FINAL REPORT OF THE STATEWIDE TASK FORCE ON RIPARIAN FOREST BUFFERS

UNIVERSITY OF SOUTH CAROLINA

Center for Environmental Policy • Institute of Public Affairs

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University of South Carolina

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TABLE OF CONTENTS

Part 1
ACKNOWLEDGEMENTS

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Claire Prince, Director
Center for Environmental Policy
USC Institute of Public Affairs
July 2000

Part 2
EXECUTIVE SUMMARY

South Carolina enjoys a rich abundance of water from its many lakes and rivers to its coastal waters. Research over the last twenty years has confirmed that there are strong connections among stream health, aquatic life, wildlife habitat and the status of riparian areas. Riparian forest buffers - areas of vegetation adjacent to the water body that help to maintain the integrity of the water resources - provide important benefits that include the protection and enhancement of water quality, flood protection, water temperature moderation, stream bank stabilization, and habitat and food supply for aquatic and terrestrial life.

Many state and local governments, conservation groups, industry trade associations, and others have adopted or are developing buffer protection programs. They include both regulatory and non-regulatory approaches. In South Carolina, state agencies like the Department of Health and Environmental Control and the Department of Natural Resources have undertaken efforts to address the issue of protecting, maintaining and restoring riparian forest buffers.

Other agencies like the South Carolina Forestry Commission and the Department of Agriculture have adopted buffer protection measures as part of their respective best management practices and guidelines. Several counties and cities in South Carolina have adopted or are considering adopting ordinances to protect riparian areas within their jurisdictions. Private sector initiatives that address water quality protection such as the forestry industry's "Sustainable Forestry Initiative" have also been adopted in South Carolina.

While public and private initiatives continue, to date there has not been a coordinated, statewide effort to review the scientific, policy and educational issues surrounding riparian forest buffers, and to develop recommendations concerning the conservation and protection of these areas.

At the request of the South Carolina Department of Health and Environmental Control, the University of South Carolina Institute of Public Affairs' Center for Environmental Policy conducted a research project consisting of two, interrelated tasks:

1. Investigation of the status of riparian forest buffer protection and restoration programs in South Carolina and in the United States; and

2. Creation and coordination of a Statewide Riparian Forest Buffer Task Force to develop recommendations pertaining to the protection and restoration of riparian forest buffers in South Carolina.

In May, 1999, the Center invited representatives from government, academia, private non-profit organizations, and other public and private sector interests to serve on the Riparian Forest Buffer Task Force. The Task Force diligently worked for a year to develop the recommendations contained in this report. To tackle this complex assignment, the Task Force divided the issues into three categories — technical, policy and educational — and created a working group for each. While some issues naturally overlapped between technical and policy considerations, the Task Force painstakingly considered each issue within the respective working group, and sought consensus from the working groups as well as from the Task Force as a whole. Final Task Force recommendations were adopted by consensus and may not reflect agreement by every Task Force member or endorsement of the participating organizations.

The final recommendations of the Task Force are summarized in Chapter 1. A more detailed description of the issues, research, and deliberations that took place in developing these recommendations is provided in subsequent chapters. The appendices provide additional information to support or supplement the information contained in the body of the report. Finally, a separate working paper titled "Integration of Science and Policy: A Case Study on Riparian Buffers" provides a review of the scientific literature compiled during the project, and is available through the Center for Environmental Policy.

Chapter 1
SUMMARY OF TASK FORCE RECOMMENDATIONS

1. BUFFER WIDTH

- **Recommended Statewide Minimum Buffer Width:** To protect water quality and to realize other benefits, the Task Force should require a riparian forest buffer (RFB) with a minimum width of 35 feet of native vegetation on both sides of all perennial and intermittent streams and rivers, lakes, estuarine waters and coastal marshes. Buffer widths should increase with increasing slope in the terrain. Buffer requirements on ephemeral channels and non-coastal wetlands should be determined on a site-by-site basis. Buffers on ephemeral channels may be less than 35 feet in width and include other non-forested permanent vegetation types.

- **Recommended Buffer Widths Exceeding the Statewide Minimum:** Non-regulatory approaches at the state and/or local levels should be considered to implement buffer widths that exceed the statewide minimum. Enhanced water quality protection and additional wildlife protection may be accomplished by the following:

  - ☐ 100 foot buffer of native vegetation on both sides of the water body to better enhance water quality in non-forested areas and to provide additional benefits to wildlife; and

  - ☐ 300 foot buffer of native vegetation on both sides of the water body to provide comparable benefit of an undisturbed riparian system.

2. EXCEPTIONS

- **Existing Land Uses:** Existing land uses within the riparian buffer zone should be grandfathered in as of the effective date of adoption of the minimum buffer width. If an existing land use changes or there is additional encroachment in the RFB, the minimum RFB requirement should be met.

- **Agriculture and Forest Lands:** Lands that are in use for agriculture or forestry are exempt from the state and/or local RFB requirements so long as the owners of the land maintain their lands in compliance with the best management practices (BMP) applicable to the protection of water quality in riparian areas as referenced in the S.C. Forestry Commission's BMPs for Forestry and the Natural Resource Conservation Service's Field Office Technical Standards. If these BMPs or Standards are not followed, the state and/or local requirements should be met.

3. RECOMMENDED APPROACHES FOR BUFFER PROTECTION

- **Local Government's Role:** Local governments should develop and adopt a buffer protection plan within a specified time frame. The plan should include the implementation of buffer widths that meet or exceed the statewide minimum width of 35 feet, provisions for existing land uses, conversion or changes in land use, restoration programs, appeals, variances, and public education.

- **State Government's Role:** An inter-agency council should be created to coordinate state programs and develop guidelines to assist local governments in the development of their buffer protection plans. Local governments that have existing buffer ordinances may incorporate them into their buffer protection plans so long as they are at least as stringent as the statewide minimum width. The South Carolina Department of Health and Environmental Control should enforce the minimum buffer width if a local government does not develop and adopt a buffer protection plan within the required time frame.

- **Non-Regulatory Approaches:** Non-regulatory approaches are recommended for buffer widths exceeding the statewide minimum. Non-regulatory approaches that should be considered include the following:

  - ☐ Education Programs

  - ☐ Incentives

- ☐ Development Credits/Density Compensation
- ☐ Tax Breaks (i.e. Extend the tax-free designation given to riparian buffer lands designated under the S.C. Scenic Rivers Act to all riparian buffer lands designated under the minimum local government/ state requirement up to but not exceeding 300 feet.)
- ☐ Tax Credits (i.e. To provide a property and/or income tax credit based on the diminished value of the property contained within the protected riparian buffer (up to but not exceeding 300 feet) to help with the maintenance and upkeep of the buffer.)
- ☐ Cost-share programs
- ☐ Compensation payments
- ☐ Conservation Easements (and variations)
- ☐ Transfer of Development Rights
- ☐ Purchase of Development Rights
- ☐ Lease
- ☐ Acquisition
- ☐ Purchase/Exchange (i.e. The creation of a state fund with monies that can be accessed by local governments to purchase sensitive riparian areas and/or properties that once the buffer has been delineated have removed all economic use of the land.)
- ☐ Donation to Land Trusts
- ☐ Funding Riparian Buffer Restoration Programs

4. ALLOWABLE ACTIVITIES AND ACTIVE MANAGEMENT WITHIN THE RIPARIAN FOREST BUFFER

- **Allowable Activities within the Buffer:** Allowable activities within the RFB should be kept to a minimum but may include:
  - ☐ Activities necessary to maintain the health and integrity of the area. Such activities may include removal of debris after severe storm events, removal of diseased trees and suppression of invasive plant species;
  - ☐ View corridors as described in the BMPs for Riparian Forest Buffers (Appendix I);
  - ☐ Docks, boat launches, public/private water supply intake structures, facilities for natural water quality treatment and purification, public/private wastewater outfall structures, and similar structures, which by their nature, need to be located within the RFB;
  - ☐ Pedestrian and/or vehicle access ways leading to docks, fishing piers and boat ramps providing that only permeable or semipermeable material is used;
  - ☐ Crossing by transportation facilities and utility lines (permits will only be issued upon completion of a study identifying alternative routing and a mitigation plan to minimize impacts of the RFB);
  - ☐ Wildlife and fisheries management activities;
  - ☐ Stream, stream bank and vegetation restoration.
- **Best Management Practices:** Best management practices (BMPs) are suggested as guidelines for voluntary implementation to protect and preserve the integrity of the riparian forest buffers. Examples of these BMPs include:
  - ☐ The South Carolina Scenic Rivers Program: Recommended Best Management Practices for River Bordering Lands;
  - ☐ The Guide to Stewardship Development Concepts and Practices;
  - ☐ The S.C. Forestry Commission's Best Management Practices for Forestry; and
  - ☐ The NRCS Field Office Technical Standards (Appendix I).
- **Management Activities within the Buffer:** If active management is needed to maintain the integrity of the buffer, the NRCS guidelines for

operation and management of riparian forest buffers may be used (Appendix II).

5. GRANT PROGRAM

A grant program should be established to provide funding for existing educational organizations, conferences and programs to integrate riparian buffer educational materials into their curricula.

6. CENTRAL POINT OF CONTACT FOR EDUCATION EFFORTS

A central point of contact responsible for the overall coordination and development of new information on riparian forest buffers should be established to assist with integrating this information into existing educational efforts.

7. EDUCATION RECOMMENDATIONS

- **Education for Local Government Officials:**
  - ☐ Develop and provide fact sheets to local governments on water quality and riparian forest buffers and their benefits;
  - ☐ Approach the program directors of the existing organizations, conferences, and programs for the local government officials about including information on riparian forest buffers, including the fact sheets, in their curricula;
  - ☐ Encourage sessions on water quality and riparian forest buffers and their benefits and strategies to implement buffer ordinances into existing conferences;
  - ☐ Encourage networking by providing a contact list of existing programs, conferences and other educational materials; and
  - ☐ Provide a list of web sites and other resources on riparian forest buffers to local government officials
- **Education for K-12 Teachers and Students:**
  - ☐ Update the Environmental Education Association of South Carolina's Russ Sherer South Carolina Environmental Education Resources Directory;
  - ☐ Create a calendar of environmental conferences and workshops for science teachers;
  - ☐ Develop lesson plans that tie riparian forest buffers to the S.C. Science Curriculum Standards and provide professional development for the teachers. Professional development should contain adequate background and lead the teachers through the activities;
  - ☐ Develop and provide fact sheets to teachers on water quality and riparian forest buffers and their benefits;
  - ☐ Approach the program directors of the existing organizations, conferences, and programs for K-12 Students and Teachers about including information on riparian forest buffers including the fact sheets, in their curricula; and
  - ☐ Encourage sessions on water quality and riparian forest buffers and their benefits in existing conferences
- **Education for the General Public:**
  - ☐ Develop and provide fact sheets to the general public on water quality and riparian forest buffers and their benefits when visiting state, county, and city parks, town and city halls, county administration buildings and visitor centers; and
  - ☐ Approach the program directors of the existing organizations, conferences, and programs for the general public about including information on riparian forest buffers, including the fact sheets, in their curricula
- **Education for Land Development Professionals:**
  - ☐ Develop and provide fact sheets to land development professionals on water quality and riparian forest buffers and their benefits;
  - ☐ Approach the program directors of the existing organizations, conferences, and programs for the land development professionals about including information on riparian forest buffers, including the fact sheets, in their curricula;
  - ☐ Encourage sessions on water quality and

riparian forest buffers and their benefits in existing conferences;

- ☐ Educate land development professionals on BMPs for development;
- ☐ Encourage networking by providing a contact list of existing programs, conferences and other educational materials; and
- ☐ Provide a list of web sites and other resources on riparian forest buffers to land development professionals.

Chapter 2
BACKGROUND & INTRODUCTION

South Carolina enjoys a rich abundance of water from its many lakes and rivers to its coastal waters. Within South Carolina, there are about 29,898 miles of perennial and intermittent rivers and streams, 366,576 acres of lakes, 682 square miles of estuarine waters,190 miles of ocean coast, 4,146,510 acres of freshwater wetlands, and 512,490 acres of tidal wetlands (Figure 1).

South Carolina also has a rich and diverse topography ranging from the foothills of the Piedmont to the Coastal plains. Apart from the 935,000 acres of federally owned lands, South Carolina has about 19,000,000 acres of land. Of that, about 60 percent is forest land, 25 percent is agriculture, 10 percent is developed land and 5 percent is minor cover/land use (Figure 2).

Interest in the preservation of riparian forest buffers comes at a time when many riparian areas are being adversely impacted by land practices like increased urbanization and land conversion. Nationally, it has been estimated that 70 to 90 percent of the nation's original riparian areas have been subjected to extensive alteration (Knutson and Naef 1997).

Growth patterns indicate that land use is rapidly changing in many areas of South Carolina. Since 1970, the percentage of population increase (51%) has almost equaled the growth experienced during the entire first half of the century (Institute of Public Affairs 2000). By 2010, the current population of 3.9 million is expected to grow to 4.3 million. As expected, growth has been most dramatic in the urban areas and coastal counties of South Carolina. Between 1970 and 1990, counties along the I-85 corridor near Greenville experienced growth rates in excess of 30 percent. Beaufort County, fueled by growth surrounding Hilton Head, increased by 69 percent (Figure 3).

While most riparian areas in South Carolina were once forested, many of these areas have been and will continue to be threatened by growth and development. They will be cleared to accommodate commercial, residential, and industrial development as well as other land uses, or will be converted from agricultural and forest lands to other uses. The development of these areas potentially impacts not only water quality but also wildlife habitat.

Recognizing the need to examine the protection, conservation and restoration of riparian forest buffers in South Carolina, the Department of Health and Environmental Control (DHEC) provided support for the creation of a statewide Riparian Forest Buffer Task Force. The Center for Environmental Policy at the University of South Carolina's Institute of Public Affairs (CEP) was commissioned to conduct research on riparian forest buffers, and to convene and staff the

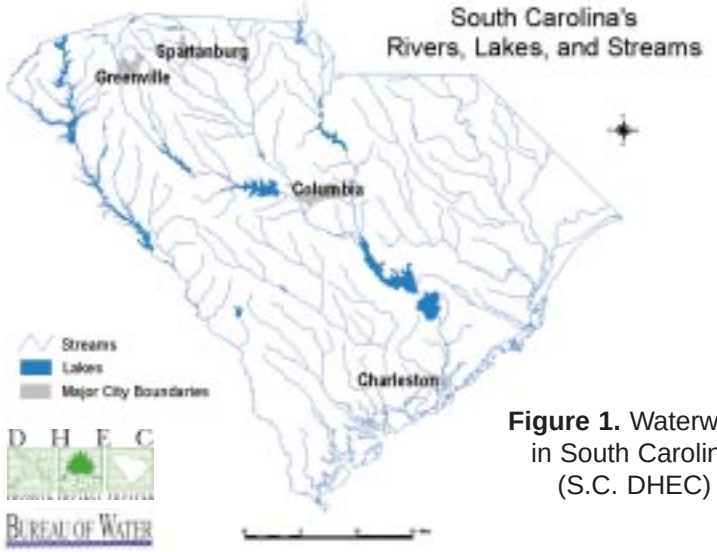

Figure 1. Waterways in South Carolina (S.C. DHEC)

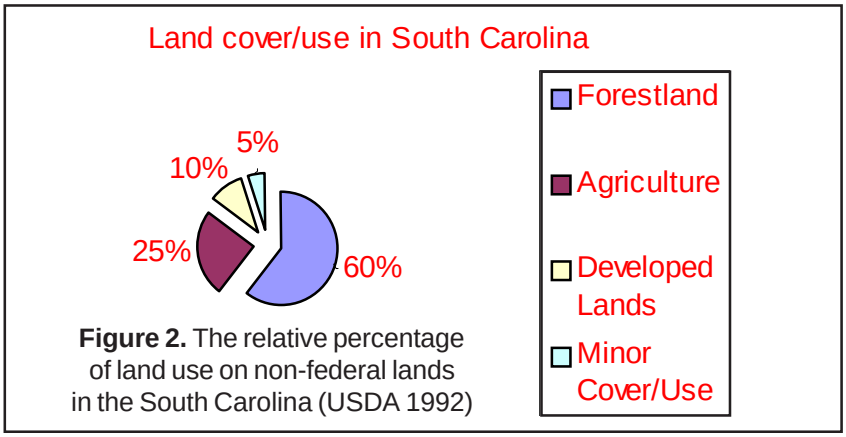

Figure 2. The relative percentage of land use on non-federal lands in the South Carolina (USDA 1992)

Task Force. The CEP was asked to undertake two, interrelated tasks:

1. Investigate the status of riparian forest buffer protection and restoration programs in South Carolina and in the United States; and

2. Create and coordinate a statewide Riparian Forest Buffer Task Force to develop recommendations pertaining to the protection and restoration of riparian forest buffers in South Carolina.

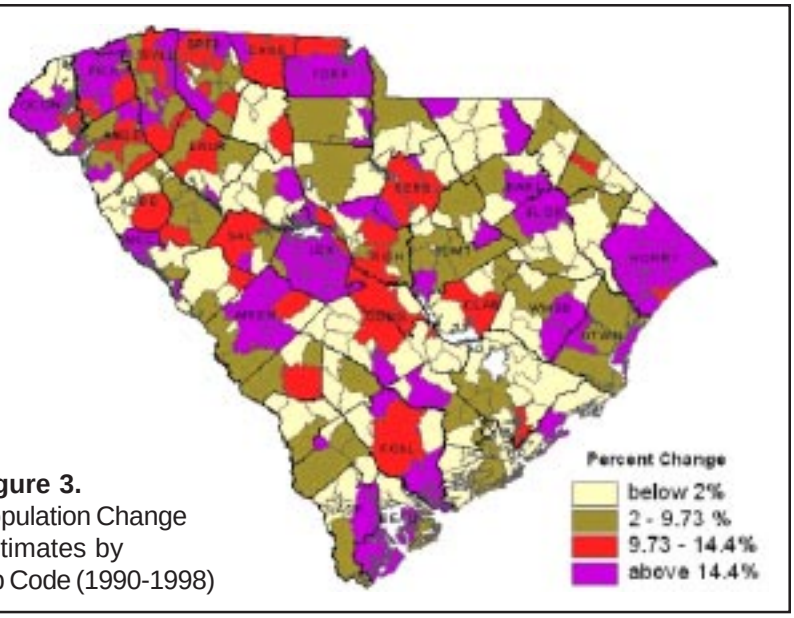

Figure 3.
Population Change Estimates by Zip Code (1990-1998)

Analyzing existing regulations, programs and initiatives relating to riparian forest buffers proved to be a significant undertaking because of the diversity in approaches that were found across the country. In conducting this task, the CEP was asked to review the information gathered in the context of several, specific questions posed by DHEC:

1. Why are riparian forest buffers a critically important resource to the health of South Carolina's streams and watersheds, and what is the current state of knowledge concerning water quality, habitat and aquatic ecosystem health-related functions of riparian forest buffers in various land use settings?

2. What efforts currently exist to protect and restore riparian forest buffers on different land settings? Specifically,

    a. What statutes, regulations and programs have been implemented at the federal, state, and local levels and within the private sector? How do they address the conservation or restoration of riparian forest buffers?

    b. Do these statutes, regulations and programs directly or indirectly discourage restoration or conservation of riparian forest buffers? How can they be modified to eliminate any disincentives?

    c. Do these statutes, regulations and programs offer sufficient incentives for the restoration or conservation of riparian forest buffers? How can they be improved or new programs added to provide more effective measures?

3. Are there opportunities in existing statutes, regulations or programs to encourage restoration or conservation of riparian forest buffers that are not being utilized? What changes would be needed to realize these opportunities?

4. What additional tools are needed to effectively promote restoration or conservation of riparian forest buffers as related to different land uses?

5. What actions should be taken by federal, state, and local agencies and within the private sector to improve the restoration and conservation of riparian forest buffers?

The CEP conducted its research throughout the summer of 1999, and provided a draft report of its initial findings to the Task Force in August, 1999. This report then became the working document of the Task Force, and was modified, added to, and refined as the Task Force completed its work.

To accomplish the second task, the CEP created a statewide task force on riparian forest buffers in May, 1999. The CEP invited representatives from government, academia, private non-profit organizations, and the public and private sectors in an effort to assemble as broad and as balanced a set of interests as possible. The initial list of individuals and organizations was developed by the CEP with input from DHEC. As the work of the Task Force progressed, other individuals who asked to be included on the Task Force were added. Although active participation by members on the Riparian Forest Buffer Task Force members varied throughout the year, the members grew from the initial list of 36 to the present list of 46. A list of members is included in Appendix III.

An organizational meeting of the Task Force was held on June 8, 1999. The Task Force was asked to accomplish two broad objectives:

1. To review the status of existing riparian buffer protection and restoration programs; and

2. To develop statewide recommendations for the preservation, conservation, and restoration of these critical natural resources in South Carolina.

The Task Force felt it was important to develop a clear mission statement first. While general objectives were presented to the Task Force in the context of the research project, the members felt it was critical to adopt a mission statement that reflected the consensus of the group. Because of the diversity of the membership, they also agreed that recommendations should be adopted by consensus. After extensive deliberations about the role of the Task Force, the nature of the issues to be addressed, and the desired outcomes to be achieved, the Task Force developed and approved the following mission statement:

> **Mission Statement:** "Reflecting the multiple roles that riparian forest buffers play in protecting and enhancing the water quality, terrestrial and aquatic ecosystems, and recreational, economic, and aesthetic value of the State's waterways, the goal of the Riparian Forest Buffer Task Force is to develop recommendations for the preservation, conservation, and restoration of these critical natural resources in South Carolina."

Next, the Task Force addressed the need to adopt a working definition of a "riparian forest buffer." Discussions centered on the nature of riparian buffers generally, and the more specific focus on riparian forest buffers. After extensive deliberations, the following definition was adopted by the Task Force: Riparian Forest Buffer

"An area of vegetation that is natural or designed and managed, consisting of trees, shrubs and grasses adjacent to a stream, river, wetland or shoreline that helps maintain the integrity of water resources."

The Task Force felt it was not only important to define a riparian forest buffer, but also to describe the benefits provided by the buffer. The benefits provided by riparian forest buffers are:

- Trap/filter sediment from runoff;
- Trap/filter nutrients/pesticides/other pollutants from runoff;
- Stream bank stabilization;
- Flood control;
- Maintain flow during dry periods;
- Maintain aquatic/terrestrial wildlife habitat and species diversity;
- Aesthetic value; and
- Recreational and educational opportunities

For ease of reference, other terms used by the Task Force and throughout this report are defined and included in Appendix IV.

Key Terms

- **Buffer** – an area or strip of land maintained in permanent vegetation to help control nonpoint source pollutants and manage other environmental problems as typically measured from the streambank.
- **Riparian** – refers to land adjacent to a body of water.
- **Riparian Forest Buffer** (as defined by the Task Force) – An area of vegetation that is natural or designed and managed, consisting of trees, shrubs and grasses adjacent to a stream, river, wetland or shoreline that helps maintain the integrity of water resources.
- **Perennial stream** – A stream or river that normally flows throughout the year, except during extreme droughts. These streams typically have a defined channel and support a diverse population of aquatic insects, including some with life cycles that require permanent water. Their channels are able to sort and move stream channel materials (Hansen, in press).
- **Intermittent stream** – A stream or river that flows beyond rainfall events, but does not flow throughout the year. These streams typically have defined channels and do not support a diverse population of aquatic insects. Their channels flow often enough and with enough force to scour, sort or move stream channel materials (Hansen, in press).
- **Ephemeral stream** – A stream or river that flows only in response to rainfall events or for very short periods afterwards. Groundwater levels seldom if ever reach the surface. These streams often do not have enough flow quantity or duration to develop a

defined channel in forested conditions. In their stable form, they seldom are a problem for water pollution. Some intensive land uses can activate these streams to scour, move sediments and contribute to water quality problems (Hansen, in press).

To meet the research objectives, the Task Force created three work groups — Technical, Policy, and Education — and assigned specific issues to each. A list of the members of the work groups can be found in Appendix V. The work groups met over the course of the year, and developed preliminary recommendations on their assigned issues. The preliminary recommendations were then submitted to the full Task Force for review and approval. Final Task Force recommendations were adopted by consensus and may not reflect agreement by every Task Force member or endorsement of the participating organizations. In one instance, a participating organization requested to go on record opposing the final recommendation.

One challenge in assigning issues to the work groups was the recognition that in some cases there would be areas of overlap particularly between policy and technical issues. Some issues, therefore, were subdivided and the work groups were asked to examine them either sequentially or in tandem. The issues and the work group assignments were as follows:

1. What are the current regulatory and non-regulatory approaches to protecting and restoring RFB's in the United States?

   - **Policy Work Group:** Identify and gather information about current RFB initiatives around the country.

   - **Technical Work Group:** Take information and evaluate the effectiveness of the initiatives in protecting water quality and to determine how or if they could be implemented in South Carolina.

2. What types of buffer protection policies are needed for South Carolina? What are potential obstacles to implementation? As subsets of this issue:

   (a) Should buffer protection measures be mandated, incentive-based, or other; and

   (b) Should buffer requirements be set at the state or local level, or both, or either?

