

Integrated Watershed Management in North Carolina's Upper Neuse Riverbasin:
A Blueprint for Future Collaboration and Consensus

by

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Abstract

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The availability of clean and plentiful water in watersheds is often taken for granted, and is becoming increasingly difficult to ensure. Water conservation to preserve future water availability is necessary particularly in rapidly urbanizing areas like the Triangle region of North Carolina. The main potential causes of water scarcity in North Carolina currently are population growth, uneven distribution of water, and overuse of the resource. Issues specific to North Carolina watersheds are aquifer depletion, saltwater intrusion, overuse, upstream/downstream issues, trans-boundary conflicts and water quality. A drought, as occurred in 2007, can amplify these problems, and the ability to adapt to drought is dependent on excellent management and adequate regulations. The use of an adaptive management approach, such as Integrated Watershed Management, which has been used to varying degrees of success in recent years, should be developed in the Upper Neuse River Basin region to best cope with these issues. Through an analysis of several case studies in watersheds where IWM has been used, key elements necessary for success will be identified and applied to the Upper Neuse River Basin and its stakeholders. This will help future water managers in the region cope with these evolving water quality and quantity issues.

Biography

Growing up on the beaches of South Florida as a child, I learned early on the joys of sandcastle-making and red snapper dinners. Every morning at eight o'clock, my grandparents and I would make our way to the same shady spot under three coconut palms, where my adventure began. Neon-pink shovel and bucket in hand, I spent hours along the turquoise water, picking up whatever I could find - spiraled seashells, weathered beach glass, an occasional sand dollar. In late summer, the Gulf Stream would bring in swaths of seaweed under which numerous unidentifiable fish of odd shapes and colors would swim, easily caught by my large bucket. They would swim contently for an hour or so, when my grandmother would say, "It's time for the fish to go home now", and I would release my treasure to their true home amongst the waves, glad for the afternoon company. It was during my childhood that I learned to love and appreciate Nature.

In college, after much searching for the right major, I decided I loved anthropology, studying the way people have lived and survived in the natural world, and chose a minor in environmental studies after taking an introductory course and learning the seriousness of ecological problems facing mankind. The interface of ecology and society, and the need for better laws and regulations to manage the environment, led me to apply for law school. In my law study, I focused on environmental law and environmental equity, working to protect the public's rights to a clean environment. I interned at Legal Aid of NC, working in the environmental poverty law project representing underprivileged clients. In spring 2007, I re-entered school at North Carolina State University to study for a master degree in natural resource management at the Department of Forestry and Environmental Resources with a focus on policy and administration. At NC State, I have had many great opportunities including traveling abroad to Chile, serving as a teaching assistant for several classes, and taking a variety of informative field trips in the beautiful NC natural environment. In the summer of 2008, I spend six weeks at the Duke Marine Lab in Beaufort, NC, learning more about coastal management and problems in the ocean environment. It is my hope that my MNR degree will

complement my law degree, and will add more knowledge and experience in the environmental arena, particularly in water policy and coastal and wetlands protection. I would like to work for the federal or state government in watershed management and continue to be active in advocacy groups and NGOs.

In my other life, I like to write poetry and paint. Also, I enjoy gardening, cooking, and living in the country with my 3 cats, 2 dogs, and 1 musician-husband. Traveling to natural places and seeing diversity is another love that I hope to continue to explore.

Acknowledgements

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Also, I would like to express gratitude to my graduate committee members, Dr. William Kinsella and Dr. James Gregory for their participation and enthusiasm for my project. Dr. Kinsella works actively to bridge the gap between communications and the environment, and his work has inspired me to further my interest in this area. Dr. Gregory is a foremost expert in hydrology, stream ecology and water conservation in North Carolina, and I am honored to have his guidance in my paper. I would like to thank Dr. Sarah Warren for her deep insights into the social relationship with water that generated my interest for this subject. I would like to thank Dr. Gary Blank for allowing me to work as a teaching assistant for him and learn about forest history. Finally, nothing would be possible without the constant support and love of my family, John, Mom, Dad, Jim, Grandma, Sandy, Seamus, Nimo, Luna, and Little Bee.

Introduction

“The trouble with water, and there is trouble with water, is that they’re not making any more of it. There is the same amount of water on the planet now as there was in prehistoric times. People, however, they’re making more of, many more, far more than is ecologically sensible. Humans consume water, discard it, poison it, waste it, and restlessly change the hydrological cycles, indifferent to the consequences: too many people, too little water, water in the wrong place and in wrong amounts. “--- Marq de Villiers, *Water: The Fate of Our Most Precious Resource* (2000)

Water, which is essential to all life, is becoming scarcer all over the world. As population and development increases, demand for water increases while the supply of water is limited. According to Gregersen, Ffolliott, & Brooks, “Increasing human populations and the need of alleviating or preventing water scarcity will remain one of the, if not the paramount, natural resource-related issue faced in the 21st century” (2007, p. 4). Global warming is predicted to bring more severe weather fluctuations in rainfall patterns, with periods of drought and flooding (Frederick & Gleick, 1999). Large amounts of water may be needed to squelch the flames of more intense and frequent wildfires. In the summer, when droughts are more common, more water is needed for human consumption, agriculture, and cooling systems. Humans cannot live without water for more than 3 days.

One-third of all water that runs to sea is accessible by humans and one-half of that is already being appropriated and used, much of what is available is degraded by eroded silt, sewage, industrial pollution, chemicals, excess nutrients, and plagues of algae (Gregersen *et al.*, 2007). The US has a theoretical availability of over 9,000 cubic meters per person per year, more than five times the stress level (Gregersen *et al.*, 2007). Yet there are water shortages, “virtually all the available rivers have been dammed, and already more water is being shifted

from one place to another than in any other country on earth, and major wetlands have been thoughtlessly drained” (Gregersen *et al.*, 2007, p. 25).

While water scarcity has been a well-known fact of life in the semi- arid and arid regions of the American West and Southwest, the Southeastern United States has historically had a lot of good water for everyone. That was before everyone decided to start moving here. It is among the fastest growing regions of the country, and that places a strain on water systems that were designed and regulated for a smaller population. Meeting the water needs of humans and wildlife is becoming a huge challenge. Widespread development in the Southeast reduces water quality and quantity. Power plants need more and more water to cool their energy generators. Erosion and sedimentation due to development and deforestation degrades rivers and impedes stream flows. Local and natural reservoirs are being depleted because they are being drained at faster rates than can be produced naturally. The number and size of streams and rivers are diminishing, leading to saltwater intrusion, which could cause a major problem for irrigation. During droughts, which have intensified in recent years, the stress on water resources becomes even greater. Improved management strategies are now needed to cope with these increasing numbers of people and problems.

A critical aspect to remember in all watershed planning is the upstream/downstream connection. Water flows downstream ignoring all political boundaries (Gregersen *et al.*, 2007). Most of the things people do to their land and water upstream affects the water quality, timing of flow and quality downstream. “What is done on upland watersheds of one country, state, community or landowner can significantly affect other countries, states, communities, or landowners occupying a downstream location” (Brooks *et al.*, 1992). This has been the case within large river basins such as the Mekong River Basin, the Amazon River Basin, the Congo and Nile river basins and the Mississippi River Basin (Manzungu, 2004). On the Neuse River Basin in North Carolina, development and its effects and water allocation for drinking reservoirs from the populated Triangle region has affect the lower river basin users who use the water for more agricultural uses. In turn, the hog farms of the lower Neuse region and its related

pollution and *Pfiesteria* problems affect the further downstream coastal fishing economies (see Appendix B for further discussion).

There is a pressing need for improved water resource management in North Carolina. Dr. George R. Hess, a professor at NC State University believes implementation of water conservation plans in the Central Piedmont region of North Carolina is difficult due to "rapid suburbanization, changes in habitat, high land prices, and large number of municipal and county governments in the region" (2001). While some argue there is plenty of water right now, the future availability and quality of water is uncertain. It is best to err on the side of caution, and take preventive steps to ensure water is clean and plentiful. This study focuses on the Upper Neuse River Basin that encompasses the Research Triangle region of North Carolina, located in the central piedmont of North Carolina. The Research Triangle is (RTP) is the largest research park in the United States. It is located near Durham, Raleigh, and Chapel Hill in the Research Triangle region of North Carolina.

The question posed is:

"How can stakeholders in the Upper Neuse River Basin be enabled to act in a cooperative and coordinated fashion to achieve future water availability as best as possible?"

To answer this question, it is necessary to have a good knowledge of the "biophysical realities of the watershed and its response to natural forces and the actions of humans" (Gregersen *et al.*, 2007, p. 26). Also, an understanding is needed of the institutional dynamics of the communities that exist within the Upper Neuse River Basin, the motivations of the various stakeholders, and the incentives that would influence them to change their actions that adversely affect the watershed within which they live and work (Gregersen *et al.*, 2007). To reduce and manage potential conflicts between citizens, businesses, NGOs, and cities, a collaborative approach using adaptive management should be developed to incorporate all stakeholders in making water allocation decisions. *Integrated Watershed Management (IWM)*

is a modern strategy being incorporated across the world that has shown promise of success. Water management is a very complex task and should be tackled in a broad holistic way, from an ecological, political, socio-cultural, and economic perspective. “An effective interaction of institutional and technical information is required for successful watershed management that results in lasting benefits to the stakeholders living in the watershed or river basin” (Gregersen *et al.*, 2007, p. 3)

“Ultimately, effective planning and management are dependent on local cooperation and participation” (Gregersen *et al.*, 2007, p. 75). Public awareness and education are keys to solving the water problems now and in the future. Concern about water conservation does not always come naturally, and therefore, the media play an important role. Individual choices on a large scale, such as choosing to water your lawn, going to a car wash, or choosing organic gardening methods, can have huge effects on a watershed. Many environmental regulations and policies came out of public concern and pressure, but people must know there is a problem first. Educators can teach water conservation in schools so that future generations will be able to cope with these issues. Local community organizations and river associations bring people together for educational workshops, conservation and rehabilitation projects, and recreation opportunities. Therefore, education, public outreach, and using media to increase communication should be included in any Integrated Watershed Management Plan.

