet the permittee's future needs. South Carolina incorporates some consideration of the future needs of the basin in its determination of whether a proposed withdrawal is reasonable (see table below).

Georgia first regulated surface water withdrawals in 1978 and has subsequently updated its water withdrawal policies (Chapter 391-3-6-.07). The program is administered by the state Department of Natural Resources' Environmental Protection Division (EPD). One prominent feature of Georgia's legislation is the privileged position of agricultural water use. Withdrawal permits for farm use have no term limit, they can be passed onto subsequent landowners if the property is sold, and the application requirements are much less rigorous. Farm uses are also given high priority during water shortages, second only to personal and health uses. Like South Carolina, Georgia's water withdrawal program includes protections for instream flow. However, unlike South Carolina's approach which places an emphasis on measures related to ecosystem health (e.g. maintaining aquatic habitat and seasonal flow variation) and recreational uses, Georgia's characterization of instream flow is based on the 7Q10 flow,

which is primarily a water quality measure, meant to ensure there is enough flow to dilute undesirable constituents. It is not directly related to maintenance of ecosystem health.

Another significant feature of Georgia’s water withdrawal policy is the importance it places on planning, system management, and water efficiency and conservation. Applications for non-farm use permits must include a Drought Contingency Plan and Water Conservation Plan, which provide detailed information on a wide range of topics, including an applicant’s rate-making policies, recycle or reuse programs, educational programs to encourage conservation, system management, treatment plant management, water use data, long-range planning, water use prioritization, and low flow protections.

Table 1. Summary of Surface Water Permitting Programs in South Carolina and Georgia

Provision	South Carolina	Georgia
Permit Trigger	Surface water withdrawals > 3,000,000 gallons/month	Surface water withdrawals > 100,000 gpd
Exemptions	Farm ponds, emergency withdrawals, private ponds fed by groundwater, nonconsumptive instream mining, wildlife habitat management, and hydropower generation.	Farm ponds, filling new impoundments, diversions ≤ 150,000 gpd as part of construction of transportation project.
Criteria for Permitting Decision ⁺	Proposed water use must be “reasonable.” Surface water source must provide sufficient safe yield. If insufficient, applicant must provide supplemental water supply OR state may meet with other permitted withdrawers in the basin to determine if they can reach mutually agreed upon permit reductions to accommodate the new applicant.	Proposed water use must be reasonably necessary to meet applicant’s reasonable needs and must not have an unreasonably adverse impact on existing and future users. If a water source is insufficient to support all withdrawals (existing or applicants), competing withdrawers will be ranked according to a list that prioritizes categories of water use. If two users have equal priority, their withdrawal volumes will be prorated equitably; however, existing users are given priority over new applicants. Likewise, withdrawals that do not involve an interbasin transfer are given priority over those that do.
Definition of Reasonable ⁺⁺	DHEC will consider the following when determining if a proposed water use is reasonable: Minimum instream flow and safe yield at withdrawal point; effect of proposed withdrawal on existing users (including instream users); reasonably foreseeable future needs of all sectors (including instream) and of applicant; reasonably foreseeable negative impacts of withdrawal; beneficial impacts of withdrawal; impact of industry standards on applicant’s efficiency; and specific impact of withdrawal on: interstate and intrastate water use, public health and welfare, economic development and economy of State, and applicable federal laws and interstate compacts.	None specified.

Provision	South Carolina	Georgia
Public Notice	DHEC publishes notice of each permit application on its website, in a statewide newspaper, in a local newspaper, and in the State Register. If, within 30 days of publication, at least 20 people request a public hearing, the agency will hold one. For applications involving interbasin transfers, public notice is more extensive and hearings are held whether people request one or not.	Public notice is provided only for permits that would involve an interbasin transfer. Notice is published in a local newspaper 7 days prior to permit issuance. If EPD determines there is sufficient public interest, a public hearing is held.
Permit Conditions	<p>_ Permit specifies the location and amount of water withdrawn, location and amount of water discharged, volume of supplemental water needed, minimum instream flow. Permit requires permittee to report actual withdrawals annually and reduce withdrawals during low flow periods.</p> <p>_ Permits can be revoked if water is not withdrawn for 36 consecutive months.</p>	<p>_ Each year, non-farm permittees must provide EPD with monthly average and daily maximum water use for each month.</p> <p>_ Permit prohibits depletion of established instream flow.</p> <p>_ Permits may be suspended, restricted or otherwise modified by EPD during an emergency water shortage.</p> <p>_ Permits for non-farm use can be revoked if a significant portion of the permitted water is not used for two consecutive years.</p>
Permit Term	20 to 40 years (or up to 50 for municipalities), depending on the needs of the withdrawer to pay for capital investments related to the water project.	10 to 20 years for non-farm permits (or up to 50 for municipalities, if needed to retire bonds). Farm permits have no term limit and may be transferred to subsequent owners.
Instream Flow	The flow that provides an adequate supply of water to maintain the biological, chemical, and physical integrity of the stream taking into account the needs of downstream users, recreation, and navigation. This flow is set at 40% of the mean annual daily flow for the months of January through April; 30% of the mean annual daily flow for the months of May, June, and December; and 20% of the mean annual daily flow for the months of July through November.	The required instream flow may be the 7Q10 flow if no unreasonable adverse impacts to other users are expected; or the non-depletable flow, if adverse impacts to other users are probable; or some other level set by EPD. The 7Q10 is the lowest average stream flow expected to occur for seven consecutive days, once every 10 years. The non-depletable flow is the 7Q10 plus additional flow needed to ensure sufficient water for downstream users.
Miscellaneous	<p>_ Existing registered withdrawals grandfathered</p> <p>_ Although permits may be transferred with State permission, the statute clarifies that permits do not convey a property right to water.</p> <p>_ A renewed permit must be issued for a quantity at least equal to the expired permit unless the state demonstrates that quantity is not necessary to meet the permittee’s future needs.</p>	<p>_ Statute has disparate requirements for farm use withdrawals and non-farm use withdrawals.</p> <p>_ Permit renewals are treated the same way new permit applications are.</p>

+ Note: Georgia’s statute prioritizes water uses as follows: 1) emergency facilities for essential life support, 2) domestic uses, 3) farm uses, 4) industrial uses, 5) other uses including lawn sprinkling, 6) outdoor recreation.

++ Note: As mentioned previously, “reasonable use” is typically not clearly defined by statute, but through case law. Because it is a criterion for determining whether a withdrawal permit may be issued in South Carolina, the statute examined above offers a more specific explanation of what “reasonable use” is, although it does not provide an explicit definition. The Georgia statute, however, does not offer any additional guidance on what constitutes “reasonable.”

Allocation in North Carolina

Although North Carolina does not have an allocation system for surface water, it is a topic that has been given some attention at the state legislature. In 2007, the General Assembly directed the Environmental Review Commission (ERC) and state Department of Environment and Natural Resources (DENR) to study and recommend a process for regulating surface water withdrawals. The resulting Water Allocation Study (WAS) was used as the basis for legislation introduced during the 2009-2010 session, proposing implementation of a water allocation system for the state. That bill, the Water Resources Policy Act of 2009 (S907), was never brought for a vote, but it provides an illustration of the components that at least some legislators found important. The key elements of the legislation are summarized in the table below.

Table 2. Summary of Surface Water Allocation Program as proposed in S907

Permit Trigger	Surface water withdrawals of $\geq 100,000$ gpd.
Exemptions	None identified.
Criteria for Permitting Decision ⁺	Proposed water use must be “reasonable.” Withdrawal would not lead to overallocation or cause degradation of water quality. Applications must include plan for water conservation. If river basin is overallocated, DENR may 1) modify allocations and permits to eliminate the overallocation, 2) request a river basin planning organization prepare a plan to remedy the overallocation, or 3) request the EMC undertake rulemaking for a CUA.
Definition of Reasonable	<p>_ When considering whether other uses are reasonable, DENR will consider: the number of people using the water body; the necessity of the withdrawal; the economic and social importance of proposed, existing, and planned uses of the water body; the probable effect of the withdrawal on other uses, including ecological health; incorporation of water conservation or efficiency measures.</p> <p>_ The following are presumed to be reasonable: historical withdrawals (those occurring 2006-2009), prior allocations, and nonconsumptive uses that would not increase the need for future withdrawals.</p>
Public Notice	DENR would publish notice of permit applications in a local paper and the state Register, and notify units of state and local government with authority over the water body and NPDES permit holders on the affected water body. People would have 45 days to submit comments on an application.
Permit Conditions	Permit specifies the use to which the water will be put; the location, amount (with daily limit), and timing of the withdrawal; reporting requirements; obligations to reduce use during water shortage emergencies; water conservation and water efficiency measures; and if applicable, the location and amount of return flows.
Permit Term	5 years
Instream Flow	A policy statement at the beginning of the bill declares that it is the policy of the State to preserve flow regimes in order to protect their physical, chemical, and ecological integrity by reserving a portion of surface water from allocation. Instream flow and ecological flow requirements would be identified via basinwide hydrologic models.
Miscellaneous	_ The permitting system is based on an approved basinwide hydrologic model.