Policy Work Group

3. Should different buffer protection programs be developed for different land uses?

   - **Technical Work Group:** Evaluate the technical merit of the need for different programs based on land use. If such action is needed, then,

   - **Policy Work Group:** Decide how to implement such a program.

4. What activities are allowed in the RFB? Are the buffers actively managed?

   - **Technical Work Group:** Make initial recommendations on this issue.

   - **Policy Work Group:** Make final recommendations on this issue.

5. What and where are the critical areas in South Carolina?

Technical Work Group

6. What is the minimum width of a buffer? Should there be exceptions to buffer widths in order to make programs more flexible? And, what should the buffer width be a function of (i.e. land use, physical controls, vegetation, etc.)?

   - **Technical Work Group:** Make recommendations on this issue.

   - **Policy Work Group:** Examine the question of whether buffer width should be dependent on the parameters that are being protected (i.e. terrestrial wildlife, aquatic wildlife, water quality, etc.).

7. For whom should educational efforts be directed? What audiences should be targeted? As subsets of this issue:

   (a) How do you evaluate the success of buffer educational programs?

   (b) What sources of funding exist for buffer educational programs?

   (c) Who should be responsible for the overall coordination of the collection and development of the new information to be integrated into existing educational efforts?

Education Work Group

The project officially began with the first Task Force meeting on June 8, 1999. The Task Force was asked to complete its recommendations by May, 2000. To facilitate its work, the Task Force initially agreed to meet on a bi-monthly basis with the work groups meeting in between. By the October Task Force meeting, however, it became clear that the Task Force needed to meet monthly to meet the May 2000 deadline. The work groups met between the monthly Task Force meetings to develop their preliminary recommendations. The schedule of Task Force and work group meetings, and the major agenda items for each, can be found in Appendix VI.

Chapter 3
TECHNICAL RECOMMENDATIONS

This chapter describes the technical issues that were reviewed by the Technical work group and the Task Force, and the resulting recommendations. A substantial amount of scientific literature on the functions and benefits of riparian forest buffers was reviewed and is summarized here. A more complete list of scientific references and citations is included in Appendix VII, and in the " Integration of Science and Policy: A Case Study on Riparian Buffers" a Working Paper published by the CEP as part of this research effort.

ISSUE #1:

What and where are the critical areas in South Carolina?

TECHNICAL CONSIDERATIONS

This issue focuses on whether there are certain water bodies, geographic areas, areas of significant land development, or types of land development practices that warrant designation as "critical areas" in South Carolina where riparian forest buffers should be required.

DHEC is required under Section 305(b) of the federal Clean Water Act to conduct a general assessment of water quality conditions in South Carolina. From 1987 to 1994, DHEC collected data on 19,487 miles of rivers and streams, 211,462 acres of lakes, and 221 square miles of estuaries to determine their ability to support aquatic life and recreational uses (S.C. DHEC,1996). Tables 1 and 2 include the level of use support for the waters of South Carolina and the major cause of the nonsupport in each water body type for aquatic life and primary contact recreation uses.

Presently, approximately 66% of rivers and streams, 95% of lakes, and 81% of estuaries in South Carolina have water quality that either fully supports or partially supports aquatic life and recreational use. Where partial or nonsupport of classified uses is identified, nonpoint sources, rather than point sources, appear to be most responsible. Unlike point sources of pollution that enter a water body from a discrete source (i.e. a pipe), nonpoint source pollution enters a water body from large or dispersed land areas usually during or after a rainstorm. Studies have shown dramatic reductions in nonpoint sources of nutrients, sediments, pesticides and other pollutants in surface and groundwater after passing through a riparian forest buffer.

Table 1: Ability of S.C. Water Bodies to Support Aquatic Life

Waterbody Type	Fully Supported	Partially Supported	Non-Supported	Predominant Cause
Rivers	87%	3%	10%	Dissolved Oxygen
Lakes	92%	3%	5%	Metals
Estuaries	68%	16%	16%	Dissolved Oxygen

(S.C. DHEC, 1996)

Table 2: Ability of S.C. Water Bodies to Support Recreational Use

Waterbody Type	Fully Supported	Partially Supported	Non-Supported	Predominant Cause
Rivers	53%	21%	26%	Fecal Coliform
Lakes	>99%	<1%	<1%	Fecal Coliform
Estuaries	89%	5%	6%	Fecal Coliform

(S.C. DHEC, 1996)

Critical areas of the state may also be impacted by land development practices or land use. Urban development, for example, has considerable impact on nearby water bodies. Streams and rivers adjacent to urban settings usually have greatly elevated sediment loads as compared to many other land use settings (Wahl et al., 1997; Frick et al., 1998). These higher sediment loads, along with other pollutants, result from the increase in impervious surfaces which carry rainfall in the form of runoff directly from the land and into water bodies thus bypassing the natural filtration that takes place in soils (Wenger, 1999). The increased flow in the stream causes greater flow in velocities that in turn increases channel erosion. Riparian forest buffers in urban settings help to decrease the rate of runoff reaching the water bodies and in the process decrease sediment loading and pollutant delivery to the water resource.

Riparian forest buffers may also offer benefits in different land use settings, however, some benefits may be more important than others depending on the specific land use. Without proper management agriculture lands, for example, yield large amounts of pollutants from runoff due to the use of fertilizers and pesticides. Riparian forest buffers are crucial for trapping and removing these pollutants before they reach water bodies, thus helping to control the amount of agricultural nonpoint source pollution (Lowrance et al., 1985).

Without proper management, forestry practices can cause increased erosion of the landscape from activities like timber harvesting, construction and use of haul roads, stream crossings, site preparation and reforestation which impact water quality by increased loading of sediments into adjacent streams. The protection and restoration of riparian forest buffers can help prevent erosion of the landscape by trapping sediments and minimizing channel erosion by stabilizing streambanks.

TASK FORCE RECOMMENDATION:

After considering these questions, the Technical Work Group initially recommended that there should be no designation of "critical areas" of the state because by definition all waters of the state are critical and should have riparian forest buffers. However, the Task Force felt that "all waters of the state" was too broad, and that consideration should be given to the types of streams (intermittent, ephemeral, and perennial) where riparian forest buffers might be required. For example, the Forestry Best Management Practices contain recommendations appropriate for each stream type. Upon further consideration, the Task Force agreed that recommending riparian forest buffers based on stream order would be addressed and included as part of the issue relating to recommended minimum buffer widths, and that no further recommendation would be made on identifying critical areas of the state.

ISSUE #2:

What is the minimum width of a buffer? Should there be exceptions to buffer widths in order to make programs more flexible? And, what should the buffer width be a function of (i.e. land use, physical controls, vegetation, etc.)?

TASK FORCE RECOMMENDATIONS:

- **Statewide Minimum Buffer Width:** To protect water quality and to realize other benefits, South Carolina should require a riparian forest buffer with a minimum width of 35 feet of native vegetation on both sides of all perennial and intermittent streams and rivers, lakes, estuarine waters, and coastal marshes. Buffer widths should increase with increasing slope in the terrain. Buffer requirements on ephemeral channels and non-coastal wetlands should be determined on a site-by-site basis. Buffers on ephemeral channels may be less than 35 feet in width and include other non-forested permanent vegetation types.

- **Buffer Widths Exceeding the Statewide Minimum:** Non-regulatory approaches at the state and/or local levels should be considered to implement buffer widths that exceed the statewide minimum. Enhanced water quality protection and additional wildlife protection may be accomplished by the following:

  - ☐ 100 foot buffer of native vegetation on both sides of the water body to better enhance water quality in non-forested areas and to provide additional benefits to wildlife; and

  - ☐ 300 foot buffer of native vegetation on both sides of the water body to provide comparable benefit of an undisturbed riparian system.

TECHNICAL CONSIDERATIONS:

1. **MAJOR BENEFITS AND FUNCTIONS OF RIPARIAN FOREST BUFFERS**
   Riparian buffers act as a "right of way" for a stream, and function as an integral part of the watershed ecosystem (Schueler 1995). Riparian zones perform a broad range of functions with significant economic, ecological, and social value to people (Wenger 1999; Schueler 1995; DHEC 1999). The major benefits and functions of riparian forest buffers are:

   - ☐ **Trap /remove sediment from runoff** — Riparian buffers reduce the velocity of sediment bearing storm flows, which allows the sediment to settle out of the water and be deposited on land.

   - ☐ **Protect streambank from erosion** — Tree roots consolidate the soils of the floodplain and the streambank, reducing the potential for severe bank erosion.

   - ☐ **Trap/remove of phosphorus, nitrogen, and other nutrients that can cause eutrophication of aquatic systems** — Nutrients are removed through uptake by

vegetation, biochemical processes by plants and bacteria, and the geophysical trapping of the soil in the vegetation.

- ☐ **Trap/remove other contaminants, including organic matter, biological contaminants, pesticides and metals** — Contaminants are removed through similar processes as nutrients including uptake by the plant community and biodegradation by plants and bacteria.

- ☐ **Effective flood control** — Other, expensive flood controls, such as levees, are not necessary if the buffer includes the 100-year floodplain.

- ☐ **Provides food and habitat for wildlife** — The leaf litter provided by the trees is the base of the food source for many stream ecosystems. Trees also provide woody debris that creates cover and habitat structure for terrestrial and aquatic plants, insects and other animals. In addition, trees also provide shading to protect the stream from solar heating.

- ☐ **Increased property values** — There is some evidence that homebuyers perceive buffers to be attractive amenities to the community as seen in the neutral or positive impact on property values in communities where buffers are present.

- ☐ **Reduced maintenance costs** — Results of some studies have shown that corporate landowners can save between $270 to $640 per acre in mowing and maintenance costs when open lands are managed as vegetated buffers rather than as turf grasses.

- ☐ **Decreased Public Investment Needs** — By reducing, flood, erosion, and sedimentation, riparian buffers minimize the public investment in stormwater management and waterway restoration and protection.

- ☐ **Recreational and educational opportunities** — The nature of the buffer provides opportunities for connected open space that allows pedestrians, bikers and runners to move efficiently through a community.

The effectiveness of riparian forest buffers in achieving these benefits may depend on several conditions, including: buffer width; buffer slope; soil type and characteristics; vegetation; and buffer design (DHEC 1999; Schuler 1999).

2. BUFFER WIDTH AND WATER QUALITY

One of the major benefits of riparian forest buffers is the protection of water quality by removing or reducing the amount and kinds of sediments and pollutants entering a water resource from surface runoff. The following is a is a discussion of selected research that has addressed buffer widths in this context.

Sediment Removal

Buffers serve to reduce sediments from runoff. Riparian buffers remove or reduce stream sedimentation in six ways:

1. By displacing sediment producing activities away from waterways (setbacks);

2. By trapping terrestrial sediments in surface runoff;

3. By reducing the velocity of sediment bearing storm flows, allowing the sediments to settle out of the water and be deposited onland;

4. By stabilizing streambanks, preventing channel erosion;

5. By moderating stream flow during floods, reducing bed scour; and

6. By contributing large woody debris to streams that can trap sediment (U.S. ACOE 1991).

Trapping/Removal of Sediment

There is a positive connection between a buffer's width and its sediment trapping capacity (Wenger 1999). Many studies have attempted to show the correlation between sediment reduction and buffer width in agricultural and urban settings. A 1982 study by Wong and McCuen produced an equation based upon sediment particle size, slope, surface roughness, and runoff characteristics (Castelle et al.1994). While the equation showed that small buffers were adequate to remove small volumes of sediment, the relationship between buffer width and percent sediment removal was nonlinear and disproportionately large widths were required to achieve incrementally greater sediment removal. For example, increasing the percent sediment removal from 90 to 95% would require the buffer width to be increased from 100.1 to 200.1 feet. Other researchers have documented similar trends in buffer width and sediment removal in field studies.

It should be noted that long term studies have supplied significant evidence that much wider b[illegible]

are needed to maintain sediment control (Wenger 1999). These studies suggest that while riparian buffers serve as efficient sediment traps, the width required for long term retention may be significantly higher than what is indicated by the short-term experiments (Wenger 1999).

The riparian buffer width recommendations for forestry operations, contained in the South Carolina's Best Management Practices for Forestry, were developed based on water quality research conducted at southeastern universities and government research facilities. Water quality research related to forestry operations has been ongoing since the 1930s at the USDA Forest Service's Coweeta Hydrologic Laboratory in western North Carolina. Forestry buffer width recommendations are intended to protect water quality while conducting forestry activities. In South Carolina, research conducted by the South Carolina Forestry Commission, in cooperation with the S.C. Department of Health and Environmental Control and Clemson University, utilizes U.S. Environmental Protection Agency approved Rapid Bioassessments Protocols (Plakfin et al. 1989) to evaluate the effectiveness of the forestry buffer recommendations in protecting water quality. The results indicated that a weight-of-the-evidence approach utilizing a BMP compliance check, a stream habitat assessment, and a benthic macroinvertebrate bioassessment was an accurate method of evaluating BMP effectiveness. This research conclusively showed that implementation of state-approved forestry buffer guidelines along with other applicable BMPs, was sufficient for the protection of the water quality of associated streams (Adams et al. 1995). This type of BMP effectiveness research has been duplicated in other southeastern states with similar results.

In summary, studies have yielded a range of recommendations for buffer widths and the ability to trap sediment from surface runoff. Buffers as narrow as 15 feet have proven fairly effective in the short term, although wider buffers provide significantly better sediment control, especially on steeper slopes. Yet, long term studies suggest the need for 100-foot buffers (Lowerance et al. 1988; Wenger 1999). Wenger, after conducting a thorough literature review, concluded that a minimum width of 30 feet is needed for adequate sediment control. Activities that permanently or semi-permanently increase flow and erosion (i.e., roads, house roofs, parking areas, repeated cultivation, overgrazing) need wider buffers than those activities that produce only temporary changes in soil cover quality (e.g., logging with reforestation, land development with rapid lawn development, no-till farming methods). In other words, the intensity and the duration of the activities should be considered. The type of stream, slope of the land and other circumstances can make a difference in the effectiveness of the buffer.

Phosphorus Removal

Sedimentation rates are also closely associated with the deposition of nutrients such as phosphorus. Other nutrients, such as nitrogen, act independently from sedimentation processes in riparian buffers. Phosphorus retention and removal from runoff in buffer zones is driven by a combination of chemical, biological and physical processes. The three most important mechanisms are: (1) the deposition of phosphorus with sedimenting material; (2) adsorption of dissolved phosphorus; and (3) the uptake of phosphorus by vegetation (Uusi-Kämppä et al. 1997).

Since most of the phosphorus arrives in the buffer as particulate phosphorus usually associated with sediment, buffer widths designed to remove sediment from runoff should also be successful in removing phosphorus. A number of studies have demonstrated that riparian buffers retain the majority of phosphorus that enters over the short term, and the retention increases with buffer width, although results vary considerably (Appendix VII). Relative to buffer width, the filtration process of phosphorus is exponential. The phosphorus absorbed and transformed in the upper portion of the buffer is significantly greater than that in the middle and lower portions of the buffer indicating that even narrow vegetative buffers may be important in removing phosphorus from runoff (Uusi-Kämppä et al. 1997).

Several studies (Dillaha et al 1988 and 1989, Magette 1987 and 1989) have documented the ability of riparian buffers to reduce total phosphorus levels in surface runoff, yet these studies have also noted a decline in the effectiveness of the buffers over time. This may occur when environmental conditions change and the soil gradually becomes enriched with phosphorus or when the assimilative capacity of the buffer zone is exhausted, allowing previously trapped phosphorus to be released from the buffer and the soil as dissolved phosphorus (Uusi-Kämppä et al. 1997). Dillaha et al. (1988) goes further and assumes that dissolved phosphorus removal should decrease with time as filtration decreases, as the adsorptive capacity of vegetation is saturated and as adsorptive sites of the surface soil become occupied.

Despite their associated problems, buffers wide enough to provide adequate sediment control (30-100 feet) should provide efficient short term removal of sediment bound phosphorus (Wenger 1999). However, wider setbacks should be considered for certain land

uses such as the application of animal wastes and fertilization.

Nitrogen Removal

Riparian buffers have also been utilized to remove nitrogen from both agricultural and urban surface runoff. Nitrogen occurs in numerous organic and inorganic forms, which are interconvertible under suitable circumstances. Nitrate has been the target of many buffer programs because of its potential toxicity to humans and animals at concentrations greater than 10 mg/L in drinking water. Ammonia is another form of nitrogen that buffer programs also consider because of its toxicity to many aquatic organisms and because it is readily taken up by plants and algae (Wenger 1999). Nitrogen is commonly quantified three ways: total Kjeldahl nitrogen (TKN) which represents organic and inorganic nitrogen species; ammonium concentration; and nitrate concentration.

Riparian buffers remove nitrogen by two methods - uptake by vegetation and denitrification. Denitrification is the conversion of nitrate into nitrogen gas by anaerobic bacteria. This process represents the permanent removal of nitrogen from the riparian ecosystem with the gas being released into the atmosphere. There is some evidence that denitrification is the dominant mechanism of nitrogen reduction in the riparian buffer (Wenger 1999).

As it was with sediment and phosphorus removal, reduction of nitrogen in surface runoff is correlated with buffer width (Dillaha et al. 1988, 1989; Magette 1987, 1989; Castelle et al. 1994). Yet, the nitrogen removal efficiency is quite variable between different studies (Appendix VII). Dillaha et al (1988) found that a 15 foot grass buffer would remove 67% of the total nitrogen and a 30 foot buffer of the same design would remove 74% of the total nitrogen, but was ineffective in removing nitrate. In a similar experiment, Magette et al. (1989) found that a 15 and 30 foot buffer would remove 0% and 48% respectively of the total nitrogen in the surface runoff.

Unlike phosphorus, nitrate is quite soluble and readily moves into shallow ground water. In many areas, much of the nitrogen enters riparian areas through subsurface flow (Wenger 1999). The ability of riparian areas to reduce nitrogen concentrations in subsurface flow depends a great deal on the pattern of the subsurface flow. For example, if the flow is shallow and passes through the root systems of the riparian vegetation, vegetative uptake and denitrification can be significant pathways of removals, while if the flow bypasses the riparian zone and recharges an aquifer or contributes to the flow of a stream, nitrogen removal may be insignificant (Wenger 1999).

Several studies have demonstrated the success of riparian buffers in reducing nitrate concentrations in shallow groundwater (Gilliam et al. 1996; Gilliam 1994; Jordon et al. 1993; Peterjohn and Correll 1985). Gilliam and Jacobs observed a reduction of 87-93% in subsurface nitrate concentration from a 50 foot buffer (Gilliam 1994). The percentage reductions observed by Peterjohn and Correll (1985) and Jordon et al. (1993) are very similar. However, there is not a clear correlation between subsurface flow nitrate removal rate and riparian buffer width. Some studies have suggested that hydrologic pathway and dentrification potential may be more significant than buffer width in nitrate reduction in subsurface flow (Peterjohn and Correll 1985).

However, the distribution of denitrification sites, the predominant pathway of nitrogen removal, varies spatially, indicating that wider buffers, on average, will provide more dentrification sites than narrower buffers. Wenger (1999) recommends a minimal width of 50 feet to reduce nitrogen levels, but suggests that buffers of 100 feet or greater will provide more nitrogen removal. Wenger notes the importance of preserving riparian wetlands, which are sites of high nitrogen removal.

Removal of Organic Matter, Biological Contaminants, Pesticides and Metals

Few studies have investigated the efficiency of riparian buffers to remove organic matter and biological contaminants from surface runoff. The sparse research that exists indicates that buffers are useful for reducing these contaminant concentrations, but that they may not be sufficient to protect water quality (Wenger 1999). Coyne et al. (1995) applied poultry manure to two test plots and measured fecal coliform reductions across a 30-foot wide buffer. After artificial rain was applied, fecal coliform concentrations were reduced by 74% and 34% on the two test plots. However, it should be noted that remaining fecal coliform concentrations were still above the primary contact standard. From what is seen by the current research, it may be wisest to control these contaminants at their source and not rely on riparian buffers as treatment systems.

Riparian buffers may also be useful in reducing the concentrations of pesticides and metals in waterways. Most pesticides are broken down by bacteria in the soil, while metals tend to bind to the soil particles (Wenger 1999). Therefore, wider buffers are believed to be most efficient in reducing pesticide and metal

concentrations because they provide greater retention times allowing more opportunities for contaminants to decompose and more binding sites for metals (Wenger 1999).

The mechanisms of pesticide transport are not well understood. Rhode et al. investigated the movement of the herbicide "trifluralin" in the runoff from three kinds of plots: a 11,155 square foot watershed without a buffer strip, after natural rainfall; a 92 square foot plot without a buffer strip, after simulated rainfall; and a 92 square foot plot from which runoff, after simulated rainfall, was directed into a 65 foot grassed buffer. Results, after the two-year experiment, showed that a large amount of the trifluralin applied to each plot was carried away as surface runoff. However, the grassed buffer adjacent to one of the plots removed over 85% of the waterborne trifluralin (Norris 1993). Other studies (Lowrance et al. 1997; Neary et al. 1993) have all shown similar results. Yet, the width necessary for adequate removal of pesticides and metals is unclear from the existing research (Wenger 1999).

3. BUFFER WIDTH AND HABITAT PROTECTION

Riparian forest buffers have the potential to support an exceptional level of biodiversity due to natural disturbance regimes, a diversity of habitats, and small-scale climatic variation (Wenger, 1999). However, Gregory and Ashkenas (1990) have noted that riparian buffers designed for the protection of water quality may not meet the habitat needs of terrestrial wildlife. The ability of a riparian forest buffer to protect and support terrestrial wildlife is usually dependent on its width. A narrow buffer may support a limited number of species, but wider buffers are required to maintain populations of riparian-dependent species (Wenger, 1999). Generally, most researchers advocate preserving as wide a buffer as possible for the protection of wildlife.

In the past ten years, there has been an abundance of research on the recommended riparian buffer width for birds. Table 4 summarizes the buffer width recommendations from eight of these studies (Wenger, 1999).

Relatively few studies have addressed how wide riparian forest buffers need to be in order to support mammal populations. In one study, Cross determined that riparian zones in mixed conifer forest sites in southwest Oregon supported a higher density and diversity of small mammal species than upland habitat. He also found that diversity and composition of mammal species in a riparian buffer of 220 feet in width bordered by a clear cut forest was comparable to the diversity and composition of an undisturbed site (Wenger, 1999).

Table 4: Recommended Buffer Width for Birds

Article	Width Studies (feet)	Minimum Width Recommendation (feet)
Hodges and Krementez (1996)	118-6849	328
Keller et al (1993)	82-2624	328
Kilgo et al (1998)	82-1640	Both Narrow and Wide
Kinley and Newhouse (1997)	46-230	230
Smith and Schaefer (1992)	65-492	No Recommendation
Spackman and Hughes (1995)	82-656	492-574
Thurmond et al (1995)	49-164	49
Triquet et al (1990)	49-75	No Recommendation

(Wenger, 1999)

4. ECONOMIC IMPACTS OF BUFFERS

Although riparian forest buffers are frequently seen as a loss by developers and property owners, studies have shown that the preservation of these buffers increases the value of property (Reynolds, 2000). A national survey was conducted in 1992 by the Metropolitan Washington Council of Governments to determine the financial impact of existing riparian buffer programs. Twenty-nine of the thirty-one respondents indicated that existing buffers had a positive or neutral effect on the value of adjacent property. The remaining two respondents indicated that they were unsure of the effect that buffers had on adjacent property values.

Builders, real estate agents, and homeowners have acknowledged the financial advantage of having forests and trees near home sites. A survey of builders by the National Association of Home Builders found that home buyers are willing to pay more for lots with trees. The survey results showed that 43% of home buyers paid up to $3,000 more for homes on wooded lots, 30% paid between $3,000 and $5,000 more, and 27% spent over $5,000 more for wooded lots – with 8% of that group spending an additional $10,000. In a 1994 Bank of America Mortgage survey, 50% of 1,350

real estate agents surveyed believed that trees had a positive impact on potential buyers' impression of a home and its neighborhood and 84% felt that a home on a treed lot would be as much as 20% more sellable than a similar, treeless home.

Riparian forest buffers may decrease the public's investment needs in stormwater management and waterway restoration and protection. For example, Fairfax County, Virginia reduced its stormwater costs by $57 million by protecting riparian forest areas and buffers. Citizens in Johnson County, Kansas voted to spend $600,000 to create a streamway park system, as opposed to $1.2 million on stormwater control projects. Also, New York City opted to spend $1.5 billion to protect 80,000 acres of its upstate watershed to avoid the need to build a $8 billion water filtration plant that would need an additional $300 million annually to operate.

The preservation of riparian forest buffers can also have additional economic value to landowners. For example, on a typical subdivision construction site, the average cost for clearing a forest is $4,000 per acre and sediment control is $800 per acre. However, by conserving some forest, developers will reduce sediment loss from the site and reduce the time and labor needed for regrading, stabilizing, and re-landscaping the site.

