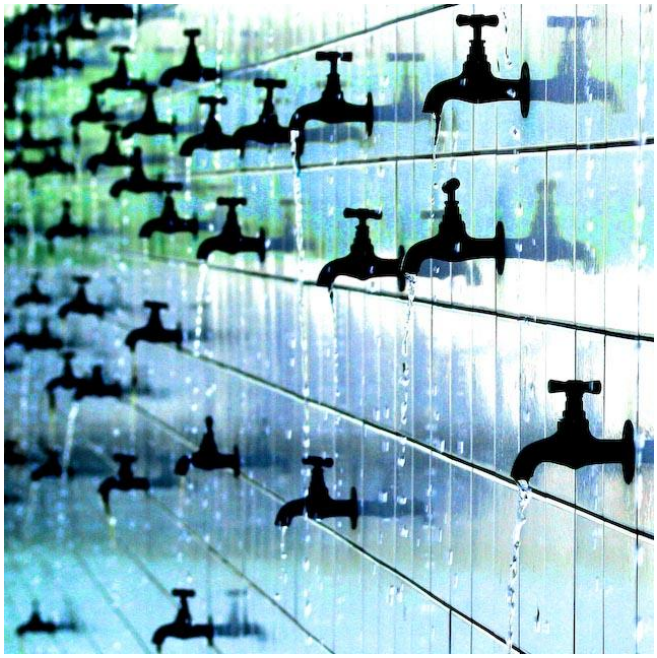
2010 Report of the Water Allocation Study of the Environmental Review Commission

Final Report to the Environmental Review Commission of the North Carolina General Assembly



By the Principal Investigators

Richard Whisnant
Professor of Public Law and Government
School of Government
UNC-Chapel Hill

Bill Holman
Director of State Policy
Nicholas Institute for Environmental Policy
Duke University

Richard Whisnant

Digitally signed by Richard Whisnant
DN: cn=Richard Whisnant, o=UNC Chapel Hill, ou=School of Government, email=richard_whisnant@unc.edu, c=US
Date: 2010.12.03 09:44:21 -05'00'

December 1, 2010

CONTENTS

I. Summary

The Water Allocation Study of the General Assembly's Environmental Review Commission began in 2007 in response to the need for a fundamental review of state and regional water allocation law and policy. The study was triggered by severe conflict over a proposed interbasin transfer of water, and its importance was heightened by historic droughts in 2002-2004 and 2006-2007. The research team that carried out the study submitted a comprehensive series of findings and recommendations in 2008-2009. This report summarizes further work in 2009 and 2010, at the request of the General Assembly, that focused on several aspects of the original recommendations.

As of this report, many aspects of the water allocation challenges facing North Carolina remain unaddressed. The high growth areas of the state cannot sustain economic growth for the next forty years without much more active and robust state and regional means of managing water demand, sharing water resources and increasing water storage.

On the central topics of this report, however, which are the possibilities for regional water resource planning and the incorporation of ecological flows into hydrologic models, there is significant and promising work underway. Groups of water systems (and in some cases, other stakeholders) are charting regional approaches to water security in the Greenville region, the Lumber River basin, the Triangle, the Catawba River basin, the French Broad basin, and perhaps others. DENR has assembled a Science Advisory Board to develop a way to integrate ecological flow requirements into hydrologic models. And legislative action in 2010 directing how those models should be created and used can be expected to help with the critical first step in improving North Carolina's water allocation policy: understanding where and when the "water budget" is likely to be out of balance. Also, largely as a result of the droughts in the past decade and increased recognition of the need for water systems to have sustainable finances, the price of treated water has risen in the state. Over the long term, maintaining the price of finished water at something like its actual cost to extract, treat and distribute will be essential to the efficiency improvements that certain areas of North Carolina inevitably must make.

So there is hope and there has been progress on the water allocation front. But the authors of the Water Allocation Study predicted that conflict over increasingly scarce water in the state and the region will rise in coming years and decades, and that rise has already begun. It will be felt by the legislature as increased local requests for relief from the interbasin transfer law. Much work remains for policymakers to sort out better ways to prevent and manage this conflict.

Water supply can be one of North Carolina's real strengths and comparative advantages globally, both for economic development and quality of life in a more general sense. But this.will not happen automatically, or by the historical, default approach the state takes to water allocation—letting each water system and water user figure out how to secure their water supply on their own, and leaving any conflicts that emerge largely up the courts to sort out.

II. Review of 2008 Study Conclusions and Recommendations

A. Review of the need for reform

The principal investigators see the main factors driving water availability and the need for water law reform in North Carolina as:

- ample average annual precipitation;
- in the last two years, demand drops from economic slowdown, loss of industry, ongoing conservation from 2007-2008 drought, and greater efficiency due to increases in price of water;
- few easy ways to significantly increase storage;
- a history of highly-decentralized decision making and responsibility for water resources (largely at the local jurisdiction level), with water sometimes used as a competitive weapon between jurisdictions, making regional cooperation even more difficult;
- a reluctance of local political leaders to acknowledge and publicize their water problems, due to short term thinking and fears of economic development stigmatization;
- in the longer term, significant demand increases, particularly in low-yield, high growth headwaters areas, including the Research Triangle and Charlotte metropolitan regions;
- less availability in streams and in highly-tapped groundwater aquifers;
- the likelihood of fewer, more intense storms with longer periods of low precipitation;
- an annual late-summer confluence of peak demands from cities (mainly lawn irrigators), power plants (air conditioning) and agricultural irrigators at the same time as rivers are at low flows.

The result is inevitably more conflict over water. There will be continued confusion over the law with resulting legal surprises for water providers and users. There is a strong trend to loss of state control as federalization continues, with decisions by the U.S. Army Corps of Engineers and the Federal Energy Regulatory Commission increasingly driving state water allocation decisions. Globally and across the United States there will be more pronounced shortages, with water coming to be understood as a major factor in economic development. Regions within and between states will compete over their quality and quantity of water and its management. North Carolina and its neighboring states in the southeast are naturally well-endowed, but culturally and legally they are poorly positioned to win in this competition.

1. Water availability

North Carolina receives average annual precipitation of 40-50 inches, which averages to 115 billion gallons per day. The rainfall recharges aquifers, infiltrates to groundwater, runs off the surface of the land and becomes stream flow. A large portion of the rainfall evaporates. But these numbers only partially describe North Carolina's water budget. Precipitation is seasonal—the state does not receive 115 billion gallons every day. Climate fluctuations lead to both drought and flood events. The State's population is located in areas that have limited surface water and ground water supplies. In times of drought, the urban centers have low resilience and limited ability to increase storage. Agricultural, municipal, and utility use all peak at the same time—the same time of year that drought conditions are likely. As the state grows, the demand for consistent, sustainable water supply increases.

These are the reasons that a year or two with below average precipitation can send North Carolina into severe drought—even though the amount of rain received in that period will exceed the average annual rainfall of most of the western United States. This happened in 2007. It will happen more frequently in the future, putting great stress on our water institutions and political leaders.

North Carolina's water allocation policies, derived primarily from legal disputes, are premised on ample water supply. The only legal limit on using water, outside of the capacity use area, is the requirement to "be reasonable." As demand grows for water resources and risk of water shortages increases, the importance of improved water allocation policies will grow.

Furthermore, the more time that passes with North Carolina's current, largely unregulated major water withdrawals, the more withdrawers there will be and the higher the amount that existing withdrawers will expect to have "protected" when the State decides it needs to regulate more carefully. This ever-ratcheting-up in demand expectations will make meaningful regulation harder with each passing year.

The droughts of 2000–2002 and 2007–2008 helped focus North Carolina on the importance of an assured water supply. The state's economy and environment depend completely on adequate fresh water. When the water supply is short, conflict can rise quickly to terrible levels, because people will do whatever it takes to get water.

The projected population increase in the next decades makes it very likely there will be more water shortages, and thus more conflict. Moreover, ongoing research shows that the long-term trend in many of the state's (and region's) streams is to less water than was historically available. See Figs 1 and 2.