Upper Neuse River Basin

The Neuse River Basin is one of the fastest growing river basins in the nation in terms of population. Approximately 2 million people, one-sixth of the state’s population, reside in the basin. The Neuse River originates in North Carolina’s northern Person and Orange counties, and runs southeast through 18 counties and 74 municipalities. The river’s watershed spans an area of almost four million acres and is one of only four watersheds whose boundaries lie completely within the state. With more than 3,400 miles of tributaries, the river flows from the Upper Neuse River Basin for 250 miles into the Lower Neuse sub-watershed, where it greatly broadens at New Bern and becomes a tidal estuary eventually pouring into the Pamlico Sound

(Burke, 2009). The Neuse River has many uses in North Carolina, such as for fishing, wildlife habitat, drinking water, agriculture, and recreation.

There are 70 separate water systems in the Neuse River Basin that have local water management plans registered with the North Carolina Division of Water Resources (NCDWR 2008). Most are municipalities, but others are non-profits, businesses, authorities, or districts (NCDWR 2008). There are 9 public drinking water reservoirs in the Upper Neuse River Basin: Falls Lake, Lake Michie, Little River Reservoir, Lake Holt, Lake Orange, New Hillsborough Lake, Lake Johnson, and Lake Rogers. The river, via Falls Lake, provides drinking water to 400,000 Raleigh-area residents, which includes the towns of Garner, Rolesville, Wake Forest, Knightdale, Wendell and Zebulon. There are also numerous NGOs which work in the Upper Neuse Riverbasin, and are involved either directly or indirectly in managing the Neuse River and its water. (*Appendix A* at the end of this paper provides a partial list of NGOs and their websites for more information describing these stakeholders).

There are many current problems facing the Neuse River. The Neuse was designated as one of North America's most threatened rivers by the American Rivers Organization in 1995, 1996, 1997 and 2007 (Burke, 2009). The 2006 North Carolina Clean Water Act Section 303(d) Threatened and Impaired Waters List, which lists water bodies that are impaired or are threatened to be impaired by pollutants, has 41 waters listed within the sub-watersheds making up the Neuse River watershed (Burke, 2009). Of these, the Upper Neuse has the most waters listed, at 28 (Burke, 2009). According to the EPA's Section 303 (d) list Fact Sheet for the Upper Neuse Watershed, problems with biological integrity were the main reasons, and Crabtree Creek had the most impairment in the Upper Neuse River Basin (EPA, 2009). Some main issues facing the Neuse River are drought, pollution, rapid development. There are many related problems as well, such as conflicts between municipalities, water quality, PCB contamination in Lake Crabtree, *Pfiesteria*, and pollution caused by hog farms, sedimentation and storm water runoff (Neuse River Foundation, n.d.).

In his resignation letter, Dean Naujoks, the former Upper Neuse Riverkeeper with the Upper Neuse River Basin Association, gave some advice for the future of the Upper Neuse River which sums up many of the problems in the region (Raleigh Eco News, 2008):

“Increasing population growth combined with poor land use practices will continue to degrade our water resources. As we have seen with recent droughts, our drinking water supplies will continue to be strained due to global climate change and unsustainable development practices that fail to link projected population growth to available water supplies. We need local governments to understand there are limits to growth and avoid short-sighted solutions like inter-basin water transfers or restricting flows to the river and downstream communities. Many of the solutions to deal with these problems already exist, but we need our elected officials to recognize the environmental and economic value of clean water rather than cave into industry lobbyists who profit from compromising our public trust waters.” (as cited in Raleigh Eco News, 2008)

Review of Paper

Through background research and two case studies, I investigated the major elements of the problems and the solutions to water management in the Upper Neuse River Basin. The first section on population growth, urbanization and development discussed the major problem these issues have on water resources. The second section discusses smart growth practices which can help alleviate the problems of development that were discussed in the first section. The third section discussed the concepts of adaptive governance, integrated watershed management and co-management and key elements of these concepts that can be utilized by water resource managers in planning. The fourth section explores the idea of collaboration and consensus building and its importance to watershed management. The fifth section touches on water conflicts more specifically and how conflicts more generally occur in natural resource contexts. The sixth section explains water law and ways to make more effective law in watersheds. The seventh section looks at the confounding issue of drought to this Riverbasin

and how the 2008 Drought Bill in North Carolina helps and could be improved. The eighth section briefly addressed the importance of public awareness and the media in any watershed plan. Then, two case studies are described and discussed to help analyze elements that may or may not be effective in any watershed management plan for the Upper Neuse Riverbasin. Finally, through this discovery, a “Blueprint for the Upper Neuse Riverbasin” is listed that can be used as a preliminary, holistic checklist for water resource managers to use to better ensure the future sustainability and integrity of the Upper Neuse Riverbasin watershed.

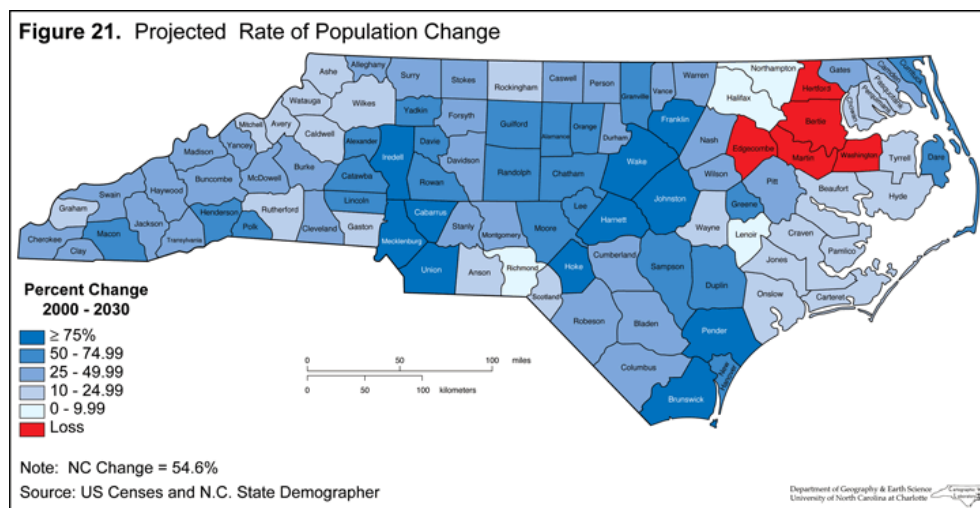
Population Growth, Urbanization, and Development

Population Growth, urbanization, and development in the Upper Neuse River Basin are growing basin-wide threats that are poised to exacerbate the problems associated with factory hog production farther downstream. With population in the Neuse River basin projected to increase by one million in the next 20 years, major developments are being proposed in both the upper and lower watersheds. This threat is far-reaching and multifaceted (Neuse River Foundation, 2008) and proper watershed planning is an urgent need if water is to remain in ample supply for the Neuse River Basin as a whole.

The EPA “recognizes that land use decisions occur at the state and local level, and that inter-jurisdictional coordination at the watershed or regional level results in more effective protection of water resources” (EPA, 2008c). Currently, the Triangle region, which is in the Upper Neuse region, is undergoing rapid development and major shifts in land use that will alter ecological communities (Hess 2001). The population in this 972,000 hectare region has roughly tripled since 1950, to approximately 1.1 million people in 1999 (Hess 2001). Between 1950 and 1990, the amount of urbanized land, as defined by the United States Census Bureau, increased more than 10-fold, from 70 km² to 730 km² (Hess 2001). As a whole, North Carolina has lost more commercial forest area than any other U.S. state, over one million acres from 1982 to 1997 (Bardon, Moorman, & Hamilton, 2002). In the Triangle, approximately 5200 hectares of forest were converted to developed land each year between 1987 and 1997;

an additional 2200 hectare of crop and pasture land were converted annually (Hess, Dixon, & Woltz, 2000).

A copy of Figure 21, provided by the University of North Carolina- Charlotte, shows the projected population growth in North Carolina by 2030. Wake County is projected to grow by over 75 percent and the surrounding areas between 50 to over 75 percent. Raleigh residents consume an average of 52 million gallons of water daily, with the number hitting 70 million gallons on a peak day. Dale Crisp, Raleigh’s public utilities director explained, "If you were to average (water usage) over the past five to six years, it's increased 3 percent each year," (as cited in Bachman, 2007).



There are great challenges to increase yield and resilience of water supplies in the high-growth regions of the central North Carolina Piedmont region. Because the population is dispersed in a scattered pattern across the Piedmont, there are very few sites where significant new reservoirs could be built that would not impinge on other towns’ jurisdictions and substantial developed property (Whisnant *et al.*, 2008). In addition, North Carolina’s laws regarding inter-basin transfers make it very difficult to move large quantities of water (more than two million gallons per day) from one river basin to a city in another river basin (Whisnant *et al.*, 2008).