Real world examples also exist to demonstrate the high cost of restoring degraded waterways. In response to public demands, Montgomery County, Maryland is spending $20,000-$50,000 per household lot in some areas to repair damaged streams and riparian forests. Also, Fairfax County, Virginia has passed a local bond issue to supply the needed $1.5 million to restore two miles of stream and riparian areas that were degraded.

Buffer requirements also have economic costs—primarily borne by the owners of non-urbanized agricultural, forest, and vacant lands at the edge or within urbanized areas. Because the value of these lands varies substantially, a precise monetary value cannot be placed upon them. Programs to compensate landowners or to provide economic incentives to establish buffers beyond the recommended statewide minimum buffer width should be considered.

A study done by the Center for Environmental Policy and the Central Midlands Council of Governments on approximately 86,000 acres, including the Town of Lexington and vicinity, a portion of the Lake Murray shoreline, and the Twelve Mile and Fourteen Mile creeks approximates that:

1. A 35-foot buffer would include 5.9% of the land within the study area (lands classified as rural and vacant);

2. A 100-foot buffer would include 12.9% of the land within the study areas;

3. A 300-foot buffer would include 30.7% of the land within the study area. A full copy of this study is included in Appendix VIII.

5. OTHER BUFFER CHARACTERISTICS

Slope

Buffer slope, like buffer width, is another important factor that must be considered in determining the functions and benefits of riparian forest buffers. Areas of steep slope (greater than 15%) may not allow for long retention time of the runoff in the buffer, and since pollutant removal is at least partially time dependent (i.e., to allow for plant uptake and denitrification to occur), steep slopes may reduce buffer effectiveness. Even though a steeply sloped area may be thickly vegetated, it may be ineffective at removing sediment and other nutrients because the steep slope promotes erosion and channelization of the runoff through the buffer. The shallower slope of the buffer allows for slower flow, longer residence time in the buffer, promoting longer times for vegetated uptake and settling out of pollutants (Desbonnet et al. 1994).

A slope of less than 15% reportedly provides sufficient retention time and pollutant removal (DHEC 1999; Wenger 1999; Desbonnet et al. 1994). Clark (1977) supplies some examples of minimal buffer width for water quality protection according to slope and soil erodibility. A minimum width of 33 feet for areas with no slope on slightly erodable soils extending to 165 feet for 30-percent slopes on severely erodable soils is recommended.

Many of the field studies previously discussed also considered slope as a factor. Dillaha (1988), using a 15 foot grass buffer adjacent to plots to which dairy manure was applied, demonstrated the decreased effectiveness of the buffers with increased slope. An 11-percent sloped buffer removed 87% of the Total Suspended Solids, 61% of the total nitrogen and 63% of the total phosphorus while a 16-percent sloped buffer removed 76% of the TSS, 67% of the nitrogen and 52% of the phosphorus.

Soil Characteristics and Soil Type

Soil characteristics and soil type are other parameters that must be considered in buffer design. The vast majority of natural riparian buffer areas are comprised of alluvial soils deposited in floodplains or on adjacent terrace landscape positions.

Soils with a high permeability generally provide greater filtration of sediment and attached pollutants than relatively non-permeable soils. Contaminants, once they enter the soil, become incorporated into soils and plant tissue through physical, chemical, and biological interactions (Desbonnet et al. 1994). However, highly permeable soils may percolate water rapidly into the subsurface flow. This movement may be so rapid that no removal of pollutants by plant uptake is possible and only minimal removal by chemical and physical adsorption occurs (DHEC 1999).

Research has indicated that poorly drained sediments are twice as effective at removing nitrogen and other contaminants than well-drained sediments (DHEC 1999; Desbonnet et al. 1994). Poorly drained sediments tend to retain water for longer periods of time and are favorable for pollutant removal longer than well-drained soils. It has also been noted that poorly drained soils that contain a higher organic content, such as those typically found in salt marshes, wetlands and wet forests, are more prone to promote growth and maintenance of microbial community development and hence to greater pollutant removal. Therefore, saturated organically rich soils can be useful in the removal of both soluble and sediment-bound particles, while sandy soils may be most effective in removing sediment and bound pollutants, but only marginally effective at removing soluble forms of pollutants (DHEC 1999; Wenger 1999; Desbonnet et al. 1994).

Soils with a high clay content, because of their low permeability, tend to be ineffective soil types for buffer development (Desbonnet et al. 1994). However, mixed clay soils are often most effective in the removal of pollutants. Clay soils, acting as anions (negatively charged particles), have high affinities for binding positively charged particles, particularly metals. Providing the mixed clay soils are not compact, and runoff over the area is slow, pollutant removal via this mechanism may be significant (Zirschky et al. 1989). However, removal by chemical binding is not always permanent. The metals can be freed or moved during the next runoff event. Experimenting with copper, nickel, zinc, cadmium, chromium, iron, lead, and manganese, found that only copper and zinc were consistently removed from the runoff (Zirschky et al. 1989).

Vegetative Groundcover

Vegetative groundcover within a buffer serves multiple purposes with regard to overall effectiveness by removing pollutants, providing habitat, and creating aesthetic appeal. The type, age and density of the vegetation has a significant effect on the ability of the riparian buffer to remove sediments, nutrients, and other pollutants from surface runoff.

Grasses and woody-stemmed species, because of their unique characteristics, exhibit differences in their capacity to remove sediment and pollutants from runoff. For example, grasses respond rapidly to increased concentrations of nutrients, and they grow rapidly and densely in all climates. A grass buffer increases the roughness of the terrain and acts as an obstructive barrier to horizontal flow. This slowing of the velocity allows for an increased residence time in the buffer and increases sediment and adsorbed pollutant removal efficiency (Desbonnet et al. 1994). Woody-stemmed species generally have more well-developed and deeper root systems with more macropore area than grasses, allowing the system, when used as a buffer, to be effective in the removal of pollutants from groundwater.

Furthermore, the literature on the two types of groundcover is very different. Most of the literature on grass buffer strips focuses on sediment retention and its absorbed pollutant load from treated agricultural source areas. Studies on wooded areas, typically, have focused in on nitrogen removal through a natural forested buffer in urban and logged areas. This complicates comparisons between grass and forested buffers because of differences in study designs (Desbonnet et al. 1994).

Buffer Design

a. 3-Zone approach: Researchers have also considered a “three-zone” approach for multi-use buffers (Desbonnet et al. 1994; Schueler 1995; Wenger 1999). For example, using this approach, a 100-foot buffer is divided into three lateral zones — streamside, middle core and outer zone. Each zone performs a different function, and has a different width, vegetative target and management scheme (Schueler 1995).

The streamside zone is designed to protect the physical and ecological integrity of the stream ecosystem by stabilizing the streambank and providing habitat for aquatic organisms (Alliance Public Policy Program 1999). The vegetative target of mature riparian forest consists of mature trees two stems deep (which is equivalent to approximately 25 feet). Land use is highly restricted

in the streamside zone and should be limited to stormwater channels, footpaths and a few utility or roadway crossings (Schueler 1995).

Immediately upslope of the streamside zone, the middle core is designed to remove, transform and store nutrients, sediments and other pollutants flowing over the surface and through the groundwater (Alliance Public Policy Program 1999). This zone varies in width depending on stream order, the extent of the 100-year flood plain, adjacent steep slopes and protected wetland areas with a minimum recommendation of 50 feet. Its vegetative target is also mature forests, but some clearing and plantings may be allowed for stormwater management, access, and recreational uses. A wider range of activities is also permitted in this zone. Biking and running trails and recreation areas are often provided and stormwater best management practices are located in these areas (Schueler 1995).

The outer zone, immediately upslope from the middle core, consists of grass filter strips or other control measures which help slow runoff, filter sediment and its associated chemicals, and allow infiltration of ground water (Alliance Public Policy Program 1999). The estimated minimum width of this zone is 25 feet. There are very few restricted uses in this areas, however, septic systems and new permanent structures are generally prohibited (Schueler 1995).

b. Buffer Continuity: The importance of continuity is another factor that must be considered in buffer design. Very few studies have considered continuity, so little is known. However, it is assumed that a buffer needs to be contiguous in order to realize the maximum effect of the buffer. Additional research is needed to determine what effect changes in buffer width along a stream channel and breaks in the buffer have on overall buffer efficiency.

c. Stream Order: Another area that is associated with continuity that is rarely addressed in the research is the concept of stream order. Stream order is defined by stream branching patterns, with order 1 channels being the headwater channels closest to the ridge (Strahler, 1957). Stream size is related to stream order. Many local buffer protection programs have focused on developing guidelines and recommendations for riparian buffers along larger order streams while neglecting to include first and second order streams. This practice of only buffering larger waterways may not provide the water quality improvement and protection needed in many areas.

d. Buffer Delineation: The question of where one begins to delineate the start of the buffer must also be considered as there is no concrete method for buffer delineation. Typically, a buffer begins at the streambank. The South Carolina Forestry Commission Best Management Practices delineates the streamside management zone from the top of the streambank for perennial, intermittent and ephemeral streams. However, the Commission has a different requirement for braided streams. Braided stream systems have multiple interconnected channels, resembling the strands of a braid, with very low stream gradient (<0.5% channel slope). For braided streams, bankfull discharge measurement points are used to delineate the start of the buffer. Bankfull discharge is a measure of the channel depth, measured from a level line across the channel from bank to bank, and it changes very little. It is independent of water depth. In these systems, if a forested streamside management zone is required, the buffer begins at the points on the bank used to make the bankfull discharge measurement.

However, the South Carolina Department of Natural Resources does not delineate buffers from the streambank in conservation easements. Instead, it delineates the start of the buffer at the ordinary high water mark. Ordinary high water mark is defined as “the natural or clear line imposed on the shore or bank representing the ordinary height of the water. It may be determined by bank shelving, changes in the character of the soil, destruction or absence of terrestrial vegetation, the presence of litter or debris, or a combination of the above.”

The NRCS Field Office Technical Standards denotes that a buffer begins at the normal water line, or at the upper edge of the active channel and is measures horizontally on a line perpendicular to the water course or water body.

The Technical work group had primary responsibility for addressing the question of buffer width, and spent a significant amount of time discussing the benefits provided by riparian forest buffers at varying widths. A secondary issue assigned to the Policy work group was whether buffer width should be dependent on the parameters that are being protected, for example, wildlife, water quality, aquatic life, etc. These issues proved to be the most complex and most heavily debated by the work groups and the Task Force. The

Technical and Policy work groups reviewed a substnatial amount of research on buffer widths, and examined best management practices and other programs that had already established minimum buffer widths.

Based upon its review of the scientific literature and established buffer programs, the Technical work group concluded that a 35 foot buffer on both sides of the stream was the minimum necessary to protect water quality. The work group went on to recommend that a 100 foot buffer on both sides of the stream fully protects stream integrity and provides substantial wildlife benefits. Further, a 300 foot buffer on both sides of the stream would provide the benefits comparable to an undisturbed riparian system (Technical Work Group Recommendations 1-11-00).

The Technical work group also examined the influence of stream order, soils, slope and vegetation on the effectiveness of riparian buffers The Technical work group recommended that riparian forest buffers be required on all intermittent and perennial streams. It also recommended that for ephemeral channels and non-coastal wetlands, determinations about the buffer width should be made on a site-by-site basis. The work group recommended that buffer widths should increase with increasing slopes in the terrain. The work group agreed that native vegetation should be the ground cover within the buffer.

When the Task Force reviewed the Technical work group's recommendations, there was considerable discussion about existing buffer programs that had established minimum widths. For example, the Forestry Best Management Practices recommend a minimum of 40 feet, and the Natural Resource Conservation Service recommends a minimum buffer of 35 feet. The Task Force also discussed whether it was necessary to consider different buffer widths for different land uses. For example, different agricultural practices like livestock grazing and row farming all have different impacts and may require different buffer widths and/or different types of ground cover. The Task Force concluded that Forestry BMPs and NRCS Guidelines for agriculture are effective and should be encouraged without further recommendation. With these exceptions, the recommended buffer widths of 35, 100 and 300 feet were adopted by the Task Force.

ISSUE #3:

Should buffer protection programs be developed for different land uses/land types?

TASK FORCE RECOMMENDATIONS:

- **Existing Land Uses:** Existing land uses within the riparian buffer zone should be grandfathered in as of the effective date of adoption of the minimum buffer width. If an existing land use changes or there is additional encroachment in the RFB, the minimum RFB requirements should be met.

- **Agriculture and Forest Lands:** Lands that are in use for agriculture or forestry are exempt from the state and/or local riparian forest buffer requirements so long as the owners of the land maintain their lands in compliance with the best management practices applicable to the protection of water quality in riparian areas as referenced in the SC Forestry Commission's Best Management Practices for Forestry and the NRCS Field Office Technical Standards. If these BMPs or Standards are not followed, the state and/or local requirements should be met.

  This issue was divided between the Technical and Policy work groups. The Technical work group was asked to consider the need for different programs based on land use. If warranted, the Policy work group was then asked to decide how to implement such a program.

  The Technical work group recommended that different protection programs/mechanisms be developed for different land uses/land types (Meeting Summary 11/16/99). The group identified the following land uses: agriculture (crop and pastureland); forest lands; mining lands; urban areas; water dependent activities; and recreational areas. Land types were identified as: mountain; piedmont; sandhills; upper coastal plain and lower coastal plain.

  With that recommendation, the Policy work group then further considered the need to develop different buffer protection programs for different land uses/land types specified by the Technical work group. It decided, and the Task Force ultimately agreed, not to attempt to develop different buffer protection programs for different land uses/types. The Task Force felt that there was not enough South Carolina data available on land use, slope, vegetative cover and other factors to adequately address this complex issue. The Task Force did determine, however, that forestry and agricultural land uses maintained in compliance with their respective best management practice guidelines should be exempt from the recommended minimum buffer width.

The question of how to handle existing land uses and the conversion of existing land uses was also raised by the Policy work group. The Policy work group felt that the major cause of water quality degradation is more likely to be associated with land use changes rather than the activities associated with existing land uses. On this basis, the Policy work group recommended that existing land uses within the riparian forest buffer be grandfathered in upon adoption of the minimum buffer width. However, if an existing land use changes or there is additional encroachment in the riparian forest buffer, the minimum width requirement should be met. This was adopted as a final recommendation of the Task Force.

ISSUE #4:

What activities are allowed in the riparian forest buffer? Are the buffers actively managed?

TASK FORCE RECOMMENDATIONS:

- **Allowable Activities within the Buffer:** Allowable activities within the RFB should be kept to a minimum but may include:

  - ☐ Activities necessary to maintain the health and integrity of the area. Such activities may include removal of debris after severe storm events, removal of diseased trees and suppression of invasive plant species; and

  - ☐ View corridors as described in the BMPs for Riparian Forest Buffers (Appendix I).

  - ☐ Docks, boat launches, public/private water supply intake structures, facilities for natural water quality treatment and purification, public/private wastewater outfall structures, and similar structures, which by their nature, need to be located within the RFB;

  - ☐ Pedestrian and/or vehicle access ways leading to docks, fishing piers and boat ramps providing that only permeable or semipermeable material is used;

  - ☐ Crossing by transportation facilities and utility lines (permits will only be issued upon completion of a study identifying alternative routing and a mitigation plan to minimize impacts of the RFB);

  - ☐ Wildlife and fisheries management activities; and

  - ☐ Stream, stream bank and vegetation restoration.

- **Best Management Practices:** Best management practices (BMPs are suggested as guidelines for voluntary implementation in order to protect and preserve the integrity of the riparian forest buffers. Examples of these BMPs include the South Carolina Scenic Rivers Program: Recommended Best Management Practices for River Boarding Lands, the Guide to Stewardship Development Concepts and Practices, the SC Forestry Commission's Best Management Practices for Forestry and the NRCS Field Office Technical Standards (see Appendix I).

- **Management Activities within the Buffer:** In general, management activities within the riparian forest buffer should be minimized, however, if active management is needed to maintain the integrity of the buffer, the NRCS guidelines for operation and management of riparian forest buffers may be used (Appendix II).

  This issue was divided between the Technical and Policy work groups. The Technical work group was asked to make preliminary recommendations, and the Policy work group was then asked to finalize these recommendations. After much discussion, the Technical work group recommended that to the extent practical, land disturbing activities within the width of the buffer should be minimized. It also recommended that the riparian forest buffer be actively managed. The work group went on to list examples of "active management:"

  - ☐ Hand application of pesticides for targeted species;

  - ☐ Hand clearing of vegetation for specific purposes;

  - ☐ Selected harvesting of timber;

  - ☐ Compliance and monitoring (although may be different type of management/enforcement);

  - ☐ Maintenance of allowable, non-conforming activities;

  - ☐ Removal of dangerous/diseased trees;

  - ☐ Restoration-type activities, including stream bank stabilization and re-vegetation; and

  - ☐ Activities for habitat management.

The Policy work group specified that although active management may take place within the riparian buffer, activities should be kept at a minimum and done only to maintain the integrity of the buffer. The work group felt that it should make recommendations regarding the types activities that are defined as "active management." After much discussion, the Task Force decided to use the NRCS guidelines for operation and management of riparian forest buffers as examples of active management. The NRCS guidelines for operation and management are found in Appendix II.

The Policy work group then determined it was necessary to formulate a list of activities that are allowed within the riparian forest buffer. After closely reviewing the allowable activities permitted by existing buffer ordinances in South Carolina, the work group drafted what it felt was a comprehensive list of allowable activities. These are included in the final Recommendation approved by the Task Force.

During the discussion pertaining to allowable activities in the riparian forest buffer, the Policy work group also felt that it would be helpful to include recommended BMPs for voluntary implementation to help with the design and maintenance of riparian forest buffers. The work group made recommendations for BMPs based on the three goals of the buffers:

1. Water quality;

2. Scenic value; and

3. Wildlife protection.

These recommended BMPs can be found in Appendix I.

Chapter 4
POLICY RECOMMENDATIONS

One of the two major tasks outlined in the project was to investigate the status of riparian forest buffer protection and restoration programs both within and outside of South Carolina. This broad task was captured in the first issue assigned to the Policy work group. The work group reviewed information obtained about other riparian forest buffer programs in the context of whether they were: mandatory or voluntary and/or incentive-based; regulatory or non-regulatory; developed and administered by the public or private sector; and if government was involved, whether it was at the federal, state or local level. The information contained in this chapter represents the results of the research and the policy options considered by the work group and the Task Force as part of the development of final policy recommendations.

ISSUE #1:

What are the current regulatory and non-regulatory approaches to protecting and restoring riparian forest buffers in the United States?

POLICY CONSIDERATIONS

A 1993 national survey on riparian forest buffer protection and restoration programs found that most buffer programs have strong citizen support. In the survey, greater than 80% of the local governments agreed with the statement that "a majority of our citizens think that the community is better off having stream buffers" (Wenger and Fowler, 1999). On the basis of Heraty (1993), Schueler (1995) identified eight key points to consider about riparian forest buffers:

- Buffer boundaries are largely invisible to local governments, contractors and residents;
- Buffers are subject to extensive encroachment in urban areas;
- Few jurisdictions have effective buffer education programs;
- Allowable and unallowable uses are seldom defined;
- Few jurisdictions specified mature forest as a vegetative forest;
- Accuracy of buffer delineation is seldom confirmed in the field;
- Most buffers remain in private ownership; and
- The stream buffer program needs to be responsive to the interests of the development community.

These key points were underscored by many of the federal, state and local initiatives, both public and private, that were identified by the Policy Work Group in its review of existing programs and policies.

1. Existing Federal Statutes Related to Riparian Forest Buffers

The Federal Clean Water Act

a. Section 319: When the federal Clean Water Act was enacted in 1972, scientists and policy makers alike agreed that point source discharges of wastewater and other contaminants were the greatest threat to water quality. Since that time, evidence has shown that nonpoint sources of pollution (those coming from a diffuse source) actually account for the majority of impaired water quality. The Clean Water Act was amended in 1987 to add provisions to address nonpoint sources to a limited degree, but left the development of nonpoint source strategies to the discretion of state and local governments under Section 319 of the Act. States are using provisions of the Clean Water Act to support nonpoint source pollution control strategies that include the preservation of trees adjacent to waterways. (Pronsolino v. Marcus, 2000 U.S. Dist. LEXIS 4267 (N.D.Calif. 2000)). Riparian forest buffers have the potential to become a valuable tool to help the nation meet the goals of the Clean Water Act generally, and to specifically address nonpoint source pollution concerns.

b. Section 404: Because there is evidence that riparian forest buffers can significantly protect water quality from nonpoint source pollution, they are currently being implemented by the U.S. Army Corps of Engineers under § 404 of the Clean Water Act (Federal Register, Vol. 65,

No. 47 (March 9, 2000)). Section 404 of the Clean Water Act provides that the Secretary of the U.S. Army Corps of Engineers may issue permits for the discharge of dredge or fill material into navigable waters after notice and opportunity for public hearing (33 U.S.C. § 134(a)). Section 404 has been interpreted by regulation to include wetlands as navigable waters (33 C.F.R. § 328.3). The Corps of Engineers is given responsibility for regulating wetlands (33 U.S.C. § 134(d)). Wetlands have also been given protection under Executive Order 11990 signed May 24, 1977, requiring federal agencies to take action to avoid adversely impacting wetlands wherever possible, to minimize wetlands destruction and to preserve the values of wetlands (40 C.F.R. pt. 6, App. A, § 1(b)).

Wetlands are defined by regulation as "...those areas that are inundated by surface or ground water with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction" (40 C.F.R. pt. 6, App. A, § 4(j)). Such jurisdictional wetlands often occur within riparian areas. Dredge or fill activities in jurisdictional wetlands are regulated under §404.

On March 9, 2000, the Corps of Engineers published changes to its nationwide permit program in the Federal Register (Federal Register, Vol. 65, No. 47 (March 9, 2000)). These changes, which are effective June 7, 2000, contain express provisions for vegetative buffers next to intermittent and perennial streams as well as other open waters (not to include wetlands or ephemeral streams). These vegetated buffers can be considered by states as part of the compensatory mitigation required as part of General Condition 19 of the Nationwide Permits. While public comments on the draft changes to the Nationwide Permits indicate opposition to the inclusion of vegetated buffers in the regulatory program, the Corps has taken the position that implementation of vegetated buffers is expressly enabled by the stated objectives in the Clean Water Act.

The Federal Endangered Species Act

The habitat value of riparian areas may also be protected under the critical habitat provisions of the Endangered Species Act (16 U.S.C.A. § 1533). The Endangered Species Act provides federal protection to species that are found to be either endangered, meaning "in danger of extinction throughout all or a significant portion of its range," (16 U.S.C.A. § 1532(6)) or threatened, meaning the species "is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C.A. § 1532(20)). Protection of riparian forest buffers would improve habitat conditions for sixteen of the thirty-five endangered and threatened species found in South Carolina. Water quality enhancement and riparian habitat protection provided by forested buffers support the goal of endangered species conservation.

Yet, reliance on the Endangered Species Act may fall short in justifying riparian forest buffer protection for two reasons. First, because species are only listed once their existence is threatened, the amount of area which they occupy is, by definition, minimal, and it has been determined that the critical area may not include the entire area that the species could occupy (16 U.S.C.A. § 1532(5)). The second reason is that critical habitats have been designated for only 16 percent of the listed species. (Rodgers, 1994). Thus, the frequency in which listed species rely upon riparian areas strengthen the argument for riparian forest buffer protection, but the Endangered Species Act may not provide the mechanisms needed to require protection through the use of riparian forest buffers.

The Federal Magnuson-Stevens Fishery Conservation Management Act

The Magnuson-Stevens Fishery Conservation Management Act (16 U.S.C. § 501) also has extensive provisions for habitat protection where habitat is essential to the protection of managed fishery resources (Essential Fish Habitat (EFH) provisions). Riparian forest buffers could be integral parts of the protected areas when such habitats are designated. But, once again, as the area for such protection under the EFH is likely somewhat limited, and since the protection is triggered only by federal action, reliance on EFH for riparian forest buffer protection may not be warranted.

2. Existing State and Local Programs Related to Riparian Forest Buffers

a. State Laws: GEORGIA adopted a law that prohibits land disturbing activities within 25 feet of the banks of any state water as measured from the point where vegetation has been wrested by normal flow or wave action (Ga. St. Code §12-7-6). State waters include but are not limited to streams, ponds, lakes, reservoirs, and coastal marshes. For trout streams, the Act provides that no land disturbing activity may occur within 100 feet of

stream banks. No land uses are exempt from this requirement, however, variances are allowed at the discretion of the director of the Georgia Environmental Protection Division.

In 1992, Georgia enacted a law that requires the protection of a natural vegetated buffer of 100 feet in width on either side of a perennial stream as measured from the river bank at mean high water (Ga. St. Code § 12-2-8). The Act also prohibits septic tanks and drain fields in the buffer. The construction of single family homes where specific conditions are met are exempt from the Act as are certain land uses specified by local governments.

MAINE law protects areas within 250 feet of coastal wetlands, freshwater wetlands, rivers, saltwater bodies, and great ponds. Streams are protected within 75 feet of the highwater line. The statute requires a setback for development and vegetation buffers between buildings and shorelines (Environmental Law Institute, 1998).