	<p>_ The General Assembly may establish river basin planning organizations, which would plan for and manage water supply and demand, with the goal of preventing or recovering from overallocation. The organizations would include members from multiple stakeholder groups (e.g. permitted withdrawers, environmental advocates, local governments).</p>
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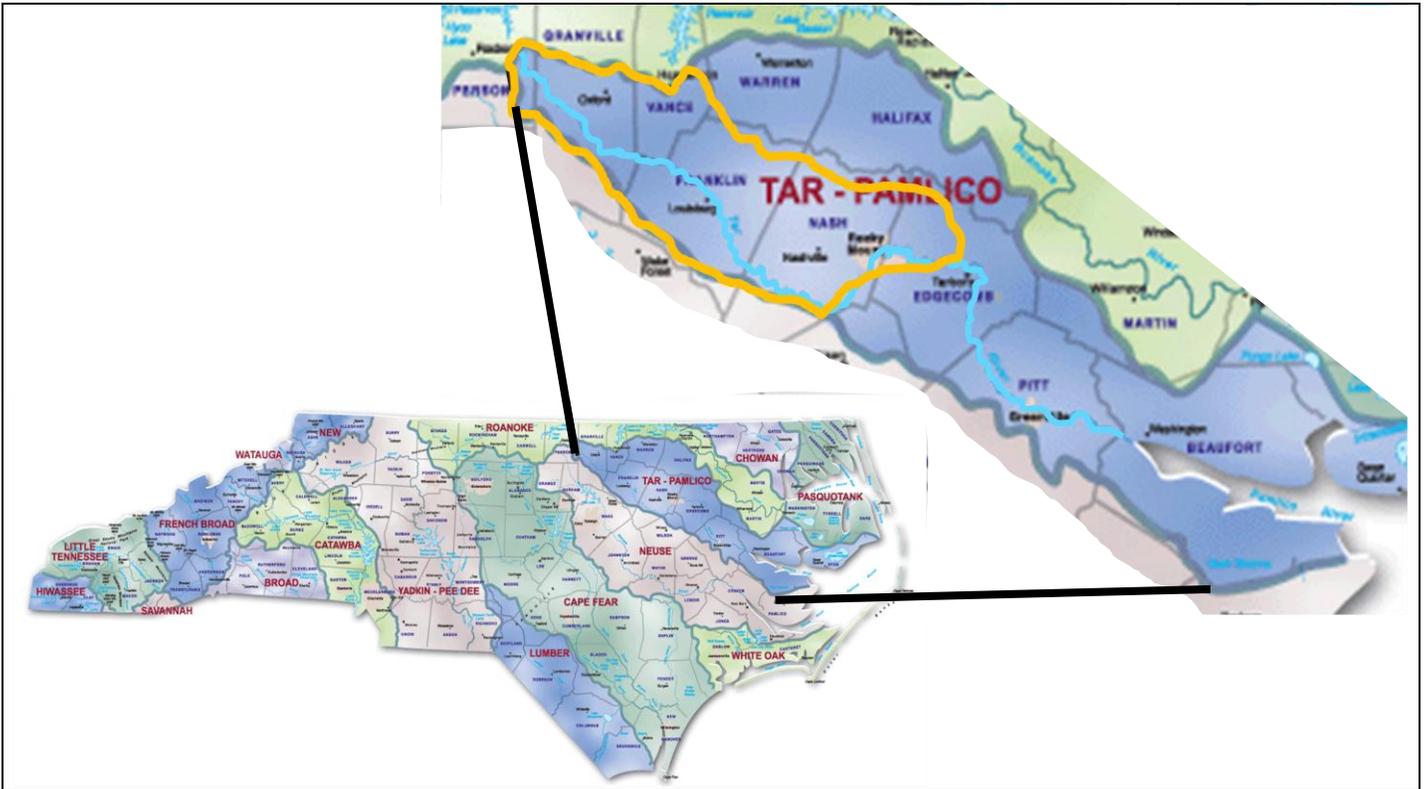
+ **Note:** Overallocation is defined to occur when an approved hydrologic model shows there would be insufficient water (daily yield) for both withdrawers and instream water users anytime over the next 40 years; and more than one permitted withdrawal would have insufficient water to meet both present and future needs for > 7 consecutive days in ≥ 2 years. If DENR chooses to modify allocations and permits to eliminate an overallocation, priority is given to the following: 1) prior allocations, 2) historical withdrawals, 3) expanded withdrawals within limit of existing treatment capacity, 4) other new or expanded withdrawals, and 5) all other essential uses.

METHODS

This project is a prospective policy analysis, whose goal is to “anticipate the implications and consequences” of a potential statewide surface water allocation policy, in order to inform future policymaking (Patton 2002, 200). Consistent with this goal, I gathered information from water professionals who have expertise in a range of water use, management, and planning arenas. Data was collected through a series of hour-long, semi-structured, in-person interviews. Informants included managers of municipal water systems in the Upper Tar River basin, water utility professionals from the private sector who work in the Upper Tar River basin, staff from state resource agencies, and environmental policy experts working on water issues in North Carolina. Certainly, there are other important stakeholders for the issue of water allocation (electric utilities and agriculture are two notable groups), but for the scope of this project, I limited my interviews to the four groups specified.

I chose to focus on a single river basin, the Upper Tar River basin (Figure 1), in order to gain a deeper understanding of the issues at play in that region. I hypothesized that many of the factors that drive an individual’s views on the subject could be employer-specific or even person-specific. In order to delve into the experience and perspectives of interviewees, I felt a deeper understanding of a single river basin would be more valuable than a more general understanding of statewide conditions. This is also the reason I conducted qualitative rather than quantitative research – I wanted to understand the thinking underlying my informants’ opinions. Accordingly, the results of my research are specific to the context within which it was conducted (i.e. the basin and stakeholders interviewed), and may or may not be representative of other stakeholders or other basins (Firmin 2008). Additional detail about the interview participants and interview questions is provided below. Following that is a discussion of the data analysis methods I employed.

Figure 1. Upper Tar River Basin



Note: The image in the lower left shows the 17 major river basins in North Carolina. The Tar-Pamlico basin is inset in the upper right corner. The Upper Tar River basin is outlined in orange. (Sources: DWQ, NC Office of Environmental Education)

Interview Participants

In choosing interview subjects, I sought key informants who had expertise in various areas of water management or planning. While some had spent considerable time contemplating the potential usefulness or design of a surface water allocation system, many had not. For the municipal water system stakeholder group, I attempted to interview a representative from every system in the basin. For the other three stakeholder groups, interview subjects were selected from recommendations. The discussion below describes the process by which I identified and solicited potential interview subjects and the reasons I thought each category of subjects was relevant to this study. A little background on each interviewee is also included, to provide some context for their remarks.

Municipal Water Systems. Public water supply is a major surface water user in the state. Within the whole Tar-Pamlico River basin, public water supply is the second largest withdrawer of surface water (behind hydroelectric power) (DWR 2009). The managers of these systems are most familiar with the long-term planning and day-to-day practicalities of providing drinking water to millions of North Carolinians statewide. I felt it was crucial to get their perspective on what a surface water allocation

system would mean for public water supply. To identify potential interviewees, I reviewed DWR maps of the Upper Tar River basin and compared the water systems identified therein with systems that submitted LWSPs in 2007 (the most recent year for mandated submission). Using this information, combined with internet searches for contact information, I compiled a list of 12 potential participants. I sent a preliminary email introducing myself and my research to all of the systems for which I could find a contact's email address. I followed up with phone calls to arrange for in-person interviews. The systems for which I could not find a valid email address I contacted by telephone. Six water systems declined to be interviewed or failed to respond to repeated attempts to contact them. I interviewed the managers of five municipal water systems in the Upper Tar River basin and the manager of one system that draws water from outside the basin, but sells water to multiple communities who use and discharge the water within the Upper Tar River basin.² The systems ranged in size, age, and complexity. The water managers interviewed also varied in their familiarity with water allocation. Some respondents were very knowledgeable and had well-formed opinions on the subject, while another was not sure what the term "surface water allocation" meant. Most fell in the middle of the spectrum: they were familiar with the concept but it was not something they gave much thought to on any given day. Regardless of their specific knowledge of water allocation, all the respondents had expertise in water planning and management that would enable them to evaluate (or at least hypothesize about) the potential usefulness of an allocation system.³

- *City of Oxford – Larry Thomas, City Engineer and Public Works Director.*

The City of Oxford obtains its water from Kerr Lake and in 2009 requested an IBT certificate to expand their withdrawal from the lake. This request is proceeding through the IBT process. The City provides water to a predicted 12,800 people in 2010 and has built a strong cash reserve for future infrastructure improvements.

- *City of Rocky Mount – Wayne Hollowell, Director of Water Resources.*

The City of Rocky Mount supplies and treats water for 68,600 people within its service area and sells water to Dortches, Edgecombe County, Nash County, Nashville, Sharpsburg, and Whitakers. The City

² I also spoke with Lindsay Mize, Executive Director of South Granville Water and Sewer Authority (SGWASA). This interview was very helpful in my understanding of issues facing the region and some innovative solutions that systems are considering. Because the system is located outside the Upper Tar River basin, however, the interview was used as background and not analyzed with the text of the other interviews.