New reservoirs would be very expensive and would require either extensive intergovernmental cooperation, or years of litigation. The problem is that many of the towns that might optimally be part of a multi-jurisdictional solution have historically kept their water rates as low as possible (Whisnant *et al.*, 2008). In order to make the needed investments in additional supply and maintenance of its infrastructure, water rates would have to be substantially higher than the rates charged now (Whisnant *et al.*, 2008). “This kind of price system would provide a straightforward mechanism to protect the resource” (Berardo, 2005). Maintaining present rates is out of alignment with the reality of population growth, such as where that growth will occur, and how long it will take to site significant new water storage facilities (Whisnant *et al.*, 2008) (UNC Study). However, politicians answer to voters, who prefer low rates and large amounts of water, and are reluctant to look for alternative sources of water (Berardo, 2005). Educating the public about overconsumption and using incentives to encourage conservation would help to alleviate some of this problem (Berardo, 2005).

Rapid development and population growth are also causing water pollution in the Triangle region of North Carolina. Atasoy, Palmquist, and Phaneuf (2007) reported that water pollution in watersheds, such as the Upper Neuse River Basin, due to urbanization is a concern in the Triangle. Waterways, which flow through developed urban land, are subject to numerous sources of polluted runoff (Atasoy *et al.*, 2007). Sediment running off poorly managed developments significantly degrades water quality. Greater populations generate more nitrogen from human and pet wastes, lawn fertilizers and auto exhausts. The spread of paved surfaces leads to huge surges in polluted runoff after storms. New construction can also harm or completely destroy vital wetlands and protective buffers along rivers. These “changes in land use, runoff from construction sites, residential fertilizer runoff, and point source pollution all negatively impact water quality” (Atasoy *et al.*, 2007). Therefore, urban water quality regulation should consider the impact of the location and timing of residential land use and land development (Atasoy *et al.*, 2007). While state and federally mandated pollution reductions have been implemented in recent years, the benefits to the health of the Neuse River have been minimal (Jobsis, Baldwin, & Naujoks, 2007). Upstream discharges and

development have already landed Falls Lake, the second largest drinking water reservoir in the state on the 2008 list of impaired waters from excessive nutrients (Jobsis *et al.*, 2007).

North Carolina should pursue a multifaceted approach to solve problems related to growth and development. It should seek to encourage, and perhaps, require smart growth practices along the Neuse River. Runoff can be reduced through clustering of development, thereby leaving larger open spaces and buffers. Although compact development generates higher runoff and pollutant loads within a development, total runoff and pollutant loads are offset by reductions in surrounding undeveloped areas (“Environment”, 2008).

While smart growth is extremely important, growth could also be limited reserving riparian land for other uses, and should pursue preservation of pristine areas along the Neuse River. Restoration of the river is another way to mitigate impacts of growth along the Neuse.

Smart Growth Practices

Development should not continue on the Neuse River in the same pattern as in the past. The developers and landowners in the Upper Neuse River Basin are in need of greater guidance for implementing smart growth practices. The EPA has issues a few guidelines for smart growth building to protect water resources which are the following: (EPA, 2008a):

- Establish community goals for water resources in the watershed
- Direct development where most appropriate for watershed health
- Minimize adverse impacts of development on watershed health
- Promote opportunities for restoration
- Assess and prevent unintended consequences of federal, state or local decisions affecting watershed health
- Plan for safe, adequate and affordable water supplies as an integral part of growth

- Consider the cumulative impacts of growth management decisions on the watershed
- Monitor and evaluate success of initiatives

Many smart growth techniques exist to help improve watershed health.

To more fully explore this issue, EPA modeled three scenarios of different densities at three scales — one-acre level, lot level, and watershed level — and at three different time series build-out examples to examine the premise that lower-density development is always better for water quality (EPA, 2008b). EPA examined storm water runoff from different development densities to determine the comparative difference between scenarios (EPA, 2008b). This analysis demonstrated (EPA, 2008b):

- The higher-density scenarios generate less storm water runoff per house at all scales — one acre, lot, and watershed — and time series build-out examples;
- For the same amount of development, higher-density development produces less runoff and less impervious cover than low-density development; and
- For a given amount of growth, lower-density development impacts more of the watershed.

Taken together, these findings indicate that low-density development may not always be the preferred strategy for protecting water resources (EPA, 2008b). Higher densities may better protect water quality — especially at the lot and watershed levels (EPA, 2008b). To accommodate the same number of houses, denser developments consume less land than lower density developments (EPA, 2008b). Consuming less land means creating less impervious cover in the watershed (EPA, 2008b). EPA believes that increasing development densities is one strategy communities can use to minimize regional water quality impacts (EPA, 2008b). To fully protect water resources, communities need to employ a wide range of land use strategies,

based on local factors, including building a range of development densities, incorporating adequate open space, preserving critical ecological and buffer areas, and minimizing land disturbance (EPA, 2008b).

State and local governments and utilities can also adopt water policies that conserve water and reduce demand for it, while indirectly supporting smarter growth patterns. Policy choices include focusing on fixing and upgrading existing infrastructure, setting prices for water that reflect its full cost, better coordinating water and land use planning, using innovative water financing mechanisms, and encouraging water-saving landscaping. Public advisory boards can help governments and utilities to choose those policies that will best fit local conditions. This report includes examples of places that have tried these policies, which can further inform the choices of other areas (EPA, 2008b).

The following are several examples of state programs that use growth management strategies to protect their water (EPA, 2008b):

Maryland - In 1999, Anacostia Watershed Toxic Alliance was developed to control runoff and sewer overflows into the Anacostia watershed. The Alliance plan includes using Low Impact Development (LID) techniques, a strategy that replicates the natural hydrology of the area by using green space to manage runoff. Washington, D.C., and Maryland use LID techniques such as rooftop gardens, porous pavements and stream buffers to reduce stormwater runoff. D.C. also uses trees along the trouble areas of the sewer system to slow stormwater flow. Reduced stormwater flow decreases the amount of pollutants that wash into water bodies since pollutants are absorbed naturally into soil and vegetation. Texas, Indiana, Arkansas, and South Carolina also use LID techniques to reduce stormwater flow.

Iowa - In 2002, Iowa enacted a “Smart State Revolving Funds (SRF) for Iowa Clean

Water” program, allowing Clean Water SRF to be used for smart -growth initiatives. Clean Water SRF is managed by the Environmental Protection Agency and provides \$1.35 billion annually to states in the form of low-interest loans for wastewater treatment infrastructure. In recent years, EPA has encouraged states to use Clean Water SRF loans for smart-growth approaches to improve water quality. New Jersey, Ohio, and California also use their Clean Water SRF loans for smart-growth projects

Adaptive Governance, Integrated Watershed Management and Co-management

Around the world there is a growing trend in all environmental management towards adaptive governance, or a community-based approach. To address complex interactions and to manage uncertainty and periods of change, governance approaches that are *adaptive* have much to offer. A key characteristic of adaptive governance is collaborative, flexible and learning-based issue management across different scales. Top-down command-and-control policies imposed by governments are overbroad and hard to implement, and overlook the variety of the communities involved on the local level. Therefore, command-and-control policies can miss the mark; creating bigger problems than are solved. Too much scientific management can lead to alienation of the very parties necessary to its success. By removing the focus away from science alone, Integrated Watershed Management can include all the elements inherent in an environmental problem, such as politics and people.

Integrated Watershed Management (IWM) has many names, and has also been called integrated catchment management, integrated river basin management, or integrated water resource management. In the European Union, the approach is called the ecosystem approach in water management or more simply ecosystem management (ECE, 2004), which is described as:

The idea is that water resources should not be managed in isolation from other ecosystem components, such as land, air, living resources and humans present in

the watershed. The watershed is thus considered as an entire ecosystem. The protection, sustainable use and restoration of its components are essential for the sustainability of water resources management.

At the International Conference on Water and Environment (ICWE) held in Dublin, Ireland in 1992, and the United Nations Conference on Environment and Development (UNCED), held in Rio in 1992, Integrated Water Resources Management (IWRM) was noted as a philosophy which has significantly influenced perceptions about water management worldwide (Manzungu 2004). There were four IWRM principles established at the ICWE which are the following:

- Fresh water is finite, essential to life, development, and the environment
- Water management should be participatory at all levels involving all stakeholders
- Women play a central role in water provisioning and management
- Water has economic value in all its uses and is an economic good

IWRM pursues the democratization of water resources through stakeholder participation (Manzungu 2004). Process, approach, what a stakeholder is, entry and levels of participation, administrative and operational realities like economic costs and public opinion, all are practical issues which must be taken into account (Manzungu 2004). Manzungu has studied water management in southern Africa, where water is critical for agriculturally based society but where low quality, quantity, and availability makes water management a very challenging proposition (Manzungu 2004). The Southern African Development Community (SADC) has coordinated a number of regional initiatives to address these water challenges, including the widespread adoption of the concept of integrated water

resource management. Manzungu (2004) outlines some practical steps and preconditions needed to improve water resource management (Manzungu 2004):

- Make participation meaningful to the participants, with clear measurable impacts
- Setting realistic participation goals
- Realizing participation is costly- financially, time-wise, human-wise
- Acknowledging differences in power between stakeholders
- Factoring in social/cultural aspects of marginalized groups, like women and poor
- Participation is a process, not an event
- Two-way communication is important, not just information dissemination

The term “co-management” has been used to designate a wide array of arrangements for shared decision making between government resource management agencies and community-based parties (Pinkerton 1996; Berkes, Preston, & George, 1991). Not all of the community-based groups need to have the same level of power, rights, or management authority if there is significant overlap in management objectives and a commitment to joint problem solving (Pinkerton 1996). “The point is that planning is more successfully implemented when all affected parties have a voice in decisions” (Pinkerton, 1996, p. 61).