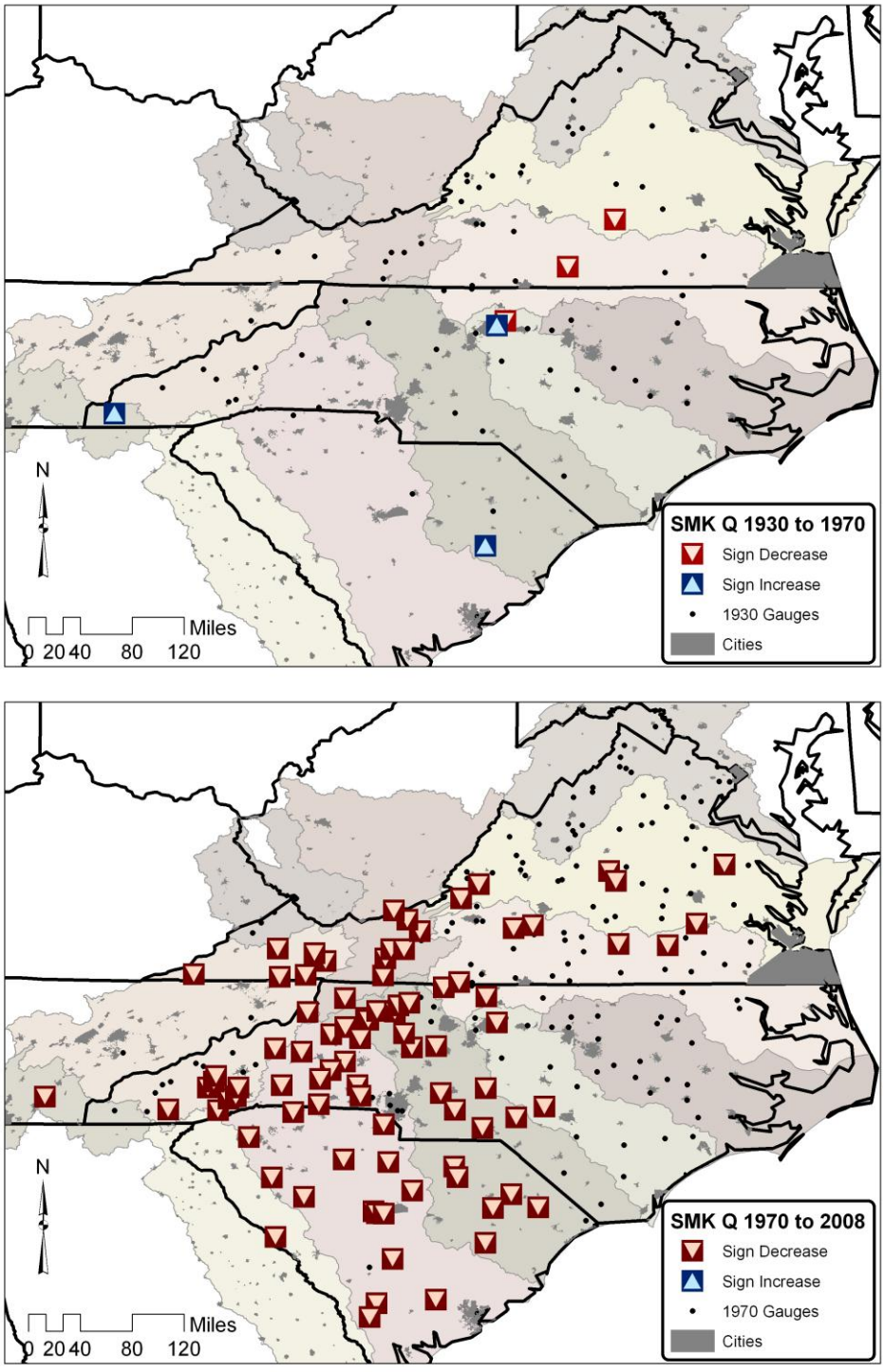


Figure 1 Changes in regional streamflow, 1930-1970 and 1970-2008. Seasonal Mann Kendall statistic; statistically significant (inflated P<0.05 - more conservative) gauges have a direction, otherwise gauges are represented as a dot. Patterson, Lauren (UNC-CH, ongoing 2010).

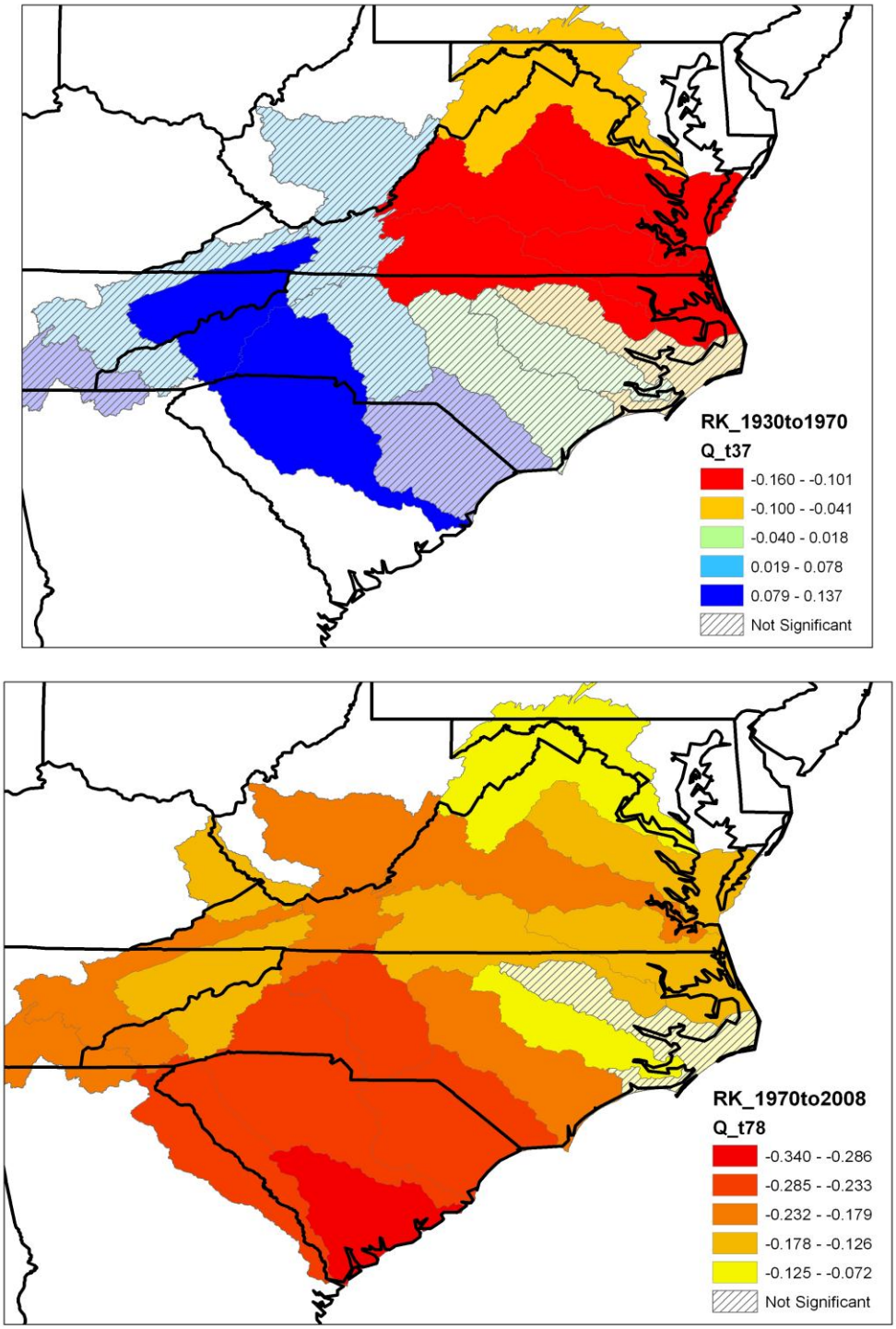


Figure 2. Change in stream flow, 1930-1970 and 1970-2008.Regional Mann Kendall test for HUC 8 boundaries. The tau value is shown, indicating the strength of the trend (ranges from 0 - no trend to +/- 1 – strong). Patterson, Lauren. (UNC-CH ongoing 2010).