In 1996, MASSACHUSETTS enacted the "Rivers Protection Act." The law creates a 200 foot wide vegetated buffer zone on each side of the state's perennial rivers and streams, but only a 25 foot wide zone is established in more densely developed areas in the state. Intermittent streams are not subject to the Rivers Protection Act. Developers must demonstrate a necessity to build in the zone, and show that no alternative site exists. They must also document how the proposed development will impact flooding, water quality, shellfish, aquatic habitat, storm drainage, and fishing (Massachusetts Rivers Protection Act, 1998).

NEW HAMPSHIRE enacted the "Comprehensive Shoreland Protection Act" to protect lands within 250 feet of public waters. The Act requires any persons engaged in land disturbing activity within the 250-foot zone to obtain a permit which may be denied to protect the public waters, health, safety, or welfare. A mandatory setback of 20 feet is imposed on the building of structures (Environmental Law Institute, 1998).

NORTH CAROLINA has enacted the "Sediment Pollution Control Act" which applies to land disturbing activities that cause sedimentation and erosion. The Act provides that no activity is permitted in proximity to a lake or natural watercourse unless there is a buffer zone "along the margin of the watercourse of sufficient width to confine visible siltation within the twenty-five percent of the buffer zone nearest the land disturbing activity."

In 1997, North Carolina enacted the "Neuse River Basin Nutrient Sensitive Waters Management Strategy," commonly referred to as the Neuse River Rule. The Rule requires a 50-foot wide riparian buffer adjacent to all surface waters (intermittent and perennial steams, lakes, ponds, and estuaries) in the Neuse River Basin. All existing land uses prior to the passing of the Rule are not subject to the provisions stated in the Rule provided such use is maintained. However, at the time an existing land use is converted to another use by the addition of impervious surface to the riparian buffer in locations where it did not exist previously (i.e. taking an agricultural operation taken out of production, or a ceasing to maintain a lawn), the Rule is applied. A similar set of rules was passed for the Tar-Pamlico River Basin in 1999 and temporary rules are being developed for the Cape Fear and Catawba River Basins (D. Kucken, personal communication).

In response to the Neuse River Rule, North Carolina enacted the "Riparian Buffers Protection Program" in 1999. This program provides compensatory mitigation alternatives when there is no practical alternative to prevent the loss of a riparian buffer. Alternatives include, but are not limited to the (1) payment of a fee into the Riparian Buffer Restoration Fund; (2) donation of real property or of an interest in real property that is or may be a riparian buffer; (3) restoration or enhancement of a riparian buffer not otherwise required to be protected or the creation of a new riparian buffer; (4) alternative nutrient reduction measures.

In the last three years, MARYLAND and VIRGINIA have passed regulations that require all counties and municipalities along the Chesapeake Bay or along a watershed that feeds into the Bay to create vegetated riparian buffers of at least 100 feet to combat degradation of the Bay.

IDAHO (Stream Protection Zones), WASHINGTON (Riparian Management Zones), CALIFORNIA (Watercourse and Lake Protection Zones) and OREGON (Riparian Management Areas) all require forest practices that protect soil and water including vegetated buffer strips. The vegetated buffer widths vary with respect to on-site conditions.

Other states, including CALIFORNIA, NEW JERSEY PENNSYLVANIA, RHODE ISLAND, and the DISTRICT OF COLUMBIA have also adopted some form of riparian buffer protection mechanism (Desbonnet et al., 1994; Reynolds, 1999).

b. Local Government Ordinances: THE CITY OF ALPHARETTA, GEORGIA maintains 100-foot buffers along all perennial streams as a requirement of its Erosion and Sedimentation

Ordinance. The ordinance allows a 50-foot buffer minimum, as long as a 100-foot average width is followed. In addition, there is an impervious surface setback that must average 150 feet in width and cannot be less than 75 feet in width (Wenger and Fowler 1999).

BALTIMORE COUNTY, MARYLAND passed regulations requiring that existing riparian lands be left undisturbed to encourage growth, and requiring that new riparian buffers be established adjacent to all perennial and intermittent streams. Buffer widths are determined by examining the slope and class of stream. The regulations provide not only restoration and protection of riparian areas, but also require certain management activities including restriction of pesticides, motor vehicles, and vegetation disturbance (Chesapeake Bay Program).

In 1998, FULTON COUNTY, GEORGIA passed an ordinance establishing protected stream corridors in the unincorporated area of the county. The ordinance has a 75-foot naturally vegetated buffer on all perennial streams plus added setbacks for impervious surfaces. Additional restrictions are established within a 100-foot protective corridor from the stream, and include prohibiting septic tanks, hazardous waste areas, stormwater retention facilities, buildings, parking lots, and roads (Wenger and Fowler, 1999).

In 1994, LOUDON COUNTY, VIRGINIA, officials adopted buffer widths of 150 feet on the Chesapeake Bay and its associated feed waters and 250 feet on the Potomac River. The ordinance applies to all new subdivisions and grants developers the ability to transfer development densities from areas within the buffer to other sections of their development tract (Chesapeake Bay Program, 1996).

THE CITY OF WINSTON -SALEM and FORSYTH COUNTY, NORTH CAROLINA passed an ordinance protecting a 100-foot stream corridor along all perennial streams. There is limited development permitted for water-dependent-structures, transportation, utilities, and recreational structures. No land disturbing activities are allowed within 25 feet of the waterways (Wenger and Fowler, 1999).

c. **State and Local Voluntary and Incentive-Based Programs:** The majority of initiatives implementing programs to protect and restore riparian forest buffers have been developed at the state and local level. The following illustrate some of the voluntary and incentive-based initiatives designed to protect and restore riparian forest buffers.

The largest and most successful incentive-based initiative to date is the Chesapeake Bay Program, which partners the states of Virginia, Pennsylvania, Maryland, and the District of Columbia. In October of 1994, the Chesapeake Executive Council adopted a directive that called upon the Chesapeake Bay Program to develop a policy that would enhance efforts to conserve and restore riparian forest buffers. A Riparian Forest Buffer Panel of thirty-one members was appointed, and consisted of a diverse group of participants who represented a wide-array of viewpoints and experiences. The Panel's long-term goal was to see that a riparian forest or other buffer protects every stream in the watershed. The Panel developed five policy recommendations to help protect and restore riparian forest buffers in the Chesapeake Bay area:

1. Enhance program coordination and accountability
2. Promote private sector involvement
3. Enhance incentives
4. Support research, monitoring and technology transfer
5. Promote education and information

The program implemented the Riparian Forest Buffers Initiative in 1996, which called for the conservation of all riparian buffers and restoration of 2,010 miles of riparian forest buffers on streams and shorelines in the watershed by the year 2010. The program recognized the importance of involving local governments, and enacted an initiative to involve the approximately 1,650 local governments in the Chesapeake Bay watershed in these conservation and protection efforts.

In 1981, OREGON led the nation by passing the Assessment of Property for Taxation – Riparian Habitat Act, which is more commonly referred to as the Riparian Lands Tax Incentive Program. This program encourages stream bank conservation practices by private landowners by offering a property tax exemption on riparian habitat maintained in a healthy condition that contributes to erosion control, improved water quality and prolonged streamflow.

ILLINOIS adopted a five-sixths property tax exemption for vegetated buffers managed in accordance with the county conservation district. The buffer zones must be at least 66 feet in width and "contain vegetation that has dense top growth, forms a uniform ground cover,

and has a fibrous root system" (Tonning, 1998).

In 1998, VIRGINIA enacted the "Real Property Tax – Special Assessment for Land Preservation Act." Under this Act, riparian buffers up to 35 feet in width are defined as a special class of property for tax purposes, and may be exempt or partially exempt from local taxation when managed in accordance with the standards developed by the Virginia Department of Conservation and Recreation (VA ST § 58.1-3666).

3. **Existing Agricultural Programs Related to Riparian Forest Buffers**

    a. **Federal and State Voluntary and Incentive-Based Programs:** The agriculture industry's efforts to protect and restore riparian forest buffers as a conservation management practice are currently centered at the federal level as a component of conservation management plans. The main source of funding is available through the United States Department of Agriculture (USDA). The Natural Resource Conservation Service (NRCS) oversees the implementation of several programs under the Federal Agriculture Improvement and Reform Act of 1996 ("The 1996 Farm Bill").

The USDA began the NATIONAL CONSERVATION BUFFER INITIATIVE in 1997, pledging to install two million miles of conservation buffers by the year 2002. The goal of the initiative is to encourage farmers, ranchers, and other landowners to convert highly erodible croplands and pastures into vegetated buffers as a means of improving water and air quality, wildlife habitats, and overall aesthetic beauty.

A number of additional federal programs are also aimed at offering assistance to landowners interested in restoring and maintaining riparian areas. These programs include the Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), Environmental Quality Incentives Program (EQIP), Stewardship Incentives Program (SIP), Wildlife Habitats Incentives Program (WHIP), and Wetlands Reserve Program (WRP). All of these programs can be used to help with the cost of implementing riparian forest buffers.

THE CONSERVATION RESERVE PROGRAM (CRP) is a voluntary program sponsored by the U.S. Department of Agriculture (USDA). The CRP encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to permanent vegetative cover such as trees, grass and wildlife plantings. A subset of CRP, the "Continuous CRP" is an open enrollment for certain environmental priority practices such as filter strips, riparian buffers, waterways, field windbreaks, and shallow water areas for wildlife. Maximum effectiveness is achieved by combining these practices with other proven conservation measures such as conservation tillage, nutrient management, and integrated pest management. Beginning April 6, 2000 the "Continuous CRP" provides practice incentives, and for some practices a sign-up bonus. Practice incentives are 40% of the cost of establishing the practice and sign-up bonuses are $100 to $150 per acre. These bonuses are in addition to cost-share assistance and annual rental payments for 10-15 years. Funds for maintenance costs associated with the buffers are also provided. The "Continuous CRP" sign-up is held in local USDA Service Centers in each county.

Producers have been enrolling land in CRP since 1986. Currently farmers in South Carolina have about 193,000 acres enrolled in the CRP. This is estimated to have reduced erosion by 13 tons per acre per year (USDA, 1999). The majority of acres enrolled are as follows: loblolly and longleaf pines (~146,000 acres), permanent wildlife habitat (~11,000 acres), and buffers (trees and grasses ~18,000 acres). In total about 4.2% of the estimated 4.6 million acres (USDA 1997) of agricultural lands in South Carolina have been enrolled in CRP since 1987. Efforts to limit agriculturally derived nonpoint source pollutants from reaching the state's waters should be continued.

Through increased effort, the promotion of riparian forest buffers can become a part of standard farm conservation planning. The USDA State Technical Committee can assist in targeting, coordinating, and monitoring implementation of federal, state, and local programs for riparian forest buffers conservation and restoration on agricultural lands (Chesapeake Bay Program, 1996). The federal programs offered have not been taken full advantage of for protecting and restoring riparian forest buffers on agricultural settings although it appears this may be changing. An example from Horry County, one of the fastest growing counties in the country, is a testament to this fact. Between the fall of 1997 and spring of 1998, about 1500 acres were enrolled in the Conservation Reserve Program (CRP), mostly for the protection and conservation of riparian forest buffers.

THE CONSERVATION RESERVE ENHANCEMENT PROGRAM (CREP) is a joint, federal-state retirement conservation program targeted at areas that experience significant environmental effects related to agriculture. It is a voluntary program that uses financial incentives to encourage farmers and ranchers to enroll in the CREP for a 10-15 year

duration. The agreement states that landowners remove the lands from agricultural production and plant and maintain vegetative conservation covers. Since March 1997, USDA has funded about 1.5 billion dollars in CREP projects for improving water quality, restoring wildlife habitat, and erosion control. Eight states accepted into the program are Illinois, Maryland, Minnesota, New York, Oregon, Washington, North Carolina, and Delaware. These states invest about 20% of the funds for the project while the federal government bankrolls the remainder. To date, South Carolina has not taken advantage of this program.

The USDA also sponsors the ENVIRONMENTAL QUALITY INCENTIVES PROGRAM (EQIP) and the Wildlife Habitat Incentives Program (WHIP). EQIP was established in the 1996 Farm Bill and is now the largest conservation program in the USDA. It offers technical, educational, and financial support to eligible persons engaged in livestock and agricultural production. The program addresses soil, water, habitat, and related natural resource problems in priority areas where significant natural resource concerns exist. Five to ten-year contracts are made that provide annual incentive payments and cost sharing for conservation practices. The cost sharing may pay up to 75% of the costs for conservation practices like grassed waterways, filter strips, animal waste facilities, tree planting, and permanent wildlife habitat. Incentive payments can be made to encourage the landowner to implement certain land management practices, such as nutrient management, pest management, animal waste management, and wildlife habitat management. About 50% of the available funds are designated for natural resource concerns involving livestock production.

WHIP is a voluntary program for landowners that provides financial incentives to improve wildlife habitat on private lands. The participants in the program must implement a wildlife habitat development plan with the help of the NRCS and allow for access to the lands to monitor the effectiveness of these practices. In return, the USDA provides technical and cost share assistance (up to 75%) for installing wildlife habitats. The agreement lasts between 5 to 10 years from the date the contract is signed.

THE WETLANDS RESERVE PROGRAM (WRP) is a voluntary program to restore and protect wetlands on private property. Almost any area that can be restored to a wetland at a reasonable cost and adjacent riparian areas connecting protected wetlands are eligible for the program. The program offers three options to landowners:

- Permanent Wetlands Protection Easement: USDA will pay up to the agricultural value of the land and 100% of the restoration costs for restoring the wetland.

- 30-Year Easement: USDA will pay 75% of the agricultural value of the land and 75% of the restoration costs for restoring the wetland.

- Restoration Cost-Share Agreement: USDA will pay 75% of the cost for restoring the wetland for a minimum 10-year agreement to maintain restoration, but will not have land use payments

The funds for the program are limited, but any worthy project will not be declined. Easements on riparian strips protecting existing wetlands receive a high priority.

THE STEWARDSHIP INCENTIVES PROGRAM (SIP) offers technical and financial assistance to non-industrial private landowners to protect and keep their forest healthy. Funds are available for rural lands with existing tree cover and lands suitable for regrowth. A Forest Stewardship Plan must be developed for the property in order to be eligible. Landowners may not have more than 1,000 acres of qualifying land, but exceptions may be made for areas up to 5,000 acres.

With funds provided through DHEC's Section 319 nonpoint source program, the South Carolina Department of Natural Resources' Land Resources and Conservation Districts Division and the USDA Natural Resources Conservation Service jointly published Farming for Clean Water in South Carolina: A Handbook of Conservation Practices in 1997. This handbook was created to educate farmers and agricultural students about agricultural nonpoint source pollution and conservation measures they can use to reduce nonpoint source pollution. However, this handbook is not a design manual for specific conservation measures and can not be used as a replacement to NRCS technical standards and specifications (DeFrancesco, 1997).

The S.C. Buffer Initiative Team was formed in 1998 by the Natural Resources Conservation Service State Technical Committee to assist in the implementation of the National Conservation Buffer Initiative. This is accomplished through federal and state inter-agency coordination, publicity and landowner technical assistance. The objectives of the S.C. Buffer Initiative Team are: to identify the types of buffer practices available in S.C.; to evaluate the extent (how many and where) that buffers have been installed in S.C. and view a representative sample of buffers to ascertain on-the-ground composition and structure; to

evaluate the specifications for each buffer practice, and, to the extent possible, modify specifications to insure practices work to the benefit of all resource concerns (i.e. soil, water and wildlife); coordinate inter-agency cross-training on buffer practices; and coordinate development of public outreach tools and incentives to encourage landowners to install conservation buffers and publicize programs that provide opportunities for landowners to apply buffer technology.

The NRCS has developed FIELD OFFICE TECHNICAL STANDARDS for the protection of riparian forest buffers on agriculture land. The South Carolina NRCS Conservation Practice Standard for Riparian Buffers is a voluntary practice a farmer can use on his lands to reduce the impact of agricultural nonpoint source pollution on water quality and improve wildlife habitat. The Standard calls for a minimum 35-foot forested buffer on stable areas adjacent to permanent or intermittent streams, lakes, ponds, wetlands, and areas with ground water recharge. The buffer is divided into two zones. Zone 1 extends a minimum distance of 15 feet from the normal line or at the upper edge of the active channel with a dominant vegetation consisting of existing or planted trees and shrubs suitable to the site and intended purpose of the buffer (water quality, wildlife, moderating wildlife temperature, providing woody debris, or removal of pollutants). Occasional removal of some trees and shrubs is permitted provided the intended purpose of the buffer is not compromised by the loss of the vegetation of harvesting disturbance and a provision is made to re-establish the trees or shrubs. Zone 2 extends a minimum of 20 feet from the edge of Zone 1 and where the floodplain allows, the minimum combined width of Zone 1 and 2 will be increased to 30% of the geomorphic floodplain or up to 100 feet, which ever is less. Zone 2 can also be increased, where practical, to 120 feet in high sediment or nutrient producing areas. Criteria for Zone 1 will apply to Zone 2 except that the removal of tree and shrub products such as timber, fruit, and nuts is permitted on a periodic and regular basis provided that the trees are replaced and the intended purpose of the buffer is not compromised.

b. Private Sector Programs: The agricultural industry has supported a wide variety of programs designed to educate and encourage the use of conservation buffers. Many of these are part of the National Conservation Buffer Initiative. Cargill, Monsanto, ConAgra, Farmland Industries, Novartis Crop Protection, Pioneer Hi-Bred International, and Terra Industries have together formed the National Conservation Buffer Council which has pledged more than $1 million over the next three years to complement the USDA's efforts.

These companies also have other programs aimed at protecting the environment. Monsanto's "Operation Green Stripe" is an educational/conservation program whereby Future Farmers of America (FFA) chapters recruit farmers to establish vegetative buffers between their fields and surface waters while educational grants are provided to FFA students who have recruited the farmers (Farmsource). Cargill has developed and implemented "Water Matters", an international community service initiative focused on water quality. It sponsors efforts to find non-regulatory solutions to water quality concerns. The program also supports monitoring of local streams and planting of trees by students. There are many other agricultural companies supporting environmental awareness programs as they pertain to the agriculture.

4. Forestry Programs Related to Riparian Forest Buffers

a. Federal and State Voluntary and Incentive Based Programs: The focus of riparian forest buffers on forested lands is different than other land uses because the land is already forested, thus efforts are concentrated towards protecting these resources and developing management techniques for these lands. In South Carolina, silvicultural guidelines were first published in 1976 by the South Carolina Forestry Association with support from the forest industry In 1988, the SC Forestry Commission published *Best Management Practices for South Carolina's Forested Wetlands* with funding from DHEC's §319 Nonpoint Source Management program. These guidelines were updated in 1994 with the publication of *South Carolina's Best Management Practices for Forestry,* and in 1999 with *South Carolina's Best Management Practices for Braided Stream Systems: A Supplement to the 1994 BMP Manual* (Jones, 2000).

The concept of best management practices or BMPs was introduced in response to the federal Clean Water Act to minimize and prevent nonpoint source water pollution. Forestry practices throughout the state are also subject to the SC Water Pollution Control Act. The

S.C. BMPs are consistent with all applicable state and federal regulations.

The "South Carolina Forest Best Management Practices Act" identifies the South Carolina Forestry Commission as the designated agency in the state to provide public oversight and guidance for technical forest management practices (Code of Laws of SC, Section 48-36). The Act provides that "the Commission shall develop, implement, and monitor Best Management Practices Program...." This includes setting riparian buffers width recommendations for water quality protection. The South Carolina Forestry Commission is responsible for the administration of the forestry BMPs while the Department of Health and Environmental Control monitors and enforces water quality standards. A Memorandum of Agreement exists between the Forestry Commission and DHEC to establish a cooperative framework for addressing silvicultural water quality issues in the state.

Technical assistance, education, and cost-share programs provide important incentives for compliance with the non-regulatory BMPs. BMP compliance in South Carolina has steadily improved since the first monitoring studies in 1990. Current compliance is 91.5%, which is comparable to states where mandatory forest practice laws have been enacted (Sabin, personal communication). A BMP Inspection Report is published monthly listing all sites that were monitored by the South Carolina Forestry Commission's BMP foresters that month. Information is provided in the report to identify the location of the site, the logger, and the nature of the problem. There has been excellent support for this unique, non-regulatory program by private industry, Compliance with BMPs is 99% on sites included in this program.

The BMPs recommend streamside management zones (SMZ) adjacent to perennial, intermittent, and ponds or lakes. These areas require special attention because they are critical areas where nonpoint source pollutants can enter the aquatic realm. The SMZ is divided into a primary and secondary zone. The recommended primary zone in perennial and intermittent streams is 40 feet wide on both sides of the stream except in designated trout waters with percent slopes perpendicular to the stream greater than 5% where the recommended width increases to 80 feet. The recommended width of the secondary zone is dependent on the percent slopes perpendicular to the stream. The recommended width of the secondary zone ranges from 0 feet for slopes less than 5% to 120 feet for slopes greater than 40%. These streamside zones can be actively managed but forestry management activities are restricted within these zones to limit the input of nonpoint source pollutants into the waterways. Ephemeral streams do not have primary and secondary SMZs; although there are other restrictions that apply in these areas (S.C. Forestry Commission, 1994).

Riparian identification and management on the National Forests has adjusted as technology and knowledge has changed over the last several decades (Hansen and Law, 1993). The Sumter National Forest includes about 85,000 acres in the Blue Ridge mountains and 280,000 acres in the piedmont and the Francis Marion National Forest has 253,000 acres in the coastal plain of South Carolina.

Estimation of riparian areas extent has improved with detailed soil, stream, timber, topography (elevation contours) and U.S. Fish and Wildlife Service wetland layers into Geographic Information System (GIS) technology. Activities that may affect riparian areas and water quality are carefully evaluated. The intent is to comply with all pollution laws and direction including state approved BMPs. Direction in Executive Orders 11988 on floodplains and 11990 on wetlands provide added restrictions on federal lands to avoid these areas whenever possible and design and mitigate activities where they can not be avoided.

The USDA Forest Service has a Memorandum of Understanding with the South Carolina Forestry Commission and Department of Health and Environmental Control concerning cooperation in nonpoint source pollution management. This enables a greater level of interaction of employees in responding to and dealing with pollution identification and control issues on the National Forests or within the state. As indicated, the National Forests fully support BMPs and state efforts to control water pollution and limit riparian activities. Consultation among the agencies and with the USDA Natural Resources Conservation Service is open and unrestricted on the topics as we work together to improve resource conditions in the water, within riparian areas and on the land within the watersheds. The Forest Service is also actively improving soil and water quality through gully, road and stream stabilization and restoration measures. Past damage to some wetland areas have been reduced by restoring the hydrology such as blocking old drainage ditches, removing fill or adding culverts to allow for more natural drainage.

b. Private Sector Programs: The timber industry also has a number of programs to protect riparian forest buffers. In 1994, the American Forest and Paper Association (AF&PA), the national trade association of the forest, paper, and wood products industries,

adopted the SUSTAINABLE FORESTRY INITIATIVE (SFI) program. The SFI program is a comprehensive system of principles, guidelines, and performance measures that integrates the growing and harvesting of trees with the protection of wildlife, plants, soil, and water quality.

The S.C. Forestry Association entered an agreement with AF&PA to serve as the State Implementing Committee with oversight for the SFI in South Carolina. The SFI calls for all wood suppliers and loggers to be trained in environmental protection techniques to maintain water quality, soil productivity, endangered species, wildlife habitat, and cultural and historic sites. The SFI program also requires all member companies to establish riparian protection measures, including leaving vegetated buffers strips along streams and the implementation of stream side-management zones, in order to meet or exceed all established Best Management Practices approved by the EPA, all applicable state water quality laws and regulations, and the requirements of the CWA for forest land. The program requires member companies to enhance quality of wildlife habitat by developing and implementing measures that promote habitat diversity and the conservation of the biodiversity of the plant and animal communities found in the forest areas. Companies must also develop special land management plans for company lands of ecological, geologic, or historic significance. Participation in the SFI program is required by all members of the AF&PA. Since 1994, 15 member companies of the AF&PA have been expelled for failure to comply with the program.

The SFI is endorsed by numerous organizations and agencies, including American Forests, Ducks Unlimited, and the Wildlife Society. The South Carolina State Implementation Committee includes representatives from the National Audubon Society and the Nature Conservancy, as well as private landowners, government agencies, and the forest industry.

A variety of additional forestry management certification, licensing, auditing and third-party verification programs are also currently in use by the forest industry. Such programs include Smartwood, ISO 14001, and SFI Verification, among others.

5. Private Non-Profit Organizations

There are a large number of private environmental organizations that contribute to the protection and restoration of riparian forest buffers. Some of these organizations include Land Trusts, Ducks Unlimited, Trout Unlimited, National Audubon Society, National Wildlife Federation, and The Nature Conservancy. There is also a wide array of smaller grassroots environmental groups concerned with rivers, wetlands, lakes that are trying to protect the quality and natural beauty of local water bodies.

