NEW HANOVER COUNTY LOCAL WATERSHED PLANNING GROUP

2002 WATERSHED PLAN SUMMARY

FOR THE HYDROLOGIC UNIT CONTAINING BURNT MILL, UPPER AND LOWER SMITH, PRINCE GEORGE, NESS, DOCK, SPRING BRANCH, AND STURGEON CREEKS AND THE NORTHEAST CAPE FEAR RIVER

NEW HANOVER LOCAL WATERSHED PLAN

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EXECUTIVE SUMMARY

On July 7, 1999, the NC Department of Environment and Natural Resources (DENR) and the NC Department of Transportation (DOT) signed a Memorandum of Understanding (MOU) designed to help address DOT future mitigation needs from state road projects while protecting and improving watershed function through the restoration of wetland, streams and riparian buffers across the state. The agreement stipulates that the DOT will contribute to the DENR Wetlands Trust Fund for the facilitation and development of Local Watershed Plans (LWP) This partnership helps DOT and DENR work cooperatively to develop mitigation strategies within a watershed restoration context, providing efficiency and higher net watershed benefits.

LWPs are focused within Local Watersheds targeted by the NC Wetlands Restoration Program (NCWRP) as having a high need for improvement and a high potential to benefit from restoration efforts. The intent of these plans is to formulate strategies for the restoration of water quality, habitat, and biological integrity of the watershed systems through the application of appropriate stream/wetland restoration, Best Management Practices (BMPs) and land use control strategies.

The watershed selected for the first Local Watershed Planning initiative was located within the Lower Cape Fear Basin, and entirely within New Hanover County. The watershed is targeted due to watershed degradation issues attributed to nonpoint source pollution issues, including sedimentation and aquatic habitat degradation. This targeted Local Watershed contains drainages of the Northeast Cape Fear River including Burnt Mill (a 303(d) listed stream), Smith, Spring Branch, Ness, Dock, Prince George, and Sturgeon Creeks.

In September, 2000, the New Hanover County Local Watershed Group was convened by Watershed Education for Communities and Local Officials (WECO) with the sponsorship and support of the North Carolina Wetlands Restoration Program (NCWRP). The stakeholders who comprise the Group represent a diverse number of interests, including local landowners, commercial foresters, private land managers, the local Sierra Club chapter, Cape Fear RiverWatch, University of North Carolina- Wilmington Lower Cape Fear Program, NC Department of Transportation, Carolina Power & Light, the City of Wilmington, and New Hanover County. The Group was charged with providing input/technical expertise throughout the planning process, in addition to recommending actions for water quality, flood prevention and fisheries and wildlife habitat improvement for overall watershed function improvement and protection. Some of the projects initiated by the NCWRP could be used to meet compensatory mitigation requirements. The NCWRP also contracted with KCI Associates of North Carolina P.A. (KCI). to conduct a technical watershed assessment and University of North Carolina at Wilmington to collect monitoring samples and data throughout specific subcatchments of interest.

Between September 2000 and June 2002, the Local Watershed Group participated in numerous activities that provided the building blocks for the watershed plan. Those activities included:

- identifying and prioritizing issues of concern in the watershed with specific examples of problem areas which depicted the issues identified
- providing feedback based on local experience to KCI and the NCWRP to help conduct the technical watershed assessment
- developing a set of broad goals and objectives for the watershed plan
- prioritizing subcatchments and stream segments for further analysis
- prioritizing restoration projects
- recommending actions for working towards goals

- helping contact landowners to begin implementing restoration projects

Watershed concerns and goals identified by the Group include; improve and protect water quality, improve flood protection, address growth and development pressures on the watershed and preserve wildlife habitat. Supportive objectives for each of these goals were also developed and are described on pages 12-17. Based on the identified and agreed upon watershed goals and objectives, a series of evaluations were conducted to assess watershed conditions. As a result of the evaluations and stakeholder recommendations, a list of potential stream and wetland restoration projects, Best Management Practices, and policy options were developed for the three targeted subcatchments, Burnt Mill Creek, Lower Smith Creek, and Prince George creek. The consultant also provided watershed-wide policy recommendations based on water quality and development/build out modeling applications (See Appendix E). Although many of the recommendations were specific to the targeted subcatchments, because common land use types exist throughout the watershed, it is practical to assume that these types of recommended practices and projects could be applied watershed wide for maximum benefits.

The Group recommended the following:

- The NC Wetlands Restoration Program should pursue implementation of specific wetland/stream restoration projects identified in the Local Watershed Plan (Appendix A)

- Stakeholders, local governments, and resource professionals should pursue other local, state, federal and nonprofit resources for implementation of projects and policy recommendations which the NCWRP cannot currently fund, including implementation of Best Management Practices (BMPs) to address stormwater runoff degradation (Appendix A)

- Entities with research and monitoring experience, including NCDENR and the University of North Carolina at Wilmington should take additional actions to monitor changes in the watershed that may result from implementing restoration projects;

- New Hanover County should implement the City of Wilmington's Watershed Protection Roundtable Final Report[1];

- The local governments should seek ways to reduce fecal coliform pollution that results from domestic pet waste;

- NCWRP should work with the NC Coastal Land Trust to explore conservation strategies for specific areas suitable for protecting water quality benefits and wildlife habitat corridors.

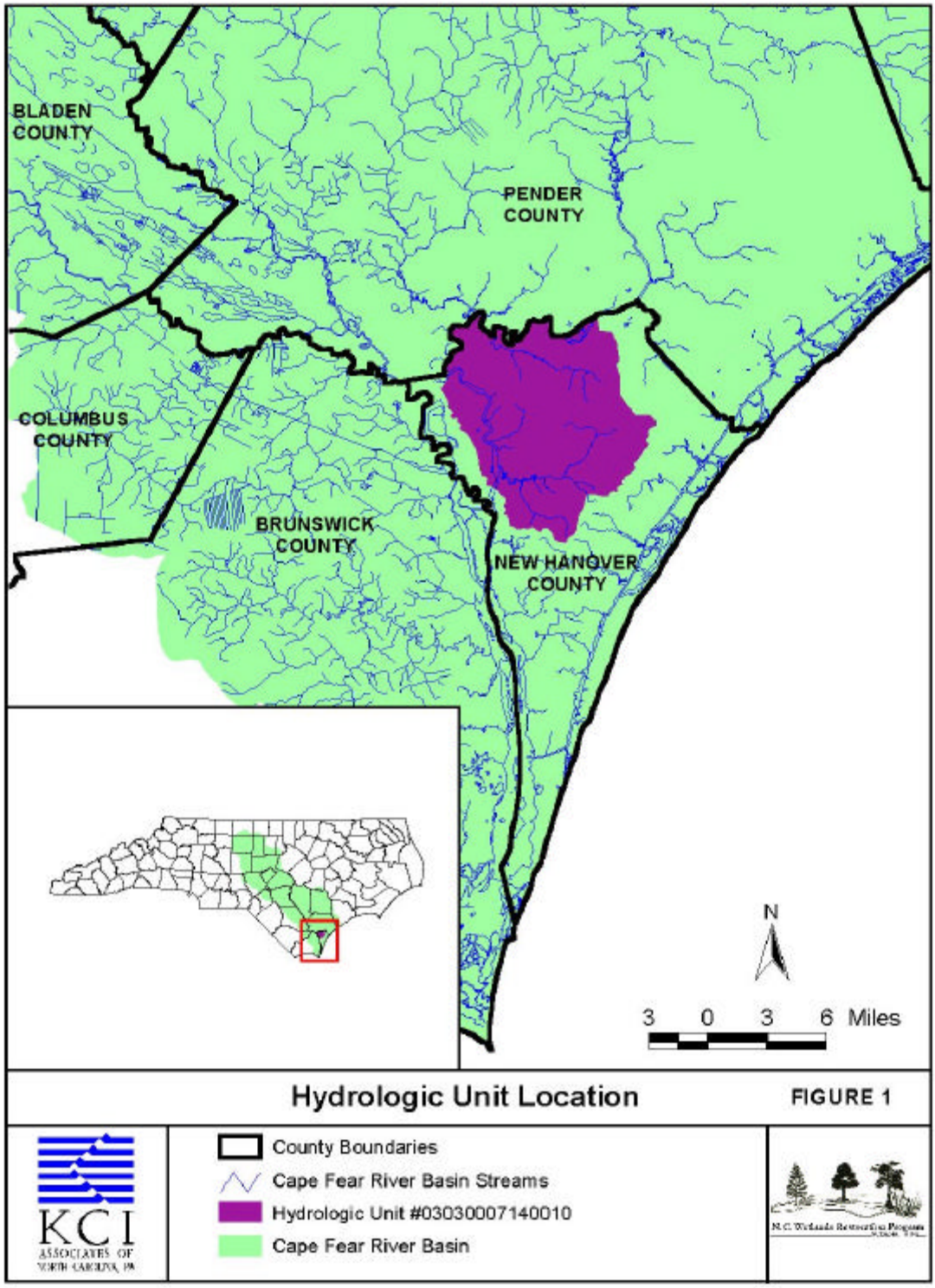
- Federal, state, local, and nonprofit agencies and organizations should pursue environmental education/ outreach with emphasis on water quality, aquatic and wildlife habitat, flooding, and impacts of growth and development within the watershed; and