³ The data in the following paragraphs were taken primarily from the LWSPs submitted by each water system in 2007. As of April 2010, most of the 2007 LWSPs are categorized as "provisional" because DWR has not yet completed their review of the LWSPs. These data are supplemented with information gained in interviews. The LWSPs are available at: http://www.ncwater.org/Water_Supply_Planning/Local_Water_Supply_Plan/.

has an impoundment and two water treatment plants on the Upper Tar River. The water system has little debt service. There is a strong emphasis on planning within this water system, including investments in modeling and monitoring technology to better predict water supply.

- *Franklin County – Bryce Mendenhall, Public Utilities Director.*

Franklin County serves a population of 6,200 with water it purchases from Henderson, Franklinton, and Louisburg. Franklin County also sells water to Lake Royale, Bunn, and Youngsville. It is a relatively young system and so has a large debt service. A high value is placed on planning, however, and the system has a 20-year Comprehensive Plan which it updates every five years.

- *Kerr Lake Regional Water System (KLRWS) – Christy Lipscomb, Director.*

KLRWS withdraws water from a U.S. Army Corps of Engineers (USACE) dam within the Roanoke River basin, and then treats and distributes the water to municipal water systems, including Franklin County, Henderson, Kittrell, Oxford, and Warren County. Twenty percent of its service population resides in the Tar River basin. As one of the largest lakes in the Southeastern U.S., KLRWS and its customers feel the lake will provide a secure supply of water well into the future, even in the case of drought. Because Kerr Lake is located in the Roanoke River basin, water systems in the Tar River basin that wish to purchase more than 2,000,000 gpd from KLRWS must first obtain an IBT certificate. The timing and volume of withdrawals from the lake are administered by the USACE to maintain electric power generation, and instream flows below the dam, in addition to other goals.

- *Nash County – Derek Hawkes, County Engineer and Utilities Director.*

Nash County's water and sewer system is nearing completion of a substantial expansion of service into underserved portions of the county. Some of this expansion was initiated because of concern over groundwater contamination in areas where residents were served by private wells. As of 2007, the system served a population of 1,400 with water purchased primarily from Rocky Mount and Nashville. It expects to bill 2,000 customers by February 2011. The County has also contracted with the Town of Dortches to operate the latter's system. Because of the recent expansion, the system has a large debt service. It has undertaken detailed long-term planning, including an Alternative Water Supply Study.

- *Town of Dortches – Gerald Batts. Town Administrator.*

The water system in the Town of Dortches serves 40 people with water purchased from Rocky Mount. The Town has hired Nash County to operate the water system. Because of its small customer base, the rates charged are higher than neighboring systems' rates and just cover the cost of service. The Town

had to replace one lift station this year and is considering whether to transition to a gravity flow sewer system in the long-term.

Private Water Management. A few of the smaller towns in the basin declined to talk with me, insisting that they did not have expertise in utility management and would not be able to answer my questions. I very much wanted the perspective of these managers because they represented an important constituency in the basin. Although I tried to convey that no specific expertise was needed – only the experience of making decisions about their water system – most still declined. One Town Manager encouraged me to talk with the president of the firm they hired to manage their utility, EnviroLink. Others referred me to the North Carolina Rural Water Association, who declined to participate. A number of people (both interviewees and experts who provided background material) suggested that private water utilities would also be an important voice in the water allocation debate. Upon the recommendation of these sources, I contacted a registered lobbyist for the largest private water utility operating in North Carolina: Aqua America.

- *EnviroLink, Inc. – Michael Myers, President.*

EnviroLink is based in Bailey, NC and serves numerous municipal water systems (primarily small ones), including some in the Upper Tar River basin. As such, Mr. Myers is knowledgeable of management challenges and approaches relevant to systems in the basin, as well as the higher-level policy changes being discussed at the state level.

- *Aqua America – Jim Johnson, Consulting lobbyist.*

Aqua America provides water supply to 250,000 residents in North Carolina, including some within the Upper Tar River basin, and operates in several other states, as well (Aqua 2011). In some of these states, their water use is regulated under a water allocation (permitting) system. The company is currently working with the North Carolina Utilities Commission, which regulates private utilities, to consolidate the rates of the various communities they serve in the state into one or two rate schedules. In his role as partner in a government relations and consulting firm (Blount Street Advisors), Mr. Johnson is a registered lobbyist for Aqua N.C. He is also a Visiting Professor at the Sanford School of Public Policy at Duke University. In our interview, I asked him to speak from his perspective as Aqua N.C.'s advocate.

State Resource Agencies. DWR staff implements the majority of the water regulations listed above and so are knowledgeable of both water resource protection and water supply planning. If an allocation system is implemented in North Carolina, DWR is likely the division that will implement it, and it is their modeling efforts that will inform decisions about available water supplies and ecological flow needs.

This fact notwithstanding, Mr. Rayno made it clear that agency staff do not advocate for any specific policy, but craft programs in response to rules passed at the General Assembly. Because surface water use and an allocation system have the potential to impact aquatic habitat and ecosystem health, I also spoke with the state Wildlife Resources Commission's (WRC) instream flow expert. I attempted to interview staff from the Public Water Supply Section within the state Division of Environmental Health (DEH), since this agency also oversees municipal water systems, but the opportunity to participate was declined.

- *DWR – Don Rayno, Water Resources Planner.*

Mr. Rayno is involved in the agency's Basinwide Hydrologic Modeling effort and water supply planning throughout the state.

- *DWR – Jim Mead, Environmental Supervisor of Aquatic Ecology Branch.*

Mr. Mead is involved in instream flow and aquatic habitat studies and has contributed to instream flow recommendations for federal relicensing of all large hydroelectric projects in the state. He serves on the Ecological Flows Science Advisory Board.

- *WRC – Chris Goudreau, Special Projects Coordinator.*

Mr. Goudreau is WRC's lead instream flow expert and serves on the Ecological Flows Science Advisory Board and the Instream Flow Council. He has worked in the Central Coastal Plain CUA (in the eastern portion of the Tar-Pamlico River basin), investigating local governments' efforts to shift their water use away from groundwater sources. (This interview was conducted via telephone.)

Environmental Policy Experts. I spoke with four non-profit organizations familiar with the Tar River and/or water resource planning and management to get their perspective on the potential pros and cons of water allocation. As indicated below, two of these key informants are involved in designing and advocating for policy at the General Assembly. They have expert knowledge of water allocation-related policy, but less specific familiarity with the Upper Tar River basin, as they work on a statewide basis. The other two key informants work for grassroots-oriented organizations and are more knowledgeable of the Tar River basin, but less familiar with water allocation policy. I met the former interview subjects through previous work I have done on state water policy; the latter two were recommended by my background sources

- *American Rivers – Peter Raabe, North Carolina Conservation Director.*

American Rivers is a conservation non-profit which advocates for healthy rivers and clean water across the country. Mr. Raabe is active at the General Assembly promoting a variety of conservation-minded

water policies. As such, he is very knowledgeable of the discussions around a potential statewide water allocation system.

- *Clean Water for North Carolina (CWFNC) – Hope Taylor, Executive Director.*

CWFNC is an environmental justice non-profit that focuses on environmental health issues, including access to clean water. Ms. Taylor owns a small farm in the Upper Tar River basin.

- *EDF – Sam Pearsall, Southeast Regional Manager for Land, Water and Wildlife.*

EDF prides itself on working with cross-sector stakeholders nationwide (e.g. industry and community groups, economic and science experts) to find solutions to environmental problems. Mr. Pearsall focuses on environmental policy and planning issues, including ecological flows. Among his other responsibilities, he also advocates for environmentally-sound water policy at the General Assembly.

- *Pamlico-Tar River Foundation (PTRF) – Heather Deck, RIVERKEEPER.*

The PTRF is a non-profit that works to promote and preserve a healthy Pamlico-Tar River and watershed. Ms. Deck serves as PTRF's Riverkeeper, conducting educational activities, advocacy, and water quality monitoring. (This interview was conducted via telephone.)

Interview Questions

The goal of my interviews was to gather the perspectives of selected stakeholder groups and gain from them a better understanding of the need (if any) for a water allocation system, the potential pros and cons of such a system, and the characteristics that would make an allocation system most helpful or effective. Most importantly, I wanted to know *why* each subject felt as he or she did regarding a surface water allocation system. What were the fundamental interests (e.g. supplying high quality water to their customers, maintaining a financially healthy system, supporting the economic development of the town or county) that led them to take a particular position on allocation? While a person (or organization) may adjust his position on a specific policy in response to variable political conditions or alterations in policy details, for example, changes in his underlying fundamental interests will be relatively small and infrequent (Keeney and Raiffa 1991). To develop a policy that benefits all parties as much as possible, it is important to focus on the fundamental interests of the parties, rather than on simple tallies of “for” or “against.” I developed an Interview Guide to direct the conversations. Each interview took a slightly different course, dependent on the interviewee, but I covered the same core questions with each participant.