Improving water supplies and becoming more efficient with the existing supply both can take many years and substantial expenditures. It is imperative, then, that the state do the best job it can today of projecting where water shortages will occur in the foreseeable future, and ensuring that those places live within a water budget, by adding more supplies and/or reducing demand.

Projecting and preparing for future water demands is critical to North Carolina's overall well-being. As noted by the Water 2030 study, conducted in 2004 by The Rural Center, Inc., a growing population will increase industrial, residential, and energy needs, thus increasing overall water usage. "The population is expected to grow from 8.5 million in 2004 to 12 million in 2030. Water consumption is expected to increase from 241 billion gallons per year for all households to 335 billion gallons if consumption continues on its current path." As a result, the Water 2030 study called for funding to address new supply infrastructure, education, and policy issues.

Water 2030 did not address future demands from agriculture. Many expect agriculture to become more intensive, more productive, and to rely more upon irrigation in the future.

It is not a foregone conclusion that as population increases water demand will increase at the same rate, especially if technology, legal restrictions, and efficiency-improvement efforts continue. The historical usage data plotted against population in North Carolina show this clearly: while water use overall does rise with population, the rates of increase in water use can vary from the increases in population. A great deal of this variation depends on how efficient water use is.

In comparison with other states of similar size, North Carolina uses more water per capita. For example, in 2000 North Carolina withdrew approximately 11,400 million gallons per day (mgd) with a population of 8,049,313, while Georgia, with a population of 8,186,453, used only 6,500 mgd. The large discrepancy between NC's and GA's water usage is due to NC's greater use of water for thermoelectric power.

There are also important potential new contenders for water use in the state. For example, the recent discovery that potentially marketable quantities of natural gas underlie parts of the Piedmont could mean that a gas drilling industry develops. This industry using large quantities of water, with additives, in a series of technologies called "hydrofracturing", to release the gas deep under the earth's surface. In other parts of the country, hydrofracturing, or "fracking," has already raised considerable concern about water use, water quality, impacts on local wells and air quality.

The 2008 Water Allocation Study reviewed North Carolina's water policies, legal structure, and state of hydrologic science. The report was presented to the Environmental Review Commission in January 2009. This report summarizes additional research into water resource allocation and the availability and maintenance in the State, with specific focus on the information needs and processes for effective water allocation planning and hydrologic modeling.

2. Water conflicts

It is inevitable that conflict over water availability in North Carolina will rise, as long as population growth continues. Use is increasing, stream flows are decreasing (see Figures 1 and 2, above), and there is inadequate prior review of increased withdrawals. Peak demands for municipal water (driven largely by outdoor watering of turf), for energy, and for agriculture (irrigation) usually coincide with each other and with low flow periods in the streams. Population is growing most rapidly in the headwaters (low surface water flow) areas, most of which lack large groundwater resources. State law makes it very difficult to move large quantities of water between the major sub-basins of rivers. Public water systems have a strong financial incentive to sell more and more water. There is little connection between most economic development and planning decisions that help drive growth patterns, on the one hand, and water availability efforts, on the other hand.

Above all, the state has an incomplete, somewhat confusing common law legal regime for sorting out conflicts and an inadequate statutory and administrative regime to draw on for avoidance and resolution of conflicts before they escalate. In sum, conflict will rise. Indeed, the rise has already begun.

As of this report, there are major lawsuits or threats of lawsuits involving water allocation in the Catawba basin, the Yadkin basin, along the Deep River in the Cape Fear basin, the Neuse basin, the Tar-Pamlico basin, the French Broad basin and the Roanoke basin. More such litigation can be expected and the state remains poorly suited to avoiding and efficiently resolving these matters.

B. Review of recommendations and status report

The original study purpose was to frame and analyze policy options for water allocation for consideration by the ERC. Consequently, the 2008 Water Allocation Study identified 9 major policy recommendations for the ERC. Over the past two years, the water allocation study team has had the opportunity to speak with multiple stakeholders and review those recommendations. Each recommendation is noted with a implementation update below.

1. **Clearly state policy goals to guide administrative and judicial decisions.** There still is no clear, general set of goals set by the legislature for water allocation to guide administrative and judicial decisions. Some of the recommended goals were included in the 2010 water allocation/modeling bill, but were stripped from the bill before it passed in light of the extremely short time frame for debate in the 2010 short session.

2. **Require a state permit for anyone who withdraws large quantities of water, either groundwater or surface water.** A version of a water withdrawal permit program was detailed in S. 907/H 1101, Water Resources Act of 2009. Stakeholders provided comments in a series of informal meetings. The study authors and stakeholders have continued to refine the ideas represented in S. 907/H1101.

3. **Conform existing laws to each other and to policy goals**. If and when the policy clarification and regulatory changes recommended above are enacted, there will need to be legislative effort to conform the many existing but scattered and inconsistent references to state water policy.

4. **Establish proactive, adaptive, river basin water supply planning: (1) models and (2) regional/river basin planning organizations.** Legislation enacted in 2010 (S.L. 2010-143) set the path for statewide hydrologic models in alignment with the water allocation study recommendations, and also directed incorporation of ecological flows into the models. When models project water shortages, it remains unclear who is responsible for solving the problem and whether the state will use regional river basin planning organizations.

5. **Integrate water data: (1) inventory state and US EPA water-reporting requirements, (2) identify and phase in both electronic reporting to DENR and provide information to the public on websites and other means, and (3) develop and begin to implement a plan to consolidate as much water data as possible into one comprehensive Water System Report to the state and the public.** S.L. 2010-144 created the Water Infrastructure Task Force, which could have done this work. However, the task force was pressed for time and focused narrowly on water infrastructure funding information. DENR has committed in its strategic plan to make integration of water quality and water quantity data and planning a high priority. As an initial step towards joint water quantity - water quality planning, the Divisions of Water Quality and Water Resources will compose a joint executive summary for each basin in the basin-wide planning process, starting with the Neuse basin. DENR reports that the Neuse joint executive summary should be completed by the end of the first quarter of 2011. This initial step is the only evidence to date of any concrete steps in the direction of integration. As of this writing the water data systems reporting to and within DENR remain as fragmented as ever. There have been some positive steps by the various funding agencies to coordinate their information, as a result of pressure by the legislature. Without a comprehensive policy to guide them and suitable incentives, the agencies and funders will continue to develop their systems without much regard for integration or the needs of local water suppliers, customers or legislative oversight.

6. **Address critical research needs.** S.L. 2010-143 took up the goal of better science on instream flow modeling. It also gave direction to DENR on use of flow models to predict shortages, as recommended by WAS. Other critical research needs identified remain important: What are the limits for groundwater withdrawal, especially in hard-rock settings (Piedmont and mountains)? How do large groundwater withdrawals effect nearby wells and surface flows, particularly in over-allocated basins? Could the entire southern Atlantic coast, including the states of Virginia, North and South Carolina, and Georgia, work on water allocation in a more coordinated way? How well does reclaimed water work with turfgrass varieties and other major landscaping needs? How much will climate change affect water availability?

7. **Legislatively direct the Local Government Commission (LGC) to take a more active role in monitoring the financial side of local government's operation and maintenance of water infrastructure.**

Direct DENR, in conjunction with the LGC, to monitor and regulate the ongoing financial and managerial capacities of water systems rather than just review system capacity when there are requests for expansion or new systems. Section 9 of the 2008 Drought Legislation (H. 2499) amended G.S. 143-355.4 to make water system financial sustainability (and rates to support it) a precondition to state funding for water infrastructure. The State Water Infrastructure Commission (SWIC) has adopted a policy to guide the LGC and funders in evaluating whether water system revenues exceed expenses. The Local Government Commission is now carrying out this function. Section 2 of SL 2010-144 required DENR and LGC to report on the financial sustainability of water systems to the 2011 General Assembly.