- Enforcement of environmental infractions should be improved

[1] Please note that concern was expressed from some Group members that the City's recommendations and the Unified Development Ordinance (UDO) do not explicitly exempt agriculture and silviculture.

This Watershed Plan is intended to act as a living document that the watershed community should revisit and update as changes occur within the watershed. Research and modeling from the planning process can be used in the future to help with future watershed management efforts.

More detailed information about the New Hanover Local Watershed Planning Process, particularly about the technical watershed assessment, can be found in the expanded NCWRP version of the Local Watershed Plan. Contact Bonnie Duncan at 919-733-5315.


BLADEN COUNTY
PENDER COUNTY
COLUMBUS COUNTY
BRUNSWICK COUNTY
NEW HANOVER COUNTY
N
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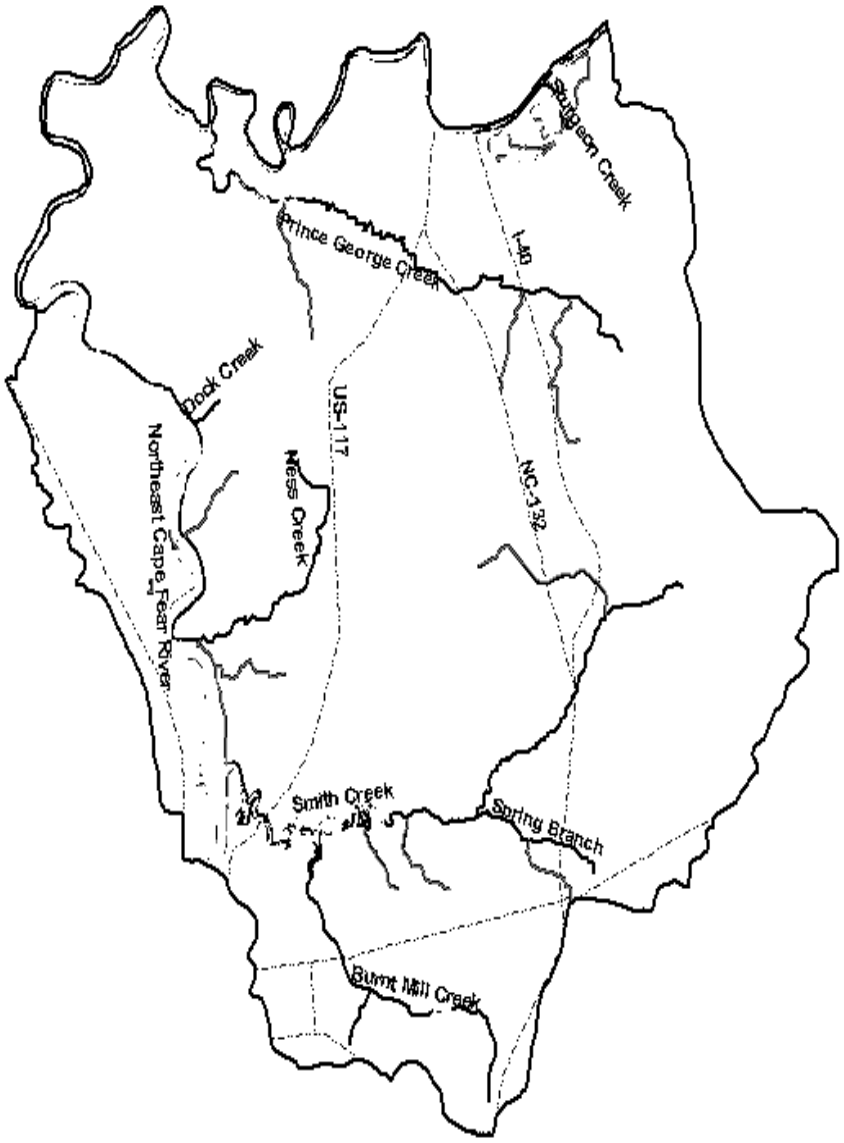
Hydrologic Unit Location
FIGURE 1
KCI ASSOCIATES OF NORTH CAROLINA, PA
County Boundaries
Cape Fear River Basin Streams
Hydrologic Unit #03030007140010
Cape Fear River Basin
N.C. Wetlands Restoration Program

Figure 1a: New Hanover County Local Watershed Planning Watershed
A Northeast Cape Fear River Drainage



PART ONE: BACKGROUND AND RESULTS

WHAT IS A LOCAL WATERSHED PLAN?

The North Carolina Wetlands Restoration Program (NCWRP) is a nonregulatory program intended to restore wetlands, streams, and riparian wetland areas throughout the state. Through the Local Watershed Planning Process, the NCWRP must identify restoration projects which could meet the NC Department of Transportation's future compensatory mitigation needs within specific watersheds. The program's goals are to improve water quality, flood prevention, and fisheries and wildlife habitat by restoring streams, wetlands, and riparian buffer areas throughout North Carolina's 17 major river basins, and to promote a comprehensive approach for the protection of natural resources.

The NCWRP is supporting the development of *Local Watershed Plans* throughout the state to help communities take a holistic look at their watersheds. Local Watershed Plans provide a framework for utilizing various management tools and financial resources to implement solutions for watershed protection and improvement. The NCWRP seeks to improve the ecological effectiveness of restoration projects, and to site projects where they most benefit local ecology for watershed improvement and protection before construction impacts occur. Local Watershed Plans will include not only wetlands, stream, and riparian buffer restoration projects, but a comprehensive package of initiatives needed to successfully improve and protect water quality and watershed function in the future.

Local watershed stakeholders are invited to assume leadership roles in the development and implementation of a plan. Along with supporting a local stakeholder group, NCWRP hires a technical consultant to conduct a *watershed assessment.* The watershed assessment, includes a compilation of available scientific information, models to predict water quality based on land use, field investigation information, and site recommendations for restoration projects based on scientific information and models. Local stakeholders are directly involved in reviewing and providing feedback on the technical consultant's work at various phases of the planning process.