- *How do you expect demand for water to change within your system over the next 20-30 years?*

I used this question primarily to set the context of our conversation and to understand to what extent an increase in demand might drive the participant's planning decisions. For interviewees who are not affiliated with a specific water system, I asked how they expected demand in the basin (or the region) to change.

- *How do you plan to meet that demand? Do you have any concerns about your system's ability to meet future demand?*

One of the advantages of an allocation system that is often mentioned is that it gives users certainty about what their future water supply will be. Because of that, I wanted to know if any of the water systems I spoke with had concerns about the dependability of their future supply. I was curious to see if that concern or lack of concern was associated with an interest in an allocation system. For interviewees who do not work for water systems, I asked whether they themselves had concerns about communities being able to meet future demand and whether they thought water managers in the basin were concerned. Even if these participants did not have direct knowledge of whether or not water managers were (or should be) concerned, the question could be used to compare the attitudes of water managers and non-managers. A systemic difference between the two groups could be instructive.

- *There have been discussions at the General Assembly about implementing a statewide allocation system for surface water. What do you think about that?*

I was not sure how familiar all of the interviewees would be with proposals for an allocation system, or whether they would be positively or negatively inclined toward the idea. I left the question very open so they could take the conversation in whatever direction they wanted. As we continued talking, I focused my questioning on whether the participant thought a water allocation system would be useful or helpful. I asked this of all participants, regardless of what their job was – did they think an allocation system would help them in their job, whether that job was operating a water system, protecting water resources, or something else. The definition of a water allocation system can vary, depending on the context (most notably between regulatory and voluntary approaches). I framed this question by referencing the General Assembly's interest in passing legislation to regulate water allocations. All but one of the informants made comments indicating that they expected the allocation system would include mandatory, enforced allocations, incorporate a permitting system, be regulatory in nature, and/or would apply to everyone (i.e. not be optional). These comments indicate that informants shared my definition of an allocation system as a regulatory program which monitors and enforces allocations.

- *What components should be included for an allocation system to be useful?*

This question and the preceding one were the core of my interview: did participants think an allocation system would be helpful and what did they think it should look like? I anticipated that some interviewees would have given this question more thought than others. Regardless, I knew they would all have relevant experience from which to draw in answering the question. This question gets to the heart of the values that inform opinions on water allocation: What is a fair way to allocate water? How should different uses be prioritized? Will politics make for an unfair playing field for some users? How should the needs of current and future users be balanced? What do we do if we find a river is already overallocated? What value should we place on instream water uses? What should the role of state and local and private water planners/managers be?

- *Are there state policies that are especially helpful to you in planning for your system? Are there policies that could be changed to be more helpful or effective?*

I was interested to know if there were state regulations in place that, although perhaps not directly connected to water allocation, might interact with a potential allocation policy, either to obstruct or facilitate its implementation. Answers to these questions also gave me more information about the planning context within which water managers operated. In the course of my interviews, several participants brought up IBTs, discussing them either as a useful tool or a damaging practice. In response to this, I began asking all interviewees whether they thought IBTs would be used more or less in the future and why.

Data Analysis

This research is a prospective policy analysis, which explores the perspective of water professionals (primarily) within the Upper Tar River basin, in order to predict the implications and consequences of implementing a statewide surface water allocation policy. The analytical approach I use draws from aspects of discourse analysis and grounded theory. According to discourse analysis theory, the language that people use reveals the way they understand the world around them. In terms of policy analysis, it reveals the way they have conceptualized an issue, making discourse analysis an effective tool for exploring the perspectives of various stakeholder groups (Detraz and Betsill 2009). Grounded theory methods explore data inductively and in great detail, discovering themes that emerge from the data, rather than following a deductive method which comes to the research with theories in mind and collects data in order to test those theories (O'Leary 2005).

I audio taped my interviews with informants and transcribed them. These “verbatim transcripts constitute the undigested complexity of reality,” as eloquently described by Patton (2002, 463). They served as the raw data for my analysis. Using NVivo9 software, I combed through the transcripts line by line, looking for themes (ideas, concepts, arguments, etc.), and continually comparing the text from other interviews to each other to identify similarities and differences. This process of inductive exploration was combined with deductive analysis. I developed specific interview questions based on what I knew to be problems, based on my previous knowledge and background reading on the issue. This led to a few themes that I had in mind as I began coding. As I proceeded through the iterative process of “identifying, coding, categorizing, classifying, and labeling the primary patterns in the data,” I used my pre-existing themes while also remaining open to new themes emerging from the data (Patton 2002, 463). As themes developed, I considered how they related to each other, which informants spoke to which themes, and how discourses within and among stakeholder groups differed.

From my analysis of the primary themes present in informants’ discussion of a potential surface water allocation system, I articulated a list of the fundamental objectives (i.e. the ultimate ends) that an allocation program must meet in order to be useful. These reflect the fundamental interests of participants. Following the lead of Gregory and Keeney (1994), I used these objectives to develop a set of policy recommendations.

RESULTS

Interviews with stakeholders revealed general support for an allocation system. Informants identified potential benefits they thought an allocation could provide, as well as some concerns regarding the way such a system might be designed and implemented. All the environmental policy experts strongly supported development of an allocation system, seeing it as critical for effective management and the long-term health of the state’s water resources. Half of the municipal water systems I spoke with also supported it, one opposed it, and the remainder saw both benefits and potential concerns with implementation of an allocation system. The private water management and state resource agency respondents were largely agnostic. In analyzing the data, I found several themes repeated by interview participants across the various stakeholder groups. These themes are discussed in more detail below.

Perceived Benefits of a Surface Water Allocation System

During my conversations with water professionals, four arguments supporting implementation of a water allocation system came through clearly. Of primary importance were arguments that an allocation system would serve as a useful planning tool and support a basinwide approach to thinking about water. Of secondary importance were arguments that an allocation system would provide certainty for water users and facilitate an explicit and public assessment of water use priorities.

Certainty

The certainty theme occurred less frequently than the other themes that will be discussed here, but it is a good entry point to understand the potential benefits of a surface water allocation system, so our discussion begins with this theme. Five participants from three stakeholder groups (municipal water systems, state resource agencies, and environmental policy experts) referenced certainty during their interviews.

Respondents that referenced this theme argued that a surface water allocation system would offer users certainty. Permitted users would know they could count on a certain amount of water, that another user would not move in upstream and reduce the flow of water reaching them, and conversely that a downstream user could not sue claiming the permittee's use was not reasonable.

Right now there's no certainty about how much water people can get unless they've built their own reservoir and then they get a priority on use of the water that's stored in their reservoir. Other than that, particularly surface water users, there's no guarantee that other people aren't going to come in and use some of that water that had been flowing to them for decades. An allocation system would provide the users more certainty in terms of how much water they actually have available to them. Under our current structure, somebody could come in and propose and install an intake upstream and use some of that water and reduce the reliability of their supply – that's straight riparian rights. – DR

Mr. Rayno summarizes the constraints of the system within which water users across the state must operate. As a water resource planner at DWR, he is familiar with the regulatory framework and the ways in which withdrawers plan for their water needs and adapt to unexpected changes. Mr. Hollowell offers the perspective of a municipal water system that balances these forces on a daily basis.

It's important that we reasonably predict what volume of water is coming into the reservoir. I know that in 2007 things happened too quickly. It was a very early drought, started at the very

beginning of the growing season and it never dawned upon us that maybe in actuality we were only getting a third of the water we were calculating was coming into the reservoir [because of withdrawals between the reservoir and the nearest upstream stream gauge]. I know for a fact that we released x number of cfs, we patrol that. How much managed to get to Tarboro, I can't tell you... It needs to be a highly predictable resource. – WH

Rocky Mount provides water to 68,600 people within its service area and six other municipal water systems. With that many people depending on them, it is natural that the City places a high value on predictability. An incident in 1968, when the City ran out of water, reinforces their aversion to risk. Because of that, Rocky Mount has invested in sophisticated monitoring and modeling system to better predict water availability within its reservoir. Allocation would provide certainty for all permitted users, even those without high tech equipment. For example, drought conditions can exacerbate uncertainty for all users, especially in a basin with agriculture.

What happens now is in serious drought situations when farmers need water they use the water and surprise people at times because they may not have needed it for five years but now they need it because it hasn't been raining and they have a crop in the ground and we want to eat it, or smoke it, or whatever it is. There are those kinds of conflicts that pop up when supply is short that could be addressed earlier if we knew they were there. – DR

This brings us to a second motivation for an allocation system: its value as a planning tool.

Planning Tool

The planning tool theme was one of the most prevalent themes, touched on by nine participants from across all four stakeholder groups. Some interviewees linked an allocation system's usefulness as a planning tool to their concerns about constrained water supplies in the basin. Others referenced water supplies only obliquely, focusing instead on the need to plan proactively for the future.