8. **Reward and spread best practices and leadership efforts in water efficiency.** As recommended by WAS and monitored by the Environmental Finance Center at UNC, water pricing has been widely adjusted to better account for the value of water. In addition, the state now requires separate meters for new in-ground irrigation systems. As directed by Section 17 of SL 2008-143 (drought bill) the SWIC, with the assistance of the Environmental Finance Center at UNC-CH, adopted "Recommended Guidance for NC Utilities Looking to Decrease Water use in the Long Term Through Rate Structure Design and Billing Practices" at its November 19, 2010 meeting.

9. **Create more storage**: (1) expedite above-ground reservoirs with minimal environmental costs; (2) encourage groundwater storage and retrieval and desalination where appropriate; (3) monitor increased used of reclaimed and grey water; (4) encourage use and restoration of decentralized storage: farm ponds, stormwater, and private property owner storage in private wells. Legislation enacted in 2010 (S.L. 2010-149) began a study of agricultural water use and storage, including the possibility of use of cost-share funds to rehabilitate farm ponds.

III. The Second Phase: 2009 to 2010

A. Overview of Study Methodology

The purpose of the study's second phase was to build on the original study and to analyze North Carolina's information needs and processes for effective water allocation planning and hydrologic modeling. The study focused on the approaches that other eastern states were taking to similar water allocation problems, particularly regional water planning.

The plan for the study's phase was multifaceted. In 2009-2010, the water allocation research team organized a seminar series to increase common understanding of water allocation issues. The team continued to refine the original recommendations, including meetings with interested stakeholders to discuss reactions to the first phase report and next steps. The research component of the study

evaluated several states' and interstate organizations' water allocation programs and processes and analyzed the current state of hydrologic modeling science and current regulation of instream flows.

B. Water Allocation Research Seminars

Background

The research team for the Water Allocation Study organized and sponsored (along with the Water Resources Research Institute) a series of seminars on water allocation and water resources, called the Water Allocation Research Seminars (WARS). The research team is indebted to the partners, co-sponsors and speakers themselves who are helped to bring experts on water resources together to UNC, Duke and other places in the state in 2010-11. The seminars were designed to raise the collective understanding of water management and to encourage dialogue among stakeholders about the right approach for North Carolina. The complete list of seminars, along with many of the presentations and presentation summaries, is available on the water wiki.

Learning objectives for the seminars

- How other states with statutory water allocation systems use planning processes, including local, regional and river-basin planning, and hydrologic models to inform their regulation of water withdrawals and consumption.
- How current limitations in hydrologic models produced by the Department of Environment and Natural Resources can be overcome to make those models useful for water allocation and planning.
- How current regulation of instream flows by North Carolina and its neighboring states is implemented and reviewed.
- How other states in the southeastern United States and elsewhere in the world are responding to threats of increased water scarcity and conflict.

C. Targeted stakeholder input

The principal investigators met with numerous stakeholders during 2009 and 2010, giving presentations, facilitating discussions and hearing the points of view of major water users, water providers, environmental and business groups, regulators, surrounding states and eastern United States water institutions. These events are summarized, with many of the presentations available, on the water wiki.

Based on the totality of this input, the principal investigators understand the views of stakeholders as follows:

- Most water professionals acknowledge that past, decentralized water resource regulations will be inadequate to assure water supply everywhere in North Carolina and the region in the coming decades.

- Water systems in the state are, however, highly diverse in every respect; it is impossible to find single "silver bullet" solutions to assure future water supplies. For example, re-use of water now considered wastewater will surely be important to some places in the near future, but the cost of creating and maintaining re-use production and distribution systems does not make sense for every place in the state.

- Given this diversity, there is widespread support for some state encouragement of regional water resource planning. The state should give the water users, providers and other interested parties in regions of predicted shortage a structure and enough authority to work out plans regionally to current projected supply problems, rather than first imposing solutions at the state level or (as at present) leaving it up to each jurisdiction to fend for itself.

- It is widely acknowledged that the state could help with future water planning by creating, improving and maintaining hydrologic models that are robust enough in their inputs to give confident predictions of future supply problems.

- It is widely acknowledged that many existing withdrawers do not have legal protection for their current inflows in the state; however, there is not widespread agreement on the details of a water withdrawal permit program at this time.

D. Investigations of other states' planning processes

The Water Allocation Study Team researched and evaluated water management governance structures implemented by other states and region. The PIs visited the Delaware River Basin Commission, the Susquehanna River Basin Commission, and the Middle Chattahoochee River Basin District, which is part of the Georgia Water Plan. The study team has also researched the applicability of Western U.S. watershed and river basin planning efforts, water planning institutions in various states, and the potential for federal interest and involvement in river basin planning. This report focuses on the models in the Delaware and Susquehanna basins and the planning model in Georgia.

1. Delaware River Basin Commission:

The Delaware River Basin Commission (DRBC) was created in 1961 by a compact between the President of the United States and each of the governors of New York, New Jersey, Delaware, and Maryland. The compact established the structure of the commission—giving each signing member, the governors of the four states, and the federal government one seat on the commission. The US Army Corps of Engineers represents federal agencies on DRBC. The compact originated from a U.S. Supreme Court case in 1937 (*NJ v. NY*) and a subsequent decision in 1954, to allocate the water resources of the Delaware River. A key tension in the Delaware basin is balancing the adequacy of water supply for New York City, from the upper basin, with the needs of downstream users, such as the need to keep saline water below the intake for the City of Philadelphia.

The DRBC was charged with creating a comprehensive plan for the Delaware River, maintaining a water resources program and keeping an annual budget to cover expenses for the programs. The DRBC has the authority to set "standards of planning, design and operation of all projects and facilities in the basin which affect its water resources." The DRBC has a staff of more than 40, many of whom have high levels of expertise in hydrology, water chemistry, aquatic biology, assessment, modeling, as well as communications and planning. The DRBC does its own water quality and quantity reviews and works with states or the federal government on all types of projects in the basin.

The comprehensive plan includes the Water Code of the Basin, the goals for basin water projects and specific water allocation measures, project review and conservation measures and water conservation and water quality goals. The DRBC has established a goal of reducing water use and requiring water efficiency from basin water users. To help basin water users achieve this goal, the DRBC has developed a list of water conservation and efficiency practices. These practices include a requirement for source metering, leak detection and repair, setting performance standards for plumbing and water fixtures, the use of conservation retail water pricing structure, and requiring auditing, leak detection and repair for municipal suppliers.

The DRBC has the right to allocate waters of the Delaware between the states in accordance with the doctrine of equitable apportionment. As part of its water allocation responsibilities, the DRBC utilizes water level gauges to determine flow conditions and hydrologic models very similar to those being prepared in North Carolina to manage the multiple, conflicting river uses. Different flow conditions correspond to drought designations and the DRBC has established specific actions for reservoir releases and diversions. Once the DRBC has declared a "drought," mandatory conservation measures are enacted. In addition to its drought powers, the DRBC is charged with ensuring that all surface waters are allocated in a fair and sustainable manner. The DRBC reviews and permits new water withdrawals to ensure that there is sufficient water. The DRBC also oversees water rates in the basin so that the cost of infrastructure is included in the rate and that rates are uniform and affordable across the states. The

DRBC authority extends to ground water and the DRBC apportions ground water with the goal of preserving the aquifer.

The DRBC has integrated management of water quality and water quantity. The DRBC maintains the quality of interstate water as well as apportioning its use.

2. Susquehanna River Basin Commission

The Susquehanna River Basin Commission (SRBC) was created in 1970 by a compact signed by New York, Pennsylvania, Maryland and the President of the United States. The compact was created to 'provide the mechanism to guide the conservation, development and administration of water resources"[1] in the Susquehanna basin. The compact created the SRBC and each signer received one seat on the newly created commission. Each member gets one vote, with majority rules except in when unanimity is required, specifically for commission budgets. Unlike the Delaware and most similar river basin planning organizations in the United States, the SRBC was created primarily to reduce future conflict, rather than to resolve problems that had already become crises. It was, in other words, forward thinking.