Notable political scientist, Elinor Ostrom, noted several advantages and disadvantages of involving local users into co-management (1999). Ostrom (1999) sees the advantages of authorizing the users of “smaller-scale common-pool resources”, like the Upper Neuse River Basin communities, to adopt policies regulating the use of these resources are use of local knowledge, inclusion of trustworthy participants, reliance on disaggregated knowledge, better adapted rules, lower enforcement costs, redundancy in coping with problems (Ostrom 1999). Ostrom (1999) also identified a series of weaknesses inherent to such system. Some resource users do not organize, some self-organized efforts will fail, local tyrannies may prevail, and

stagnation may occur, inappropriate discrimination may result from the use of identity tags, access to scientific information may be limited, conflict may arise among resource users, and resource users may be unable to cope with larger scale common-pool resources (Ostrom 1999).

Collaboration and Consensus

Watershed planning often involves hundreds or thousands of stakeholders who are influenced by or who can influence a watershed (Perrin, 2003). The Neuse River is used by over 70 separate water systems, along with hundreds of private landowners, farmers, developers, foresters, fishers, conservation groups, all with competing interests that make conflict an inevitability, and agreements next to impossible. “The North Carolina system for regulating conflicts between water users relies largely on individual lawsuits and a highly reactive regulatory approach that may not even be usable west of the fall line¹” (Whisnant *et al.*, 2008). In the areas where North Carolina is expected to grow the fastest, the water allocation system actually discourages investment in water supply and infrastructure maintenance. “In such a contentious atmosphere, the choice you face will likely lead to a win/lose outcome, an impasse, or a compromise that satisfies neither side” (Smutko, 2008).

In response to frustration with traditional forms of public participation, communities have turned to collaboration in an effort to address environmental conflicts (Cox, 2006). Collaboration is defined as “constructive, open, civil communication, generally as dialogue; a focus on the future; an emphasis on learning; and some degree of power sharing and leveling of the playing field” (Walker, 2004, p. 123). Five commonly accepted factors in successful collaboration include the following: (1) that all relevant stakeholders are at the table (2) that the participants adopt a problem-solving approach (3) that all participants have equal access to

¹ The “fall line” marks the area where an upland Piedmont region of continental bedrock changes to a softer coastal plain (coastal alluvia) meet. In the Eastern United States, the fall line is a low east-facing cliff paralleling the Atlantic coastline from New Jersey to the Carolinas. This erosional scarp, the site of many waterfalls, hosted flume- and water-wheel-powered industries in colonial times, and is the site of many hydroelectric dams and generators in modern times.

resources and opportunities to participate in discussions, and (4) that decisions usually are reached by consensus, meaning a general agreement addressing all interests to some extent (Cox 2006) and (5) that the relevant agencies are guided by the recommendations of the collaborating group (Cox 2006). Collaborative research projects that involve local people from the outset generate possibilities for complementary use of scientific and traditional knowledge (Berkes, Colding, & Folke, 2000)

Daniels and Walker (2001) are advocates for collaborative learning, which they define as a joint decision making approach where power is shared and stakeholders take collective responsibility for their actions. They see promise for collaboration to work and see a need for a change in current approaches to management (Daniels & Walker, 2001). “As management philosophies have evolved, the need for public participation processes sensitive to complexity, diversity, and systems have emerged. Collaborative learning responds to this need” (Daniels & Walker, p. 151, 2001). Collaboration in their view focuses on interdependence, cooperation, shared power, joint learning, and shared responsibilities (Daniels & Walker, 2001). It is an ongoing process, and it is necessary for stakeholders to have ground rules for decision-making (Daniels & Walker, 2001). Collaboration stems “from a moral need to find not just common ground, but a higher ground” (Daniels and Walker, p. 153, 2001). Engagement of the issues should be based on fairness, equality, openness, responsibility (Daniels & Walker, 2001).

In “Building Consensus for a Sustainable Future: Putting Principles into Practice”, from the National Roundtable on the Environment and the Economy held in Ottawa, Canada in 1996, 10 principles for building collaboration and consensus were identified (Gerald Cormick *et al.*, 1996) :

1. Purpose-Driven- People need a reason to participate in the process
2. Inclusive, Not Exclusive- All parties with a significant interest in the issue should be involved
3. Voluntary- The stakeholders participate voluntarily

4. Self-Designed- All parties have an equal opportunity to participate in designing the process. The process must be designed to meet the circumstances and needs of the situation
5. Flexible- Plans should accommodate changing issues, data needs, political environment, and programmatic constraints such as time and meeting arrangements
6. Egalitarian- All parties have equal access to relevant information and opportunity to participate effectively at all stages of the process
7. Respectful- A climate of acceptance of the diverse values, interests, and knowledge of all the stakeholders is essential and should be established at the outset
8. Accountable- Stakeholders are accountable to both their constituencies and to the process
9. Time Limited- Realistic deadlines and timeframes are necessary to ensure goals are met and that the process progresses
10. Achievable- Commitment to implementation and effective monitoring is an essential part of the agreement

Consensus is the decision rule that allows the collaborative process to be effective. It means that after all sides are heard during the collaboration; a joint decision is reached that is acceptable to everyone involved. This does not mean that all parties are equally happy, as some more contentious issues may simply be avoided. Also, it takes a much longer time to reach consensus. In some cases with a “genuine consensus”, consensus can prevent decisions being made by the most powerful or those with greater influence. Consensus which meets all the key principles for its effectiveness (see below) builds trust and information sharing among stakeholders (Smutko, 2008). Key principles of consensus are (Smutko, 2008):

- Everyone must actively participate
- All group members have a common base of information
- The group must create an open, accepting atmosphere where all feel free to state their views and to disagree
- Disagreements must be respected, as they are [or, can be] catalysts for improving the decision
- When someone disagrees, the goal of the group is to discover the unmet need that has produced the objection and to find a way to meet that need in a revised agreement.

While collaboration and consensus have worked to help solve disputes, it is a complex process and not always foolproof. It is not always guaranteed that consensus-building will be successful or possible in all cases, such as when there is a deep difference in values or entrenched polarization on the issues (Cox 2006). In some cases, only an “illusion of consensus” is reached, and is really a forced consensus imposed by those with greater power. Critics state that consensus works only when there is a high level of scientific certainty and if practices are uncontested (Peterson, Peterson, & Peterson, 2005). “Acting as though these conditions exist, when they do not, legitimizes further damage to the environment and increases apathy and cynicism among the public” (Peterson *et al.* 2005) Stakeholders will enter into a process with inflated expectations, and become disenchanted which then furthers cynical attitudes about conservation in general. Also, some suggest that conflict and argument engage the public in serious debate and is essential for the democratic process to work (Cox 2006; Peterson *et al.* 2005).

Water Conflicts

Due to the extreme complexity and large numbers of stakeholder all with competing interests, water management is fraught with serious, entangled conflicts. There are conflicts between developers and conservationists over whether to build along a river, between towns

over water allocation, between upstream users vs. downstream users, and in between states and sometimes countries, such as the U.S. and Mexico. While some conflicts are settled through negotiation and consensus-building, others cannot be resolved and make their way to court. Water conflict has long been a matter of life in the Western United States, and now that the Southeast is growing, so is the number of water conflicts over this precious resource (Ruhl, 2005). "...this tradition of intrastate and interstate water disputes is no longer confined to the western states—the water wars, with their urban, agricultural, and ecological combatants, have moved east" (Ruhl, 2005, p. 1) .

In Eastern states conflicts are now beginning to appear between water users, and in connection with both ground water and surface water fields (Ruhl, 2005). Conflict theory and management scholarship can be applied to water management conflicts, and can illuminate ways to avoid potential conflicts before they start through smart management practices.

Peterson *et al.* (2005) theorized that conflicts go through patterns and have a cyclical nature. Some conflicts start with deindividuation, where one side sees the other side no longer as individuals but more as a group of rivals (Peterson *et al.*, 2005). The next stage to occur in the cycle is dehumanization where the group is then viewed as "bad" or "evil" (Peterson *et al.*, 2005). Reinforcing mechanisms, such as selective judgments and communication breakdowns, can escalate the conflict to crisis levels (Peterson *et al.*, 2005). Then, the conflict subsides in the de-escalation stage of the conflict cycles (described by Peterson *et al.*, 2005) . Stages of the conflict may not always have definite stages, and the stages can overlap, repeat, or occur in different patterns. De-escalation can be furthered by removing the reinforcement mechanisms or using third party facilitators (Peterson *et al.*, 2005). Having pre-negotiation conditions such as organization, common definition of problem and shared commitment to resolution can help reduce the level of the conflict, and are important in conflict management (Peterson *et al.*, 2005) Tactics that prevent agreement include staking out extreme positions, withholding information, making little effort to learn the interests of others, and trading small concessions (Smutko, 2008).