6. South Carolina

a. State Laws: In 1991, South Carolina enacted the STORMWATER MANAGEMENT AND SEDIMENT REDUCTION ACT to manage stormwater runoff to "reduce pollution, siltation, sedimentation, local flooding, and stream channel erosion, all of which impact adversely on the land and water resources…" (§1 of 1991 Act No.51, eff. May 27, 1992). The Act establishes the procedures and minimum standards for a statewide stormwater management and sediment reduction program (Environmental Law Institute, 1998). Currently, the Act has no specific requirement for riparian buffers. DHEC is charged with developing a State Stormwater Management and Sediment Reduction Program. DHEC may delegate implementation of any part of the program to local governments.

The Act provides that no person may engage in a land disturbing activity without first submitting a stormwater management and sediment control plan and obtaining a permit to proceed from the appropriate implementing agency. The Act is not intended to cover all uses. It does not include agricultural lands or forestlands used for production and harvesting of timber. It does not include construction of single family residences, or mining activities otherwise covered under the SC Mining Act.

The Act also exempts state-owned or managed lands that are regulated under the EROSION AND SEDIMENT REDUCTION ACT (§48-18-20, SC Code of Laws, 1976, as amended). This Act applies only to state-owned lands, and requires DHEC to implement regulations concerning erosion, sediment reduction, and stormwater management on these lands. If these lands are found to be in non-compliance, corrective steps must be taken.

Adopted in 1994, the SOUTH CAROLINA LOCAL GOVERNMENT COMPREHENSIVE PLANNING ENABLING ACT consolidated existing planning laws, and updated them with current practices, new methods, and tools and procedures for local government planning. All counties and municipalities with planning programs on the effective date of the

Act were required to conform their plans and ordinances to the Act's provisions (Municipal Association of South Carolina 1994). The Act provides for a land use element as one of several required parts of the comprehensive plan. Upon the adoption of the plan, the governing body may enact zoning and other ordinances to implement the plan. Riparian buffer protection may be included as a component of zoning and other land use ordinances.

A bill was introduced in the South Carolina General Assembly that requires the protection of riparian buffers. The SOUTH CAROLINA RIPARIAN ZONE BUFFER ACT OF 2000 (S.1037) would require a 100-foot buffer of native vegetation on both sides of all streams, rivers, and other water situated wholly or in part in, or flowing through a county or municipality in the State. The bill would give counties and municipalities the authority to impose stricter minimum width requirements and allows DHEC to require more stringent minimums on designated "critical watersheds." The bill would give DHEC the responsibility for administering the riparian buffer zone requirements. If a local government fails to adopt and enforce the minimum riparian buffer protection program requirements, DHEC would administer and enforce the minimum statewide riparian buffer zone requirements within all of the affected portion of the local jurisdiction. The bill also contains enforcement provisions, and includes civil and criminal penalties for violations. The bill includes a comprehensive list of restricted and allowable activities in the riparian buffer.

b. Local Government Ordinances: City and county ordinances pertaining to the protection of riparian buffers are found in some localities throughout South Carolina. CHESTER COUNTY was the first county in the state to adopt a vegetative buffer ordinance in April 1998 creating the River Preservation District (Sloan, Personal Communication). The objective of the River Preservation District is to protect water quality in the Catawba and Broad Rivers from the effects of stormwater runoff. The district has 100-foot vegetative buffers along the Catawba and Broad Rivers and 50-foot vegetative buffers along both sides of the five major tributaries of these rivers in Chester County (Fishing Creek, Rocky Creek, Turkey Creek, Tinkers Creek, and Big Sandy River) (Chester County River Preservation Ordinance, 1998). The only uses permitted in the River Preservation District are recreation, public boat landings, public water and wastewater treatment facilities, intakes, discharges, and agriculture and silviculture activities that include watering of livestock, tilling, and timber harvesting, provided any disturbed soil is maintained and revegetated (Wenger, 1999).

On April 26, 1999 Beaufort County adopted a River Buffer requirement as part of its Zoning and Development Standards Ordinance for the purpose of protecting water quality and wildlife habitat. The buffer begins at the OCRM Critical Line, and extends inland from all tidal waters and wetlands for a distance of 50 feet. The River Buffer is maintained as an undeveloped and undisturbed area with a few exceptions which include view corridors, pedestrian access to waterways, utility lines, recreational uses, and flood and erosion control devices (Reynolds, 1999). A list of setbacks from the OCRM Critical Line applies to all new developments. Including a 50 foot setback for single-family detached dwellings. A 100-foot setback is required for multi-family and attached residential units, parking areas and driveways while agricultural uses and golf courses must be pushed back 150 feet (Beaufort County Council, 1999).

BEAUFORT COUNTY is now in the process of amending its original ordinance by drafting the Beaufort County River Quality Overlay District. If adopted, the Beaufort County River Quality Overlay District will still require a 50-foot buffer from all tidal waters and wetlands beginning at the OCRM critical line, but amends the setbacks and allowable uses in the buffer. The new setbacks will require agricultural uses, golf courses, recreational parks and playgrounds, and drainage systems and retention ponds to be set back 50 feet from the buffer. Detached single-single family residential units, multi-family and attached residential units, parking areas and driveways, civic buildings not larger than 4000 square feet, parking lots with no more than 6 spaces or 1000 square feet and the right-of-way of a two-lane road will be required to be set back 100 feet, while any land uses not specified in the River Protection District must be setback a minimum of 150 feet (Reynolds, 1999). Tile fields and septic tanks would be prohibited in the buffer. Allowable uses within the riparian buffer would include a view corridor, pedestrian and/or vehicular access to docks, fishing piers and boat landings, approved flood and erosion control devices, utility lines, playground equipment, benches, and picnic tables, and roads leading to brides that cross the waterway.

The TOWN OF BLUFFTON has plans to modify the Beaufort County River Protection Overlay District by expanding some of the requirements. The River Protection Overlay District will be amended to require a 100-foot buffer as compared to the 50-foot buffer widths required by the county, as well as increasing developmental setback requirements in the town (Town of Bluffton Ordinance).

In May 1999, YORK COUNTY adopted an ordinance establishing the Catawba River Buffer. This ordinance is unique in that it has multiple purposes for establishing the buffer zone that include:

> *"to protect fisheries, groundwater, and wildlife habitat; preserve scenic, historic, and ecologically sensitive areas; provide flood control and reduce storm damage; reduce point and nonpoint source pollution; facilitate the adequate provision of water supply and sanitation; encourage recreation and recreational facilities; and guide development in accordance with existing and future needs and promote the public health, safety, order, appearance, prosperity, and general welfare" (Chester County Ordinance).*

The width of the buffers along the Catawba River is 100 feet and applies to both banks below the Lake Wylie Dam. A secondary 50-foot buffer is required along the banks of all perennial tributaries in York County, but only extends 500 feet up from the Catawba River. Removal of natural vegetation for the purpose of land development, timber harvest, the clearing of land for structures, or any other uses or activities not specifically exempted is prohibited within the buffer. The only exemptions are utility lines, timber harvesting that utilizes BMPs developed by State Forestry Commission, and hiking and biking pathways or related facilities.

The CITY OF ROCK HILL in YORK COUNTY has expanded buffer width requirements along the Catawba River to 150 feet. The buffer must be naturally vegetated (Wenger and Fowl, 1999).

RICHLAND and GREENVILLE counties, and the Cities of MT. PLEASANT and ISLE OF PALMS have all discussed some type of buffer ordinance. Some of these counties and municipalities already have drafts of the proposed ordinance while others are finalizing them as part of their local comprehensive plan revisions.

c. Voluntary and Incentive-Based Programs: The South Carolina Scenic Rivers Act of 1989 has led to the development of the state's SCENIC RIVERS PROGRAM, which protects natural, scenic, and recreational rivers in the state. The first step in the scenic river designation process is for interested individuals, landowners, communities, and local governments to send a written request to S.C. Department of Natural Resources (SCDNR) to consider the river. A study is conducted by SCDNR representatives to determine if the river is eligible for the program. Approval by all county councils through which the scenic river passes is required. The next step is the designation of the river as a State Scenic River by the General Assembly.

The Scenic Rivers Program originally focused on acquiring the management rights of these riparian lands by one of three ways: 1) a donation of a perpetual conservation easement; 2) a fee simple donation; or 3) the purchase of a fee simple interest in riparian properties. This was for the most part unsuccessful because private landowners did not want to give up their land.

In response to this, the Scenic Rivers Stewardship Program was developed as a more flexible alternative. The program educates landowners about their river and the relationship between land use and the quality of the river. It uses a non-regulatory method for entering into cooperative, voluntary land management agreements with landowners. The landowner may choose among four land management options:

- Riparian land management;
- Memorandum of agreement;
- Conservation easement; or
- Donation of land.

The single most important practice for the protection of river resources is riparian land management, which promotes the establishment and maintenance of riparian buffers characterized by native vegetation. The Program recommends a minimum of a 100-foot buffer along Scenic Rivers depending on the management goal. To date, six rivers have qualified for the program - the Broad; Little Pee Dee; Lower Saluda; Lynches; and Middle Saluda - extending about 100 miles along South Carolina's streams and rivers (SC DNR, 2000).

Two bills currently pending in the South Carolina General Assembly would provide incentives for the voluntary protection of riparian areas. The CONSERVATION INCENTIVES ACT (H.3782) would provide an income tax credit for landowners that convey conservation easements to qualified conservation organizations to preserve and protect natural areas and their traditional uses. The FARM AND FOREST LANDS PROTECTION ACT (H.3024) would also provide incentives for the protection of riparian buffers by:

1. Providing protection for agricultural and forest lands as an economic and environmental resource of major importance;

2. Encouraging landowners to make a voluntary long-term commitment to agriculture and forestry by offering them financial incentives and security of land use;

3. Protecting agricultural and forestry operations in priority agricultural land areas from incompatible land uses that may render agriculture and forestry operations nonviable;

4. Ensuring permanent protection of productive agricultural and forest lands to protect the agricultural and forestry economy of this State;

5. Providing compensation to landowners in exchange for relinquishment of the right to develop their private property; and

6. Leveraging state, federal, local, and private agricultural easement purchase funds and protect the investment of taxpayers in agricultural conservation easements.

7. Tools For Protecting and Restoring Riparian Forest Buffers

a. Regulatory Tools: A variety of tools, both regulatory and non-regulatory, are available for the protection and restoration of riparian forest buffers. Regulatory actions may be included under state laws and/or through the adoption of local ordinances. There are different ways ordinances can be implemented to provide protection to riparian forest buffers. A riparian forest buffer overlay zone is one way to protect these resources in counties with existing zoning ordinances (Wenger and Fowler, 1999). An overlay zone levies more restrictions on a property in order to provide added protection for riparian forest buffers and thus splits a property into two zoning districts. Where buffers are required *buffer averaging* allows certain areas in the buffer to be narrower than other parts of the buffer so long as the average width of the buffer meets minimum width requirements.

Riparian forest buffer requirements can also be incorporated into existing regulatory programs, such as sedimentation and erosion control, development standards, and existing ordinances. Existing flood protection ordinances are chiefly aimed at preventing property damage, but may provide some limited protection for riparian forest buffers.

b. Non-regulatory Tools: Non-regulatory tools are an effective means of protecting riparian forest buffers. Often times, incentive-based options are more successful than mandatory requirements. Non-regulatory approaches include educational programs, incentives and acquisitions. These can supplement a regulatory approach or can function as separate programs. Educational programs have the potential to make a significant contribution to the protection and restoration of riparian forest buffers and should be a part of both regulatory and non-regulatory programs. Education can prevent many problems and create an awareness of appropriate activities.

Other non-regulatory provisions include transferable developmental rights, density compensation, conservation easements, and acquisition of property (Wenger and Fowler, 1999; Reynolds, 1999). TRANSFERABLE DEVELOPMENTAL RIGHTS provides a mechanism for compensating landowners who cannot develop their property because of a buffer ordinance by allowing them to sell their development rights to other landowners. DENSITY COMPENSATION allows a landowner to develop more densely in one area in exchange for developable land lost as a result of a buffer ordinance. Conservation easements are agreements in which landowners give up their rights to develop their land in exchange for a reduction or elimination of property taxes. This option can increase landowners' acceptance of a buffer ordinance since the landowner is compensated by some means for the loss of development rights on their land. PROPERTY ACQUISITION by local governments is a way to acquire key tracts of land to protect these resources, and there are sources of funds for riparian land acquisition. The purchase of full property interests is currently used in South Carolina in the Natural Heritage Trust Program and by nonprofit groups such as the Nature Conservancy.

Many states have opted to provide tax incentives to landowners for protecting and restoring riparian forest buffers. These tax incentives usually include property tax exemptions on riparian buffer areas that are managed in accordance with policies established by the government. For example, tax credits can be used to provide a property and/or income tax credit based on the diminished value of the property contained within the protected riparian buffer. Property tax

breaks can also be used to help offset the cost of protecting and maintaining a riparian buffer. For example, the S.C. Scenic Rivers Act provides a property tax-free designation to all riparian land designated under the Act, private landowners did not want to give up their land.

ISSUE #2:

What types of buffer protection policies are needed for South Carolina? What are potential obstacles to implementation? As subsets of this issue: (a) should buffer protection programs be mandated, incentive-based, or other; and (b) should buffer requirements be set at the state or local level or both?

TASK FORCE RECOMMENDATIONS:

- **Local Government's Role:** Local governments should develop and adopt a buffer protection plan within a specified time frame. The plan should include the implementation of buffer widths that meet or exceed the statewide minimum width of 35 feet, provisions for existing land uses, conversion or changes in land use, restoration programs, appeals, variances, and public education.

- **State Government's Role:** An inter-agency council should be created to coordinate state programs and to develop guidelines to assist local governments in the development of their buffer protection plans. Local governments that have existing buffer ordinances may incorporate them into their buffer protection plans so long as they are at least as stringent as the statewide minimum width. The DHEC should enforce the minimum buffer width if a local government does not develop and adopt a buffer protection plan within the required time frame.

- **Non-regulatory Approaches:** Non-regulatory approaches are recommended for buffer widths exceeding the statewide minimum. Non-regulatory approaches that should be considered include the following:

  - ☐ Education Programs
  - ☐ Incentives
  - ☐ Development Credits/Density Compensation
  - ☐ Tax Breaks (i.e. Extend the tax-free designation given to riparian buffer lands designated under the S.C. Scenic Rivers act to all riparian buffer lands designated under the minimum local government/state requirement up to but not exceeding 300 feet.)
  - ☐ Tax Credits (i.e. To provide a property and/or income tax credit based on the diminished value of the property contained within the protected riparian buffer (up to but not exceeding 300 feet) to help with the maintenance and upkeep of the buffer.)
  - ☐ Cost-share programs
  - ☐ Compensation payments
  - ☐ Conservation Easements (and variations)
  - ☐ Transfer of Development Rights
  - ☐ Purchase of Development Rights
  - ☐ Lease
  - ☐ Acquisition
  - ☐ Purchase/Exchange (i.e. The creation of a state fund with monies that can be accessed by local governments to purchase sensitive riparian areas and/or properties that once the buffer has been delineated have removed all economic use of the land.)
  - ☐ Donation to Land Trusts
  - ☐ Funding riparian buffer restoration programs

POLICY CONSIDERATIONS:

The Policy work group reviewed many existing programs and policies within and outside of South Carolina with particular interest in which level of government had jurisdiction over riparian areas. The work group discovered a wide variety of approaches at all levels of government, and within the private sector. A very high profile program like the Chesapeake Bay initiative actually involves all levels of government in a public/private partnership to restore the Bay's riparian areas. Other initiatives like the Neuse River Rule and other legislative efforts in North Carolina appear to be more driven from the state level. Other states like Oregon and Georgia have enacted state laws for specific, statewide objectives like water quality protection and protection of endangered species.

In South Carolina, local governments and industry efforts have led to the development of measures to protect riparian areas. The first county to enact a local buffer ordinance, Chester County, did so out of concern for protecting the water quality of the Broad and Catawba rivers. Other localities, concerned with rapid growth and development, have taken steps to enact buffer ordinances. Beaufort County, the town of Mount Pleasant, and Charleston County have adopted or are considering ordinances to address buffer protection.

The agriculture and forest industries have initiated successful non-regulatory programs to protection riparian forest buffers. Forestry, for example, has best management practice guidelines that include measures to establish and protect riparian areas. The Forestry Commission conducts inspections to determine if loggers are following the guidelines. If not, a list of loggers in non-compliance is published and ultimately, enforcement may be taken by DHEC under the Pollution Control Act's water pollution provisions.

Closely related to the question above is the issue of whether regulatory or non-regulatory, incentive-based programs are more effective. As before, the Policy work group found a wide range of approaches. The work group reviewed many of the non-regulatory tools for encouraging landowners to protect and restore riparian forest buffers. They include, for example, tax incentives, compensation payments, conservation easements, and land acquisitions. The work group also looked at incentive-based programs like the Scenic Rivers program as an alternative to a strictly regulatory approach.

There were several issues that factored into the discussion of regulatory and non-regulatory approaches. First, water resources and riparian forest buffers do not adhere to political boundaries. If there is a need to adopt a measure to protect buffers, it may not be effective to do it at the local level if the net result is a patchwork of local ordinances. A watershed approach is one alternative to local buffer protection plans. A watershed based buffer protection program will extend past political boundaries and promote contiguous buffers. Second, there is a concern about the extent to which regulatory approaches potentially impact the prerogative of the landowner in the use of his land. The private property rights question was discussed throughout the work group's review. Finally, there was considerable discussion about the common denominator that triggers any of these approaches. Ultimately, the change in use of the land, or the conversion of the land from one use to another, seems to be the broad trigger for which any one type of approach could be used.

The Policy work group also looked at potential obstacles to implementing buffer protection measures. The potential obstacles identified by the work group were:

- Objections from landowners and developers to a statewide, mandatory minimum;
- Objections from local governments for enacting an "unfunded mandate;"
- Objections from local governments that believe buffer protection measures fall within "land use planning" and should be left to local governments;
- Creation of a new state program requiring additional staff and fiscal resources to implement;
- Difficulty in enforcement both at the local level and by the state;
- Potential "takings" claims based upon diminution or loss of economic value and loss of enjoyment of property affected by the buffer program;
- Fiscal impacts of implementing non-regulatory approaches; and
- Potential conflict of the new buffer protection plans with existing laws and programs.

The Policy work group reviewed many different programs in the context of what would be most beneficial for South Carolina. This resulted in a recommendation that reflected shared responsibility for buffers between state and local governments as well as exemptions for successful buffer protection programs already in place.

The work group concluded, and the Task Force agreed, that because rivers, streams, lakes and wetlands do not conform to political jurisdictional boundaries, uniformity is needed to protect riparian areas. To do this, a statewide minimum should be recommended. The Policy work group agreed with the Technical work group's recommendation of a 35-foot minimum buffer width except for ephemeral channel and non-coastal wetlands. However, the Policy work group also felt that local governments should have the responsibility for implementing the buffer requirement. With assistance from a state inter-agency council,

local governments should be given a specified time frame to adopt a plan to implement buffer measures that meet or exceed the statewide minimum. Local governments should also have discretion to adopt provisions regarding conversions in land use, restoration programs, appeals, variances, and public education. If local governments fail to act, DHEC should enforce the minimum buffer width. Local governments that have existing ordinances that are at least as stringent as the statewide minimum should not be preempted.

Because forestry and agriculture have existing programs with effective buffer protection measures, the Task Force concluded that they should be encouraged without further regulation. However, this exemption applies only as long as the owners of the land maintain their lands in compliance with applicable best management practices.

The work group and the Task Force concluded that while a regulatory framework was needed to establish and enforce a minimum statewide buffer width of 35 feet, however, non-regulatory approaches should be recommended for jurisdictions that wished to go beyond the minimum width. The work group and the Task Force concurred in the Technical work group's recommended widths of 100 and 300 feet, but felt that non-regulatory approaches were preferable for encouraging adoption of widths exceeding the minimum. Therefore, the Task Force recommended that a variety of non-regulatory approaches be considered to implement buffer widths for enhanced water quality and wildlife protection. These non-regulatory approaches are listed above under the "Task Force Recommendations" for buffer widths exceeding the recommended statewide minimum width.

OTHER POLICY CONSIDERATIONS:

It should be noted that the Policy work group was asked to work with the Technical work group on several issues that have been previously addressed in Chapter 3. Specifically, the Policy work group was asked to consider (a) buffer protection programs based on different land uses; (b) allowable activities within the buffer; and (c) active management within the buffer. The policy issues that were considered in developing recommendations on these items are discussed in Chapter 3.

Chapter 5
EDUCATION RECOMMENDATIONS

The Education work group was asked to review existing educational programs, and to develop recommendations concerning education initiatives. Specifically, the work group was asked to consider the target audiences, how the success of programs could be evaluated, and sources of funding for educational efforts.

ISSUE #1:

To whom should our educational efforts be directed? What audiences should be targeted for educational programs?

- How do you evaluate the success of a buffer educational program?
- What sources of funding exist for buffer educational programs?
- Who should be responsible for the overall coordination of the collection and development of the new information to be integrated into existing educational efforts?

TASK FORCE RECOMMENDATIONS

- **Grant Program:** A grant program should be established to provide funding for existing educational organizations, conferences and programs to integrate riparian buffer educational materials into their curricula.
- **Central Point of Contact for Education Efforts:** A central point of contact responsible for the overall coordination and development of new information on riparian forest buffers to be integrated into existing educational efforts should be established.

EDUCATION RECOMMENDATIONS

- **Education for Local Government Officials:**
  - ☐ Develop and provide fact sheets to local government on water quality and riparian forest buffers and their benefits.
  - ☐ Approach the Program Directors of the existing organizations, conferences, and programs for the local government officials about including information on riparian forest buffers, including the fact sheets, in their curricula.
  - ☐ Encourage sessions on water quality and riparian forest buffers and their benefits and strategies to implement buffer ordinances into existing conferences.
  - ☐ Encourage networking by providing a contact list of existing programs, conferences and other educational material.
  - ☐ Provide a list of web sites and other resources on riparian forest buffers to local government officials.
- **Education for K-12 Teachers and Students:**
  - ☐ Update the Environmental Education Association of South Carolina's Russ Sherer South Carolina Environmental Education Resources Directory.
  - ☐ Create a calendar of environmental conferences and workshops for science teachers.
  - ☐ Develop lesson plans that tie riparian forest buffers to the S.C. Science Curriculum Standards and provide professional development for the teachers. The professional development should contain adequate background to the activities and lead the teachers through the activities.
  - ☐ Develop and provide fact sheets to teachers on water quality and riparian forest buffers and their benefits.
  - ☐ Approach the Program Directors of the existing organizations, conferences, and programs for K-12 Students and Teachers about including information on riparian forest buffers including the fact sheets, in their curricula.
  - ☐ Encourage sessions on water quality and riparian forest buffers and their benefits in existing conferences.

- **Education for the General Public:**

  - ☐ Develop and provide fact sheets to the general public on water quality and riparian forest buffers and their benefits when visiting state, county, and city parks, town and city halls, county administration buildings and visitor centers.

  - ☐ Approach the Program Directors of the existing organizations, conferences, and programs for the general public about including information on riparian forest buffers, including the fact sheets, in their curricula.

- **Education for Land Development Professionals:**

  - ☐ Develop and provide fact sheets to land development professionals on water quality and riparian forest buffers and their benefits.

  - ☐ Approach the Program Directors of the existing organizations, conferences, and programs for the land development professionals about including information on riparian forest buffers, including the fact sheets, in their curricula.

  - ☐ Encourage adding sessions to existing conferences on water quality and riparian forest buffers.

  - ☐ Educate land development professionals on BMPs for development.

  - ☐ Encourage networking by providing a contact list of existing programs, conferences and other educational material.

  - ☐ Provide a list of web sites and other resources on riparian forest buffers to land development professionals.

EDUCATION CONSIDERATIONS

The work group discovered a wide variety of education programs that either directly related to, or could be expanded to include, education on riparian forest buffers.

These programs were reviewed and considered in the context of four targeted audiences: 1) K-12 teachers and students; 2) the general public; 3) land development professionals such as planners, landscape architects, builders, developers, consultants, civil and environmental engineers; and 4) local government officials. It was recognized that each target group would need to have education programs that are tailored to the specific goals and needs of its members, and that a "one size fits all" program was unrealistic.

The work group decided that given the vast number of programs, conferences and organizations that are already in existence, the development of new education programs was not needed. The work group felt that it would be more realistic to integrate information on riparian buffers into existing programs. To successfully do this, however, the work group and the Task Force felt that a central contact responsible for the overall coordination and development of new information on riparian forest buffers was needed. In addition, the creation of a grant program to fund these new efforts was recommended.

The work group then made specific recommendations for each of the four target groups. Many of these recommendations, such as the development of fact sheets and the integration of educational materials into existing programs, conferences and organizations are similar for each of the targeted groups. All of the work group's recommendations were approved by the Task Force.

SELECTED EDUCATIONAL PROGRAMS

There are numerous educational organizations, programs, and activities for each of the target groups that can be used to incorporate information about the benefits and importance of riparian forest buffers. Some of these programs are described here. A more complete listing of education programs and organizations can be found in Appendix IX.