The New Hanover County Local Watershed Planning Initiative is the first Local Watershed Planning effort to be supported by the NCWRP.

BACKGROUND OF THE NEW HANOVER LOCAL WATERSHED PLANNING GROUP

In April 2000, the NCWRP held a public meeting to recruit local input regarding the identification of an appropriate Lower Cape Fear River watershed for a Local Watershed Planning effort. Over 25 participants were asked to share their knowledge of water resource degradation issues within the Lower Cape Fear River drainage. With this information, a team of resource professionals, including representatives from the US Army Corps of Engineers, UNC Wilmington, Lower Cape Fear River Program Staff, Natural Resources Conservation Service, Cape Fear River Watch, NC Cooperative Extension Service, New Hanover County and the City of Wilmington, conducted a follow-up field investigation of the identified degradation issues. Professionals viewed the issues in the field to assess the restoration potential. Some criteria they considered when choosing which watershed in which to work included degradation issues, local interest, and amount of land viable for traditional restoration implementation.

Watersheds considered for the local Watershed Planning process include Futch Creek, Hewlett's Creek, Bradley Creek, Motts Creek, Barnards Creek, Howe Creek, and the watershed that was ultimately chosen that contains Burnt Mill Creek, Prince George's Creek, Smith Creek, and their tributaries. Many of the degradation issues identified within the tidal creek watersheds of the Lower Cape Fear basin were within private residential communities that afforded little opportunity for traditional restoration due to less land availability. However, when investigating the ultimately chosen watershed which extends from Castle Hayne into downtown Wilmington, resource professionals found numerous nonpoint source pollution degradation issues, viable opportunities for restoration, and a chance to address rapidly changing land uses. In addition, Burnt Mill Creek, a major tributary running through this watershed, was and still is listed on the state's 303(d) list of impaired waters since it is currently not supporting its State designated uses (for more information see page 12). Based on the input from the April public meeting and the field assessment, the NCWRP chose a watershed (classified by the NCWRP as a Targeted Local Watershed / 14-digit hydrologic unit) that is completely contained in New Hanover County, and contains Burnt Mill, Smith, Spring Branch, Ness, Dock, Prince George, and Sturgeon Creeks, a portion of the Northeast Cape Fear River, and all the land that drains into these streams.

Another public meeting was held on June 22, 2000 within the selected watershed to identify potential interests within the watershed and stakeholders to represent the various watershed interests in the Local Watershed Planning process.

The NCWRP contracted with Watershed Education for Communities and Local Officials (WECO), a Cooperative Extension Program based at N.C. State University, to convene a local watershed stakeholder group and facilitate the watershed planning process. The NCWRP also contracted with KCI, Inc. to conduct a technical watershed assessment, and the University of North Carolina at Wilmington to collect monitoring samples and data.

WECO interviewed watershed stakeholders by phone and compiled an initial Issue Assessment Report to determine how to proceed (available at www.ces.ncsu.edu/WECO), and convened the New Hanover County Local Watershed Planning Group in September, 2000. The following stakeholders participated in the watershed planning process and were party to the final agreements:

Bouty Baldridge
Cape Fear River Watch

Stacy Smaltz
Burnt Mill Creek resident

Jim Bordeaux
Castle Hayne Steering Committee

Don Cooke
CP&L

Dick Loeffert
North Chase Homeowners Association

David Mayes
City of Wilmington

Marian McPhaul
Lower Cape Fear River Program, UNCW/ CMS

Dexter Hayes and Chris O'Keefe
New Hanover County Planning

Michael Pope
Sierra Club/ Wrightsboro Community

Jabe Hardee
Cameron Company

Tommy Tew
Corbett Timber Company

Randy Turner & Joe Blair
NC DOT, Division of Highways

The following stakeholders participated in the watershed planning process initially but were not party to final decisions:

Karen Moorefield, Carolina Heights Neighborhood Association (unable to attend after beginning classes); Curt Hensyl, Local watershed resident and International Paper (moved out of state).

Several technical resource/ agency advisors also attended Group meetings and provided technical expertise throughout the planning process, and included:

Bonnie Duncan
NC Wetlands Restoration Program

Scott McLendon
US Army Corps of Engineers

Marilyn Meares Stowell
Natural Resources Conservation Service

Joanne Steenhuis
NC Division of Water Quality
Wilmington Regional Office

Anne Deaton
NC Division of Marine Fisheries
Coastal Habitat Protection Planning

Penny Tysinger
Cape Fear Council of Governments

Dexter Hayes
New Hanover County
Planning

Larry Hobbs
NC Wetlands Restoration Program

Angie Pennock
US Army Corps of Engineers

Greg Walker
US Department of Agriculture
Resource Conservation & Development Council

Bennett Wynne
NC Wildlife Resources Commission

Scott Logal
Cape Fear Council of Governments

Alex Marks
New Hanover County

Matt Hayes
City of Wilmington

Bruce Watkins
NC Coastal Land Trust

Chris Yerkes
Cape Fear River Watch Program

Steve Smutko
Natural Resources Leadership Institute, NC State University

NEW HANOVER COUNTY LOCAL WATERSHED

PLANNING GROUP PURPOSE

The Group agreed the primary purpose of the New Hanover County Local Watershed Planning Group was to recommend actions to improve water quality, flood prevention and fisheries and wildlife habitat for overall watershed function improvement and protection. To accomplish this, the Group can recommend utilizing available resources including but not limited to the NCWRP, the Clean Water Management Trust Fund, local government programs and others. Some of the projects initiated by the NCWRP may be used to meet compensatory mitigation requirements.

GOALS AND OBJECTIVES FOR THE LOCAL WATERSHED PLAN

Throughout the watershed planning process, Group members discussed potential goals and objectives for the Local Watershed Plan. The following numbered headings outline broad goals. The Group believes the suggested objectives and actions listed after each goal can work towards achieving those goals. Achieving the goals will take a concerted effort by local governments, state agencies, and other interested organizations. The watershed plan is an evolving document, as such the following objectives and actions should be evaluated in the future and adjusted according to new information, as it becomes available.

The information provided to the Group and their decision-making process is described in two sections that follow the Goals and Objectives Section: The Technical Assessment and the Local Watershed Planning process.

A. IMPROVE AND PROTECT WATER QUALITY

WATER QUALITY OBJECTIVES:

1) The Group agreed that a 10% reduction in nutrients (N and P) was reasonable to model for the purpose of the technical watershed assessment

As Burnt Mill Creek is listed on the State's list of polluted waters, the 303(d) List submitted to the Environmental Protection Agency, improving water quality for Burnt Mill Creek to achieve a "fully supporting" rating was suggested as an objective. A surface water such as Burnt Mill Creek is placed on the 303(d) list if it does not support its State designated uses. In this case, Burnt Mill Creek is a classified C Sw water which means it is protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, agriculture and other uses suitable for Class C. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner. "Sw" is a supplemental classification intended to recognize that waters like Burnt Mill Creek generally have naturally occurring very low velocities, low pH and low dissolved oxygen. Burnt Mill Creek is on the 303(d) list due to biological water quality impairment. Biological impairment refers to inadequate conditions necessary to support a population of naturally occurring aquatic insects. The degree of presence or absence of these insects provides an indication of the types and levels of pollutants which may be present in freshwater stream systems (see Appendix F for more information about biological impairment). Biological samples procured from Burnt Mill Creek indicate that the creek is not currently supporting its designated uses as described above.