Conflicts are predominantly between resource users with different interests or values (Ostrom, 1999). Ostrom (1999) has identified certain characteristics of conflicts. Conflicts are:

“abstract with regard to values from which they derive, but simultaneously concrete with regard to the interests and the resource use claims of the parties in conflict; they are rooted in diverging values, needs and interests, and depend on varying subjective perceptions, valuations and interpretations of facts; the conflict can vary in size from conflicts between two persons to conflicts between rich and poor countries; and they have cultural, social, economic, and ecological dynamics that cannot be reformulated only in political terms” (Ostrom, 1999).

Solutions to conflicts can be found through reframing the conflicts or re-defining the situation, through enlarging the knowledge base for the management of conflicts, and through knowledge sharing and joint learning by the actors (Berkes *et al.*, 1991). Conflict management is not only for the solution of present conflicts, but “part of integrated resource management systems where knowledge transfer, institutional development, collective learning of scientific, political and administrative actors, and cooperation between scientists and resource users can occur” (Bruckmeier, p. 70, 2005).

Effective Laws and Regulations

Historically, there were two basic approaches used in the United States to allocate water among users (Tarlock *et al.*, 2002). In the arid and semiarid portions of our country the Appropriation Doctrine prevails, while east of the Mississippi, the Riparian Doctrine is applied (Tarlock *et al.*, 2002). The modern form of riparian law "gives each owner of land bordering on a stream, a right to make a reasonable use of the water and imposes a liability on the upper riparian owner who unreasonably interferes with that use" (McCall, 2003). This right exists whether or not the water is actually being used by the downstream riparian owner. Non-riparian landowners have essentially no rights at all to the use of surface water (Tarlock *et al.*, 2002)

The Appropriation Doctrine, often called Prior Appropriation, was developed in the arid West of the United States. It arose from recognition that there was an obvious shortage of water and it protects those who first put the water to a beneficial use (McCall, 2003). It establishes a rule of priority that ensures that those who first obtain water rights are protected from those who come later (McCall, 2003). The appropriation doctrine is often condensed to the rubric, "First in time, first in right" (McCall, 2003). Certain steps must be followed to obtain a right to water, typically obtain a permit, but once this right is perfected, it is superior to those that follow (McCall, 2003). The place of use of the water is not restricted to riparian land or even to the watershed (McCall, 2003). The water right may be sold separately from the land, and may cease to exist if it is not used (McCall, 2003).

Currently, many eastern states are rethinking their water-rights legislation, as development and population growth are placing greater demands on eastern water supplies. There is a realization that management is "compounded by a snarl of laws and regulations designed for a simpler era, when natural resources seemed to be limitless". Riparianism lacks a reliable method of allocating water uses in times of shortage (Abrams, 1989). Many eastern states are considering the establishment of permit-based water rights systems to provide a means of regulation, through administrative agencies of existing and future water uses (Maloney et al., 1968). Through permits, states can avoid conflicts before they arise by refusing a permit, imposing conditions, and acting to reduce the overall demand for water (Abrams, 1989). When a permit expires, new conditions that protect the environment or require better efficiency can be required before it is reissued, and its duration can be regulated. The system is more adaptable than prior appropriation because the permitting agency is empowered to consider the impact of the permit on competing uses, if it is done in an equitable way, considering all affected stakeholders and using sound technical science (Abrams, 1989). Permits also allow easy introduction of price-induced conservation methods, such as a consumption fee per unit basis (Abrams, 1989).

There are drawbacks to permit issuing, such as rigidity, a tendency to over regulate, and a lack of clear policy objectives (Abrams, 1989). A trading system that provides for permits to be transferred to new uses can help. Overall, administrative regulations are often, “like their riparian common-law forbearers...made on an ad hoc basis with little regard for integrated water system management” (Abrams, 1989, cited in Tarlock et al., p.). Therefore, an integrated water management plan should include permits as a part of the entire strategy, but it should not solely rely on administrative rules to effect change in a watershed.

North Carolina’s Capacity Use Area (CUA) program is a good example of what happens when the states takes a more rigorous approach to water allocation than under the traditional riparian rights, common law approach (Whisnant *et al.*, 2008) . Currently, the Capacity Use Area program is applied to the Central Coastal Plain (CCP), a rural region in the eastern third of North Carolina experiencing a problem with over extraction of water (NCDENR, 2008). A group of formations, collectively known as the Cretaceous aquifers, supply the vast majority of water to communities in the CCP (Whisnant *et al.*, 2008). The aquifers have had a reasonable yield and produce high-quality water that generally requires little treatment (Whisnant *et al.*, 2008). As population and water demand have increased in the CCP, water levels within the aquifer have been declining at a rate of more than one foot per year in many regions (Whisnant *et al.*, 2008). Lower aquifer levels can create problems if wells are not deep enough and, as a result; pumps need to be lowered (Whisnant *et al.*, 2008). Lower aquifer levels also permit salt water intrusion to move inward from the coast (Whisnant *et al.*, 2008). Monitoring data throughout the 1980s and 1990s suggested that the future viability of the formation was at risk, and the state invoked the Water Use Act of 1967, which authorizes the state to declare the affected region, including all or parts of fifteen counties, a “capacity use area” (NCDWR, 2009). The Water Use Act of 1967 “designates a capacity use area where use of groundwater and/or surface water require coordination and limited regulation for protection of the interests and rights of property owners and residents or of the public interest” (NCDWR, 2009).

The North Carolina Capacity Use Area Program requires withdrawal permits for significant groundwater users in its capacity use area (NCDWR, 2009). It has also begun a long-term program of mandated reductions in withdrawals. Finally, North Carolina's current capacity use rules allow trading of water allocations, thus providing potential insight into the ability of water markets or quasi-markets to work in riparian rights setting (Whisnant *et al.*, 2008). The Capacity Use Area Program could potentially be expanded to include more regions of North Carolina having water shortage problems, or it could be used as a model to develop a more comprehensive permitting system (Whisnant *et al.*, 2008).

Drought

Multiple severe droughts since 1996 have had substantial economic, social, and environment impacts in many regions of the country (Geological Society, 2007). Drought is defined by the North Carolina Division of Water Quality as "a period of abnormally dry weather sufficiently prolonged from a lack of rainfall to cause a hydrologic imbalance" (NCDWR, 2008). North Carolina uses the U.S. Drought Monitor designations to determine what stage of drought conditions exist (Session Law 2008-143, 2008). The extent of drought increases in the summer, and rainfall amount and frequency is important in the fall, winter and spring to replenish groundwater tables to prepare for summer (WRAL interview, 2008). The Geological Society of America (2007) states:

"Vulnerability to drought, a routinely occurring part of the natural hydrologic cycle, is increasing in all parts of the United States due to: population growth and population shifts, especially in the water-short western states and in the Southeast; land use changes; global climate change; and increased water resource demands"

Most government drought management plans that do exist are often ineffective and tend to reinforce the status quo (Walker, Hrezo, & Haley, 1991). To improve the situation, federal, state, local, and tribal governments need to collaborate with water managers and water users in a shift from "crisis-based, reactive drought management to risk-based, proactive

drought management, with greater emphasis on drought monitoring and early warning, prediction, mitigation, and preparedness planning” (Walker *et al.*, 1991, p. 147). “To better understand why society is still reacting to droughts rather than planning for their eventuality, the activities of various levels of government in planning for droughts must be examined” (Walker *et al.*, 1991, p. 150).

From spring 2007 to fall 2008, North Carolina experienced an extreme drought. Around May 2007, local newspapers started reporting that drought was becoming a problem in Raleigh (WRAL news archive, 2008). Over the course of the next year and a half, cities in the Neuse River Basin started tightening water restrictions on residents and local businesses (Bachman, 2007). The severity of the drought led to the desire for better legislation to guide local governments in dealing with a drought situation.

2008 Drought Bill

On July 31, 2008, Governor Mike Easley signed House Bill 2499, commonly known as the 2008 Drought Bill, into law as Session Law (SL) 2008-143 (GANC 2008). The bill underwent revisions after challenges by agricultural interest and private well owners, and a number of good provisions were taken out or weakened during the legislative process, such as mandatory minimum conservation measures for local governments during times of drought (NCCN, 2008). Overall, however, the bill strengthens North Carolina's ability to weather droughts and takes several steps towards better management of our water resources (NCCN, 2008). The 2008 Drought Bill consists of 21 sections to “improve water use data; reduce drought vulnerability; and allow for quicker response to water shortage emergencies” (GANC, 2008). The drought bill revises earlier drought laws makes a number of stricter requirements. It tightens water use reporting requirements for persons who withdraw or transfer more than 100,000 gallons of water per day for non-agricultural uses or 1 million gallons of more per day for agricultural uses, shortening the time to register a new withdrawal or transfer from 6 months to 2 months, and increasing the fines (GANC, 2008). It makes a new requirement for the Department of

Agriculture and Consumer Services to survey and report every year on agricultural users of more than 10,000 gallons per day or more within a county and watershed basis (GANC, 2008).

The bill includes several new definitions. It defines “essential water use” as water necessary for fire fighting, to sustain human and animal life, to satisfy federal, state, and local laws for the protection of public health, safety, welfare, the environment and natural resources , and “a minimum amount of water necessary to maintain the economy of the State, region, or area” (GANC, 2008). It defines a “water shortage emergency” as a shortage of water that “presents an imminent threat to public health, safety, and welfare or to the environment” (GANC, 2008). A “large community water system” is one that serves 1,000 or more service connections or 3,000 or more individuals (GANC, 2008).