After its creation the SRBC was tasked with creating a Comprehensive Plan for the Water Resources of the Susquehanna River Basin, ensuring that the comprehensive plan is being followed and creating a budget for the commission's activities. For the implementation of the comprehensive plan "the primary responsibility for managing the waters of the Susquehanna falls on the three member states; the SRBC works to fill in regulatory gaps that exist in each states management program."[2] The Comprehensive Plan focuses on six management areas: water supply, water quality, flooding, ecosystems, Chesapeake Bay, and 'coordination, cooperation and public information.'[3] For each of the six management areas the commission does a variety of work, in some cases taking a major role in the development and regulation and in others providing a coordinating role between different jurisdictions.

Water supply

The Commission takes a major role in regulating the water allocation in the Susquehanna basin. The commission requires notification of any usage above a certain amount and large diversions of water require project approval from the commission. The commission works to keep an inventory of basin water supplies and uses to facilitate an equitable distribution of water, including the ecosystem needs for in-river and Chesapeake Bay systems.

[1] SRBC Overview
[2] Information sheets
[3] SRBC Comprehensive Plan

Water quality

The SRBC's role is coordination to protect public water resources and ensure uniform enforcement by signatory parties. The majority of the regulation regarding water quality is overseen by the local jurisdictions that are part of the commission. The SRBC has created the Watershed Assessment and Protection (WAP) Program which maintains its own personnel for monitoring water quality in the Susquehanna including chemical, biological, hydrologic and other parameters. The SRBC has also created a Water Quality Advisory Committee which has people from the SRBC, state, local and federal agencies. The SRBC can, with the appropriate agencies, make periodic inspections to state parties.

Flooding

The SRBC created a strategic plan for the Susquehanna Flooding Forecast and Warning System, SFFWS. The SRBC maintains a flood forecast website, serves as a liaison between the National Weather Service and local jurisdictions and works to provide appropriate flood action information to local jurisdictions.

Ecosystems

The SRBC performs ecosystem monitoring and assessment to acquire data for watershed management. In this capacity the SRBC has authority to discuss water quality and supply issues with any basin authority.

Chesapeake Bay

The SRBC has taken an active role in quantifying the water flow need to 'restore and maintain the ecological health of the Chesapeake Bay."[4] The SRBC works to provide habitat for migratory waterfowl and shorebirds. The SRBC works to support member states sediment and nutrient reduction strategies.

Coordination, Cooperation and Public Information

The SRBC tried to encourage consistent interstate water management policies and actions. It executes, reviews and updates memoranda of understanding (MOUs) with member jurisdictions to coordinate programs that overlap.

Conclusion

The main goals for the SRBC are to facilitate uniform management practice throughout the basin, relying on the local jurisdictions to enforce regulations and to inventory and allocate water within the basin through SRBC's own project review. Because the water allocation is handled comprehensively the SRBC can foresee over-use before it occurs and make alterations to large water-users dockets.

[4] http://www.srbc.net/about/geninfo.htm

3. The Georgia Comprehensive Water Plan

The Georgia legislature passed the Comprehensive State-wide Water Management Planning Act in 2004[5] (2004 Water Act) requiring a state-wide management plan, the development of regional water planning and the creation of the Water Council. The Water Council has eight members from state agencies including two from the Department of Natural Resources (DNR), two members from each of the branches of the Georgia General Assembly, and two members who are not in the Georgia legislature but are appointed by the house and senate respectively.[6] In 2008 the Environmental Protection Division (EPD) of the DNR finalized the Georgia State-wide Comprehensive Water Management Plan (State Plan), which was approved by the Water Council and approved by the Georgia assembly. Any changes to the State Plan must be approved by the Water Council and authorized by the assembly.

The State Plan lays out four steps to begin working on a statewide framework of regulation.[7] The first step was for the EPD to complete a water resource assessment to see the supply and pollution assimilation capacities of the river basin by region. These assessments were distributed to regional water planning councils and combined with local economic and social data to forecast regional water needs. The third step, where regional councils work to develop a regional water management plan, is currently in the process of being completed. Finally these regional plans will be adopted and acted upon both by regional users and the EPD, which will base permitting off of the regional plans. These plans are not intended to address emergencies or extreme conditions including droughts.

As the 2004 Water Act required regional level contributions to water management, Georgia divided its river basins into regions (see map) and put these under the control of regional water councils. Regional water councils are set up such that their members will represent a wide variety of water uses in the area. The regional councils have no more than twenty-five members with the balance of representation determined by the Governor or Lieutenant Governor.

Each regional council signs a Memorandum of Agreement (MOA) with the EPD and the Georgia Department of Community Affairs (DCA)[8]. The MOA requires that the regional councils submit Water Development and Conservation Plans (WDCP) based on EPD and a regional contractor's data, involve the public, work with other regional councils that are hydrologically-connected and coordinate with EPD on planning. The EPD is required to provide technical assistance and planning documents, monitor water resources in the basin and consistently update the data, review and adopt the WDCP if it is in compliance. The DCA will provide land use planning information and coordinate between the WDCP goals and local governments' or regional commissions' comprehensive plans.

---

[5] Water Management Act
[6] Water Council membership
[7] State Plan
[8] example MOA

The regional councils will use the water resource assessment for their region and 10, 20, 30 and 40-year forecasts for water usage to create the WDCPs.[9] For councils that are hydrologically-connected the regional councils are responsible for coordinating shared resources. After the plans are a developed a draft of the WDCP is to be sent to the EPD for approval. After approval the EPD will consult with the WDCP when making permitting decisions and grants or loans for water projects will be guided by the plan. The WDCP's will be reviewed and revised as needed or every 5 years. One of the main goals for the WDCPs is to close current and avoid future gaps in water needs either through conservation or advance planning about additionl supplies.[10]

Each of the regional councils has a fact sheet that discusses who is on the council, where the regional area is, the key issues for the area and the current water use for the area[11]. Most of the legwork for the each of the regional councils is done by the EPD and its various contractors, which include many engineering and consulting firms from Georgia and elsewhere. EPD has the primary responsibility for ultimate decisionmaking about water allocation.

It is still premature to assess the value of the Georgia Water Plan, relative to its cost. The state has committed to spending upwards of $30 million on its planning effort over the three years 2009, 2010 and 2011. What the principal investigators of the Water Allocation Study observed in their trips to Georgia, however, was an admirably high level of involvement of state and regional leaders in evaluating their water supply challenges. If nothing else, the Georgia process has greatly raised the level of understanding of water resources issues in the ranks of local leaders and elected officials,outside of the realm of water professionals, who are already attuned to these matters..

E. Hydrologic Modeling in North Carolina

Review of 2010 Hydrologic Modeling Legislation and Efforts by DENR to implement statewide modeling

On May 17, 2010, Reps Gibson & Harrison introduced H 1763, Improve River Basin Modeling and H 1765, IBT Enforcement and Notice, as recommended by the Environmental Review Commission. Senators Clodfelter and Kinnaird introduced S1169, IBT Enforcement and Notice and S 1170, Improve River Basin Modeling, as recommended by the ERC. Representatives Crawford, Gillespie, Owens & Tarleton introduced a package of bills recommended by the Legislative Study Committee on Water & Wastewater Infrastructure --H 1743 - H 1751.

On June 29, 2010, in one of the shortest legislative sessions in recent history--with a budget agreement in place--the Senate Agriculture and Environment committee took up the package of water infrastructure bills as well as the river basin modeling bill. The modeling bill had been calendared for

[9] Regional WDCP development guidelines
[10] Additional Guidance for WDCP creation
[11] Georgia regional water council pages

committee consideration on June 24, but it was pulled in the face of concern from both business and environmental stakeholders. The bill had gone through several versions resulting from informal stakeholder meetings prior to June 24. After being pulled from the committee agenda, Sen. Clodfelter called the major concerned stakeholders together for a meeting on the morning of June 25, where concerns and possible solutions were aired. All the stakeholders present supported the development of hydrologic models and achieved a general consensus. Over the next several days more versions of the draft consensus bill were circulated.