Mr. Mendenhall is the manager of a water system in a county that he describes as "water poor," so he is highly attuned to issues of supply and demand and the need to plan ahead. Like many of the managers I spoke with, he complained about the numerous regulations and paperwork obligations to which he was subject; however, he was also appreciative of the state requirement that communities prepare LWSPs and WSRPs. Perhaps because of his concern over the County's limited water supply, Mr. Mendenhall sees value in regulations that encourage long-term planning and water efficiency.

[A water allocation system] would affect public utilities because we would know we only have x amount of gallons to give out in a given year's time. That's fine because then the Planning Department plays off of that, so they're only going to approve x amount of dwellings and lots in this zoning for this fiscal year. That's fine. Then my Tax Department plays off of that. "This is the revenue we're going to generate. This is the tax base we're going to see. This is the expansion we're going to see." Finally the Finance Department for the County ties those three entities in and [decides] what we can suggest for expenditures and what we're going to see for the growth of the County. So from my standpoint – I hate to argue the point because it's another outreach of the government trying to limit what I'm doing, but underlying, I'd certainly have to support it, too, because it makes absolute sense, considering the resource that we have. – BM

Mr. Batts is the Town Administrator for a small town with a very small water system (18 customers). The town places a high value on maintaining its identity as a small, rural community and makes decisions regarding its water system consistent with this no-growth goal. Like other small systems, Dorchest sometimes feels ill-equipped to respond to increasingly technical regulatory requirements and water system planning decisions. While Mr. Batts is understandably hesitant to invite more regulation, he sees the value that a state-regulated allocation system could provide.

I think we need to be proactive and [an allocation system] needs to be one of the tools we need to use, because [the constraints on water supply are] not going to go away... I agree with those comments [about not wanting more state regulation], but at the same time, when we're all caught in a drought and we're looking for some water, I think we need some help. – GB

In the same way that Mr. Mendenhall praised WSRP regulation as “a valuable tool,” Mr. Batts expects that an allocation system would offer certainty while also forcing communities to do the planning necessary to ensure their future sufficiency. Ms. Taylor also sees the need for more proactive planning in advance of constrained water supplies, although she comes to this conclusion from a different angle.

In the same way that the CUAs have been used to try [to] begin to back away from the heavy groundwater withdrawals from the eastern part of the state, we're going to need to apply something like CUAs in [river] basins, not just for groundwater but for surface water as well so that there are regulatory teeth, consequences for not adjusting water usage... It seems to be human nature in a state with such a history of believing in infinite supply of water not to do anything until the gun is to the side of your head. – HT

Clean Water for North Carolina is an environmental justice and social change organization, and so has the role of encouraging or compelling decision makers to make different choices with respect to natural resource usage. Ms. Taylor's ability to change water use decisions comes from either changing people's minds or from there being "regulatory teeth, consequences" to compel specific action. Naturally, managers of water systems see regulations differently (e.g. as helpful tools or time-sucking paperwork), because their role as managers empowers them (indeed, requires them) to make decisions about water use.

The regulatory controls on withdrawals that would be part of a surface water allocation system arise from an understanding of water availability that extends beyond the boundary of a single water system. This broader lens is the strength of an allocation system and a large part of why it could be a helpful planning tool. Mr. Goudreau, who spends a lot of time looking at the related effects of surface water and groundwater withdrawals on various users, sees this connection clearly.

I think having a system or a process that is done in a way that is comprehensive, in terms of looking at an entire river basin at a time, instead of just looking at [one] individual project at a time, which is the way things typically work, that's definitely a benefit. Looking at things in a holistic way, particularly projecting things out and saying "here's where the bottlenecks are and everyone can't expect to have all the water they want forever." At some point there's going to be some constraint in the system and having those conversations up front is really helpful, particularly when there's this longitudinal discussion that needs to be had – someone upstream is going to affect someone downstream. Doing it before the problem is always a good thing, rather than waiting until [people are] ready to start throwing rocks at each other, which is kind of the way things happen now – a crisis management type of approach. – CG

The benefit of thinking about water use on a basin scale, rather than an individual water system scale, was brought up by several participants. The next section will discuss reasons basinwide thinking could be helpful.

Basinwide Thinking

As alluded to in the preceding paragraphs, the basinwide thinking and planning tool themes are related and some data was coded to both themes. The two are distinct, however. Discourse that described an allocation system's contribution to water planning at any scale was coded to the planning tool theme. Discourse related to planning over a river basin (or across multiple water systems) was cross-coded to the basinwide thinking theme. This latter theme also includes larger resource

management issues and discussion of cross-system collaboration. Data from nine participants from all four stakeholder groups was coded to the basinwide thinking theme, making it one of the two most frequently referenced “perceived benefit” themes.

There are signs that the State is beginning to move to a regional or basin-based approach to thinking about water. DWR’s river basin modeling efforts are, of course, focused on a basin scale. LWSPs now ask water systems to report whether they have connections with any other water systems. Many of the water professionals I spoke with predict a shift over the long term from managing water supplies on a municipality-by-municipality basis to a more regional approach. The primary drivers these experts cite are increasingly constrained water supplies, water quality problems, and increasing costs of obtaining, treating, and distributing water.

It’s becoming harder and harder for the little guy to keep up with regulations because the money’s just not there to do the upgrades and all that need to be done. So they’re kinda being dissolved into bigger systems. – CL

The water supplies of various communities in the same river basin are not independent of each other. There are potential pitfalls to managing them as if they were. Conversely, there are potential benefits to considering the management of water resources within a basin in a more holistic manner. The manager of Nash County’s water and sewer system hypothesized that an allocation system and the river basin models underpinning it could have practical advantages for systems’ long-range planning and perhaps lighten the burden of other regulations.

If we put a water treatment plant on the Tar River near Spring Hope, then Rocky Mount is going to have an immediate objection to that [because it could affect the amount of water that reaches Rocky Mount’s reservoir]. However, if there was a good model and a good allocation system in place, you may be able to show them this isn’t a concern. [Similarly]... if it can be shown that if you were going to transfer water out of one river basin into another, if it doesn’t affect the model or doesn’t hurt any of the watersheds, then it may not be that cumbersome a process [to get an IBT approved]. It may just be a case of running the model to determine that everything’s OK or within some amount of acceptability and then you move forward. – DH

Nash County recently completed a county-wide Alternative Water Supply Study that examines all the water resources available in the county and evaluates their potential to serve as water supply in the future, as the County’s needs change. The system is also concluding a large expansion of its service area and while it doesn’t anticipate expanding again for some time, the process of identifying and weighing

options for new supply is in the forefront of Mr. Hawkes' mind. His suggestion that a more comprehensive understanding and more integrated management of surface water would allow for better decisions on resource use is a point that several subjects made.

There are things that slip through the cracks. We don't directly regulate water withdrawals in North Carolina, unless it's in a designated CUA... It's not like we just throw up our hands and ignore water withdrawals and their potential effects... [But there are] lots of little [withdrawals], particularly agricultural ones, golf courses, plant nurseries, which often fall below the regulatory threshold but can have a significant effect on stream flows, particularly during drought and if there's multiple cumulative withdrawals. One advantage [of an allocation system] is that you may be able to get a better handle on those types of uses. – JM

A surface water allocation system correlates well to a regional approach to resource management, so long as allocations are based on an understanding of water flows within and among river basins (and optimally between surface water and groundwater). Thinking about water on a basinwide scale is necessary in order to evaluate and protect the ecological health of surface waters. One environmental policy expert pointed out that maintaining the health of natural resources is something that is critical for all water users, not only those interested in outdoor recreation or “green” issues.

If we don't maintain ecological integrity, then at some point, we don't have rivers, we have ditches, and the quality and quantity of water available to people will go down. – SP

The water managers I spoke with oversaw both water and wastewater systems and the two issues are naturally connected for them. With the recent public debate over the Falls Lake Rules, which address nutrient management in portions of the Neuse River basin, my questions about allocation led many subjects to reflect on wastewater as well as drinking water. Mr. Hollowell pointed out that the problems of one river basin are not restricted to that basin – they can easily spill over into adjacent river basins. Such interconnectedness calls for a more integrated approach to managing water resources.

Right now, we've got a little town called Creedmoor who is up at the top of the Neuse, right above Falls Lake and they've been told they can't discharge into the Neuse, so now they're talking to us about discharging into the Tar River. So now you've got IBTs going left and right and you're telling me you think that's going to get better? I can't tell you that Raleigh won't have a pipeline to the Roanoke River basin sometime in the next 10-20 years. It's a driving force. – WH

In a future where water withdrawals, water quality, and municipal water systems themselves are more interconnected, taking a wider view would provide a better context within which to make decisions. This “wider view” may mean that estimations of water availability include interactions among withdrawers in a river basin, connections between river basins, the relationship between surface water and groundwater, and interannual variations in flow. Mr. Goudreau argues that discussions regarding how to use existing water resources should include all affected parties (e.g. municipal water systems, power generators, agriculture, ecologists, fisheries, recreation users) instead of having the state address each use individually – or not address some uses at all. This wider view is more representative of the interconnected reality of surface waters, and so offers a more realistic picture of what water is available to users. A broader conversation also offers the opportunity for finding new, cooperative solutions that could not be considered if all parties were not at the table.