In a water shortage emergency, which must be declared by the Governor, the Drought Bill streamlines the process, eliminating the need for a public hearing or a 19-member committee for declaration (GANC, 2008). It shifts a number of powers from the Environmental Management Commission (EMC) to the Secretary of the Department of Environment and Natural Resources (DENR), giving him authority to recommend an emergency declaration after the initial 30 day declaration by the Governor and after consulting the water system and the local government where the water system is located. In such an emergency, the Secretary can require a water system that has more than enough water to meet its own “essential water uses” to give water to a system experiencing a water shortage, and can adopt conservation rules for both the receiving and the supplying water system (GANC, 2008) . If this occurs, the supplying water system cannot charge more than 110% of the retail cost of the water plus system costs (GANC, 2008). Temporary emergency water lines can be installed but must be removed within 90 days after the water shortage emergency(GANC, 2008).

The Drought Bill sets criteria for local water shortage response plans, which must be approved by DENR. The plans, other than meeting all other EMC rules, must use a tiered level of water conservation, which are progressively more stringent and relate to the increased severity of drought (GANC, 2008). The plans cannot regulate or meter private drinking water

wells, defined as wells that serve 14 or fewer service connections or 24 or fewer individuals. The Drought Bill now requires that a local government implement drought measures within 10 days after such water shortage conditions exist. The DENR can now require a local water system to step up water conservation efforts in a drought, moving them to a greater tier for instance (GANC, 2008). Local government and community water systems must also report the amount of water used, reported, diverted, or obtained on a weekly basis in times of extreme drought (GANC, 2008). Local governments must now put separate meters on new irrigation systems to help distinguish irrigation from household use (GANC, 2008).

There are more conditions on eligibility for state grants to expand a water system infrastructure. The system must have an approved local water supply plan, implement a water conservation education program and a leak detection and repair program, meter water users, use reclaimed water to meet some future water needs, and its rate structure must be adequate to maintain the system in both normal and drought periods and cannot give residential customers a lower per-unit rate as water use increases (GANC, 2008). The DENR can penalize a local government up to \$10,000 per month if it fails to implement water conservation measures, \$100-\$500 per day for failure to comply with a weekly water use request for information. (GANC, 2008)

The NC Conservation Network suggested ways that the 2008 Drought Bill might be improved in upcoming legislative sessions (NCCN, 2008). Some key points were the following:

- **Tying growth to resource realities.** State law could require local governments to be sure that existing water supplies will be able to meet expanded demand before approving new development
- **Water efficiency standards.** Water efficient buildings can cut year-round water use relatively painlessly versus

- **Rainwater capture.** State laws should encourage the collection of rainwater for such purposes as watering gardens and flushing toilets, uses that currently waste treated drinking water.

Obviously, requiring local governments to limit growth is much more controversial than using rainwater capture or encouraging water efficient buildings. Any restrictive law is much harder to sell to lawmakers, than suggestive, education practices. However, in the future, stricter laws may just be necessary if droughts in North Carolina become more frequent and severe.

Public Awareness and Media

A huge barrier to effective watershed management is that it is, “far too poorly understood by the public and policymakers alike” (Andrew, 2006). Perhaps one good thing about drought is that its effects are easily seen and usually spur conservation actions in the public, media, and government. During the recent drought, Former Governor Mike Easley made a concerted effort to reach out to the community through the media, and the issue became a hot topic in the local newspapers. News media, including video and photographs of dry lakes, increased public awareness of the severity of the drought. State and local officials asked the public to conserve water, and most citizens responded positively. A Raleigh resident said she “didn't mind mandatory water restrictions, but said the city should look at what's draining the water supply” (as cited in Bachman, 2007). She said, “(Watering) every other day is adequate, but I think the city needs to take up its own part and that is to restrict growth so we don't drain our reservoirs dry and then cry help” (as cited in Bachman, 2007).

The public became interested in information about the drought, steps they could take to conserve water, and steps the community could take to conserve water (Whisnant *et al.*, 2008). Communities with year-round conservation programs responded to the public demand for information, but the state, most local governments, and private water systems were not prepared to respond to the demand (Whisnant *et al.*, 2008). With perhaps a desire to change

this, the 2008 Drought Bill included a condition that Local Water Supply Plans include public education in their water conservation plans.

During the drought, public awareness and comfort in using different “grades” of water or using different kinds of water for different purposes increased (Whisnant *et al.*, 2008). However, according to the UNC- Duke Water Allocation Team’s study (Whisnant *et al.*, 2008, p. 24):

“most of the public the public and state and local policy makers in North Carolina understand basic facts about water such as where their water comes from or the connection between groundwater and surface water in the state. Many people do not realize how much water is being used or wasted, how much pollution is occurring, and how their everyday actions translate on a bigger scale”

Gerry Preble, the vice president of an environmental engineering firm in Massachusetts, believes that increased public awareness can lead to the steady acceptance of water management initiatives (Andrew, 2006). Preble says, "I equate this issue to what happened with recycling. A lot of people said recycling would never work, but as people learn more and see the need to do it, they end up doing the right thing." (as cited in Andrew, 2006)

Definitely, more can be done by the media to improve public awareness and desire to conserve water resources. Media coverage has very powerful effect in shaping public opinion on issues, and the way it frames an issue can greatly impact people’s feelings (Cox, 2006). The “mainstream media present different and even contradictory images of nature-as both nurturing and treacherous, sublime and dangerous, as victim, sick parent, a problem (threat), and a resource” (Cox, 2006, p. 196). However, media issues tend to move in cycles and revolve around what is the “hot topic” of the moment (Cox, 2006)

Once rain picked up in North Carolina, stories about drought moved to the background and then left most media all together. Now, the problems with the economy are at the

forefront of the media's attention, and thus the public's. Often, the media are reactionary, rather than proactionary, perhaps in an effort to remain as neutral an image as possible. As a result, public attention and turns to a matter when it has already become a huge problem and is very difficult to solve. Government officials act according to their constituents concerns and demands, hoping to get votes, so needed policies are a case of "too little, too late" many times in environmental problems. The availability of alternative sources of media, such as the Internet or public television, are important sources of environmental news, as many "have grown frustrated with the insufficient depth, range, and accuracy of commercial media coverage of environmental topics" (Cox, 2006, p. 191).

Two Relevant Case Studies

Two case studies which utilized integrated watershed management in the context of a riverbasin were chosen to help analyze what key elements may or may not have worked in past attempts at collaboration. This analysis will help to determine what kinds of practices, policies, or methods may be effective in Upper Neuse Riverbasin planning. Both case studies chosen are located in rapidly developing regions of the Southeastern United States, in order that they would more closely match the demographics of the rapidly developing Upper Neuse Riverbasin in North Carolina. The first case study was the White Oak River Watershed Advisory Board which was an example of a fairly successful project in North Carolina that utilized public awareness and education as main components of its collaborative process. Since it was located in North Carolina, it shared a similar legal, cultural and political background to the Upper Neuse Riverbasin. Also, it also involved a number of different types of stakeholders such as universities, citizens, and scientists which would be similar to the types of stakeholders that might collaborate in the Upper Neuse region. The second case study, The East Central Florida Regional Water Supply Planning Initiative located in Central Florida, was chosen because it was in a region experiencing similar development and urbanization as is occurring in the Triangle region where the Upper Neuse River is located. I also choose this example because it was one situation that was largely unsuccessful due to a high degree of conflict and competing interests

favoring development, which, in my opinion, is also occurring in the Triangle region of North Carolina. It is helpful to show how to avoid potential problems that might occur in the Upper Neuse Riverbasin between developers and conservationists.

Case Study One: White Oak River Watershed Advisory Board (WORWAB)

This case study of the White Oak River Watershed Advisory Board is a good example of a successful integrated watershed management process involving public awareness and collaboration. The Watershed Education for Communities and Local Officials Program (WECO), started in 1996, is a NC Cooperative Extension program based out of NC State University's Department of Agricultural and Resource Economics. WECO stated its main objective was "to improve water quality through education of citizens and government officials who live and work in the watershed" (Perrin, 2003).

WECO outlined three primary objectives for their education strategy (Perrin, 2003):

- (a) Delivering technical information and educational material on water quality;
- (b) Creating collaborative partnerships at the watershed level between communities, local officials and state agencies
- (c) Involving local stakeholders in the development of recommendations to improve water quality in their watershed.

Early on, WECO founders agreed that all projects should follow a defined set of principles which are inherent to integrated watershed management (Perrin, 2003). WECO projects must be:

"locally-empowered and stakeholder based, must develop methods for sustainable, collaborative, community-based solutions, should partner with other state and local agencies to foster watershed-based solution, must develop methods for the synthesis, integration, and application of multi-disciplinary scientific and technical information to support policy making, and should examine sustainability of policy alternatives by estimating economic costs and benefits" (Perrin, 2003).