1. Local Government Officials

The NONPOINT EDUCATION FOR MUNICIPAL OFFICIALS (NEMO) PROGRAM is a program that can be adapted to teach local government officials about the benefits of riparian forest buffers. Originally developed by the University of Connecticut Cooperative Extension System in 1991, the program is aimed at helping local decision makers better understand the complex relationship between land use, urban growth and water quality. The program also encourages local officials to make better educated and more informed decisions on strategies to improve water quality and control nonpoint source pollution (University of Connecticut Cooperative Extension Service, 2000). To guide local officials, NEMO outlines a three-tiered strategy of natural resource-based

planning, site design, and the use of best management practices to address land use and NPS pollution: (1) an overview of NPS pollution; (2) a GIS component visually depicting the connection between critical land use and NPS pollution through a series of local GIS images and maps; and (3) recommended alternatives to present development practices (University of Connecticut Cooperative Extension Service, 2000).

Since the creation of NEMO in 1991, over 25 states are in some stage of adapting the program. The states of Alaska, Idaho, Indiana, Maine, Massachusetts, New Hampshire, New Jersey, North Carolina, Ohio, and South Carolina all have active and funded NEMO programs. Georgia, Kansas, Oregon, and Washington are in the planning stage of the NEMO project. Several states including California, the District of Columbia, Florida, Hawaii, Nebraska, Oklahoma, Tennessee, Utah and Wisconsin have all showed an interest in the NEMO program but have not actively began planning (University of Connecticut Cooperative Extension Service, 2000).

South Carolina initated its NEMO program in May 1998 with a pilot study in the Waccamaw River watershed with funding provided under the DHEC Section 319 program. S.C. Sea Grant Consortium, the Clemson University Cooperative Extension Service and the Waccamaw Regional Planning and Development Council are overseeing the pilot project, which is geographically focused in Georgetown and Horry counties. The project is aimed at county councils, planning and zoning commissions, city councils, grass roots environmental organizations and civic groups that focuses on nonpoint source pollution and sound comprehensive planning. Educational tools used in this project include a slide presentation, fact sheets, and an interactive workshop based on the three tiers of the NEMO program (University of Connecticut Cooperative Extension Service, 2000). Beginning in July 2000, the SC NEMO program will be expanded to four of the five priority watersheds in South Carolina: Pee Dee River; Upper Catawba; Saluda; and Seneca/Keowee.

2. K-12 Teachers and Students

Within the South Carolina Department of Education's CURRICULUM STANDARDS FOR SCIENCE there are many opportunities for the introduction of coursework regarding the benefits, importance, and function of riparian forest buffers. Examples of the S.C. Curriculum Standards for Science and how riparian buffer education might be integrated into the standards is shown in Appendix X.

ACTION FOR A CLEANER TOMORROW ("Action") is a kindergarten through 12th grade, activity-based, interdisciplinary curriculum supplement that can serve as a starting place for incorporating environmental education in the classroom. Introduced in 1993, "Action" was developed and tested by South Carolina teachers through DHEC's Office of Solid Waste Reduction and Recycling. In three-hour sessions provided at no cost by DHEC, teachers are exposed to the "Action" curriculum that includes lessons on recycling, waste reduction, composting, buying recycled, energy, air and water. These lessons are hands-on activities that help students get the facts, think for themselves, form opinions and make decisions. The curriculum supplement, which is given to all teachers completing the workshop, has a glossary and extensive resource section that offers background on specific issues from a global, national and South Carolina perspective.

Currently there are 10 lesson plans within the "Action" program on water quality issues including *Runaway With Runoff, We All Live Downstream, South Carolina's Bodies of Waters, The Water Cycle* and *Evaporation* (SC DHEC, 2000). Currently, the "Action" curriculum is being correlated to the new SC Curriculum Standards for Science developed by the State Department of Education.

In addition to teacher education programs, there are programs that are tailored specifically for student participation. THE TEACHING KATE (KIDS ABOUT THE ENVIRONMENT) PROGRAM gives 3rd to 6th grade students the opportunity to learn about natural resources in an outdoor setting, through hands-on interdisciplinary activities. Sponsored by the South Carolina 4-H Centers, the Clemson Extension Service, and the Coalition for Natural Resource Education, the core curriculum is divided into four, three-hour classes: forestry; soils; water; and wildlife. In addition to the original program, a 7th and 8th grade curriculum is available for returning or advanced groups (Teaching KATE, 2000). The KATE activities are also in the process of being correlated to the S.C. Science Curriculum Standards.

3. General Public

The SOUTH CAROLINA SCENIC RIVERS PROGRAM, administered by the Department of Natural Resources, includes an educational/ stewardship program that could be expanded beyond its current scope and used as a model educational program for riparian forest buffers. In its current form, the Scenic Rivers Program protects unique and outstanding rivers. Through a community planning approach, the program identifies and prioritizes river management needs and strives to protect resources including plant and animal life, wildlife habitat,

wetlands, scenic views, geologic formations, recreation areas, and cultural or historic treasures through riparian land management.

Through the Scenic Rivers Stewardship Program, local communities including landowners and river users, are provided basic information on their local river with emphasis on the relationship between land/water use and the short term and long term of the river. Essential tools for the program include river-specific slide shows, a fact sheet on the respective land management options, and a list of common sense measures or best management practices designed to protect river resources. For each state-designated scenic river, staff at S.C. DNR develop a slide show that focuses on river-specific information including pertinent river issues and management plan recommendations. Each slide show will also include general information on land management options available to riparian landowners through the Scenic Rivers Stewardship Program such as a donation of a perpetual conservation easement, a fee simple donation, and the purchase of fee simple interest in riparian properties. These management options afford two major benefits to the landowner: 1) long-term protection of the resource and 2) financial gains associated with tax advantages and/or revenue from the sale of management rights or property (S.C. DNR 2000)

4. Land Development Professionals

Many planning and other land development professionals in the public and private sectors are members of national and state organizations through which they participate in programs, conferences, and clinics. For example, each year the South Carolina Chapter of the American Planning Association in conjunction with the USC Institute of Public Affairs' Center for Governance and the Clemson University Department of Planning and Landscape Architecture hold courses for the South Carolina Academy for Planning. This training program provides "systematic, ongoing quality training for members of boards and commissions, staff, municipal and county councils, and others involved in land development planning (South Carolina Academy for Planning, 1999). The Academy consists of two tracts in which participants enroll: Planning Commission or Board of Zoning Appeals. Completion of a path is reached after attending a total of eight courses, of which some are electives. Each participant completing the requirements is awarded a certificate of completion. Examples of courses include Introduction to Local Planning; Planning Tools; Ethics in Planning; and Getting Public Participation in the Process (South Carolina Academy for Planning, 1999). Currently, there are no specific courses offered on environmental planning and management.

Chapter 6
CONCLUSION

Riparian forest buffers are valuable natural resources in South Carolina. As the state grows and develops, riparian forest buffers will play a more critical role in the natural protection of our water resources, our wildlife, and the aquatic life that depend on clean water for survival. Properly managed, riparian areas will also protect the natural, aesthetic beauty of our waterways and preserve the recreational enjoyment of these waters.

Part of the overall strategy to protect these areas depends on our knowledge of where they are, how they are used, who owns them, and whether they are being properly maintained. One critical area of needed research is a site inventory and database of riparian forest buffers in South Carolina. This information would assist state, local, and private organizations in developing different alternatives to protect and restore these resources.

The Task Force recognized early on that there is clearly not a “one size fits all” approach to this issue. To be effective, a broad, public-private, coordinated strategy is needed. The Task Force recognized this by recommending: a statewide minimum buffer width with local enforcement; non-regulatory options to encourage wider buffer widths; exemptions for successful programs; and the expansion of existing educational efforts rather than the creation of new programs.

This report represents a first step. State agencies, local governments, industry associations, non-profit groups, and the public will hopefully use this report and the work of the Task Force to take the next, crucial steps toward the ultimate goal of protecting riparian forest buffers in South Carolina.

Appendix I

RECOMMENDED BEST MANAGEMENT PRACTICES FOR THE PROTECTION OF RIPARIAN FOREST BUFFERS

Adapted from the *South Carolina Scenic Rivers Program: Recommended Best Management Practices (BMPs) for River Bordering Lands* and from a draft document entitled *Guide to Stewardship Development Concepts and Practices* (Fairey 1998).

Water Quality

Forestry: The South Carolina Forestry Commission has published BMP guidelines in *South Carolina's Best Management Practices for Forestry* that should be followed in all riparian forest buffer (RFBs) as defined by the Forestry Commission. The BMPs include the following as important in the protection of water quality:

- A minimum of 40 feet should be identified as a "streamside management zone" (SMZ) on perennial and intermittent streams. The width of the SMZ is determined by stream type and the slope adjacent to the stream. On ephemeral streams, the forest floor should be protected.
- Forestry activity within the SMZ should be conducted with caution. Thinning within the SMZ should be conducted with minimal exposure of mineral soil. Trees should be felled away from the stream, and logging debris should be removed from stream channels.
- Forestry operations should be timed to avoid wet weather and wet soil conditions.
- Forest roads should be designed to minimize the amount of sediment leaving the site and entering stream channels. Road construction in sensitive sites such as the RFB should be avoided except where necessary for stream crossings.
- Broadcast application of herbicides should be avoided within the primary SMZ.
- Landowners are encouraged to make use of a licensed forester or other certified professional for site-specific BMP recommendations.

Agriculture

Agricultural activities adjacent to waterways should be carried out according to BMPs. Farmers should consult the Natural Resources Conservation Service (NRCS) for case-by-case guidance. The following are examples of agricultural BMPs to protect water quality:

Row Crop Production:

- A naturally vegetated buffer should be maintained within at least 35 feet on both sides of all perennial and intermittent streams.
- To help keep agricultural chemicals such as fertilizers and pesticides out of waterways, a no-till filter strip of at least 15 feet in width is encouraged along both sides of all drainage ditches.
- New drainage ditches should not be constructed within the riparian corridor. When maintaining existing ditches, care should be taken to minimize sediment loading to the river.
- Integrated pest management should be used, e.g., pesticides should be applied only when the economic benefit of spraying exceeds the cost of spraying; pesticides should be applied as efficiently as possible and at times when runoff losses are unlikely; the toxicity, runoff potential, and leaching potential should be considered when choosing pesticides; pesticide containers should be triple rinsed and disposed of properly.
- Aerial spraying of pesticides should not be conducted within 100 feet of a waterway.
- Steps should be taken to control erosion and sedimentation, including establishment of perennial vegetative cover to protect the soil; establishment of cover crops that generate nutrients; practicing conservation tillage; and construction of sediment control structures.
- Highly erodible soils should be removed from production.
- With the aid of NRCS and/or extension personnel, farmers should develop and implement nutrient management plans.

Livestock/Poultry Production:

- As required by law, any new or expanded animal waste treatment lagoons should not be located within 1/4 mile of waters of the State including perennial streams, major tributaries, and adjacent wetlands, unless the lagoon is of "fail safe" design. In this case it may be located as close as 500 feet to a waterbody. In addition, all waste treatment lagoons should have a clay liner. Synthetic liners are required for lagoons at large swine facilities (420,000 pounds or more of animal live weight).

- Animal waste treatment lagoons/storage ponds should not be located within 50-100 feet of drainage ditches.

- Waste from confined animal facilities should be disposed of in such a manner as to prevent contamination of surface or ground water. Animal waste sprayfields should not be located within 100 feet of perennial streams, major tributaries, adjacent wetlands, or drainage ditches or within 50 feet of drainage ditches.

- Pastured or free-roaming animals should not be allowed uncontrolled access to rivers, tributaries, or adjacent wetlands. The animals should be fenced out to prevent destruction of riparian forest buffer and to prevent contamination of the water from pollutants associated with fecal waste. Where it is necessary to allow access for drinking water, the access should be limited to one location.

Urban Development

It is recommended that all urban development activities in a waterway's corridor be conducted according to BMPs developed by the Environmental Protection Agency and the South Carolina Department of Health and Environmental Control. Urban development activities include those associated with commercial, industrial, municipal, and residential development. The following are examples of urban BMPs to protect water quality:

- In plan and site development, disturb as little of the natural groundcover as possible.

- If large areas are to be excavated or land-scraped, consider removing and stockpiling top soil to be replaced over the site after construction.

- Plan land development in harmony with the natural runoff pattern and along the contour.

- Limit impervious surfaces.

- Accommodate runoff from land disturbed during construction through the construction of catchment basins, berms, dikes, or diversion drains in accordance with the S.C. Stormwater Management and Sediment Reduction Act.

- In areas of low topographic relief, conduct drainage from the developed sites to natural drainage ways or construct ditches to prevent ponding of water or sedimentation around the site or onto adjacent properties. Keep drainage in ditches, swales and other grassed areas as long as possible and minimize the use of piped systems.

- From pre-existing or post-development of the site, fill gullies, reestablish ground cover, and reshape eroded or excavated land to lessen the slope and reduce erosion. Use erosion nets, mulch or temporary seeding on bare or unstable soil.

- Use bioengineering techniques such as live stakes, wattles, brush layering, brush matting, vegetated dikes, etc to stabilize shorelines, stream banks or other eroding areas of the site.

- Whenever possible, leave stream channels and flood plains in their natural, undisturbed state.

- Where topography provides sufficient space, align traffic patterns with streams, and plan streets parallel to waterbodies while retaining an undisturbed stream buffer.

- Instead of shoreline or roadside strip development, cluster buildings and dwellings.

- Use streams and natural drainage ways to conduct storm water after preliminary controls and attenuation.

- Maintain streams as major landscape or site features.

- Rather than have a road simply follow the shoreline of a waterbody, provide viewing points and water access points off the main highway.

- Septic systems should be set back at least 50 feet from a waterway as required by existing DHEC guidelines and properly designed and installed by a qualified contractors in suitable soils.

- Chemicals such as fertilizers and pesticides should be applied at appropriate rates and should not be mixed or disposed of within 100 feet of waterways.

Along roads and their right-of-ways:

- Adequate culverts should be installed to manage drainage/runoff.
- The area around culverts should be stabilized.
- Proper erosion and sediment control measures should be implemented at all times.
- Mowing along roads is preferable to the use of herbicides when managing roadside vegetation.

Scenic Quality

Land use activities of waterfront landowners have a major effect on the scenic qualities. Land uses that are compatible with the existing scenic, natural, and cultural qualities of the corridor should be encouraged while others should be discouraged. The following BMPs are critical to the protection of scenic quality and aesthetic values along the state's waterways and are recommended for implementation by waterfront landowners:

- Openings or thinnings in the riparian buffer to allow for a view of particular features or scenes should be established by selectively thinning underbrush, shrubs, and low-hanging limbs. Cutting and felling trees should be avoided when attempting to create views. Such view corridors should extend no more than 75 feet or 1/3 of the lot width, whichever is less.
- The exterior design and height of buildings and other structures may be designed to be compatible with and unobtrusive to the scenic, natural, and cultural qualities of the corridor.
- All signs should be designed to be unobtrusive and blend with the surroundings. Commercial signs should be prohibited and procedures for the removal of existing signage should be provided.
- Restore the scenic quality of overused and abused areas in the corridor by landscaping and revegetating eroded and abused areas, planting additional wooded buffers in areas where the buffer is thin, and by controlling access and specific uses that are causing degradation.

Wildlife Habitat

Riparian habitats, or water-bordering habitats, are ecologically diverse and productive places. When managed to conserve natural conditions, riparian habitats can support many wildlife species. The following BMPs are recommended to waterfront landowners for the protection of wildlife diversity:

- To conserve and enhance wildlife diversity, landowners are encouraged to maintain riparian habitat corridors of naturally occurring vegetation. For the protection of wildlife values, a vegetated forest buffer measuring at least 100 to 300 feet from the ordinary high water mark is recommended. The wider the buffer, the greater the benefits for wildlife.
- Forest management within the riparian habitat corridor should be designed to promote wildlife habitat and diversity.
- Lands adjacent to the riparian buffer should be managed in a manner that sustains riparian habitat values.
- Leave some groups of mast-producing tress such as oak, hickory and dogwood.
- Maintain an understory of native herbaceous and shrub plants, a multi-layered tree canopy, diverse tree sizes, and some standing dead snags and fallen trees.
- Riparian areas that have been devegetated and degraded should be restored by re-establishing the naturally occurring vegetation, particularly where restoration can enhance connectivity between adjacent riparian habitats.
- Maintain large, contiguous blocks of natural habitats and avoid habitat fragmentation that can be caused by permanent land clearing. Enhance the connections between existing natural habitat blocks, particularly to those that are isolated, by establishing forest stands or habitat corridors.
- Fences or barriers which create a hindrance to the movement of wildlife should not be constructed in the riparian corridor.
- The use of recreational vehicles in RFBs should be avoided or minimized to avoid degradation caused by the destruction of vegetation, erosion of soil, and disturbance of wildlife.

Appendix II

RECOMMENDED OPERATION AND MANAGEMENT ACTIVITIES FOR RIPARIAN FOREST BUFFERS

Adapted from the NRCS guidelines for operation and management of riparian forest buffers.

- The RFB should be inspected periodically and protected from damage and destructive fire.
- Debris and sediment should be removed from all structures as needed.
- Inspect RFB after heavy storms and check for and disperse water where it is concentrated.
- Excess use of fertilizers, pesticides, or other chemicals, vehicular traffic and the removal or disturbance of vegetation and litter inconsistent with erosion control and buffering objectives should be avoided.
- Stable debris should be conserved except where fallen trees and debris create unstable streambank.
- Vegetation should remain undisturbed except for removal of trees that represent a hazard to streambank stability or individual trees of high value or trees that are too old for effective nutrient removal.
- Deposit material removed from the RFB should be deposited at a sufficient distance so that it can not be redeposited by high water into the stream.
- Where debris dams must be removed, try to retain useful stable portions, which provide fish habitat.
- Vegetation, undergrowth, forest floor, duff layer and leaf litter should remain undisturbed except for periodic harvesting of trees to maintain the functioning of the buffer.
- No mechanical or heavy equipment to be used in site preparation. Practices must be consistent with good forest management practices for regeneration.
- Replacement of dead trees and shrubs and control of undesired vegetation competition will be continued until the buffer is or will progress to a fully functional condition. Non-native plants, which are invasive or are not naturalized for the area are not to be used. Native species that thrive in the specific stream or site conditions are preferred.
- Adequate erosion control shall be continued in the up-gradient area immediately adjacent to the buffer to maintain buffer function.
- Any removal of tree and shrub products should be conducted in a manner that maintains the intended purpose and in accordance with forest practices guidelines.
- For purposes of moderating water temperatures and providing woody debris and detritus, RFB management must maintain a 50% canopy cover.
- For providing habitat and corridors for wildlife, manage the buffer to favor food, shelter, and nesting cover that would satisfy the habitat requirements of the indicator or target wildlife.
- For purposes of reducing excess pollutants in surface water runoff and shallow ground water or providing habitat and corridors for wildlife, manage the canopy to maintain a vigor of overstory and understory species.
- Use of fertilizers, mechanical treatments, pesticides and other chemicals should not compromise the buffer and its intended function.

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Recommendations of the Task Force were adopted by consensus and may not reflect agreement by every Task Force member or endorsement of the participating organizations.

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Appendix IV DEFINITIONS

Aquatic Ecosystem – Any body of water, such as a perennial, intermittent and/or ephemeral streams, lake, or estuary and all the organisms and non-living components within it, functioning as a natural system (Kuntson and Naef, 1997).

Aquatic Habitat – Habitat for fish and other aquatic organisms within bodies of water (Kunston and Naef, 1997).

Bank Stability – The ability of a stream bank to withstand the erosive forces of water (in several forms as flowing, detained rainfall or saturated soils and groundwater); gravity; ice (freeze-thaw cycles); woody debris accumulations; and wind. The forces associated with soil and geological materials and the rooting strength of plants combine to promote stability (Hansen, personal communications)

Brush Layering – Live branches placed in excavated terraces, covered with soil and compacted to form a series of benches (Fairey, in draft)

Brush Mattressing (matting) – A mattress like branch layer placed on a stream bank and anchored with stakes or twine (Fairy, in draft)

Buffer - an area or strip of land maintained in permanent vegetation to help control nonpoint source pollutants and manage other environmental problems.

Canopy – The vertical layers of stories of vegetation within a forest that extend from the ground to the top of the tallest tree. The canopy is formed by a combination of trees, shrubs, herbaceous plants, mosses, fungi, humus and various age classes of these plants. Species in different layers of the canopy often have different light and moisture requirements (Knutson and Naef, 1997).

Diversity – The variety, distribution, and abundance of different plant and animal communities and species within an area (Knutson and Naef, 1997).

Ecosystem – Community of different species interacting with one another and the chemical and physical factors making up its nonliving environment (Miller, 1996).

Endangered Species – Wildlife species native to an area that are significantly threatened with extinction throughout all or a significant part of their range (Knutson and Naef, 1997).

Ephemeral stream – A stream or river that flows only in response to rainfall events or for very short periods afterwards. Groundwater levels seldom if ever reach the surface. These streams often do not have enough flow quantity or duration to develop a defined channel in forested conditions. In their stable form, they seldom are a problem for warer pollution. Some intensive land uses can activate these streams to scour, move sediments and contribute to water quality problems (Hansen, in press).

Erosion – Process or group of processes by which loose or consolidated earth materials are dissolved, loosened, or worn away from one area and deposited in another (Miller, 1996). The forces that cause erosion include gravity, moving water, wind, ice, volcanic activity, earthquakes, and animal and human activities on the land.

Eutrophication – Physical, chemical, and biological changes that take place after a lake, estuary, or a slow-flowing stream receives excessive inputs of plant nutrients—mostly nitrates and phosphates—from natural erosion and runoff from the surrounding land (Miller, 1996).

Geotextiles – New, strong, natural or man-made netting that contains some combination of sand, gravel, rocks, wattles or matting (Fairey, in draft).

Herbicide – Chemical that kills a plant or inhibits its growth (Miller, 1996).

Intermittent stream – A stream or river that flows beyond rainfall events, but does not flow throughout the year. These streams typically have defined channels and do not support a diverse population of aquatic insects. Their channels flow often enough and with enough force to scour, sort or move stream channel materials (Hansen, in press).

Litter – Dead plant material, commonly leaves, needles, tiwgs, etc (Knutson and Naef, 1997). The materials are mostly intact and can be identified as to what they are.

Live Cribwall – A retaining wall of logs or other material with live branch cuttings planted in between spaces which grow to help stabilize the slope and hide the original structure (Fairey, in draft).

Live Stakes – Fresh cut like stakes, such as willow stakes, driven into the ground which later root and

stablize stream banks or slumping areas (Fairey, in draft).

Native vegetation – Vegetation that naturally occurs and thrives in a given area (Miller, 1996).

Non-Point Source – Pollution associated with activities that do not normally have a confined point source or conveyance of pollutants, which may come from localized, distributed or accumulated natural conditions and activities across a landscape.

Nutrients – Any food or element an organism must take in to live, grow, or reproduce (Miller, 1996).

Ordinary High Water Mark – The natural or clear line imposed on the shore or bank representing the ordinary height of the water. It may be determined by bank shelving, changes in the character of the soil, destruction or absence of terrestrial vegetation, the presence of litter or debris, or a combination of the above.

Perennial stream – A stream or river that normally flows throughout the year, except during extreme droughts. These streams typically have a defined channel and support a diverse population of aquatic insects, including some with life cycles that require permanent water. Their channels are able to sort and move stream channel materials (Hansen, in press).

Pesticides – Any chemical or biological agent that kills plants or animal pests, e.g., herbicides, insecticides, fungicides, rodenticides (Citizens' Task Force on Urban Stormwater Runoff, 1999).

Point Source – A single identifiable source that discharges pollutants into the environment (Miller, 1996)

Pollution – An undesirable change in the phsyical, chemical, or biological characteristics of water, air, soil or food that adversly affects the health, activites, or the survival of humans and other living organisms (Miller, 1996).

Porous Check Dam – A dam for small gullies usually made from posts, rocks, brush, wire or boards which allows for accumulated sediment and growth of vegetation (Fairey, in draft).

Riparian - refers to land adjacent to a body of water. Riparian Forest Buffer (as defined by the Task Force)- An area of vegetation that is natural or designed and managed, consisting of trees, shrubs and grasses adjacent to a stream, river, wetland or shoreline that helps maintain the integrity of water resources.

Runoff – Water that flows across surfaces rather than permeating land. Runoff eventually enters a water body and may pick up and carry a variety of pollutants (Citizens; Task Force on Urban Stormwater, 1999).

Sediment – Material carried in suspension by water, which will eventually settle to the bottom (Knutson and Naef, 1997).

Sedimentation – The process of sediment being carried in and deposited by water (Knutson and Naef, 1997).

Snags – Standing dead or partially dead trees that show signs of decay (Knutson and Naef, 1997).

Stream Bank – The part of the stream channel, when seen in cross section, that restricts the sideways water movement at normal flows (Knutson and Naef, 1997).

Terrestrial Wildlife Species – Animal and plant species that live primarily on land (Knutson and Naef, 1997)

Threatened Species – Animal and plant species native to an areas that are likely to become endangered within the foreseeable future throughout significant portions of their range, without cooperative management or the removal of the threat (Knutson and Naef, 1997).