When you're looking at things from a parochial viewpoint, there's a danger in either over-confidence on the one hand or, on the other hand, missing opportunities for creating and sharing water either up and down the river basin or across river basins. Until you get everyone at the table and understand where there are bottlenecks or additional water available, it's hard to get folks to talk about how we can work together to solve problems. Some folks understand that and other folks really haven't been confronted with it yet. For me personally, you can have a lot of prioritizations on it's better not to take water out of one basin and put it in another, but on the other hand, maybe sometimes the best answers to solving the problem are things like that and if folks aren't open to it and having an analysis on a larger scale, you're never going to find those opportunities. – CG

Research in the field of conflict resolution echoes this view that better decisions can be made with all the affected parties participating in the conversation and all relevant issues on the table for discussion. The key is to focus on the fundamental issues of concern to each party (e.g. having sufficient water to support 15% population growth over the next 40 years), rather than specific positions (e.g. authorization to build a new reservoir just north of town), and to work jointly to create solutions that address all participants' fundamental concerns (Susskind and Cruikshank 1987). An allocation system is well-suited for basin-scale management of surface water resources. It also provides a mechanism for considering and balancing the interests of disparate groups of water users.

Social Priorities

The social priorities theme was referenced by six participants from three stakeholder groups (private water management, state resource agencies, and environmental policy experts).

Decisions about resource use are value-laden. They reflect the concerns and priorities of the community making them. North Carolina has limited regulations related to water use, in part because the state has historically had more than enough water to meet demands. As concern over constrained supplies and competition among users has increased, the state has expanded water regulations.

After the drought in the '80s, the state legislature created the requirement for local government water utilities to do LWSPs. After each serious drought since then, they've made changes to that legislation that have made it more comprehensive, each time they added more pieces to the puzzle. – DR

Most participants whose comments referenced social priorities spoke about the value trade-offs inherent in the design of environmental regulations or conversely, the fact that societal values are often ignored under current regulations. Mr. Mead's and Ms. Taylor's comments provide illustrations of each perspective, respectively.

No one knows what form [a surface water allocation system] is going to take. Are you going to grandfather existing amounts? What's the ecological flow going to be? And of course everyone wants the most water when it's least to be had... during drought and hot. – JM

As a part of the state agency that would likely be responsible for designing and implementing a water allocation program, Mr. Mead is attuned to the difficult value questions that would have to be navigated during that process. Ms. Taylor highlights the incongruity she sees between social values and existing environmental regulations – specifically the idea that an individual business should not benefit privately from the use of a shared resource while passing on the cost of this use to the larger community. She proposes that an allocation system could partially remedy the problem of negative externalities related to surface water use.

I'd say it's sort of in the Wild West right now in terms of all the externalized costs of water usage for industry – paper as well as power utilities. Those are the two biggest water users in the state. And I think the economics for them and their impacts would be changed greatly if we actually had an allocation policy that more fully internalized those costs to the public's waters. – HT

A few interview participants pointed out that the state has no comprehensive system of managing water use, and hence no way of having a comprehensive conversation about citizens' fundamental interests with respect to surface water use. An allocation system would provide a forum for making communal choices about how water is valued and used in the state and a mechanism for enforcing those decisions.

There really does come that point of what sort of communities do we want to sustain with the amount of water we have? Community can be defined really broadly – it's ecological community, people community, business community. That's the question and that's why it's such a controversial issue – it is the question of what sorts of communities do we want to support in what places... [Once you] get a real understanding of how much water is in the river [and how much water each community needs], I think it's OK for society to then say, "we're going to sacrifice this river in order to make sure agriculture gets it. Or we're going to sacrifice agriculture to make sure that this manufacturer gets enough water. That's a societal decision. I have my opinions on it, but that's the right place for the politics to happen. – PR

It should be noted that when Mr. Raabe uses the term "politics," he is referring to the formal process of governing, of translating the needs and desires of society into laws. In this context, the word has a functional meaning and no particular positive or negative connotations. This contrasts sharply with other informants who use "politics" in a pejorative sense to suggest that a process has been unduly influenced by considerations of power or wealth to give one side an unfair advantage. Mr. Raabe's comment suggests he sees an allocation system as a way to balance and prioritize the needs of all water users, according to societal values and given the limitations of the resource. This view was consistent across all of the environmental policy experts interviewed. While both environmental policy experts and municipal water systems highlight the importance of treating all water users equally, the former group generally sees an allocation system as a solution, as a way to create a just distribution of water. The latter group worries that an allocation system could, instead, extend a system of water regulations that they feel unfairly advantages some users over others. This concern for fairness (as I've labeled it) is explored more deeply in the following section.

Concerns for a Surface Water Allocation System

Two primary themes of concern emerged from my interviews with water professionals. The first focused on questions about how water would be allocated, specifically the worry that a water allocation could constrain water systems' ability to grow (especially systems that are small now) or disadvantage

them relative to other users who may have better political or financial resources. The second theme surrounded small communities and their ability to undertake or comply with a water allocation system.

Fairness

Fairness was referenced by more interview subjects than any other theme: ten participants across all four stakeholder groups. In our conversations, the benefits and drawbacks of a potential water allocation system were hypothetical – there was not a specific, detailed policy that we could reference. Speakers could not know exactly how technically difficult or politically contentious issues would be handled. These details turned out to be their biggest concerns with a potential allocation system. Comments fell in two general categories (1) the method by which water systems' allocations would be determined, (2) whether all water users would be required to play by the same rules. Both of these are important procedural justice considerations.

I don't know how you can proportionately assign [an allocation] to a given entity. If you look at Franklin County, and we're obviously a water poor county – all we have is the Tar River. Is my allocation based on those daily flow values for that river? I've got Louisburg that's using water out of the Tar River. Subsequently, I have Rocky Mount downstream. Upstream I have Granville County. Everybody wants to keep a minimum instream flow so that everybody's satisfied along the way. But is it the case that because I'm in a water poor county, I'm going to have a disproportionately low allocation to draw from? If that's the case, then you're going to minimize my ability to develop this county, or to see industrial users or commercial growth. There's a trickle-down effect... With interbasin transfers and water allocations, nobody's going to want to see water leave their river basin to go to somebody like me. So, I don't know exactly how you can fairly divide it amongst people. – BM

Mr. Mendenhall promotes a concept of fairness in which each community has an equal opportunity to grow and develop. Franklin County is a young system in a location that is “water poor.” Questions of how to ensure the system has the financial and water resources it needs are at the forefront of Mr. Mendenhall's mind. When asked how confident he was about meeting future demand, his answer was “I worry about it every day.” Not knowing how an allocation system would proportion water among users, Mr. Mendenhall is concerned that his system would be put at a disadvantage. Political and financial power are not mentioned directly, but his comments make it clear that he does not expect to be able to influence the policy decision of how to determine allocations. Ms. Lipscomb, the director of a large regional water system, echoes this point.

Some of these smaller communities, who's to say they won't get a big user? And then they're not allocated but so much, you know? You're going to penalize them because they're small? Really big communities – they've got the money, got the politics. – CL

Depending on how the policy is designed and implemented, an allocation system could balance power inequalities, or it could reinforce existing imbalances.

Water allocation is as much as anything a way to ensure predictability and to prevent the big straw syndrome [in which] he who can get the biggest pipe in the river gets the water. – SP

One of the disparities in current water regulations that received a lot of attention from interview participants in all stakeholder groups was the fact that state law places different requirements on disparate types of water users. For example, WWTR has different registration thresholds for agricultural and non-agricultural users. Several municipal water system managers and environmental policy experts voiced concern that user groups who they saw as receiving preferential treatment under current water use regulations would receive similar advantages under an allocation system.

It's very apparent, and you well know in the research you've done, that average municipalities and average states are not ever going to win against the power companies. They play on their own set of rules. – BM

The volumes [power generators] are evaporating completely dwarf the minimum amount [required for an] IBT in terms of daily volume. Many of them are on the orders of tens of millions of gallons a day... This is something that we knew was not being taken into account in any kind of allocation issues and needed to be dealt with in a serious policy manner. At the very least, in any kind of permitting schemes for withdrawals there should be an additional charge for consumption of water. Certainly that evaporation qualifies as consumption since it [is not] going to be re-accessible in the same basin. – HT

The farming operations, they seem to get away with not having to do a lot of the same things that we have to do. I'm not saying that they don't need to pull water out of the river, but that should be accounted for. – DH

I would guess that agriculture between Rocky Mount and Tarboro uses 10 times the water volume that Tarboro does. I think agricultural [users] should be monitored. I think they should pay a permit fee, just like we do. Water use is water use. – WH

This discourse appeals to norms of fairness and equal treatment under the law. The first two speakers reference a power differential that offers energy generators better access to water than other users have. The latter two comments indicate that the speakers feel agricultural water use has been privileged under current regulations. But they believe municipal water use is just as socially valuable as agricultural water use and therefore claim the two uses deserve equal treatment. Inherent in all four comments (and others not cited here) is a belief that all water users should be treated equitably. In his description of the necessary characteristics of a surface water allocation system, a DWR water planner makes the same claim. Mr. Rayno's and Mr. Hollowell's comments go further than making claims on fairness, however. They also voice a more practical concern that an allocation system that does not apply to all water users could be fundamentally flawed.