These tenets were first applied in 1996 to WECO's original pilot watershed planning group, the White Oak River Watershed Advisory Board (WORAB) (Perrin, 2003). WORAB experienced early success when they developed recommendations to address potential impacts of a proposed highway expansion spanning the mouth of the White Oak River. Since the watershed was located in portions of three NC counties (Carteret, Onslow and Jones), the board's recommendations needed support from all three county commissioners' boards (Perrin, 2003). Local support provided the justification needed for state and federal agencies to act upon WORAB's recommendations for managing water quality in the river (Perrin, 2003). Ultimately, the North Carolina Department of Transportation redesigned the expansion to reduce the potential impacts of stormwater runoff to the river (Perrin, 2003). Also, the board worked with the U.S. Army Corps of Engineers and U.S. Congressman Walter Jones to provide the Congressional Act needed to authorize a flow study in the river (Perrin, 2003).

In 1999, after its early success, WORAB moved on to investigate a more complicated water quality problem: the increased closures of shellfish beds in the White Oak River due to elevated counts of fecal coliform bacteria, a common problem in coastal communities (Perrin, 2003). Noting the recent high rate of urbanization in coastal North Carolina, WORAB chose to focus on urban stormwater runoff as a dominant contributor to bacterial contamination in the White Oak River (Perrin, 2003). After being presented with an exhaustive list of policy, education alternatives, and engineering tools for addressing stormwater runoff, the board chose to pursue educational activities centered around stormwater "best management practices" (BMPs) (Perrin, 2003). The stormwater BMPs were in-the-ground projects that would slow down and treat stormwater runoff (Perrin, 2003). In 2000, WECO staff delivered a presentation highlighting actions individuals can take to reduce stormwater runoff from their property to over 100 citizens at local civic clubs and homeowners associations (Perrin, 2003).

Supported by the board, WECO partnered with the NCSU College of Design, the town of Swansboro, the N.C. Shellfish Sanitation Division, and Duke University to obtain a three-year, \$300,000 EPA grant aimed at protecting and enhancing sensitive shellfish waters in two specific

watershed areas (Perrin, 2003), which were Swansboro and Pettiford Creek, an estuarine tributary of the White Oak River (Perrin, 2003). After the grant was approved and funded, a team of professionals investigated various locations suggested by WORAB for potential BMPs. WECO compiled a list of selection criteria, and the team toured the sites to determine which potential BMPs ranked highest (Perrin 2003). Three projects emerged due to their highly visible public locations, and because they exhibited significant potential for reaching many locals and tourists (Perrin, 2003). The projects selected were smart growth projects and included a rain garden at the Swansboro Town Hall, a rain garden at a town park adjacent to the White Oak River, and a permeable pavement site (Perrin, 2003). The two rain gardens and permeable parking lot were constructed with the oversight of the Department of Biological and Agricultural Engineering and the assistance of the Carteret County Cooperative Extension Horticulture agent and Master Gardeners (Perrin, 2003). Demonstration BMPs were installed in Swansboro in highly visible locations. Educational signs were posted to increase awareness of water quality issues facing the White Oak River and to offer solutions (Perrin, 2003). In the Pettiford Creek watershed, a project team conducted research to identify likely non-point sources of pollution (Perrin, 2003). Educational outreach and in-the-ground solutions to specific pollution problems followed (Perrin, 2003).

The Pettiford Creek Watershed portion of the project was “the most comprehensive aspect of the EPA grant” (Perrin, 2003). The project included number of activities that ultimately will help reduce shellfish closures in Pettiford Creek (Perrin, 2003). These tasks included (Perrin, 2003):

§ *Water quality monitoring* – The Duke Marine Lab monitored the pollutants in the water of Pettiford Bay, while NCSU installed equipment to monitor stormwater flow. Monitoring to identify sources of pollutants helps to determine any ultimate impacts of the project on Pettiford Creek and the shellfish beds.

§ *A watershed survey* - Project partners and volunteers from WORAB, including a class of fifth graders, fanned out in neighborhoods within the watershed to collect

information on land uses and water movement. Information they collected, such as the number of pets in the watershed, identified potential activities that contribute to pollution.

§ Educational Outreach - The survey results were reviewed to direct an education program. Educational materials about ways to reduce bacterial loading to the watershed were developed and distributed to watershed residents

§ Identifying pollutant-loading areas – The NCSU College of Design compiled the monitoring results, the watershed survey results, and land cover data to create maps to show potential pollutant-loading areas that would make good sites for the projects.

§ Community Design Meeting - The project team and WORAB held meetings where participants helped identify specific locations where BMPs may be constructed to reduce stormwater runoff and pollutants entering the creek.

§ BMP Construction - The project team and WORAB worked with local residents to construct BMPs in locations where bacteria entering the shellfish beds might be reduced.

This plan formed a good methodology for creating a partnership for in identifying pollutant sources leading to shellfish bed closures, and implementing solutions to increase the amount of time that local shellfish resources are open for harvest (Perrin, 2003).

The White Oak River Watershed Advisory Board was a successful model for watershed management. Since this time, WORAB has convened four additional local watershed groups across North Carolina with the sponsorship of interested state agencies (Perrin, 2003). The WECO model could be used for the Upper Neuse River Basin to improve its water resources. By focusing on the key points in the WORAB model, the Upper Neuse River Basin can make significant improvements in building collaborative partnerships. Involving the local community

in all aspects of the planning process, from the BMP location and construction, to the watershed monitoring and surveying for pollutants, helped ensure compliance and long-term success. An Upper Neuse River Basin Watershed Management Initiative should focus on educational outreach, using collaborative partnerships at the watershed level between communities, local officials and state agencies, effective monitoring and surveying techniques, and involving the stakeholders in the development of recommendations to improve water quality in their watershed.

Case Study Two: The East Central Florida Regional Water Supply Planning Initiative

The East Central Florida Regional Water Supply Planning Initiative was created as a collaborative response to the environmental problems posed by overuse of groundwater resources in the East Central region of Florida, a rapidly growing area. The Initiative illustrates a consensual decision process to meet the legal planning requirements while minimizing conflicts and degradation of water resource (Berardo, 2005). It was largely successful in its initial stages of getting stakeholders together, but there were obstacles which led to the Initiative's demise. The challenges faced in this watershed initiative are informative and describe ways the Upper Neuse River Basin could collaborate most effectively.

The main water source for the East Central region of Florida is the Floridian Aquifer, one of the most productive aquifers in the world, covering over 100,000 square miles in Alabama, South Carolina, Georgia and Florida (Purdum, 2002). Like the piedmont region of North Carolina, the East Central region of Florida is growing rapidly. The water consumption in this region is expected to rise from 567 gallons per day in 1995 to 926 million by 2020 (Berardo, 2005) Vergara noted that "salt water intrusion, reduction of spring flows, and drying of lakes and wetlands due to rapid growth threaten the ecology of this region" (as cited in Berardo, 2005, p. 65).

The Initiative was created out of concern for the overconsumption by the Water Management Districts, which issue Consumptive Use Permits to permit holders to withdraw

water from surface and ground sources (Berardo, 2005). In the past, the main district with authority in the area was the St. Johns River Water Management District (SJRWMD) (Berardo, 2005). The SJRWMD had identified several counties with aquifer depletion problems. The SJRWMD organized a workshop in 1997 as a “cooperative public process” to discuss the problems and to “ensure that planning was conducted in an open public process” (as cited in Berardo, 2005). The SJRWMD then presented findings to local governments that predicted water shortage by 2006, stressed the importance of the issue, and the need to find some new water sources (Berardo, 2005). This in turn prompted the chairman of Orange County to create two water summits in Orlando, Florida, to “identify cooperative solutions and to avoid unnecessary conflict among public supply utilities that could result in expensive and time-consuming litigation” (Berardo 2005, p. 66).

In the first meeting, the over 150 participants agreed that there should be an equitable distribution of the costs, management, and control of any new regional supplies (Berardo, 2005). There was agreement to have a partnership between local governments and public supply utilities and a commitment to long-term planning (Berardo, 2005). In the second meeting, the three water districts hired the Florida Conflict Resolution Consortium to help create a formal agenda, and to interview the stakeholders to clarify their interests and motivations (Berardo, 2005). A goal was to avoid a “water war” situation as had occurred in the Tampa Bay area of Florida (Berardo, 2005) some years earlier.

In Phase 1, the Initiative held a series of workshops to set goals (Berardo, 2005). They identified water reuse and conservation and the creation of new supplies as important objectives (Berardo, 2005). They supported the use of reclaimed water to offset the use of high quality water and to recharge the aquifer, and the use of financial incentives for reclaimed water projects (Berardo, 2005). Also, the Initiative stressed coordination and cooperation between cities, and educating the public about water conservation (Berardo, 2005). Also, they added the goal of linking water use and planning with land development (Berardo, 2005).

In Phase 2, the Initiative focused on developing new water supply sources and linking land use with water use (Berardo, 2005). Eleven new water supply projects were identified, including using surface waters from the St. John's River and the lower Ochlawaha River, three seawater demineralization plants, and use of Lake Apopka (Berardo, 2005). To link land use with water use, the legislature in 2002 required local governments to create a work plan to identify water supply needs and sources for 10 years (Berardo, 2005). By 2003, the SJRWMD recommended that the Initiative start education about water conservation and reuse, the promotion of regional cooperation, and prioritizing the new water supply projects (Berardo, 2005). In 2005, the Initiative was discontinued after the Florida Legislature enacted Florida Senate Bill 360 and SR 444, which strengthened the coordination of water supply and land use planning, and to increase local government and water management districts link (East-Central Florida Water Supply Planning Initiative: final report, 2005).