Due to current discrepancies regarding Division of Water Quality methods for evaluating swamp waters, such as Burnt Mill Creek, a specific percentage reduction goal for removing Burnt Mill Creek from the State's 303(d) List could not be established. Although a numeric benchmark could not be established, the Group developed other recommendations that could improve water quality within Burnt Mill Creek as well as other subcathments within the watershed. A basic assumption in working toward the water quality improvement goal is that improving water quality within the watershed will also benefit and improve aquatic habitat conditions.

A Division of Water Quality (DWQ) biological study effort (being conducted by the DWQ Modeling Unit) is currently working to evaluate the causes and potential sources of the biological impairment within the creek. This information was not available for consideration at the time this watershed assessment was completed, although the technical watershed assessment and Local Watershed Plan were developed to compliment this effort.

Because of the difficulties associated with evaluating surface waters classified as swamp waters at the time of the assessment, the contracted consultant recommended using nutrient loading as an indicator of overall nonpoint source pollution loads from stromwater and sheet flow runoff within the watershed. In addition, a 10% improvement in nutrient loading over a span of 12 years (1998-2010) was recommended as a realistic nutrient reduction goal for modeling subcatchment solution alternatives. The 10% improvement goal was used to suggest an array of Best Management Practice and restoration solutions that would achieve the goal for specific subcathments and for the entire watershed based on current and projected growth and development trend information. This improvement/ removal goal was established based on several intrinsic factors:

1. The potential for ecological response;
2. The ability to calculate loading and removals, and
3. The potential to achieve the established goal

Upon evaluation of these factors, the recommendation to pursue a 10% improvement goal (related to nitrogen and phosphorus) was based on researched information and best professional judgement indicating that a reduction of pollutant loading by 10% would improve biological integrity to the watershed system and receiving waters.

Researched information was founded on the work developed for the Chesapeake Bay Critical Area Commission and included:

Shueler, T.T. 1987. Urban Best Management Practices: A Practical Manual for Planning and Design. Prepared for the Metropolitan Washington Council of Governments, Water Resources Planning Board. Washington, D.C. 220 pp.

U.S. Environmental Protection Agency (US EPA). 1983. Chesapeake Bay: A Framework for Action. Chesapeake Bay Program. Philadelphia, PA. 186 pp.

Schueler T.T., Bley M.R. 1987. Department of Environmental Programs, Metropolitan Washington Council of Governments: A Framework for Evaluating Compliance with the 10% Rule in the Chesapeake Bay Critical Area. Prepared for the Maryland Critical Area Commission and Maryland Department of the Environment.

RECOMMENDED ACTIONS:

The Group agreed that further monitoring and research would be necessary to pinpoint specific causes and sources of water quality degradation (particularly with regard to fecal coliform bacteria) within the watershed.

The Group also agreed that some type of water quality monitoring should occur before and following any restoration project implementation, in order to document any improvements that may occur as a result of the projects. Monitoring would help to set a baseline for water quality that is realistic for any identified project to achieve. The NCWRP agreed to consider the Group's specific recommendation and to develop measurements of success for each of the projects it funds and implements. Best Management Practices that are implemented will be monitored as funding sources allow. Coordination with current monitoring efforts conducted by the NC Division of Water Quality and UNC-Wilmington is recommended.

2) Reduce sediment from eroded stream banks

RECOMMENDED ACTIONS:

The Group agreed that implementing stream restoration and riparian buffer restoration projects could assist in improving eroded stream banks.

3) Protect and improve water quality and aquatic habitat through wetland, stream, and buffer projects, and other water quality improvement programs

Wetland, stream, and riparian buffer restoration and enhancement projects can contribute to better protection of water quality and can improve water quality and aquatic habitat. Some questions arose amongst the group about the specific improvements in water quality that may be attributable to stream restoration. They agreed that stream restoration projects should be monitored to quantify potential benefits on water quality from these projects.

RECOMMENDED ACTIONS:

NCWRP will fund wetland and stream restoration projects on a priority basis, as listed in the short list of prioritized projects that starts on page 28. The complete list of projects considered by the Group is in Appendix A.

4) Reduce fecal coliform inputs and ensure safe human contact (recreation, fish consumption)

Data collected by the Lower Cape Fear River Program has shown that excessive fecal coliform is a problem in some of the creeks within the watershed, including Burnt Mill Creek, Smith Creek, and Prince George Creek. KCI's review of water quality data collected by UNC-W indicated that fecal coliform was not likely coming from sanitary sewer leaks, so most of the fecal coliform would likely be coming from animal waste, including domestic pets.

The Group discussed alternative methods of education and enforcement of the City of Wilmington's pet waste ordinance. The ordinance requires proper disposal of pet waste on public property.

The Group reviewed recommendations for addressing the pet waste problem that were developed by the Greenfield Lake Committee. Although the recommendations were developed particularly for the protection of Greenfield Lake, they can be applied on a broad scale.

RECOMMENDED ACTIONS:

The Group discussed education and awareness problems concerning people fishing in Burnt Mill Creek. They agreed it was an issue meriting further investigation, but did not have the time to address it themselves during their planning process. They suggest that the city and county health department investigate and address this issue to protect the health of people who may fish in Burnt Mill Creek.

The Group recommends that the City of Wilmington and New Hanover County implement the Greenfield Lake Pet Waste recommendations. The County should implement all that can be applied on the county level. These include the following techniques:

- Include informational literature on preventing pet waste pollution to multi-family developments and owners of registered pets
- Provide pet waste public service announcements
- Increase signs around public water bodies
- Conduct school presentations about effects of non-point source pollution like pet waste
- Provide education at Earth Day
- Post duck feeding stations

- Improve existing city pet waste ordinances to include city right of ways and require carrying something to pick up waste with (on public city property)

In regards to enforcement of the pet waste ordinance, as well as other local ordinances related to environmental issues, the Group was concerned that violations of these ordinances were viewed as unimportant relative to other court cases and were usually thrown out by judges. Enforcement of regulations in the field is a concern as well. The Group recommends that local governments and stakeholders work to improve enforcement of environmental infractions.

B. ADDRESS GROWTH AND DEVELOPMENT PRESSURES ON WATERSHED

GROWTH AND DEVELOPMENT OBJECTIVES:

a) Encourage proactive government action to address potential watershed impacts related to growth and development, and to improve enforcement

b) **Encourage and educate developers concerning the value of complying with regulations**

RECOMMENDED ACTIONS:

The Group recommends support of the Wilmington Watershed Roundtable Report to the City of Wilmington and to New Hanover County. The Roundtable Report can be viewed at http://www.ci.wilmington.nc.us, then click on "What's New" to view the Report. The Report provides recommendations for development design that can reduce the environmental impacts of development. *One of the members, Jabe Hardee, dissents from this recommendation as it is based on implementation of a Unified Development Ordinance (UDO). He and some other members had concerns that the UDO does not explicitly exempt forestry and agricultural uses from the ordinance, and do not want to imply support of the UDO.*

The Group expressed concern about the state's stormwater permitting process for new development. They provided a letter to the Environmental Management Commission's (EMC) water quality subcommittee expressing the following concerns and suggestions, in hopes that the EMC would consider the suggestions in the development of the state's EPA Phase II Stormwater Rules.