On June 29 the Senate Agriculture, Environment and Natural Resources Committee moved the provisions of H1743 into another of the water infrastructure bills, H 1746; passed the whole package of water infrastructure bills with only one question (Sen. Bingham: Q: is there any funding being provided for the study of infrastructure needs and the needs survey? A: "no, there is no funding, so we are giving it to the University and DENR..."). The Committee passed the modeling bill as a committee substitute to H 1743, with one significant amendment by Sen. Clodfelter to address some of the last minute concerns of major water users. The bill passed second reading in the Senate on June 30. The House concurred; Governor Perdue signed SL 2010-143 into law.

This legislation gives formal legislative imprimatur to the statewide development of hydrologic models. It also gives direction to DENR on some ways the models should be designed and used. The Water Allocation Study research team commends the legislature and DENR for passage of the bill. It is an important milestone for water allocation in North Carolina.

Status of Hydrologic Models

DENR developed a hydrologic model for the Neuse River Basin in 2008-2010, and put out a summary of its findings.

> The Neuse River Basin Hydrologic Model predicts that six systems may not be able to withdraw the amounts of water needed to fully meet their demands in the 2050 demand scenario under all 78 annual flow patterns contained in the model. These systems include Raleigh and Durham as well as four additional systems - Hillsborough, Orange-Alamance, Piedmont Minerals and South Granville Water and Sewer Authority.
>
> As demands increase, the frequency and duration of supply shortages also increase.Any impacts on target ecological flows would also increase. The long-term, or 2050, demand scenario has higher water demands to support significantly more residents.
>
> The long-term demand estimates were derived from information included in water system's local water supply plans. Raleigh anticipates needing 129 million gallons per day to meet demand in 2050, which is a 183 percent increase over 2008 usage. Durham's system is expected to need 41 million gallons per day to meet the expected demand in 2050.

> The occurrence of shortages for these two systems increases from once in 78 annual flow patterns for the 2030 demand scenarios to 36 of 78 for Raleigh and five of 78 for Durham for the 2050 demand scenario.
>
> If Durham's demand for water reaches the predicted average of 41 million gallons per day with only their current sources of water to meet the need, then the system could expect to experience up to 60 continuous days when demand could not be fully satisfied over the range of flows that have occurred in the basin from 1930 to 2008. If Raleigh's demand reaches the predicted average of 129 million gallons per day with only their current water sources, then the water system could expect to see up to four continuous months when demands could not be fully satisfied. And shortages could occur during 36 of the 78 annual flow patterns seen since 1930.[12]

This model and report were completed before the legislative direction to include ecological flow needs in its modeling, so in that respect the findings of probable future shortfalls are conservative.

DENR reports that both the Tar-Pamlico and Broad models are scheduled to be completed by December 2011, not including EMC model approval, which DENR hopes to have completed by the summer of 2012. It sees the model completion as a first step to what is for DENR currently the final goal, which is the compilation of a water resources river basin plan. The internal target for the completion of the Tar-Pamlico and Broad water resources basin plans is December 2012.

The Water Allocation Study team applauds DENR and the Division of Water Resources and its advisors and consultants for its work on the Neuse model; however, as this study has tried repeatedly to point out, the production of a plan is not the end of a good planning process. Who is responsible for addressing the problems identified in the plan, and when, and how? North Carolina cannot yet answer these questions, other than leaving it up to the individual systems to take or leave the disquieting information.

DENR is working on a Cape Fear model update with two parts: 1) an update to the existing Cape Fear hydrologic model and 2) combining the Cape Fear and Neuse models into a single model (because these two basins are so interconnected). The target date for the completion of the initial update to the existing model is the summer of 2011. DENR reports that the completion of the combined model and the publication of a new Cape Fear water resources plan will take longer because these elements are critical components in the EMC's ongoing 4th round of the Jordan Lake water supply allocation process. At present, the updated Cape Fear Plan, the combined Neuse & Cape Fear hydrologic model, and the new allocations are projected to be completed by the spring of 2013, if there are no allocations that will require an IBT certification.

Regarding DWR's current efforts in the Roanoke Basin, the Division of Water Resources reports that it is working on an update and expansion/enhancement of the existing hydrologic model (which will include

[12] DENR, Division of Water Resources, Neuse River Basin Water Resources Plan (July 2010) at 1-5-6.

the entire basin), but, at present, there is no scheduled completion date for this project. Roanoke Basin model kickoff meetings have been scheduled for December 13 and 17, 2010, in Weldon and Reidsville, respectively. The complications with the Roanoke schedule include:

- The Roanoke update is intrinsically linked to the Kerr Lake Regional WS IBT impact analysis. Therefore, DENR is trying to coordinate the IBT analysis with the big picture planning needs.

- DENR is still trying to determine the best approach to handle all the overlapping interstate issues in this basin that involve Virginia, work with the USACE on the Kerr 216 study, and how best to coordinate North Carolina's planning efforts with the Roanoke Bi-State Commission's needs and expectations.

DENR has not yet developed a full schedule for completing the models for the remaining basins. For the 2011 session it does not need additional funding as the ongoing work has adequate funding for the next two years. Costwise, it estimates the Yadkin model to cost $250,000; less for smaller basins such as the New and Lumber. DENR has a report due by November 1, 2011, with a full schedule to the ERC, which is supposed to present as well the agency's thoughts on areas with the highest probabilities of shortages. It is planning to meet in January, 2011 with TVA to start discussions on the best approach for the Tennessee Valley sub-basins (Watauga, French Broad, Little Tennessee and Hiwassee Basins).

F. Instream Flows in North Carolina

Introduction and current regulation

"Instream flow" is the amount of water needed in a stream to adequately provide for uses occurring within the stream channel. Instream uses may include some or all of the following: aquatic habitat, recreation, wetlands maintenance, navigation, hydropower, riparian vegetation, and water quality. In North Carolina, the instream flow has historically been equated with the "7Q10," which is the lowest flow expected to occur on a particular stream for 7 consecutive days once every 10 years. The 7Q10, however, is a very low flow which under natural conditions is the result of drought. This understanding of "instream" or "minimum flow" as equal to "7Q10" has arisen largely from the use of that statistic to calculate wasteload allocations for purposes of discharge permits. It has nothing to do with the needs of other instream uses besides wasteload allocation. Managing water flows for long-term sustainability will requiredifferent, probably more complex, flow regimes that protect ecological integrity. In order for the instream flow to provide for all instream uses, the State must develop a better understanding of flow requirements.

North Carolina's efforts to maintain instream flows have been limited to minimum flows or minimum releases from dams. As the state's water withdrawals increase for municipal, industrial, irrigation, or power generation, minimum flows no longer accurately reflect the hydrologic needs of the ecosystem. Minimum flows are intended to be low flows of short duration—not the new normal. Minimum flows

also fail to incorporate all aspects of a flow regime, including the magnitude, timing, frequency, duration, variability, and rate of flow change. Minimum flows do not account for seasonable variability or variability across years.

The only North Carolina statute that directly regulates withdrawals is the Water Use Act of 1967 (Capacity Use Area). The Water Use Act of 1967, G.S. 143-215.11 through .22, provides for the designation by the Environmental Management Commission of capacity use areas--areas in which the supply of water (surface and/or groundwater) is insufficient to meet demand. Water withdrawals in capacity use areas require coordination and regulation, in order to protect the interests and rights of residents and property owners and of the public interest. Instream flows can be protected through imposition of conditions by the Division of Water Resources when reviewing various other permits. These permits include sections 401 and 404 of the Clean Water Act, the N.C. Dam safety Act, federal hydropower licensing, and reviews and environmental studies required by the National and State Environmental Policy Acts.