[An allocation system] has to consider all the water users, all the people who want to be able to withdraw... In addition to [keeping] water in the stream for ecology, there's a lot of recreational use of water in NC that has to be factored in. There's municipal withdrawals and agricultural withdrawals and industrial withdrawals – there's got to be a way for all of those to be factored into the process and not have a group of latent demands out there that only pop up periodically. – DR

Every municipal user has a permitted allocation, [but] there are invisible [users] on surface water who drive a computer program crazy... [Making] sure that wise decisions [about water use] are made is highly dependent on all users being accounted for. – WH

Either explicitly or implicitly, many of the fairness concerns that participants mentioned grew out of a feeling that the smaller municipal water systems cannot compete for water on equal footing with other water users. The causes that interview subjects cited for this inequality varied from state regulatory structures to differences in political and financial resources. Regardless of the cause, participants indicated this disparity would be a concern that must be addressed during the design of a water allocation system.

I think somehow from a philosophical level you have to give smaller communities the ability to control their own destiny. Not that I have the answer, that's a very hard question to answer. But they have to have the ability to get water if they need it. – MM

Small Communities

Eight participants referenced the theme of small communities, including subjects from three stakeholder groups (municipal water systems, private water management, and environmental policy experts). Most of this discourse reflected broad challenges that affect small municipal water systems regardless of whether or not an allocation system is involved. Most speakers who referenced this theme focused on financial resources and human resources.

Nash County now is our operator, which gives me a better feeling because... I can pick up the phone and say, "We've got a problem and need you here." They bring a lot of benefits. However, we are paying for it. And when you've got 18 customers and you're contracting to Nash County, it's very expensive to do that. – GB

[Small water systems] largely don't have a lot of resources. Raleigh/Durham they have a large resource pool to pull from, a large knowledge base to pull from. For those people who really are our clients, the guy who's in charge of their water/sewer is the same guy... that's doing public works who's doing streets and roads and whatever else they can throw on him. He's getting all of that thrown on him and the industry is driving towards tighter regulations and specializations. You really need to be specialized in the industry to know what's going on. – MM

Limited technical expertise and financial resources are two of the drivers for small water systems to partner with (or sell their systems entirely to) larger water providers, either larger municipal systems or private water utilities. While this transition may be an efficient solution, it brings with it a new set of concerns, compounding and compounded by disparities in political power.

The only thing that I can make it analogous to is... I used to do this same [job] in the Town of Apex a long time ago. We were in the process of building a wastewater treatment plant. In the interim, we pumped our sewage over to Raleigh and Raleigh treated our stuff. If we wanted to have any additional capacity, we had to go to them – it was worse than going to the State! [Raleigh would say] "Well, you know, the plant was built 30 years ago and we paid 7.5% interest, and you're trying to buy one-tenth of one-millionth of a percent of it so therefore you owe us..." When you begin to account for it and you begin to regionalize it, us little guys kind of lose our autonomy. Then Raleigh or somebody big comes in and kind of jerks you around. We're pretty much a firm believer in if we can supply our own, we're going to try to supply our own, because we've got a better chance of expanding that way than we do if the State or the City of Raleigh or Wake County or somebody takes us over. – LT

Not all communities want or expect to grow substantially over the next 50 years. Even for these communities, however, there is some concern that giving up their water system could put them at a disadvantage in the future, as Mr. Thomas describes. An allocation system does not directly encourage the transition to larger water systems. In so far as it increases the technical, financial, or administrative load on water system managers, however, it could influence this trend. The water professionals I spoke with did not have a strong feeling as to whether an allocation system would require substantial new planning, monitoring or reporting activities or if current practices would suffice. Whether an allocation system would ultimately help or hinder municipal water systems' efforts to plan and prepare for the future needs of their communities, the design of water allocation policy will need to consider the variable ability of small and large water systems to participate in the process.

There's some tough questions out there. Something has to be done. We have to go to a better model and a permitted model seems to make a lot of sense. How do you get from there to here is the big question. – MM

Fundamental Objectives for a Surface Water Allocation System

The themes represented in the study participants' discourse reveal the fundamental objectives they have for a potential surface water allocation program. My analysis suggests that a successful allocation policy should meet the following goals.

Fair Process for Determining Allocations. There is a perception within the respondent group that some users receive privileged access to water, due to political power or other considerations. Electrical power generators and agriculturalists are two groups that were repeatedly mentioned. Water users are not monolithic and their needs are not uniform, so it would be unreasonable to simply allocate an equal volume of water to each withdrawer. Additionally, decisions about how we allocate a shared and limited resource are necessarily value-laden. Because reaching a just distribution of water allocations is important but very difficult, it is essential that a fair process is used to reach allocation decisions. The fairness of the process becomes a way to measure and ensure the fairness of the outcome. Users must be assured that political power, wealth, or similar factors do not have influence over allocation decisions. The process used to reach decisions must be transparent and fair, so that all users (including the general public) can see clearly how allocations were determined and judge for themselves the fairness of the process.

Apply Equitably to All Users. Regulations should apply to all user groups and treat users equitably. Users may have unique needs. For example, many agricultural users' water needs are seasonal; they may withdraw surface water primarily during very dry times, but at these times they have very low tolerance for risk. As another example, a municipal water system's needs are based in part on population growth in their service area or the recruitment of a major commercial or industrial user, both of which can be difficult to accurately predict. An effective allocation program should consider the particular needs of various user groups, but must treat groups equitably. Differences in the permitting requirements or allocations for various user groups must result from a clear and transparent process (as described above), which treats all users equitably.

Comprehensive and Integrated Approach. Water use and planning decisions made by one user can have a great effect on other users within that river basin. Indeed, with the interconnectedness of municipal water systems, these effects can easily extend beyond the boundary of a single basin. Current regulations work in a piecemeal fashion, requiring redundant reporting yet at the same time allowing some negative impacts to slip through the cracks between existing programs. The nature of the relationship between surface water and groundwater sources in North Carolina are not well known. Although the ecological health of a stream affects its ability to supply high quality water to users, considerations of ecological integrity are often divorced from water supply decisions. Water planners and resource managers need tools that provide a more comprehensive and integrated approach to understanding, managing, and regulating surface water use.

Broad Planning and Decision Context. Because the ecological health, water quality, and water quantity at any point along a river is affected by conditions at other points along the river, it makes sense to conduct planning at this scale, as well. Individual users will make decisions for their water use, but these decisions can be improved by considering the plans of other users in the basin. In cases where water quality or quantity may be constrained, broadening the decision context can provide opportunities for users to coordinate and cooperate with each other, potentially finding new solutions that would remain hidden or infeasible to users acting alone. An effective allocation system should operate at a river basin scale and include mechanisms for user groups to coordinate with each other and with DENR. The river basin planning organizations called for in S907, which would plan for and manage water supply in (potentially) overallocated basins, is one example of this type of mechanism. Such organizations could also serve as meaningful components of a fair process, as discussed above.

Plan and Prepare for Future Conditions. To be effective, an allocation system must enable users to adequately plan and prepare for future water conditions. This encompasses several elements. The assessments of water availability must be highly accurate. No prediction will ever be perfect, but models should account for all major sources of variation (e.g. flows between surface and groundwater, flows between basins, seasonal and interannual fluctuations in precipitation and withdrawals) and carefully quantify and explain the uncertainty associated with the predictions. The models should be updated periodically to account for scientific or technical advancements and improved access to data, so that the information upon which allocation decisions are based is as accurate as possible. This process of adaptive management allows the program to improve over time, as scientists and managers learn more. Similarly, allocations should also be updated periodically, not only to coincide with updated predictions of water availability and assessments of water needs, but also to respond to changes in social values related to water use. Withdrawal regulations must be enforced in order to protect permitted users' allocations. Allocations should be guaranteed for a time scale that allows users to plan, secure funding, and pay for necessary capital improvements.

POLICY RECOMMENDATIONS

There are just a few functions that a water allocation system must serve: it must proportion water among users, monitor their water use, and enforce the allocations. There are many features that could be chosen to achieve those functions (Bardach 2009). A system's design will grow out of the legal framework and political climate within which it operates, the needs and values of those designing it (and hopefully those using it), as well as the fundamental functions the program is meant to serve. The policy features I propose for an effective surface water allocation system for North Carolina are informed by all these factors. Primarily, though, these recommendations are intended to craft a policy that meets the fundamental objectives expressed by study participants.

A surface water allocation policy should be based on a scientifically valid understanding of water availability. DWR is developing basinwide hydrologic models that will provide a more holistic understanding of surface water flows, including the instream flows needed for ecological integrity and the relationship between surface water and groundwater. As currently conceived, the models will not attempt to predict changes in water availability due to climate change. To the extent that changing climatic patterns could result in changes in water availability, this would be helpful information for water planners and managers to have. This is true regardless of what one believes the underlying driver

of climate change is (i.e. human action, normal variations, etc.). Additionally, DWR has found that many agricultural users who are required to report their withdrawals do not. While the registration information the state does receive, combined with aggregated withdrawal data supplied by the Department of Agriculture may provide sufficiently fine-grained detail for the hydrologic model being developed, there is a potential for the cumulative impact of these small withdrawals to affect water availability, especially during droughts. DWR should ensure that their hydrologic models incorporate all meaningful sources of flow variation, in order to serve as a sound base for allocation decisions.