- The legislated 90-day review period provided for NC Division of Water Quality (NCDWQ) to review stormwater permits
    - Cumbersome and costly for developers since comments may come late, requiring a second review period
    - Developers do minimum required since they believe NCDWQ will add significant comments late in comment period and a second period will be required anyway
    - *Since time is money for a developer, we suggest exploring the idea of a "fast track" permit approval process to allow a developer to pay a fee to ensure a quicker review. Fees could help fund permitting review.*

- Need for improved communications among local governments and permitting agencies (NCDWQ, US Army Corps of Engineers)

- Many of the restoration projects identified to improve water quality in our watershed were retro-fits of stormwater detention ponds
    - It is difficult to locate funding to retro-fit existing Best Management Practices (BMPs) (NCWRP cannot use mitigation funds)
    - Design and maintenance of required stormwater ponds is apparently an issue

- Need for flexibility in BMP design standards to allow for innovative designs
- Use of existing wetlands for treating stormwater runoff
    - To avoid discharging into wetlands, runoff may be circumvented around them, resulting in loss of wetlands and habitat
    - If wetlands are degraded because the natural flow must be diverted to meet the regulations, the regulations are not fulfilling their intended purpose of protecting the resource
    - Research should continue to investigate the use of existing wetlands as a BMP option

C. IMPROVE FLOOD PROTECTION

FLOODING OBJECTIVES:

1) Reduce flooding and flooding impacts

2) Decrease stormwater runoff and improve the quality of runoff

3) **Reduce damage to personal property and ensure public safety**

RECOMMENDED ACTIONS:

Stormwater best management practices (BMPs) were identified and prioritized (See Appendix A). Some of the BMPs may address the stormwater flooding concerns.

The Group recommends support of the Wilmington Watershed Roundtable Report to the City of Wilmington and to New Hanover County. The Report provides recommendations for development design that can prevent additional stormwater runoff from new development. One of the Group members abstains from supporting the Report, as it is based on implementation of a Unified Development Ordinance (UDO). Some members had concerns that the UDO does not explicitly exempt forestry and agricultural uses from the ordinance.

D. PRESERVE WILDLIFE HABITAT

OBJECTIVES FOR WILDLIFE HABITAT:

1) **Maintain continuity and connectivity of habitat**

2) **Identify areas of important habitat and strive to protect these areas**

RECOMMENDED ACTIONS:

The Group recommended that NCWRP work with other organizations to develop conservation strategies for two important tracts of land adjacent to and within the watershed. Particular areas of concern were identified in the northwest portion of the watershed (for more information about areas, see Appendix C). The Nature Conservancy has acquired one of the recommended sites, a tract of land that consists of Angola Bay and Bear Gardens in Pender County that links to other NC Wildlife Resources gamelands to create a large contiguous tract of habitat for wildlife. The other identified site of concern in the watershed is a 4,068 acre tract of forestland bounded on the west, north, and northeast by the Northeast Cape Fear River, and on the east by Prince George Creek. The Group agreed that NCWRP and the NC Coastal Land Trust (NCCLT) should contact the landowner to explore the feasibility of developing a conservation plan for the site, but they did not feel comfortable recommending a particular conservation strategy without more information.

The NCWRP and NCCLT will continue to work toward investigating the viability of this project.

PART TWO: THE LOCAL WATERSHED PLANNING PROCESS

THE TECHNICAL WATERSHED ASSESSMENT

A consulting firm contracted by NCWRP, KCI, conducted a technical watershed assessment to identify deficiencies in current and future watershed functions, and to determine if the problems identified merited restoration, enhancement, creation, preservation, Best Management Practices, or policy recommendations. The watershed assessment was conducted in conjunction with the Local Watershed Planning process. With the recognition that local experience and expertise is necessary to compile a complete picture of the watershed, the New Hanover County Local Watershed Planning Group (referred to as the Group from hereon), reviewed components of the technical watershed assessment and provided feedback on collected data and information throughout the planning process. The watershed assessment was conducted in 3 phases:

Phase 1: Watershed *Characterization Report*

- Description of existing conditions within the entire watershed (including water quality, physiography, geology, soils, land use, development patterns)
- Delineation of subcatchments (smaller sub-watersheds) and rankings of subcatchments for further study based on the Group's issues of concern
- Consideration of future NC Department of Transportation impacts
- Historical Trends Analysis
- Identification of potential types of project strategies which may be appropriate for consideration based on preliminary analysis of watershed characteristics

Phase 2: Collection *of more detailed information in particular subcatchments (Causes and Sources of Water Quality Degradation Report)*

- Field investigation, ground truthing and assessment of degradation issues (causes and sources) and potential solutions
- Water quality and hydrologic modeling to determine potential degradation hot spots and to better understand the watershed plumbing / flow
- Water quality monitoring within specific subcatchments (conducted by UNC-Wilmington)
- Watershed degradation "Causes and Sources of Water Quality Degradation" documentation

Phase 3: Using *information from Phases 1 and 2, potential strategies were identified to address problems in the watershed. The final product of the watershed assessment is titled, "New Hanover County Local Watershed Planning Initiative Restoration Opportunities for Burnt Mill, Lower Smith and Prince George Creeks". "*

- Includes a build-out development model (based on 12 year build out) and a water quality model (nutrient loading and removal calculators) to illustrate the benefits of restoration and other strategies.

These models were applied to alternative scenarios based on various levels of project implementation over 12 years (1998-2010).

- GIS information, aerial photography and written descriptions of recommended strategies
- Descriptions of how recommended strategies address causes of degradation.

A description of each of the phases applied during the assessment process follows in pages 20-28. Further and more detailed information about these phases can be found in the Local Watershed Plan 2002 available on line at the NCWRP website. For a more detailed list of all documents compiled for the technical assessment, please see Appendix D.

TRAINING IN COLLABORATIVE PROBLEM SOLVING SKILLS

Upon the convening of the New Hanover Local Watershed Planning Group, the Natural Resources Leadership Institute (NRLI) of N.C. State University and the N.C. Office of Environmental Education provided a training session for the Group. The Group learned about NCWRP goals and intentions related to the Local Watershed Planning Process, the principles of collaborative problem solving, and also learned about basic watershed concepts.

IDENTIFICATION OF IMPORTANT LOCAL ISSUES

WECO staff led the Group through an exercise to help them identify issues of concern in the watershed. The Group brainstormed a comprehensive list of concerns, grouped the concerns under topic headings, and prioritized the topic headings based on importance to them. Based on this list, they determined information needed to address the concerns. The complete list of issues is available as an appendix. The topic headings, listed in order of importance are:

1. Water quality
2. Flooding
3. Growth and development
4. Quality of life
5. Wildlife Habitat
6. Public Awareness and Education

MUTUAL EDUCATION OF GROUP MEMBERS

After the Group identified their issues of concern, WECO and NCWRP staff helped the Group find sources of information to learn more about their concerns. Sharing a knowledge base about potential problem sources is an important step in collaborative problem solving. In order for the Group to choose effective watershed improvement solutions, they needed to have a mutual understanding of the problems, and of their fellow Group members'

interests in watershed planning. In addition to sharing their interests with each other, the Group participated in a comprehensive educational process, and learned about the following topics. (Complete information presented is available in the Group's meeting summaries, located at www.ces.ncsu.edu/WECO)