Tree Revetments – Dead trees, such as bushy evergreens like cedar, anchored in place (Fairey, in draft).

Vegetated Dike – A dike that is covered in a plastic net and includes layers of stone, wattles and soil upon which vegetation fills in over time (Fairey, in draft).

Watershed – Land area from which water drains toward a common watercourse in a natural basin. Organic matter, dissolved nutrients, and sediments also move toward the same watercourse within a watershed (Knutson and Naef, 1997).

Wattle – Bundles of branch cuttings toed together and anchored in gullies (Fairey, in draft).

Appendix V
WORK GROUP MEMBERS

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Appendix VI
TIME LINE OF TASK FORCE EFFORTS AND MAJOR AGENDA ITEMS

June 8, 1999
TASK FORCE MEETING
- Introductions
- Project Overview

July 14, 1999
EDUCATION WORK GROUP MEETING
- Issue Identification

July 14, 1999
EXISTING PROGRAMS WORK GROUP MEETING
- Issue Identification

July 15, 1999
POLICY WORK GROUP MEETING
- Issue Identification

July 15, 2000
TECHNICAL WORK GROUP MEETING
- Issue Identification

August 10, 1999
TASK FORCE MEETING
- Review of June Work Group Summaries
- Review and Discussion of the Preliminary Draft Report
- Discussion and Consensus Agreement on
  A. Purpose and Goals of the Task Force
  B. Process to Guide Future Work

September 20, 1999
EDUCATION WORK GROUP MEETING
- Finalization of Issue Identification

September, 1999
TECHNICAL WORK GROUP MEETING
- Finalization of Issue Identification

September, 1999
POLICY/EXISTING PROGRAMS WORK GROUP MEETING
- Finalization of Issue Identification

October 5, 1999
TASK FORCE MEETING
- Finalization of Issue Identification for the three Work Groups

November 2, 1999
TECHNICAL WORK GROUP MEETING
- Discussion and Formulating Recommendations on Technical Issues

November 16, 1999
TASK FORCE MEETING
- Preliminary Recommendations from the Technical Work Group

December 14, 1999
TECHNICAL AND POLICY/EXISTING PROGRAMS WORK GROUPS MET TOGETHER
- Discussion and Formulating Recommendations on Technical Issues

January 10, 2000
POLICY/EXISTING PROGRAMS WORK GROUP MEETING
- Discussion and Formulating Recommendations on Policy/Existing Programs Issues

January 11, 2000
TASK FORCE MEETING
- Finalized Technical Work Group's Recommendations
- Preliminary Recommendations from the Policy/Existing Programs Work Group

January 30, 2000
POLICY/EXISTING PROGRAMS WORK GROUP MEETING
- Discussion and Formulating Recommendations on Policy/Existing Programs Issues

February 17, 2000
POLICY/EXISTING PROGRAMS WORK GROUP MEETING
- Discussion and Formulating Recommendations on Policy/Existing Programs Issues

February 24, 2000
TASK FORCE MEETING
- Preliminary Recommendations from the Policy/Existing Programs Work Group

March 8, 2000

EDUCATION WORK GROUP MEETING

- Discussion and Formulating Recommendations on Education Issues

March 16, 2000

TASK FORCE MEETING

- Finalized Policy/Existing Programs Work Group's Recommendations
- Preliminary Recommendations from the Education Work Group

April 13, 2000

TASK FORCE MEETING

- Finalized Policy/Existing Programs Work Group's Recommendations
- Finalized Education Work Group's Recommendations

May 25, 2000

TASK FORCE MEETING

- Approval of the Final Report

June 24, 2000

TASK FORCE MEETING

- Approval of the Final Report

July 11, 2000

COMMENTS ON FINAL REPORT DUE

Appendix VII

A summary of pollutant removal effectiveness values according to width of the vegetated buffer (adopted from Desbonnet et al. 1994).

Author	Width (feet)	Sediment (% removal)	TSS (% removal)	N (% removal)	P (% removal)	NO_3 (% removal)	Runoff Source	Vegetation	Slope (%)	Other
Doyle et al. 1977	2				9	0	Dairy manure	Grass-fescue	10	90 mT/ha
Neibling & Alberts 1979	2	91					Bare soil	Grass	7	For coarse-grained sediments
Neibling & Alberts 1979	2	37					Bare soil	Grass	7	For clay-sized particles
Neibling & Alberts 1979	4	78					Bare soil	Grass	7	For clay-sized particles
Doyle et al. 1977	5				8	57	Dairy manure	Grass		90 mT/ha
Neibling & Alberts 1979	8	82					Bare soil	Grass	7	For clay-sized particles
Doyle et al. 1975	12			95	99		Dairy manure	Forest/ scrub	35-40	Gravely, silt-loam soils
Doyle et al. 1977	13				62	68	Dairy manure	Grass		
Young et al. 1980	13			84	83	9	Dairy feedlot		4	
Dillaha et al. 1988	15		31	0	2		Dairy manure	Orchard grass	5	Concentr-ated flow
Dillaha et al. 1988	15		87	61	63		Dairy manure	Orchard grass	11	Av.10,000 kg/ha manure application
Dillaha et al. 1988	15		76	67	52	3	Dairy manure	Orchard grass	16	Av. 10,000 kg/ha manure application
Magette et al. 1987	15		72	17	41		Dairy manure	Forest/ scrub	35-40	Gravely, silt-loam soils
Dillaha et al. 1986	15	63		63	63		Fertilized cropland	Orchard grass		
Neibling & Alberts 1979	16	83					Bare soil	Grass	7	For clay-sized particles
Neibling & Alberts 1979	20	90					Bare soil	Grass	7	For clay-sized particles
Doyle et al. 1975	25			96	99					

Author	Width (feet)	Sediment (% removal)	TSS (% removal)	N (% removal)	P (% removal)	NO_3 (% removal)	Runoff Source	Vegetation	Slope (%)	Other
Schellinger & Clausen 1992	25		4	15	6		Dairy yard runoff	Fescue & rye mix	2	Poorly drained, surface sample
Schellinger & Clausen 1992	25		27	16	18		Dairy yard runoff	Fescue & rye mix	2	Poorly drained, subsurface sample
Dillaha et al. 1988	30		58	7	19		Dairy manure	Orchard grass	5	Concentr-ated flow
Dillaha et al. 1988	30		95	77	80	4	Dairy manure	Orchard grass	11	Av. 10,000 kg/ha manure application
Dillaha et al. 1988	30		88	71	57	17	Dairy manure	Orchard grass	16	Av. 10,000 kg/ha manure application
Dillaha et al. 1986	30			78	78					
Magette et al. 1987	30	78	86	51	53					
Thompson et al. 1978	39			45	55	46	Dairy manure	Orchard grass		
Bingham et al. 1978	43			28	25	28	Poultry manure	Fescue	6-8	
Mannering & Johnson 1974	49	45						Bluegrass sod		
Doyle et al. 1977	50			97	99		Dairy manure	Forested/ scrub	35-40	90 mT/ha; Gravely, silt-loam soils
Lake & Morrsion 1977	50	46						Bluegrass sod		
Peterjohn & Correll 1984	62	90		62	0	60	Agricultural runoff	Forested		
Young et al. 1980	70	81					Feedlot runoff	Corn	4	
Young et al. 1980	70	75						Oats	4	
Schwer & Clausen 1989	85		95	92	89		Milkhouse waste	Fescue & rye mix	2	
Young et al. 1980	90	93						Corn	4	25-year, 24-hour storm simulation

Author	Width (feet)	Sediment (% removal)	TSS (% removal)	N (% removal)	P (% removal)	NO_3 (% removal)	Runoff Source	Vegetation	Slope (%)	Other
Young et al. 1980	90		66	87	88			Orchard grass	4	25-year, 24-hour storm simulation
Young et al. 1980	90		82	84	81			Sorghum/ grass	4	25-year, 24-hour storm simulation
Edwards et al. 1983	98		23	31	29		Feedlot runoff	Fescue	2	Settling basins, then thru 60 m of grass buffer
Doyle et al. 1975	100			98	99		Dairy manure	Forest/ scrub	35-40	Gravely, silt-loam soils
Patterson et al. 1977	115		71				Liquid dairy waste	Fescue	3.4	
Thompson et al. 1978	118			69	61	62				
Wong & McCuen 1982	148	90								
Woodard 1988	187	99						Natural, mixed		
Edwards et al. 1983	197		87	83	84		Feedlot effluent	Fescue	2	Moved thru 2 consecutive 30m VFS
Baker & Young 1984	259			99			Fertilizers	Grass		
Karr & Schlosser 1978	299	55	50				Bermuda grass			
Karr & Schlosser 1978	705	97.5	90							
Karr & Schlosser 1978	997	99	97							
Lowarnce et al. 1984				85	30-42	83		Forested		
Jacobs & Gillam 1985						99		Forest/ wetland		79.6ha undisturbed watershed
Rhodes et al. 1985						99				
Reuter et al. 1992			85		97	85-90	Fertilized field runoff	Man-made gravel		
Schipper et al. 1989						98	Sewage spray	Forested pine		

Appendix VIII
TOWN OF LEXINGTON AND VINICITY—EXAMPLE

The Central Midlands Council of Government has assisted the Center for Environmental Policy in determining the land area comprising the riparian forest buffer at the widths of 35, 100 and 300 foot. The study area was a 86,084.656 acre parcel of land in Lexington County that included the Town of Lexington and vicinity, a portion of the Lake Murray shoreline and the Twelve Mile and Fourteen Mile creeks.

35-Foot Buffer

Land Use	Number of Acres in RFB	Percentage of Total Area in RFB (%)
General Commercial	95.34	0.1
Industrial	35.85	<0.1
Limited Commercial	50.72	<0.1
Mobile Home	36.96	<0.1
Multi-Family Residential	16.91	<0.1
Public Parks	8.28	<0.1
Public/Institutional	343.97	0.4
Rural	1,482.70	1.7
Single Family Residential	614.72	0.7
Vacant	3,569.10	4.2
Miscellaneous	83.89	0.1
TOTAL	**6,338.44**	**7.4**

100-Foot Buffer

Land Use	Number of Acres in RFB	Percentage of Total Area in RFB (%)
General Commercial	218.74	0.3
Industrial	85.04	<0.1
Limited Commercial	116.60	0.1

Mobile Home	86.58	0.1
Multi-Family Residential	47.29	<0.1
Public Parks	26.07	<0.1
Public/Institutional	710.84	0.8
Rural	2,935.82	3.4
Single Family Residential	1,655.34	1.9
Vacant	8,176.43	9.5
Miscellaneous	212.89	0.3
TOTAL	**14,271.64**	**16.6**

300-Foot Buffer

Land Use	Number of Acres in RFB	Percentage of Total Area in RFB (%)
General Commercial	606.79	0.7
Industrial	246.06	0.3
Limited Commercial	242.87	0.3
Mobile Home	234.18	0.3
Multi-Family Residential	122.84	0.1
Public Parks	72.03	<0.1
Public/Institutional	1,608.92	1.9
Rural	6,453.53	7.5
Single Family Residential	4,832.11	5.6
Vacant	19,960.50	23.2
Miscellaneous	578.46	0.7
TOTAL	**34,954.29**	**40.6**

Appendix IX
Existing Educational Organizations, Conferences and Programs in South Carolina

TARGET GROUP: LOCAL GOVERNMENT OFFICIALS

Existing Organizations and Conferences

- **International City/County Management Association:** The International City/County Management Association (ICMA) — the professional and educational organization representing appointed managers and administrators in local governments throughout the world. The purposes of the Association are to increase the proficiency of city managers, county managers, and other local government administrators, and to strengthen the quality of local government through professional management. To achieve its goals, ICMA sponsors, develops and implements a number of programs that provide local government managers and administrators with expertise on a variety of topic areas. Programs include: a Best Practices Symposium, a Brownfields/Superfund Consortium, International Municipal Programs, and an annual awards program and conference (ICMA, 2000). South Carolina has a chapter of ICMA, the South Carolina City and County Management Association. More information on ICMA can be found at www.icma.org.

- **Municipal Association of South Carolina:** Formed in 1939, the Municipal Association of South Carolina (MASC) represents and serves the state's 268 incorporated municipalities. The Association is dedicated to the principle of its founding members: to offer the services and programs that will give municipal officials the knowledge, experience and tools for making the best possible public decisions in the complex world of municipal government. The Association organizes and sponsors conferences and workshops for its members (MASC, 2000). More information on the MASC and its programs can be found at http://masc.state.sc.us.

- **South Carolina Association of Counties:** The South Carolina Association of Counties (SCAC), chartered on June 22, 1967, is dedicated to statewide representation and improvement of county government in South Carolina. The purposes of SCAC is to promote more efficient county governments; to study, discuss and recommend improvements in government; to investigate and provide means for the exchange of ideas and experiences between county officials; to promote and encourage education of county officials; to collect, analyze and distribute information about county government; and to promote legislation which supports efficient administration of local governments in S,C. The South Carolina Association of Counties, in cooperation with the Center for Governance of the Institute of Public Affairs, University of South Carolina, and the Strom Thurmond Institute of Government, Clemson University, offers the Institute of Government for county officials. The Institute is designed to provide the opportunity for county officials to enhance their skills and abilities to function more effectively as elected officials. SCAC also sponsors a mid-year conference, and annual conference and a fall meeting of the County Council Coalition. More information on SCAC can be found at www.sccounties.org.

SOUTH CAROLINA ASSOCIATION OF REGIONAL COUNCILS

Existing Programs

- **Nonpoint Education for Municipal Officials:** Explaining environmental concepts to the public and reaching them with current information has always been a difficult task. The NEMO project was created and designed in an effort to bridge this gap. Our focus has been the explanation of nonpoint sources and their link to different land uses. Particular attention is paid to the role of impervious, or paved, surfaces in the transport and concentration of pollutants. To guide towns,

NEMO outlines a three-tiered strategy of natural resource-based planning, site design, and the use of stormwater best management practices that towns can use to address their land use and cope with nonpoint source pollution (University of Connecticut Cooperative Extension System, 2000).

- **ICMA Wetlands and Watershed Management Program:** Recently ICMA began its program, ICMA Wetlands and Watershed Management Program, in conjunction with the U.S. Environmental Protections Agency's Office of Wetlands, Oceans, and Watersheds. This educational and public outreach program is designed to promote wetland and watershed protection activities and to raise local government and community awareness of these issues. The program will educate municipal officials on wetlands and management issues and promote the conservation of these and other natural resources through local and regional planning and permitting processes. As part of this program, ICMA will soon publish a publication entitled Protecting Wetlands, Managing Watersheds… Local Government Case Studies, which will highlight various management tools and strategies used by communities to conserve and manage their watersheds (ICMA, 2000).

TARGET GROUP: K-12 TEACHERS AND STUDENTS

Existing Organizations and Conferences for Teachers

- **The South Carolina Department of Education:** S.C. Department of Education provides coordination of science activities, leadership in science education and professional development for science teachers (EEASC, 1997). The Department is also required to set the science curriculum standards. In June 2000, the department will release an implementation guide for the standards, which will include sample lesson plans for each standard (Education Work Group, personal communication).

- **Coalition for Natural Resource Education:** The mission of the Coalition for Natural Resource Education (CNRE) is to develop and implement natural resource education programs and to develop and build broad based support which may enable all S.C. children to form a commitment towards the wise and sustainable use of natural resources for this and future generations (EEASC, 1997). The CNRE provides education programs and opportunities including lectures, field studies, workshops, scholarships, credit course and non credit course across South Carolina (EEASC, 1997). For example, the CNRE offers a two-week course each year on natural resource subjects at the Harbison State Forest. Teachers can take this course for graduate credit (Education Work Group, personal communication).

- **Environmental Education Association of South Carolina:** The EEASC is a non-profit association focused on environmental and natural resource education in South Carolina. Its primary goal is to instill a greater knowledge about and appreciation for the state's natural heritage (EEASC, 1997). The EEASC holds a forum every year in August. The forum focuses on networking between educators and allows time for individuals to explain their educational programs to conference participants. The EEASC also holds conferences in the fall and spring at various locations around S.C. This year's topic will be on growth management. About 5 years ago, the EEASC published a booklet of all the educational environmental programs in the state. However, this booklet has not been updated since its original release (Education Work Group, personal communication).

- **South Carolina Science Council (SC^2):** SC^2 is a statewide professional organization of teachers and others who are concerned with the improvement of science education in S.C. (EEASC, 1997). SC^2 hold a conference each November for science teachers (Education Work Group, personal communication).

- **South Carolina Marine Educators Association:** The S.C. Marine Educators Association (SCMEA) is a group of about 150 educators in South Carolina who focus on marine science education. They range from K-12 teachers to college professors to educators outside the classroom such as those who work at the S.C. Aquarium. SCMEA is affiliated with the National Marine Education Association (NMEA) who sponsors a national NMEA conference each year around the country. SCMEA meets once each year for a three-day conference, which includes field trips and marine science activities (Education Work Group, personal communications).

- **South Carolina Middle Schools Association:** SCMSA hold a conference each year for its science educators (Education Work Group, personal communication).

- **Clemson Extension Service:** Clemson Extension provides public service programs that help citizens, private enterprises and public agencies resolve problems they face day to day. Extension and Clemson University offer many programs and opportunities for teachers, such as 4-H and other educational programs, volunteer opportunities, workshops, awards/competitions and scholarships.

Existing Programs for Teachers

- **Project WILD:** Project WILD, organized by SCDNR, is an interdisciplinary environmental and conservation education program of instructional workshops and supplementary curriculum materials for teachers K-12. Each participant receives the Project WILD Activity Guide, which contains over 100 activities. Workshops are six hours in length with a minimum of 15 participants. There is no charge for the program (SCDNR, 1999). More information on Project WILD can be found at http://www.SCDNR.state.sc.us/cec/educate/img/projectwild.pdf.

- **Aquatic Project WILD:** A continuation of the Project WILD program, Aquatic WILD emphasizes aquatic wildlife and ecosystems. Each participant receives the Aquatic WILD Activity Guide with over 40 activities. Workshops last four hours with a minimum of 15 participants. There is no charge for the program (SCDNR, 1999).

- **Environmental Institutes For Teachers:** The Institutes are held in cooperation with local school districts and cover many topics related to environmental education. The Institutes offer teachers an excellent opportunity to learn about conservation education services available to the community. Teachers who participate in the environmental institutes can earn recertification and/or graduate credit (SCDNR, 1999).

- **Environmental and Natural History Courses for Teachers:** Clemson University offers a variety of graduate-level science courses for in-service teachers, allowing them learning opportunities in topics such as: the natural history of South Carolina; wildlife biology; forest and natural resources; and the geography and geology of South Carolina. Teachers may also conduct directed research with Clemson life sciences faculty.

- **Teacher's Wildlife Conservation Workshop:** The South Carolina Chapter of the Wildlife Society and the SCDNR sponsor an annual workshop for teachers of all grade levels. It is designed to enhance an instructor's understanding of the principles of ecology and wildlife biology. The workshop is staffed by wildlife biologists and emphasizes the scientific management of wildlife and their associated habitats. A combination of classroom lectures and field trips are utilized in the workshop. Participants have the opportunity to experience a "hands on" approach to wildlife biology. Accommodations are dormitory style at the Webb Wildlife WMA in Hampton County. A fee of $175 is charged for meals and lodging. Participants have the option of receiving graduate credit from Clemson University for the course at no cost for the first 25 participants registered (SCDNR, 1999).

- **South Carolina Teachers' Tour:** The South Carolina Teachers' Tour is a four-day tour of the forests and forest industry in South Carolina. Teachers tour public, private and industrial forests; discuss current forest issues and forest management practices with professionals in the industry; and visit wood products production facilities (furniture, lumber mills, paper mills, and other wood products manufacturing facilities). In short, teachers experience how forests are grown, harvested, made into useful products and regenerated into new forests for future generations. The purpose of the tour is to provide an unbiased look into the impact forests have on our state's environment, economy, and quality of life, and familiarize teachers with the Sustainable Forestry Initiative (SFI), a land stewardship program practiced by the forest industry and landowners. More information can be found at http://www.state.sc.us/forest/tour.htm.

- **Project WET:** Project WET is an interdisciplinary water education learning in all subject and skill areas. WET has many water related topics including atmospheric, surface and ground water, chemistry, water history, watersheds, wetlands, aquatic life, water quality, water use, water rights, water conservation and stewardship. Workshops are six hours in length with a minimum of 15 participants. This program is sponsored by SCDNR (SCDNR, 1999).

- **SC MAPS:** SC MAPS is designed to introduce students in grades 7-9 to South Carolina's landscape by using high altitude aerial photography, satellite imagery, topographic maps, other special purpose maps. It's a balanced, supplementary curriculum that encourages students to examine the natural and cultural history and landscapes of the state. The maps and curriculum activities were chosen to provide

statewide and regional perspectives centered around unique geological features in the state. Study activities include history, geography, geology, ecology, earth science, development trends, and environmental issues. Teachers must participate in a SC MAPS workshop to obtain an activity guide. This program is coordinated through SCDNR (SCDNR, 1999).

- **SC LIFE:** SC LIFE is a middle-school natural history curriculum being developed for South Carolina. The SC LIFE project uses the natural history of South Carolina and the Southeast to illustrate basic biological concepts and to stimulate inquiry-based learning. Among other endeavors, the SC LIFE project includes a team of Clemson University naturalists and researchers who offer summer field courses for middle- and high-school teachers, as well as research opportunities for teachers and students. More information can be found at http://www.clemson.edu/SCLife/home.htm.

- **Teacher of the Year:** The objective of this awards program is to create an awareness and appreciation of the value of environmental conservation education and to stimulate efforts by teachers to advance the wise use, protection and enhancement of the nation's soil and water related resources. The award recognizes two teachers annually (K-6 and 7-12) who have been actively teaching and been responsible for developing an outstanding program of conservation education. This program is sponsored by SCDNR (SCDNR, 1999).

- **Environmental Education Award:** The EEASC presents this annual award at its Spring meeting to an individual or organization for outstanding contributions in environmental education.

- **Conservation District Education Award:** An award presented by the EEASC to a teacher. The prize includes an invitation to attend the spring meeting and a free membership in the association.

- **EEASC scholarships:** Teachers may apply to the EEASC for scholarships to attend college credit environmental education workshops or courses offered by universities or colleges in S.C. The program provides tuition reimbursement upon successful completion of the workshop or course.

- **Action for a cleaner tomorrow:** "Action" is a kindergarten through 12th grade, activity-based, interdisciplinary curriculum supplement that can serve as a starting place for incorporating environmental education in the classroom. Whether you are teaching students about recycling, energy conservation, the water table, or air quality in South Carolina, these lessons are hands-on activities that help students get the facts, think for themselves, form opinions, make decisions, and take action for a cleaner tomorrow. "Action," introduced in 1993, was developed and tested by South Carolina teachers. The curriculum supplement has a glossary and extensive resource section that offers background on specific issues from a global, national and South Carolina perspective. The workshops, provided at no cost to teachers by the Department of Health and Environmental Control (SCDHEC 2000). There are 10 lessons plans within the Action program on water quality issues (Education Work Group, personal communication).

- **Project Learning Tree:** Project Learning Tree (PLT) is an environmental education program designed for teachers and other educators working with students from pre-kindergarten through high school. It uses the forest as a "window" into the natural world, helping young people gain an awareness and knowledge of the environment and their place within it. The S.C. program is sponsored by the South Carolina Forestry Foundation, forest industry, S.C. Dept. of Education, and S.C. Forestry Commission (PLT, 2000). More information including the PLT curriculum, Branch newsletter and resources can be found at the Project Learning Tree's national website located at www.plt.org.

- **Investigating Your Environment Series:** This series is sponsored by the U.S. Forest Service. Investigating Your Environment (IYE) is a supplemental interdisciplinary curriculum for use in grades 6-12. The goal of IYE is to help develop participants' skills and motivation to interact with and understand their environment. An investigative "hands-on" approach in which participants observe their surroundings and collect, record and interpret data is used in each unit. Questions and discussions are designed to elicit maximum response and involvement from participants and eliminate prolonged lecturing and teacher demonstrations. As students participate in the activities, they hone critical-thinking skills and follow basic problem-solving steps to predict and draw conclusions from their data. Each lesson plan provides a framework in which succeeding activities and discussions build on previous lessons and lead to an understanding of environmental problems and possible solutions.

Learners are then asked to synthesize the information they have gathered to predict physical, social and economic impacts upon the environment in a variety of situations (IYE, 2000). More information on IYE can be found at http://willow.ncfes.umn.edu/cons_ed/iye/iyeintro.htm.

Existing Programs for Students

- **Discover Carolina:** Discover Carolina is run by the Division of Parks, Recreation and Tourism. This is an umbrella effort by the state park system, targeting school children that come to the park and combine classroom and experiential learning, using the following activity guides (Education Work Group, personal communication):

  - ☐ Project Learning Tree
  - ☐ Project Wild
  - ☐ Project Aquatic Wild
  - ☐ Project WET

- **S.C. Teaching KATE:** Teaching KATE (Kids About The Environment) Program continues to give students the opportunity to learn about natural resources in an outdoor setting, through hands-on interdisciplinary activities. The core curriculum is divided into four, three-hour classes: forestry, soils, water, and wildlife. In addition to the original program, a seventh and eighth grade curriculum is available for returning or advanced groups (Teaching KATE, 2000). KATE's (http://4hcamps.clemson.edu/kate.htm) site has a collection of environmentally related teaching materials that can be downloaded and viewed in your word processor.