A surface water allocation policy should be based on technically rigorous assessments of users' true water needs. LWSPs require water systems to provide estimates of projected demand for the next 50 years. There is no requirement to share the methodology used to develop these projections, however, and some water systems simply use North Carolina Office of State Budget and Management population projections as their guide to future water demand. An allocation system should use a more rigorous methodology to assess users' needs or establish minimum requirements for projections that users self-supply. The state should exercise oversight to verify that self-supplied estimates are accurate and reasonable and provide technical assistance to users requesting it. The accounting of water needs should include an estimate of the instream flow needed to maintain ecological integrity and to support other instream uses.

A surface water allocation policy should apply to all users. Philosophically, an allocation system is a statement of societal needs and priorities. Its meaning and value is weakened if all user groups are not included. Practically, an allocation system is a mechanism to ensure that water is proportioned equitably among users. In a situation where sufficient water is not available for all users, an allocation system makes this shortage apparent early on, allowing affected users and state government to plan accordingly. When users are exempted, their withdrawals cannot be accounted for in calculations of water availability, and the system will not function. If we want to privilege one or more user groups, excluding them from the allocation system is not an effective approach. Instead, a water allocation policy should assign this use a higher priority or include special provisions for it, such as reduced application requirements or longer permit terms.

A surface water allocation policy should preserve allocations for instream flow uses. This is a corollary to the recommendation that an allocation system cover all users. Water uses that depend on instream flow would not require a withdrawal permit, but should receive an allocation in order to protect their use. An allocation would make explicit the value citizens place on the services of surface

water that are difficult to monetize, such as being able to swim in the lake near one's home. It would also protect instream uses that contribute significantly to the state's economy (e.g. tourism and fishing). Underpinning all surface water use is the ecological health of the resource. If instream flows are so reduced as to damage the ecological health of surface water systems, the quality and quantity of the water these systems provide to human communities will be reduced, as will myriad other aquatic and riparian ecosystem services. Instream flow uses are important in their own right. They also contribute to the health of a resource that citizens and businesses depend on. An allocation system should protect instream flow uses.

A surface water allocation system must be fair. Water should be apportioned in a careful and thoughtful way, through a just and transparent process. Allocations should not privilege users with greater financial resources or political power. It must account for the need of new users to enter the market and permitted users to grow.⁴ Current and potential water withdrawers need to understand and be able to predict how much water they will be able to access, in order to effectively plan for the long-term health of their business and/or community. That an allocation system must be fair may seem self-evident. However, it was the concern study participants mentioned most frequently when talking about the potential value of an allocation system. Procedural fairness enables stakeholders to reach agreement on allocations more easily and produces allocation decisions that are more durable (Smith 1994). An allocation system must be designed around processes that assure fairness for all users.

A surface water allocation system should include a mechanism for rebalancing allocations. New water users may want to enter the market. Industry may develop water-saving innovations. Climate change may alter long-term flow patterns. Conditions can change substantially over the course of many years, as can our technical ability to predict and respond to those changes. An allocation system should be able to adapt accordingly. The challenge may be designing a system that can both adapt to changing conditions and provide certainty to users. One approach would be to allow the state to rebalance allocations at set intervals (e.g. every 30 years). The right to use a particular volume of water or percentage of flow would be guaranteed for that period of time, after which the state may assess the need for rebalancing.

⁴ Not all users see growth as a goal and even for those who do, water efficiency and conservation practices may allow them to increase production or population without increasing their aggregate water demand.

State management of a surface water allocation system should be integrated with other regulatory programs. Oversight of water resources is split among multiple state agencies, including DWR, Division of Water Quality (DWQ), and DEH. This leads municipal water suppliers to report similar information in different formats at different times to different agencies. If this information could be collected through a single online database available to all appropriate agencies, the reporting process would be streamlined for reporters and provide a broader picture of water use and water quality to agencies. This more comprehensive approach could simplify permitting decisions, as well as improve management of water resources. Additionally, state water regulations should be revised, as necessary, to incorporate the improved understanding of ecological flow needs, surface water–groundwater interactions, and (potentially) climate change effects on water flows that is developed during implementation of the hydrologic modeling and allocation program. If possible, the state should make the basinwide hydrologic models available and provide the necessary technical assistance to make the models accessible to users, in order to facilitate independent coordination and cooperation among users with respect to their individual planning decisions (e.g. siting of a new water intake or development of water reuse programs).

CONCLUSIONS

Based on the data gathered from informants in this study, there is support for a surface water allocation system in North Carolina. Questions remain regarding how an allocation policy would be designed, however. In order to realize the potential benefits identified by informants and minimize their concerns, a successful surface water allocation program should (1) provide a fair process for determining allocations, (2) apply equitably to all user groups, (3) incorporate a comprehensive and integrated approach to understanding, managing, and regulating surface water use, (4) provide a broad planning and decision context, and (5) enable users to adequately plan and prepare for future water conditions.

This study provides insight to the perspectives of four stakeholder groups in the Upper Tar River basin and could serve as the basis for larger, perhaps quantitative studies. Future research is needed to investigate the transferability of these findings to other river basins in the state and to explore the perspectives of other important stakeholder groups, including agriculture and electric power generation.

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REFERENCES

- Aqua. 2011. "Aqua North Carolina Service Area." Accessed on February 28.
<https://www.aquaamerica.com/Documents/NorthCarolina.pdf>.
- Bacow, L.S., and M. Wheeler. 1984. *Environmental Dispute Resolution*. New York: Plenum Press.
- Bardach, E. 2009. *A Practical Guide for Policy Analysis: The Eightfold Path to More Effective Problem Solving*. Washington, D.C.: CQ Press.
- Barrett-Howard, E., and T. Tyler. 1986. "Procedural Justice as a Criterion in Allocation Decisions." *Journal of Personality and Social Psychology* 50: 296-304.
- Costanza, R., H. Daly, C. Folke, P. Hawken, C.S. Holling, A.J. McMichael, D. Pimentel, and D. Rapport. 2000. "Managing our environmental portfolio." *BioScience* 50:2, 149-155.
- DeBell, K.M. 2006. "The Effectiveness of Environmental Dispute Resolution in Water Quality Negotiations." PhD diss., George Mason University.
- Detraz, N., and M. M. Betsill. 2009. "Climate Change and Environmental Security: For Whom the Discourse Shifts." *International Studies Perspectives* 10: 303-320.
- DWR. 2001. *North Carolina State Water Supply Plan*. Raleigh: Department of Environment and Natural Resources. http://www.ncwater.org/Reports_and_Publications/swsp/swsp_jan2001/swsp_j01.php.
- DWR. 2009. "Water Withdrawals." Last modified September 28.
http://www.ncwater.org/Water_Withdrawals/ResultsTabJS.php?tab=data&basinid=15&byRegionType=basin.
- DWR. 2011. "River Basin Water Supply Planning." Last modified February 8.
<http://www.ncwater.org/basins/>.

- Firmin, Michael W. 2008. "Replication." In *The Sage Encyclopedia of Qualitative Research Methods*. SAGE Publications. http://www.sage-ereference.com/research/Article_n381.html.
- Getches, D. 2009. *Water Law in a Nutshell*. St. Paul: Thomson/West.
- Gregory, R., and R. L. Keeney. 1994. "Creating policy alternatives using stakeholder values." *Management Science* 40:8, 1035-1048.
- Holman, B., L. Kleczek, and E. Polk. 2007. "The Future of Water in North Carolina: Strategies for Sustaining Clean and Abundant Water." Conference report, Raleigh, North Carolina, March 1.
- Keeney, R. L., and H. Raiffa. 1991. "Structuring and Analyzing Values for Multiple-Issue Negotiations." In *Negotiation Analysis*, edited by H.P. Young, 204. Ann Arbor: University of Michigan Press.
- U.S. Department of the Interior. 2011. "National Atlas: Precipitation Maps of the Individual States and the Conterminous States." Last modified January 27. <http://www.nationalatlas.gov/printable/precipitation.html>.
- Nickens, T. E. 2010. "North Carolina Rivers." *Our State*, March 2010. Accessed on February 26, 2011. <http://www.ourstate.com/articles/north-carolina-rivers>.
- O'Leary, Z. 2005. *Researching Real-World Problems: A Guide to Methods of Inquiry*. Thousand Oaks: Sage Publications.
- Patton, M. Q. 2002. *Qualitative Research and Evaluation Methods*. Thousand Oaks: Sage Publications.
- Smith, K. 1994. "Fairness in Water Quality: A Descriptive Approach." *Duke Environmental Law and Policy Forum*. 4: 85-113.
- Susskind, L., and J. Cruikshank. 1987. *Breaking the Impasse*. New York: Basic Books.