- N.C. Wetlands Restoration Program's Local Watershed Planning Process & Discussion of the Technical Watershed Assessment Components, *Bonnie Duncan, NCWRP*
- N.C. Wetlands Restoration Program Goals and Activities, *Ron Ferrell, NCWRP*
- Current water quality research, *Dr. Mike Mallin, UNC-Wilmington Center for Marine Science*
- N.C. Basinwide Planning and water quality in New Hanover County, *Cam McNutt, N.C. Division of Water Quality*
- U.S. Army Corps of Engineers Wetlands Regulations, *Scott McLendon, U.S. Army Corps of Engineers*
- Coastal Area Management Act (CAMA) permitting, *Bob Stroud, N.C. Division of Coastal Management*
- Urban stormwater run-off and stormwater Best Management Practices (BMPs), *Bill Hunt, N.C. Cooperative Extension Service*
- City of Wilmington and New Hanover County stormwater management, *David Mayes, City of Wilmington; and Chris O'Keefe, New Hanover County*
- Natural History Overview for New Hanover County, *Scott Pohlman, N.C. Natural Heritage Program*
- Wildlife habitat in New Hanover County, *Andy Wood, Audubon Society of North Carolina*
- Conservation easements and land preservation, *Camilla Herlevich, N.C. Coastal Land Trust*
- N.C. Department of Transportation's Planning and Mitigation Program: Focus on the Wilmington Area, *W.D. Gilmore, Gordon Cashin, and David Schiller, N.C. Department of Transportation*
- Wetlands and Stream Restoration Requirements and Techniques (including a field trip to a stream restoration site at Pine Valley Country Club), *Larry Hobbs, NCWRP*

PHASE 1: WATERSHED CHARACTERIZATION AND SELECTION OF TARGET SUBCATCHMENTS

While the Group was learning about watershed issues, the *Watershed Characterization Report* was being compiled. This document was important in laying the groundwork for understanding existing watershed conditions and for determining where degradation existed based on available information (including stakeholder input).

In addition to describing existing watershed conditions, the information compiled in the *Watershed Characterization Report* was used to determine where future, more detailed assessment efforts (Phase 2) would be most meaningful. The purpose of Phase 2 was to study areas, which needed further investigation, in an effort to identify likely causes of watershed degradation problems. With the Group's permission, stakeholder rankings of important local issues were collected. These rankings were coupled with the data and information collected in the

Watershed Characterization Report, to analyze and rank the subcatchments based on the stakeholder issues ranked within the watershed. This information would ultimately be used to recommend which subcatchments should be pursued for further study.

To integrate these rankings, specific methods were developed to evaluate and rank stakeholder identified watershed issues, and subcatchments for more detailed study. Methodologies to allow for evaluation and ranking were developed for two discrete areas- 1.) stakeholder weighting factors and 2.) issue of concern mapping. The methodologies focused on ensuring that the selected issues could be mapped consistently and evaluated across the entire watershed without bias, and weighted without emphasis to the interests of any one individual or group. To accomplish this, a democratic nomination of weighting values was utilized and a normalized standard of reporting units was developed, as percentages or "per acre" values, to equally compare small and large watersheds.

The Group identified four issues of concern that were measurable physical parameters of the watershed; water quality, wildlife habitat, flooding, and growth and development. The stakeholders were asked to rank these concerns in order of importance for the entire watershed. A point value was assigned to each rank such that the sum of all points equaled 100. Thus, each stakeholder was allocated 100 points to assign across the four issues. The value assigned to each issue ranked was:

Importance	Value
#1	40
#2	30
#3	20
#4	10

The values were applied to each stakeholder ranking and input into a matrix table. The sum of the values for each issue was then divided by the total maximum points available. The weight for each concern is expressed as a percentage. Twelve stakeholders responded to the request and the resultant weightings tabulated;

#1 Water quality 33%
#2 Growth and development 27%
#3 Flooding 26%
#4 Wildlife habitat 14%

ISSUE ANALYSIS FOR SELECTING SUBCATCHMENTS

Evaluation of existing data led to mapping each issue of concern. Each map was analyzed to establish the extent and distribution of the mapped information for each subcatchment. Scores were assigned to subcatchments based on the mapping, and stakeholder weightings were applied. Following are more detailed descriptions of the data/information used for mapping each of the stakeholder issues;

- **Water Quality:** Potential phosphorus (a keystone pollutant) loading was used as an indicator of water quality degradation within the subcatchments, since land use-driven modeling accounting for this nutrient was readily available and could be applied watershed-wide. Group members pointed out that some historical monitoring information collected in Wilmington (by UNC-W) indicated that fecal coliform bacteria was a serious local problem and thought modeling efforts should be focused on this problem pollutant. The Group was assured that this historical data collected by UNC-W and historical data collected by the Division of Water Quality would be considered with current water quality sampling data, collected by UNC-W, as part of the technical assessment process. Unfortunately, at the time this

assessment was conducted, an Environmental Protection Agency approved modeling tool did not exist for assessing fecal coliform inputs at the broader watershed level. At this point in the assessment process, the Group needed a modeling tool which could be applied at the watershed scale and based on available and existing information to provide an indication of pollutant loads/water quality within various subcatchments. Fecal coliform loading does not relate as directly to land use as nutrients do (such as phosphorus). The reasoning prevailed that the loading of phosphorus may indicate the loading of other pollutants.

- **Flooding:** Flooding was evaluated by estimating the extent of the 10 year storm (based on FEMA flood insurance studies and flow calculations) and calculating the acres of occupied land uses impacted in each subcatchment The 10-year storm interval was requested by the Group to provide a realistic time frame for consideration.

- **Growth and development:** Growth and development were mapped by calculating the potential for future development which is defined as a percentage of the existing developed area compared to the proposed development area based on zoning in each subcatchment. The Group looked at growth and development in two ways- (1) ranking a subcatchment high if the watershed was already developed, and (2) ranking a subcatchment high if the watershed was not developed but had a high potential for development. The Group discussed the merits of protecting watersheds that were highly developed as opposed to attempting to restore watersheds that were not developed. In the end the Group recommended that both types of watersheds be chosen for Phase 2.

- **Wildlife Habitat:** Wildlife habitat was evaluated calculating the average species habitat frequency for each subcatchment using the Virginia GAP analysis. Subcatchments with lower frequencies of species were rated higher than subcatchments with greater frequency of species. Areas not developed were more likely to have greater species diversity than developed areas. The rating intended to reflect the potential for *improving* frequency of species in subcatchments.

- **Historical Trends Analysis:** Additional analyses were conducted to support the decision making process for historical land use trends and restoration potential. Historical trends were evaluated in the entire watershed. The trends show a significant decrease in agriculture, scrub/range land, and evergreen forest and significant increases in urban land uses from 1969-1998.

- **Stream and wetland restoration potential:** Since an essential component of the watershed planning process was to identify stream and wetlands restoration projects for compensatory mitigation, the subcatchments chosen for further study needed to have the potential for restoration projects. The NCWRP staff helped rank each of the subcatchments based on these criteria. While identified stream and wetlands restoration projects can help meet compensatory mitigation requirements, these projects will more importantly, also help address stakeholder identified issues which include water quality, habitat and flood degradation issues.

RESULTS

Following the issue analysis, scores for each issue were tabulated and compiled and the stakeholder weighting factor was applied. The sum of the scores represents the ranking of the subcatchments as defined by the stakeholders. Two variations of the rankings are presented. The first is based on tabulations regarding the growth and development score ranked by increasing severity with high development potential and the second is ranked based on increasing severity with lower development potential. In both Tables 1 and 2 located on page 23, the higher numbers represent subcatchments with more severe problems.