- **JASON Project:** Each year, JASON mounts a major scientific expedition that examines one or more of Earth's dynamic systems. Scientists and their work become the basis for developing a year-long, supplemental science and geography curriculum crafted for students in grades 4 - 9. Endorsed by the National Science Teachers' Association, the JASON Project curriculum enables teachers and their students to use the expedition as a framework for hands-on science learning throughout the school year. It is rich in opportunities for classes to do local experiments and data gathering that mirror the research being conducted at the site. Using JASON's Online Systems, teachers and their classes link to the expedition and interact with other JASON classes throughout the world. Teachers share teaching ideas and link their classes in teams with other classrooms and schools. Students can share data derived from their own local experiments with other schools and can interact with expedition scientists. All of the discussion and sharing takes place in our gated website, known as Team JASON Online. Each current JASON curriculum includes a registration for Team JASON Online. The effort is supported by on-going teacher training that enables teachers to incorporate a wide variety of technologies in their instruction and helps them bring science alive for their students. JASON's training program changes the way teachers approach the use of technology in their teaching, encourages interdisciplinary instruction, and makes teachers co-learners with their students. During the spring, JASON conducts two weeks of live, interactive "Telepresence" broadcasts that bring students into direct audio, visual, and data contact with the expedition site (JASON Project, 2000). More information can be found at the JASON project's website www.jasonproject.org.

- **South Carolina's Wood Magic Forest Fair:** Wood magic is jointly sponsored by Clemson University, the South Carolina Forestry Association, and the South Carolina Forestry Commission. The goal of the program is to teach 4th graders how important forests and forest products are in their everyday lives. A key point made during this event is that through sustainable management we can enjoy the many benefits of a growing forest and can also harvest trees for the thousands of useful products that improve our quality of life. More information can be found at http://www.state.sc.us/forest/wm99fair.htm.

- **4H20 - Pontoon Classroom:** This is a week-long, youth water quality education summer program, run through Clemson Cooperative Extension, in partnership with local community associations and state agencies. Programs are produced on lakes throughout South Carolina, to provide children ages 8-14 with knowledge about their local water resources and to teach them field, analytical and critical thinking skills needed to intelligently participate in making decisions that affect the quality of these environments. Each 4H20 - Pontoon Classroom is produced as an independent community partnership. Each program team consists of Cooperative Extension County agents, local representatives of state agencies and members of a local lake or other community association. This team approach not only enhances the educational experience for the children, but also forges strong links between the partners.

- **ENVIROTHON:** The Envirothon is a natural resources problem-solving competition for high school students. The event is sponsored by the South Carolina Conservation Districts Foundation and the South Carolina Association of Conservation Districts, and coordinated by SCDNR. It is a hands-on learning experience in the form of a team competition to stimulate students and provide incentive to learn about their role in nature - how they are a part of nature and how decisions they make can be beneficial or harmful to the environment. Students are tested on their knowledge of aquatics, forestry, soils, wildlife and one current environmental issue, which changes yearly. Winners at the state level receive college scholarships and travel to the national competition (SCDNR, 1999).

- **Conservation Poster Contest:** The annual conservation poster contest is sponsored by the SCDNR in cooperation with conservation districts and the South Carolina Wildlife Federation. The contest is open to students in grades K-4. The theme rotates each year between four topics: soil, water, wildlife and forest conservation. Winners at the state level are displayed in the State Museum (SCDNR, 1999).

- **Conservation Essay Contest:** This annual contest is sponsored by the SCDNR in cooperation with Conservation Districts. The contest is open to students in grades 5-9. The theme rotates every year between four topics: soil, water, wildlife and forestry. The purpose of the contest is to help students gain knowledge of our resources, our responsibility as caretakers, and to help students develop organizational and writing skills. The S.C. State Library prepares a bibliography of reference publications for use with schools. Winners at the state level receive $500 savings bonds and passes to the S.C. Aquarium (SCDNR, 1999).

- **Champions of the Environment:** A unique program that recognizes and rewards students for their outstanding environmental achievements sponsored by SCDHEC, DuPont, International Paper, and WIS. The program has two main components (Champions of the Environment, 2000).

- **Champions Monthly Recognition Program:** The Champions of the Environment Monthly Recognition Scholarship program is open to students in grades K-12. Each month individual students, classes or groups of students are selected as Champions of the Environment based on their environmental achievements. They are rewarded with a $100 saving bond scholarship, T-shirts, medallions, a feature of the Champions webpage, and star in a thirty second television spot highlighting their work. At the end of the school year, all of the monthly Champions are reviewed. From that group, yearly Champions of the Environment are selected and awarded a $1000 saving bond scholarship.

- **Environmental Awareness Competition:** An annual competition for sixth, seventh, and eight graders. The S.C. Environmental Student Awards Competition has five divisions of competition (poster, photography, quiz bowl, spokesperson and essay) with awards given in each area. Four finalists in each category will receive a $100 saving bond scholarship and the winners of each category will receive a $300 saving bond scholarship. All poster, photography, essay and spokesperson entries must reflect each year's theme. The 1999-2000 theme is "Do Your Part".

- **South Carolina Wildlife Federation Schoolyard Habitat:** The Schoolyard Habitats Program was formally created in 1995 by the National Wildlife Federation as an extension of the Backyard Wildlife Habitat Program to focus specifically on assisting schools, teachers, students and community members in the use of school grounds as learning sites for wildlife conservation and cross-curricular learning. NWF recognizes the on-going efforts of schools across the country through a certification process. Certified schools provide essential habitat for wildlife, as well as use these sites as teaching tools integrated into the curriculum. More information can be found at the SCWF homepage: http://www.scwf.org/schoolyard/index.html.

- **Camp Wildwood:** Camp Wildwood is designed for high school students who enjoy being out-of-doors and strive to increase their knowledge and experience in natural resources management. This camp has received numerous awards and was originated in the 1950s. Located at Kings Mountain State Park about fifteen miles northeast of York, S.C., Camp Wildwood is open to all tenth (must have completed ninth grade prior to camp) through twelfth grade high school students. Enrollment is limited to one-hundred campers. Sponsorships are available through local chapters of the South Carolina Garden Club and the South Carolina Wildlife Federation. Sponsorship usually includes payment of the camp fee by the sponsoring organization. A limited number of scholarships and spaces are available. $500

college scholarships are awarded to the top male and female campers of the week (SCDNR, 1999).

- **S.C. Conservation Workshop for Youth:** This is a nationally recognized education program for high school students sponsored by the S.C. Conservation Districts Foundation and local conservation districts. Conducted by staff of the SCDNR, other state agencies, industries and university faculty, the workshop provides hands-on studies in topics such as soils, forestry, land and water management, reclamation, wildlife, conservation leadership and career opportunities. Tuition is paid by the Conservation Districts, and 1 hour of college credit in Environmental Science is awarded to students who earn passing grades. College scholarships are also awarded to participants who excel in workshop activities (SCDNR, 1999).

TARGET GROUP: GENERAL PUBLIC

Existing Organizations

- **Palmetto Conservation Foundation:** Palmetto Conservation Foundation (PCF) is a Columbia-based, nonprofit organization dedicated to natural and cultural resource protection in South Carolina, including managing growth in a way which protects our quality of life. We bring a research-based, nonadversarial approach to land use, development, and conservation issues. The Foundation board has adopted four programs. They are:

  1. Conservation of South Carolina's natural and cultural resources;

  2. Preservation of South Carolina's historic resources;

  3. Promoting public access to natural and historic resources; and

  4. Encouraging sustainable economic development policies

  In March, 2000 PCF was a sponsor and organizer of a state-wide summit on Smart Growth. More information can be found on their website located at http://www.palmettoconservation.org.

- **S.C. Federation of Women's Clubs:** The Federation of Women's Club has an environmental committee, which takes on several environmental projects a year (Educational Work Group, personal communication).

- **South Carolina Downtown Development Association:** The Downtown Development Association is a statewide non-profit organization that provides assistance to communities to re-develop their central business districts. They also have established a statewide citizen advocacy organization called "1,000 Friends of South Carolina. Members of the group receive information on issues affecting the quality of life in their communities, become networked to learn of successful efforts throughout the state, and are given the opportunity to participate in a statewide grassroots consensus on approaches to address issues and policies that are communicated to decision makers. Issues addressed by 1,000 Friends include: growth management, land use issues, re-engaging people in the life of their communities, transportation reform, and environmental concerns. The Downtown Development association also sponsors a Lovable Communities Conference each year.

- **River Alliance:** Formed in 1995, The River Alliance works to create economic prosperity and enhance the quality of life in Central South Carolina. This not-for-profit, public/private partnership developed a plan that provides for residential, commercial, environmental, recreational, historical and cultural improvements along the lower Saluda, Broad and Congaree rivers. This strategic design is based on the principles of sustainable growth, conservation and community dialogue. Today, The River Alliance guides and advises in the plan's implementation. Included in the Alliance's proposal are nine components that collectively represent the goals this community has for its 90 miles of riverfront: economic development; greenway system, paddling system; river villages; Congaree Swamp National Monument; environmental preservation; historical preservation; public involvement; and education.

- **Lake and Watershed Association of South Carolina:** This statewide organization is a chapter of the North American Lake Management Society. The purpose of the Lake and Watershed Association of South Carolina (LWASC) is to promote understanding, protection, and comprehensive management of water resources and their watersheds. The objectives are to: educate the public on the importance of protecting South Carolina's rivers and streams, lakes and

reservoirs, and their watersheds; provide a forum for sharing information and experiences on scientific, administrative, legal and financial aspects of lake, reservoir and watershed management; support the development of local river, stream lake and reservoir restoration and protection programs, policies, and legislation promoting river, stream, lake, reservoir and watershed management; encourage the development of local, state and national programs, policies and legislation promoting river, stream, lake, reservoir and watershed management; encourage the cooperation between and partnering of individuals, non-profit citizens organizations, industries and government agencies for the promotion of watershed protection and improvement; encourage the development and enforcement of legislation and laws to protect rivers, lakes and reservoirs and the rights of the public to enjoy these natural resources safely and responsibly. The LWASC presents an annual conference and collaborates in producing bi-annual southeastern regional lakes management conferences. For more information: http://www.nalms.org/lwasc/index.htm.

- **Land Trusts:** Several Land Trusts exist in the state. For more information, contact each directly.

  - ☐ Aiken County Land Trust
  - ☐ Beaufort County Open Land Trust
  - ☐ Black Creek Land Trust
  - ☐ Congaree Land Trust
  - ☐ Edisto Island Open Land Trust
  - ☐ Hilton Head Island Land Trust Katawba Valley Land Trust
  - ☐ Kiawah Island Natural Habitat Conservancy
  - ☐ Lord Berkeley Conservation Trust
  - ☐ Lowcountry Open Land Trust Nation Ford Land Trust
  - ☐ Naturaland Trust
  - ☐ Pacolet Area Conservancy
  - ☐ South Carolina Battleground Preservation Trust
  - ☐ S.C. Heritage Trust Program: http://www.heritage.tnc.org.nhp/us/sc
  - ☐ Spartanburg Conservation Endowment
  - ☐ The Nature Conservancy Wetlands America Trust
  - ☐ York Forever
  - ☐ Upstate Forever: http://www.upstateforever.org

- **Community/Civic Organizations:** Many local communities and neighborhoods have formed their own community or civic organizations, which meet periodically throughout the year to discuss issues that affect their communities.

- **Lake Management and River Advocacy Groups:** Many local communities and neighborhoods have formed their own organizations dedicated to the protection and management of local lakes and rivers.

Existing Programs

- **Discover Carolina:** The Discover Carolina program, run by the Department of Parks, Recreation and Tourism, also reaches the general public through its 50 parks and properties, which conduct nature, based programs including forest stream ecology (Education Work Group, personal communication).

- **Water Watch:** The South Carolina Water Watch program is a unique effort to involve the public and local communities in water quality protection. The Water Watch program was developed to encourage South Carolina's citizens to become stewards of the State's lakes, rivers, streams, and wetlands. Volunteers select a water resource on which to focus and perform one or more activities in the areas of awareness (watershed surveys, shoreline surveys and familiarizing participants with water quality regulations and ordinances); protection, restoration and enhancement (litter cleanups and storm drain stenciling); and outreach and education (media campaigns), aimed at protecting water quality (SCDHEC, 2000). More information on Water Watch can be found at www.state.sc.us/DHEC/eqc/water/html/wtrwatch.html.

- **South Carolina Aquarium:** The theme of the museum is "waters from the mountains to the sea." The Aquarium will officially open in May 2000 (Education Work Group, personal communication).

- **South Carolina State Museum:** The Division of Natural History at the South Carolina State Museum is charged with the task of collecting, storing, documenting, interpreting and, where appropriate, exhibiting this remarkable diversity of South Carolina's corner of the natural world. Since the Museum's opening, numerous collections have been donated by private collectors, and the collections are becoming strong in the fields of Vertebrate Paleontology and Entomology. The museum maintains a Science Gallery with a rotating exhibit on science and technology. The museum has also begun a new weekend hands-on educational program called NatureSpace. The May and June 2000 curriculum will focus on plants and

endangered species (South Carolina State Museum, 2000). More information about the museum and its programs can be found at http://www.museum.state.sc.us/Index.htm.

- **South Carolina Scenic Rivers Stewardship Programs:** Through SCDNR's Scenic Rivers Stewardship Program, landowners and river users are provided basic information on "their" river with emphasis on the relationship between land/water use and the quality (short- and long term) of the resource. Essential tools for the education/landowner contact component include river-specific slide shows, a fact sheet on the respective land management options, and a list of common sense measures or best management practices (BMPs) to protect river resources. For each state-designated scenic river, program staff will develop a slide show that focuses on river-specific information such as outstanding and unique resources, river issues, and management plan recommendations. Each slide show will also include general information on land management options available to riparian landowners through the Scenic Rivers Stewardship Program. To promote stewardship, project staff will meet with each riparian landowner one-on-one or in a small group setting to explain the program and how it could apply to the landowner's parcel(s). An effort will be made to build a relationship with the landowner that results in effective land management. Landowner response will be tracked over time (SCDNR, 2000). More information on the Scenic Rivers Stewardship Program can be found at http://water.SCDNR.state.sc.us/water/envaff/river/stewardship.html#education.

- **South Carolina Home A Syst:** South Carolina Home A Syst - the Homestead Assessment System is a program that teaches home dwellers to protect the quality of surface and ground water. It consists of information and confidential self-assessments that help residents identify and correct water pollution and health risks from their homes and yards. S.C. Home A Syst is published by Clemson University through a grant from S.C. DHEC and distributed through county Extension offices and the Clemson University Bulletin Room. The current version of Home A Syst (84 pages) covers five topics: Site Assessment; Stormwater Management; Managing Hazardous Household Products; Home Septic Systems; and Yard and Garden Care. A new chapter, Drinking Water Source Protection, is planned for Summer, 2000 printing.

- **South Carolina Wildlife Federation Backyard Habitat:** Backyard Wildlife Habitat Program focuses on assisting homeowners and community members in the use of backyards for the conservation and protection of wildlife. NWF recognizes the on-going efforts of homeowners across the country through a certification process. More information on this program is located at: http://www.scwf.org/backyard/moreinfo.htm.

- **South Carolina Wildlife Federation Wildlife and Industry Together:** Wildlife and Industry Together (WAIT) is a program of the South Carolina Wildlife Federation in partnership with Duke Energy, the South Carolina Department of Natural Resources and the National Wild Turkey Federation. WAIT is designed to encourage corporate landowners to integrate wildlife habitat needs into corporate land management decisions. Corporate landowners can offset habitat loss by devoting their under-utilized lands to wildlife. This is achieved by matching site employees who are interested in wildlife with community partners to develop habitat plans. The WAIT program also assists corporations, employees, facility neighbors and other groups who desire to develop environmental projects in partnership with each other. More information on WAIT can be found at: http://www.scwf.org/backyard/wait.htm.

- T**op Logger Training:** The Timber Operations Professional (TOP) Program and Workshops are the South Carolina Forestry Association's commitment to raising the professional standard of timber harvesting. TOP is designed to improve safety, efficiency, and environmental protection. The three-day TOP Program provides the latest information on timber harvesting, safety, business, and environmental regulations. The course is tailored primarily for owners and job foremen of logging and site preparation operations, foresters, and landowners. The TOP Program is supplemented by one-day Workshops addressing specific aspects of timber operations. Workshops are offered on chainsaw and skidder operation, truck driving, road construction and other subjects. Additionally, to maintain their status as TOP trained operators, TOP graduates must attend a field-oriented BMP training session and a one day TOP Refresher Workshop within three years of completing the original TOP Logger course. The TOP Refresher Workshop updates attendees on changes in BMPs, regulations, safety, and trends in business management. Since its beginning in 1994, over 1,700 people have graduated from the TOP Program — including loggers, foresters,

landowners, and many other forest-related professionals. The training is taught by cooperators from forest industry, the South Carolina Forestry Commission, and experts on safety and insurance issues relevant to forestry operations.

TARGET GROUP: LAND DEVELOPMENT PROFESSIONALS

(builders, developers, consultants, landscape architects, civil and environmental engineers)

Existing Organizations and Conferences

- **S.C. American Planning Association:** The South Carolina Chapter of the American Planning Association (SCAPA) is organized to advance the art and science of planning and to foster the activity of planning - physical, environmental, economic and social - in South Carolina. The objective of SCAPA is to encourage planning that will contribute to the public well-being by developing communities and environments that meet the diverse needs of South Carolina (SCAPA, 2000). SCAPA holds quarterly mini-conferences throughout the year for its members (Education Work Group, Personal Communication). Members also participate in national APA conferences and other related conferences. More information on the SCAPA can be found on their homepage located at www.scapa.org.

- **Homebuilders Association of South Carolina:** The Home Builders Association (HBA) of South Carolina is a professional association comprised of residential home builders. They include small-, moderate- and large-volume home builders, multifamily and commercial builders and remodeling contractors. The Home Builders Association of South Carolina represents builders to the General Assembly and provides liaison with state government agencies. Each year the, HBA of S.C. organizes a state convention featuring workshops, speakers and a trade show. Members in the HAB are also invited to participate in national HAB conferences and workshops (HBA of Greater Columbia, 2000). There are also local chapters of the HAB. Many of which hold workshops and educational programs for its members. More information on the HAB and local HAB chapters can be found at www.habofsc.org.

- **South Carolina Association of Realtors:** The S.C. Association of Realtors is a trade association comprised of realtors and other professionals in related industries united in purpose and dedicated to providing knowledgeable and ethical real estate services to consumers and fellow realtors. The S.C. Association of Realtors strives to provide its members with programs and services which enhance the members' ability to successfully conduct their individual business in a competent and ethical manner, to promote cooperation among its members, and to promote the public's right to use and transfer real property. The Association also participates in lobbying efforts of the National Association of Realtors on issues affecting property rights and the Real Estate industry in general. There are also local chapters of the S.C. Association of Realtors. Both the local and state wide chapters of the Association of Realtors sponsor continuing education classes and workshops (York County Association of Realtors, 2000). More information on the local and state chapters of the Association of Realtors can be found at www.screaltor.com.

- **South Carolina Society of Professional Engineers:** The mission of SCSPE is to promote the ethical, competent and licensed practice of engineering and to enhance the professional, social, and economic well being of its members. The SCSPE works to promote the licensed practice of engineering; to uphold high standards of qualifications for licensing, and to communicate the importance of licensing; to represent the engineering profession to the government and other factions that influence our future; to provide learning opportunities that enable licensed engineers to maintain practice competency; to provide the ability to network with other engineers; and to provide information to engineers regarding issues and trends affecting the profession. Each year the SCSPE sponsors and annual conference and numerous other continuing educational programs and workshop. Member are also encouraged to participate in both local and national chapters of the Society of Professional Engineers conferences and workshops (SCSPE, 2000). More information on the South Carolina Society of Professional Engineers can be found at www.scspe.org.

- **American Society of Landscape Architects:** The ASLA is a professional organization for landscape architects and other design professionals. The mission of the American Society of Landscape Architects is the advancement of the art and science of landscape architecture by leading and informing the public, by serving members and by leading the profession in

achieving quality in the natural and built environment. ASLA is the largest network of landscape architects in the world, and the most forward thinking and dedicated organization in the environmental and design professions. ASLA provides its members with many opportunities such as an annual conference and continuing education courses (ASLA, 2000). More information on the ASLA can be found at www.asla.org.

SOUTH CAROLINA ASSOCIATION OF SOIL SCIENTISTS: S.C. CHAPTER SOIL AND WATER CONSERVATION SOCIETY

Existing Programs

- **Stewardship Development Certification Program:** Sponsored by SCDNR, this certification program recognizes development projects in S.C., which demonstrate outstanding environmental stewardship through the protection, conservation, improvement and awareness of our valued natural resources (Education Work Group, personal communication).

- **SCDNR Land, Water & Conservation Division:** In 1997, the SCDNR drafted a document titled "A Guide to Stewardship Development Concepts & Practices." The document was prepared to promote natural resources stewardship to those involved in the land development process. Its primary audience is to be developers, engineers, land planners and community officials. As of April 2000, this document remains in draft form (Elise Schmidt, personal communication).

- **South Carolina Academy for Planning:** Sponsored by the South Carolina Chapter of the American Planning Association in conjunction with the USC Institute of Public Affairs' Center for Governance and the Clemson University Department of Planning and Landscape, this training program provides "systematic, ongoing quality training for members of boards and commissions, staff, municipal and county councils, and other involved in land development planning (South Carolina Academy for Planning, 1999). The academy consists of two tracts to which participants enroll: Planning Commission or Board of Zoning Appeals. Completion of a path is reached after attending a total of eight course, of which some are electives, and each participant completing the requirements will be awarded a certificate of completion. Examples of course include Introduction to Local Planning, Planning Tools, Ethics in Planning, and Getting Public Participation in the Process (South Carolina Academy for Planning, 1999). Currently, there are no specific courses offered on environmental planning and management.

Appendix X

S.C. Curriculum Standards for Science and How Riparian Buffer Education Might Be Integrated

Kindergarten:

III. Earth Science

A. 1. b. "Explore the natural flow of water downhill." (Tie in - self explanatory.)

GRADE 1:

IV. Physical Science

A. 3. a. "Investigate that some materials mix with water and others will not." (Tie in: How water pollution might occur and get into nearby water bodies.)

GRADE 2:

III. Earth Science

A. 2. g. "Investigate and describe how weather affects water supply and water conservation." (Tie in: Where does rainfall go when it runs off of the land?)

GRADE 3:

II. Life Science

C. 2. a. "Describe how habitats and organisms change over time due to many influences (effects of natural forces, wind, rain, water, air, sunlight and temperature)." (Tie in: What happens to aquatic plants when the water is cloudy and they can't get sunshine? What happens to some fish if the water gets too hot or cold?)

III. Earth Science

B.1. d. "Infer how human behavior, such as farming, mining, construction, changes the Earth's surface." (Tie in - self explanatory.)

GRADE 4:

II. Life Science

B. 3. a. "Describe changes in the environment caused by humans."

B. 3. b. "Infer the impact of agricultural technology (e.g., air/land/water pollution and improved crop yield) on society and the environment."

B. 3. c. "Infer the impact of industrial technologies (e.g., air/land/ water pollution and improved standard of living) on society and the environment." (Tie in - self explanatory.)

GRADE 5:

II. Life Science

B. 4. e. "Draw conclusions about the influence of human activity on ecosystems."

B. 4. f. "Discuss ways to minimize the negative impact of technology/industrialization on the ecosystem and maximize the positive impact."

IV. Physical Science

A. 2. f. "Research and identify common pollutants, and their sources, and infer their impact as they relate to water quality, since water is the universal solvent." (Tie in - self explanatory.)

GRADE 6:

III. Earth Science

A. 2. b. "Infer the effects of water on the weathering of the Earth's surface in terms of solubility." (Tie in - sediment and how it comes to be in rivers/ streams/lakes.)

GRADE 7:

III. Earth Science

A. 2. c. "Explain why soil (sediments) can be a major pollutant of streams."

A. 2. d. "Evaluate ways in which human activities have effected soil and the measures taken to control the impact (silt fences, ground cover, farming, land use, nutrient balance)."

A. 3. a. "Define groundwater, runoff, drainage divide and drainage basin (watershed)."

A. 3. b. "Infer what happens to water that does not soak into the ground or evaporate."

A. 3. c. "Analyze the factors that affect runoff."

A. 3. f. "Identify technologies designed to reduce sources of point and non point water pollution." (Tie in - self explanatory.)

GRADE 8:

No specific standards - some may loosely tie in.

GRADES 9-12:

II. Life Science

D. 5. b. "Discuss the conflicts that could occur between developers and conservationists." (Tie in - self explanatory)

Appendix XI
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