Ecological Flows

Ecological flows are a more comprehensive approach to understanding flow requirements. The 2010 legislation on river basin modeling in North Carolina specifically directed DENR, including the Environmental Management Commission and a newly created Science Advisory Board, to work out an approach to the modeling of ecological flows in the state. Further work on instream flows in North Carolina should be done only with the insight and input gained from the work required under this 2010 legislation, which defined ecological flow as "the stream flow necessary to protect . . . . the ability of an aquatic system to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity and functional organization comparable to prevailing ecological conditions and, when subject to disruption, to recover and continue to provide the natural goods and services that normally accrue from the system."

Other states are also in the middle of review processes for their instream flow approaches. DENR and its Division of Water Resources as well as the Wildlife Resources Commission should continue to monitor this work through participation in interstate groups and conferences.

IV. Revised Findings and Recommendations

On the basis of further work in 2009-2010, the Water Allocation Study Team continues strongly to believe in the importance of its original nine recommendations. But the work underway on river basin modeling should give the state a better basis for its future, deferred decisions about water withdrawal permitting or other significant new ways to manage water conflict. And in lieu of a general, legislatively-led directive on how to carry out river basin planning, the study team believes that much will be learned by encouraging and analyzing the nascent regional planning efforts that are now arising on their own. It may be that a diverse, "bottoms-up" generated set of planning organizations, with tailored authority and modifications appropriate to the particular water challenges in each region, will be preferable to a Georgia-style statewide water plan.

1. **The PIs found most stakeholders support legislation clearly stating policy goals to guide administrative and judicial decisions in concept but have not agreed to specific policies and language.** Legislation setting policy goals deserves and requires considerable time for public and legislative discussion and debate. Economic recovery, balancing the state's budget and other pressing issues are likely to require most of the 2011 General Assembly's time. Furthermore, a number of important water disputes are working their way through the Office of Administrative Hearings and the courts, including *L&S Water Power, Inc. v Piedmont Triad Water Authority* (seeking compensation for downstream hydropower water users from upstream reservoir construction despite permitting by the State). Decisions in these cases may clarify or unsettle North Carolina's complex mixture of common and statutory water law. **The PIs recommend that the ERC ask the stakeholders to continue to work with legislative staff on policy goals and report to it before the 2012 Session of the General Assembly.**
2. **The PIs found that only NC and one or two other states do not require permits for large water withdrawals. Many industrial and local government stakeholders recognize the value and certainty that state water withdrawal permits provide to them. Most agricultural stakeholders oppose water withdrawal permits.** Some stakeholders would be more willing to accept water withdrawal permits in exchange for relaxation or repeal of the state's law regulating interbasin transfers of water. Other stakeholders oppose amending the state's interbasin transfer law. The South Carolina

General Assembly, SC Department of Health & Environmental Control and SC stakeholders discussed and debated Act 247 (SB 451) for over five years before enacting it in 2010. The details of many provisions of a permitting program require and deserve considerable time for public and legislative discussion and debate**. The PIs recommend that the ERC ask the stakeholders to continue to work with legislative staff and DENR on water withdrawal permitting and report to it before the 2012 Session of the General Assembly.**

3. **The PIs found that North Carolina may have economically recoverable shale gas resources in the Triassic Basin, including Chatham, Lee and Moore Counties in the Cape Fear River Basin. Extraction of shale gas requires large volumes of water. West Virginia, Pennsylvania, New York, Susquehanna River Basin Commission, and Delaware River Basin Commission regulate water withdrawals for gas extraction in the Marcellus shale. The PIs recommend a moratorium on water withdrawals for shale gas development until the relevant river basin model has been completed and shows there is no water resource problem for existing users.**
4. **The PIs found and recommend that conforming existing laws to each other and to policy goals will have to wait until policy goals and water withdrawal permitting are set.**
5. **The PIs found growing support and interest in the development of hydrologic models. The PIs recommend that DENR continue to implement SL 2010-143, Improve River Basin Modeling, and develop models for each river basin. The PIs recommend that DENR work with the General Assembly, water withdrawers, other states, and other stakeholders to fund the development of models for the remaining river basins, including the French Broad, Little Tennessee, Lumber, New, and Roanoke Rivers by 2013.** The French Broad Water Resources Study Committee, staffed by the Land of Sky Regional Council, and a working group in the Lumber River basin, staffed by the Lumber River Council of Governments, would utilize hydrologic models for water resources planning. **The PIs found that the energy-**water model developed by Duke Energy for the

Catawba-Wateree River Basin in 2005 predicts water shortages between 2048-2058. The Catawba-Wateree Water Management Group (Duke Energy and the water utilities that withdraw water from the basin) have funded a study to update to safe yield analysis for the basin to include the 2007-2008 new drought of record, climate change and other information. The update will be completed in 2011. The PIs also found that the hydrologic model developed by DENR for the Neuse River Basin appears to predict water shortages in the Upper Neuse/Research Triangle region in the very near term. The PIs found little support or interest in trying to apply the Water Use Act of 1967 and write state rules to address these future shortages.

6. **The PIs found that most successful regional collaboration and environmental problem solving from the Catawba to the Delaware to the Neuse requires an outside driver, like the FERC in the Catawba, the US Supreme Court in the Delaware and the Environmental Management Commission in the Neuse (Falls Lake rules).** Although the state transportation system is heavily centralized, the NC Department of Transportation relies upon metropolitan planning organizations (MPO) and rural planning organizations (RPO) to develop regional transportation solutions and to set priorities. Because the state's "water system" is heavily decentralized, DENR and water users would benefit from regional water planning organizations that can share information and resources, evaluate tradeoffs, minimize conflicts, and develop cost effective solutions. **The PIs recommend that the ERC ask the water withdrawers and other stakeholders in the Upper Neuse River Basin what steps they individually or collectively plan to take to balance the water budget in their region. The PIs further recommend that the ERC ask the Catawba-Wateree Water Management Group for a briefing on its updated safe yield analysis in 2012 and if necessary what steps they plan to take to balance the water budget in their region.**
7. **The PIs found that DENR's strategic plan commits the Department to integrating water quality and quantity and that staff of the Division of Water Resources and the Division of Water Quality have begun discussing coordinating and integrating their planning.**

Water withdrawals can affect water quality; wastewater discharges or returns affect water quantity. Water quality models are built upon hydrologic models. Both stricter water quality standards and limited water resources will likely increase stormwater capture and reuse and use of reclaimed water and could reduce downstream flows. The PIs recommend that the ERC direct DENR to integrate its river basin based water quality and supply planning starting with the next Neuse River Basin Plan in 2012 and Cape Fear River Basin Plan in 2013.

8. **The PIs found that consolidating and improving reporting and planning and reducing reporting burdens will require time and resources by DENR and by local governments. and that no legislative proposals have been drafted for the 2011 General Assembly. The PIs recommend that the ERC ask DENR, NC League of Municipalities, NC Association of County Commissioners, NC American Water Works Association, and other interested parties if an effort to consolidate and improve reporting is a high enough priority to devote staff resources to the project after the 2011 General Assembly adjourns.**
9. **The PIs found growing support for the importance of operating and maintaining water infrastructure to the State's economy and environment. The PIs also found that the policy set by the General Assembly in SL 2008-143 (drought bill) requiring water utility revenues to exceed expenses in order to qualify for state financial assistance; the review of financial audits submitted by local governments to the State Treasurer; the technical assistance and training provided by the Environmental Finance Center at UNC-Chapel Hill, Rural Economic Development Center, NC Rural Water, and others; the work of the State Water Infrastructure Commission (SWIC) ; and the recent enactment of SL 2010-144 (water infrastructure needs bill) requiring the State Treasurer and DENR to improve coordination of the financial and environmental review of water systems are bearing fruit and are encouraging proper operation and maintenance of water infrastructure. The PIs support the recommendations made by the Treasurer and DENR to improve coordination in their November 1, 2010 report to**

the General Assembly. The PIs note that the Treasurer's office reports a large number of water systems in financial difficulty because of the recession, aging infrastructure, increased costs and other factors. The PIs recommend that the ERC request annual reports from the Treasurer and DENR as set out in SL 2010-144.