Table 1: Subcatchment Rank I

	Water Quality		Growth & Dev.		Flooding		Wildl
Subcatchment	**Raw Score**	**Wght Score**	**Raw Score**	**Wght Score**	**Raw Score**	**Wght Score**	**Raw Score**
Burnt Mill Creek	80	26.4	20	5.4	100	26	50
Lower Smith Creek	50	16.5	50	13.5	70	18.2	45
Upper Smith Creek	50	16.5	50	13.5	40	10.4	45
Spring Branch	80	26.4	20	5.4	30	7.8	50
Sturgeon Creek	10	3.3	100	27	10	2.6	30
North East Cape Fear 3	20	6.6	90	24.3	0	0	35
Prince George Creek	10	3.3	50	13.5	40	10.4	25
Dock Creek	30	9.9	50	13.5	0	0	35
Ness Creek	40	13.2	20	5.4	10	2.6	40
Unnamed Tributary 2	30	9.9	30	8.1	0	0	50
North East Cape Fear 2	10	3.3	40	10.8	0	0	25
Unnamed Tributary 1	20	6.6	20	5.4	0	0	35
North East Cape Fear 1	10	3.3	30	8.1	0	0	20

Table 2: Subcatchment Rank II (Inverse scoring for Growth and Development)

	Water Quality		Growth & Dev.		Flooding		Wildl
Subcatchment	**Raw Score**	**Wght Score**	**Raw Score**	**Wght Score**	**Raw Score**	**Wght Score**	**Raw Score**
Burnt Mill Creek	80	26.4	90	24.3	100	26	50
Spring Branch	80	26.4	90	24.3	30	7.8	50
Lower Smith Creek	50	16.5	60	16.2	70	18.2	45
Upper Smith Creek	50	16.5	60	16.2	40	10.4	45
Ness Creek	40	13.2	90	24.3	10	2.6	40
Unnamed Tributary 2	30	9.9	80	21.6	0	0	50
Unnamed Tributary 1	20	6.6	90	24.3	0	0	35
Prince George Creek	10	3.3	60	16.2	40	10.4	25
Dock Creek	30	9.9	60	16.2	0	0	35
North East Cape Fear 1	10	3.3	80	21.6	0	0	20
North East Cape Fear 2	10	3.3	70	18.9	0	0	25
North East Cape Fear 3	20	6.6	20	5.4	0	0	35
Sturgeon Creek	10	3.3	10	2.7	10	2.6	30

Issue Weights: Water Quality 33% Growth and Development 27% Flooding 26% Wildlife Habitat 14%
Highest score represents most severe condition; Maximum Score is 100

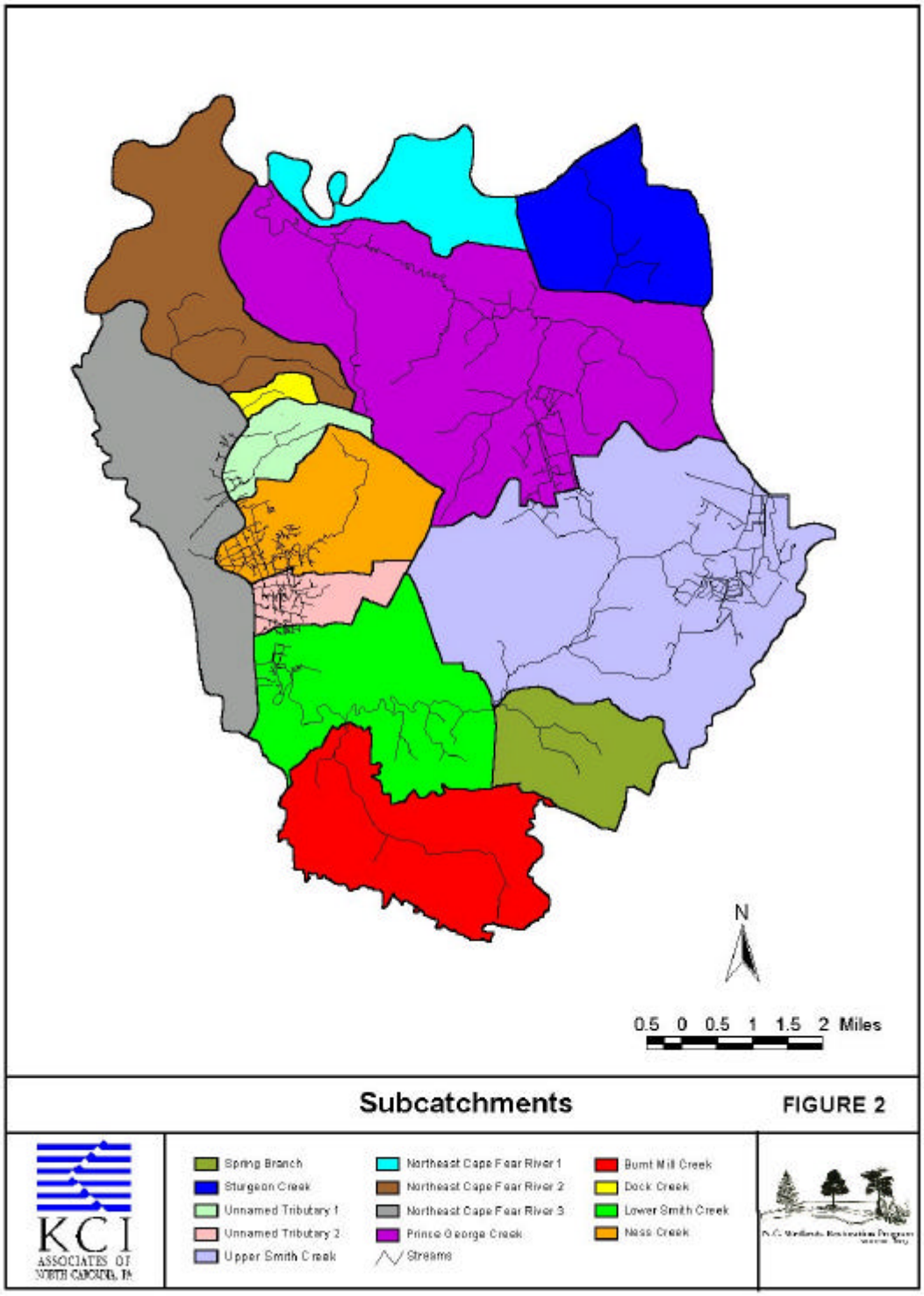
After discussing the ratings for the subcatchments, the Group provided the following subcatchment ranking for further study:

1- Upper Smith Creek
2- Burnt Mill Creek
3- Lower Smith Creek
4- Prince George Creek
5- Spring Branch
6- Ness Creek
7- Sturgeon Creek
8- And Unnamed Tributary 2 (Doctor's Creek)

Based on the Group's interest in addressing watershed areas that include developed as well as undeveloped areas threatened by future development, the agreed upon stakeholder ranking and the NC Wetlands Restoration Program's interests, **Burnt Mill Creek, Lower Smith Creek, and Prince George Creek subcatchments** were selected for further analysis. These recommended selections were then presented to the stakeholder team for consensus and agreement. The Upper Smith Creek subcatchment was omitted since it would have used up available resources due to its large land area.. Burnt Mill Creek is fully developed, Lower Smith is nearly developed, and Prince George Creek is mostly undeveloped. The Group felt that it could be just as important to protect existing resources that were functionally intact, versus directing all assessment resources toward repairing and restoring degraded systems. See figure 2 on page 25 for a look at the subcatchments within the local watershed.

The Group was encouraged to identify areas of degradation and potential project opportunities in other subcatchments as well, but in-depth study would be limited to the targeted subcatchments listed above.