While the Initiative ultimately did not last, it had important effects on the future management of water in the region. It helped to identify new sources of water to meet needs to 2025, helped create local government partnerships, increased communication, educated the public about water conservation, and secured interlocal agreements to develop county-wide water supply plans (ECFWSPI, 2005). Unfortunately, this Initiative faced a number of challenges also such as inadequate representation, process design, and problem responsiveness (Berardo, 2005). While the participation by local government leaders started out strong, it gradually dwindled to only staff members by the end of the Initiative (Berardo, 2005). Some participants explained that while environmental problems have timeframes of 15 to 20 years in the future, politicians think in 2 year timeframes to their next election (Berardo, 2005). Thus, getting conservation measures passed was not a priority for the policymakers interested in short-term results. The Initiative did make an effort to keep the non-attending stakeholders informed through other kinds of workshops (Berardo, 2005). When there was disagreement, the Initiative would keep asking for alternative to try to arrive at consensus, which was used in development of a final list of water projects (Berardo, 2005). There was some perception that the permitting system was not fair, because counties that invested more money did not get

better permits than ones that paid less (Berardo, 2005). Finally, not many concrete results were achieved soon enough to spur stakeholders to keep participating in cooperative efforts (Berardo, 2005).

Some lessons to be learned from this Initiative were to have very clear goals for collaboration set from the beginning, which the Initiative did quite well. The initial stage of creating the Initiative was very successful. In my opinion, it was wise to involve a formal organization specializing in conflict resolution. However, the effectiveness dwindled as time went on. Stakeholder participation is a must at all stage for any collaboration to work, and public awareness and education through media is a large part of the process that went largely ignored by this Initiative. Also, there seemed to be more focus on creating new sources of water, and less on water conservation strategies such as smart growth initiatives, financial incentives, or incorporation of water quality monitoring. Effects on the ecosystems health, biological integrity, and biodiversity were not discussed either, which would have make a more holistic and environmentally sound approach. A management initiative like this in the Upper Neuse Riverbasin should be wary of these concerns, and take steps at the outset to incorporate every facet in their management plan.

A Blueprint for the Upper Neuse Riverbasin Integrated Watershed Management Plan:

Based on the background research conducted and the two case studies presented above, I established a set of guidelines for the Neuse River system that incorporates the major elements of integrated watershed management to ensure a future of sustainable water quality and quantity which meets the needs of North Carolina residents while minimizing conflict and environmental degradation. It uses a holistic, collaborative, and innovative framework to guide policy decisions and further scientific inquiry into this complex natural resource dilemma. This “Blueprint for the Upper Neuse Riverbasin Integrated Watershed Management Plan” can be used as a preliminary guide or checklist of sorts for policymakers, regulators, activists, business and water managers to ensure that most of the major elements of watershed planning are not

overlooked, which can lead to conflicts and even greater problems down the road. The major elements of the blueprint for the Upper Neuse River Watershed are the following:

1. Improvement of ecosystem's health to benefit both humans and wildlife through river restoration and preservation projects
2. Effective smart growth policies and zoning restrictions and permitting that tie growth and development with water usage
3. Use of a collaborative, consensus-building approach to alleviate conflict
4. Greater public awareness and media communication to educate public
5. Better water efficiency through improved technology and infrastructure
6. Reducing water waste and consumption
7. Developing new supplies in reservoirs and catchments, preventing evapotranspiration
8. Proactive drought planning
9. Economic incentives such as tradable water rights should be considered
10. Better monitoring and stricter enforcement of river quality

Conclusion:

Due to rapid population growth, development, drought pressures and pollution, along the Upper Neuse River, the Upper Neuse Riverbasin should use Integrated Watershed Management to plan for the future water needs of North Carolina and protect the Neuse River as one of the state's most precious natural resources. It should incorporate the basic tenets of the Blueprint (listed above) in its management objectives in order to ensure the best results for long-term success. Through an IWM approach, an Upper Neuse Riverbasin Management Initiative could be created as a collaborative alliance of state managers, local governments,

water systems, conservation groups, and industry leaders. Stakeholder participation is of utmost importance and must be done in a climate of respect. To alleviate conflict and help encourage cooperation, a consensus-building approach should be utilized, and the help of a conflict resolution organization should be sought especially in initial stages of the process. New innovative technologies and practices, such as smart growth, financial incentives, and water reuse should be incorporated. Stronger policies and laws are needed to serve as guides for the direction of our communities. While meeting water demands and smart growth is important, conservation and preservation of the ecological integrity of the Neuse River for the health of humans and wildlife must be included. Finally, public awareness and education must be extensive, using all forms of media available.

The big unanswered question in this report, and on the minds of policymakers, is “Where does the money come from?” for these needed water conservation reforms. Well, help may be on its way to North Carolina. In a recent Reuters.com article from Feb. 26, 2009, “Billions flow to water, sewer projects” (Lambert, 2009), many states may soon be receiving a “significant bump in funds” for clean drinking water and sewer systems under the budget President Barack Obama recently proposed. \$3.9 billion would go to the Clean Water State Revolving Fund and the Drinking Water State Revolving Fund in an “ ‘historic increase’ that would fund more than 1,700 water projects in states, Native American tribes and territories” (Lambert, 2009) . There is no better time for this kind of support and attention to the crucial issue of water for our future. The blueprint developed in this paper can be used as a tool to help insure these new funds will be used as effectively and appropriately as possible.

As global warming, urbanization, population pressures, and water shortage threaten our very survival, failure to enact the right policies now could have disastrous effects for the Neuse River and all water bodies in North Carolina and around the United States and the world. The adage “an ounce of prevention, is worth a pound of cure” is applicable to watershed management. One can only hope that North Carolina becomes a leader in watershed management and that it will use its plethora of scientific and educational resources to the best

of its ability. Through proactive, innovative, holistic approaches such as Integrated Watershed Management, the Neuse River and other water bodies in North Carolina can be models of what can be accomplished when we put our collective minds together.

APPENDIX A – Upper Neuse River Basin NGOs

NGOs- A Partial List of NGOs who work on Neuse River Conservation was obtained from the EPA site, “Adopt-A-Watershed”

- 1.) Friends of South Ellerbe Creek, <http://www.owdna.org>
- 2.) Ellerbe Creek Watershed Association, <http://ellerbecreek.org>
- 3.) Triangle Land Conservancy, <http://www.tlc-nc.org>
- 4.) Clean Water Education Partnership, <http://www.nccwep.org>
- 5.) Albemarle-Pamlico National Estuary Program, <http://www.apnep.org>
- 6.) Upper Neuse River Basin Association, <http://www.unrba.org>
- 7.) Conservation Trust for North Carolina, <http://www.sunsite.unc.edu.ctnc>
- 8.) UNC water wiki, <http://www.water.unc.edu>
- 9.) Neuse River Foundation, <http://www.neuseriver.org>
- 10.) Eno River Association, <http://www.enoriver.org>

APPENDIX B- Hog Farms and CAFOs

Burke- Abt Associates- North Carolina is also the country's second largest hog producer, closely behind Iowa; together the two states account for 43 percent of U.S. hog production, and much of this hog production is concentrated in the Neuse River watershed. The American Rivers Organization has named swine pollution to be one of the leading causes of the river's pollution problems. For many years, nutrient-laden waste from millions of hogs living in concentrated animal feeding operations (CAFOs) in the state's Coastal Plain has overloaded the entire Neuse basin with nitrogen, phosphorus and ammonia. Excessive amounts of these nutrients feed explosive algal growth, which depletes oxygen in the water and has caused some of the largest fish kills in the nation. Nutrients from hogs and other sources have also led to outbreaks of *Pfiesteria*, a tiny one-celled organism that produces a neurotoxin deadly to fish and exceedingly harmful to humans. .

In the mid-1990s the North Carolina Environmental Management Commission adopted what is commonly referred to as Neuse Rules, or the Neuse River Nutrient Sensitive Waters Management Strategy. The high levels of chlorophyll a in the estuary were determined to be caused by excessive nitrogen loading; therefore, a 30 percent nitrogen-reduction goal was adopted for the five years between 1998 and 2003. The Neuse Agricultural Rule also included a mandatory combination of best management practices.

According to the 2006 Progress Report on the Neuse Agricultural Rule, more than a quarter of nitrogen reductions were attributed to improvements in fertilizer management and cropland attenuation. From the original goals set in 1999, implementation of agricultural best management practice has exceeded all of the original goals with the exception of nutrient management, which fell somewhat short of its goal. Other management practices that provide water quality benefits other than nitrogen reduction, such as reductions in sediment and phosphorus, have also made substantial impacts on the quality of surface water and shallow ground water. Reduction in fertilizer application rates is another important conservation effort in the watershed, and since the early 1990s the average rate of fertilizer application on major

crops has dropped by almost 30 percent. According to the 2008 Neuse River Basin Water Quality Plan Draft, point source dischargers and agriculture have met and in fact exceeded the 30 percent nitrogen reduction goal, but the overall goal of a 30 percent nitrogen reduction in the Neuse Estuary has yet to be achieved

Second, a moratorium on new large-scale hog operations in eastern North Carolina ends in August 2007. Alternative technologies have been developed and are available to replace lagoons and spray fields. In 2007, the North Carolina Legislature must implement a permanent ban on new lagoons and spray fields, and require the phasing out of existing lagoons and spray fields over a five-year period

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