10. **The PIs found broad support for increasing water efficiency. The Georgia General Assembly enacted the Georgia Water Stewardship Act in 2010. DENR provided a number of water efficiency options in a 2009 report. The PIs recommend that the ERC consider recommending legislation like the Georgia law. The PIs note that Duke Energy and water utilities in the Catawba-Wateree Water Management Group are working closely together and may find opportunities to increase both water and energy efficiencies.**

11. **The PIs found that summer demand for water for lawn and landscape irrigation in some regions increases the risks for water shortages and increases the costs of building water infrastructure sized to meet peak demands. The PIs also found that the Green Industry of nurseries and landscapers is vulnerable to boom and bust cycles between droughts because water systems restrict outdoor water use during droughts. The PIs recommend that the ERC consider banning the use of drinking water for lawn & landscape irrigation in new developments by January 1, 2015, either statewide or in regions where shortages are likely to occur. The PIs believe that more efficient irrigation systems combined with stormwater capture and reuse and reclaimed water could meet the demand for lawn and landscape irrigation for new development. The PIs further believe this policy would make both water systems and the Green Industry more resilient during times of drought.**

12. **The PIs found broad support for maintaining and increasing water storage. The PIs recommend utilizing the local water supply plans and other data to assess condition of existing water supply dams and reservoirs. How many dams need to be repaired and replaced? How much will repair and replacement cost? How much**

capacity has been lost to sedimentation? The PIs support the Division of Water Resources' proposal for the State of North Carolina to acquire NC's share of water supply storage in Kerr Lake from the US Army Corps of Engineers. (The Commonwealth of Virginia would acquire VA's share.) Water utilities in Georgia are beginning to develop off-stream reservoirs, including old quarries. The PIs believe that off-stream reservoirs have potential in NC as well. The PIs recommend using existing LIDAR data developed for the state's floodplain mapping program to improve and digitize stream maps and to aid in the identification of sites. (The 2004 General Assembly asked the NC Geographic Information Coordinating Council to develop and adopt aplan to improve and digitize stream maps. The GICC adopted a plan in 2005.) The PIs further recommend that the ERC consider legislation to provide authority to local governments and/or DENR to preserve water storage sites and prevent inappropriate development, similar to the authority that local governments and the Department of Transportation have to preserve right of way for planned transportation improvements. Dr. David Moreau at UNC-Chapel Hill has suggested that storage in certain reservoirs be reallocated to higher value uses. Capturing and reusing rainwater and stormwater for lawn and landscape irrigation and other non-potable purposes could reduce water supply and water quality problems. The PIs recommend that the ERC direct DENR to credit the use of stormwater BMPS for water harvesting. The PIs recommend that DENR continue working with the NC Department of Agriculture, and the Soil and water Conservation Districts, US Natural Resources Conservation Service and others to develop best management practices and technical and financial assistance programs for water quality and quantity, including more efficient irrigation systems, alternative watering systems for livestock, and maintenance of farm ponds.

V. Conclusion: Future of Water in NC

North Carolina is geographically blessed with ample precipitation in normal times. If the state manages its water resources properly, they can be a huge comparative advantage to the economy and the quality of life in the state. Almost all experts predict significant conflict over scarce water in much of the world, including the United States, in the near future.

However, the legacy of this ample water supply is a set of institutions, laws, and policies that do not deal very well with places and times of water scarcity. Even in North Carolina, as in the rest of the southeast, there are likely to be many more such places and times in the decades to come.

The recommendations in the 2008 report of the Water Allocation Study, as revised and extended in this report, would build on the water resource laws, institutions, and policies already in place in North Carolina to protect economic investments and the state's environment. The study team believes that adoption of these recommendations would greatly help ensure the long-term future of quality of life in North Carolina. The study team stands ready to assist the legislature and the many stakeholders on these issues as they discuss and debate these recommendations.

Appendix: Water Allocation Research Seminars

1. Mary Sadler of Hazen & Sawyer and Kenny Waldrop of Raleigh discussing the process of determining ecological flows in connection with proposed water storage reservoirs on the Little River and at Lake Benson. Feb 12, 1 pm, J.C. Raulston Auditorium, Raleigh. Abstract
2. Rick Hooper, President & Executive Director of the Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI) on "Advancing Hydrologic Science through Community Engagement" on February 19 at Duke
3. Leigh Askew, Fanning Institute, U. of Georgia, discussing the Georgia Water Plan, March 1
4. David Baize and Chuck Gorman, SC DHEC on "The Surface Water Permitting Experience in SC" on March 19 at 9:00 am at the Albert Coates Local Government Center at 215 N Dawson St in Raleigh (before the SWIC meeting at 10:30).
5. Richard Whisnant on "Fire & Water: Making Meaning out of Water Resource Policy, the keynote address at the annual conference of the Water Resources Research Institute (pdf of the powerpoint here, and draft text of the speech itself here) on March 30 at 9:00 am at NC State University's McKimmon Center.
6. Peter Raabe, NC Conservation Director for American Rivers, on the potential to increase water efficiency in NC (working title) on April 16 at 1:00 pm at the Albert Coates Local Government Center at 215 N Dawson Street in Raleigh (Directions: http://www.nclm.org/findus.htm).
7. Dr. Dave Moreau, Professor Emeritus, UNC-CH, on "Storage of Water in New & Old Reservoirs" (pdf file here) on April 23 at 1:00 pm at NC State University's J C Raulston Arboretum (Directions: http://www.ncsu.edu/jcraulstonarboretum/visit/visitor_information/directions.html).
8. Elizabeth Kistin, Research Associate in Water Resources at Duke University's Nicholas Institute for Environmental Policy Solutions on "Barriers to Basin-Wide Allocation and Opportunities for Overcoming the Zero-Sum Mentality: Lessons from the Orange-Senqu Basin in Southern Africa" on April 30 at 1:00 pm at A148 Levine Science Research Center at Duke(www.parking.duke.edu).
9. Dr. Carol Couch, Senior Public Service Associate, College of Environment & Design, University of Georgia and former Director of the Georgia Environmental Protection Division, will speak on Perspectives on the Georgia Water Planning Process on Friday, May 14 at 9:30 am in the Ground Floor Hearing Room of the Archdale Building (DENR) at 512 North Salisbury Street in Raleigh Georgia has invested about $30,000,000 in statewide and regional water planning .
10. Katie Kirkpatrick, P.E., Vice President of Environmental Affairs, Metro Atlanta Chamber, on Atlanta's situation and recent water management analysis and approaches in Georgia (with some additional slides on Georgia's new water efficiency/conservation legislation) on Monday, June 21 at 1 pm at NC State University's J C Raulston Arboretum.
11. Jim Mead, DENR Division of Water Resources Instream Flows Section, will present a WARS Seminar on NC's evolving approach to ecological flow determination. Raulston Arboretum, Raleigh, 1 pm. Jim's presentation at the WARS Seminar is here...Jim's earlier presentation on the topic to the 2010 NC Water Resources Research Institute conference is here.
12. Christophe Tulou, DC Director of the Environment, on Greening DC and Capturing and Reusing Stormwater, on September 10 at 1:00 pm at Durham City Hall
13. Scott Potter, Director Nashville Metro Water Services, on "Nashville's Approach to Water Quality" and "Nashville's Recovery From a 500 Year Flood" on Friday, October 15, 2010 at the City of Raleigh's Wetlands Education Center at 950 Peterson Street in Raleigh 27610. Metro Water Services provides drinking water, wastewater, stormwater, watershed management and other water services for Nashville and Davidson County, Tennessee.
14. David Welch, Director Division of Laboratory Services St. Johns River Water Management District, on "Water Management Districts in Florida, Ambient Monitoring Programs, Past Present and Future." October 29, 2010, place TBD.