Figure 2: Subcatchments within the New Hanover Local Watershed



PHASE 2: SUMMARY OF CONDITIONS IN THE THREE SUBCATCHMENTS

Detailed studies inventoried local conditions and performed various evaluations to aid in determining the causes of water quality degradation within the targeted subcatchments. Components of this evaluation included: land use/land cover mapping, delineation of subdrainage patterns, stream/riparian zone inventories, water quality sampling and modeling, hydrological modeling, and culvert and drainage ditch inventories. These activities were selected to isolate the physical, chemical, and/or biological modifications that have impacted the targeted subcatchments. This effort resulted in *Causes and Sources of Water Quality Degradation in Burnt Mill, Lower Smith, and Prince George Creek* document (available to view at the Cape Fear Riverwatch Educational Center and at NCWRP office in Raleigh). The *Causes and Sources* document summarizes conditions within each of the subcatchments. This information follows.

WATER QUALITY IN BURNT MILL CREEK SUBCATCHMENT

The causes of water quality degradation in the Burnt Mill Creek subcatchment originate from the degree of urbanization in the system. It is estimated that with 76% of its drainage area in urbanized land use, 64% of the subcatchment consists of impervious surfaces (surfaces that do not absorb stormwater such as rooftops and pavement). High levels of imperviousness within a watershed lead to increases in stormwater discharges. These stormwater inputs carry pollutants into streams and erode streambanks, further degrading the ability of the watershed system to function effectively. Many natural features have been denuded or severely damaged by human modification (i.e. channelization) and urbanization. Human alterations have led to increased stormwater discharges.

Increased stormwater discharges cause flooding in some areas due to undersized infrastructure and erosion, and increase of channel size in other areas. The increase in channel size, decreased slope and increased cross sectional area of Burnt Mill Creek, decreases the base flow flushing in the system. As a result some pollutants build up in the system between rainfalls, and others remain residual in the system after storms flush the system. In addition, erosive flows in the system cause the loss of instream habitat for aquatic animals.

Trends in data collected indicate that fecal coliform pollution is a recurrent problem within the watershed. During rainfall / storm events, fecal coliform concentrations remained high while oil and grease and surfactants (soaps) significantly decreased as stormwater flushed through the system. This information suggests that fecal coliform inputs may be attributed to land use based sources (i.e. animal waste, etc.) versus failing septic or straight piping systems. Increased levels of surfactants would have provided more support for investigating possible septic / straight pipe systems contributing to fecal coliform in the system.

The high degree of urbanization catalyzes a chain reaction of events through stormwater runoff that ultimately undermine natural processes and decrease stream functionality. **Restoration of the system through various practices including wetland and stream restoration, along with stormwater best management practices (BMPs), should emphasize treating/removing the effects of urbanization while assisting the system in reaching equilibrium for its current/anticipated level of stormwater / pollutant inputs. Due to land use constraints, stormwater BMP opportunities may be the most feasible and practical for this subcatchment.**

WATER QUALITY IN LOWER SMITH CREEK SUBCATCHMENT

The Lower Smith Creek subcatchment shows outward signs of a system under stress, but does not appear to be significantly degraded. It should be noted that the Lower Smith Creek subcatchment only includes the lower/southern portion of the Smith Creek watershed. Viewed independently, it is estimated that Lower Smith Creek has 37% of its drainage in urbanized land uses with an estimated 34% impervious coverage. The natural

features in the system are relatively intact with contiguous riparian (streamside) buffers along the main branch of Smith Creek. The channel is relatively stable.

On the other hand, tributary streams feeding into Smith Creek have undergone significantly greater degradation as a result of increased stormwater flows and human alteration. These streams exhibit localized bank erosion and unnatural deepening resulting in increased pollutant loads into the main branch and loss of instream habitat for aquatic species. Base flow flushing has become limited and some pollutants build up in the system between rainfalls, while others remain residual after storms flush the system.

Water quality degradation in the Lower Smith Creek subcatchment originates in Upper Smith Creek and is exacerbated by the local tributary influences in Lower Smith Creek. The main branch of Smith Creek has successfully accommodated increased flows associated with urbanization and has maintained a relative degree of stability, however its tributaries are being degraded by increased urbanization and human alteration. **Restoration efforts in this system should emphasize preservation of the main natural features, while minimizing the impacts of urbanization on its tributaries via projects such as wetland and stream restoration and installation of stormwater BMPs.**

WATER QUALITY IN PRINCE GEORGE CREEK SUBCATCHMENT

The Prince George Creek subcatchment appears to be a relatively stable system with only minor areas of localized degradation. The system has 14% of its drainage in urbanized land uses with an estimated 11% impervious coverage. The majority of its natural features are intact with contiguous riparian buffers along the main branch and its tributaries. Lack of encroachment on the floodplain and low overall slope in the main branch have contributed to its ability to retain a relatively stable channel, despite increases in stormwater discharges. However, increasing growth and development trends within this area could significantly degrade watershed functions within Prince George Creek and impact downstream systems.

Localized degradation has occurred in tributary streams where agricultural practices or urbanization encroach on the riparian buffer. These streams exhibit localized bank erosion and loss of riparian buffers. Base flow flushing has become limited and some pollutants build up in the system between rainfalls while others remain residual after storms flush the system.

Water quality degradation is localized and is ultimately diluted by the larger mass of the watershed that has not been impacted by human activities. **Maintaining the current integrity of the system should emphasize preservation of the natural features, while minimizing/restoring the impacts of urbanization that have already occurred. Water quality degradation will result if the system's natural features are allowed to be altered by primary or secondary impacts associated with land use changes.**

PHASE 3: IDENTIFICATION OF POTENTIAL PROJECTS

A cumulative score for each potential project was identified based on a formula which integrated: stakeholder issue rankings from the Watershed Characterization Report (the 4 main concerns were water quality, growth and development, flooding and wildlife habitat), data and information collected related to specific sites, and a watershed scale factor according to the proportion of the subcatchment affected by the recommended project. This formula was used to provide a cumulative score and relative ranking for each recommended project strategy. This information was used to develop a prioritized list of all the potential restoration and stormwater Best Management Practice project and policy recommendation opportunities in the three subcatchments. The Group based their

recommendations on this information, and reviewed all of the projects prioritized in the three subcatchments. For each of the 56 projects listed, they answered two questions:

- Are there historic problems with the site that you are aware of?
- Does anyone know the landowners?

Based on this input from the stakeholders, and from field analysis conducted by the NCWRP and US Army Corps of Engineers staff, the NCWRP recommended that the Group short list a top cut of projects. This resulted in the short list of the top 9 projects for pursuit. Described below is a summary of each of these sites along with the field comments. The entire list of prioritized projects bysubcatchments is included as appendices.

Additional projects that were not identified during the initial technical assessment may be added to the list of potential projects. The Group should evaluate these projects with similar methodologies to assess the possible benefits of those projects for water quality, flooding, and wildlife habitat.

THE SHORT LIST OF PRIORITIZED PROJECTS

The following short list consists of 9 projects that were prioritized by KCI, the NCWRP, and the New Hanover County Local Watershed Planning Group for immediate pursuit. The complete list of prioritized projects is available in the "New Hanover County Local Watershed Planning Initiative Restoration Opportunities Burnt Mill, Lower Smith, Prince George Creeks" (located at the Cape Fear Riverwatch Building). The codes listed in parentheses indicate the code provided for the project in the*Restoration Opportunities* document, and are used to indicate the location of the projects on maps contained within that document.

BURNT MILL CREEK

- Stream Restoration Opportunity on Mineral Springs Branch (BMSRO 106C)

  Site Description: Third order stream; entrenched and straightened channel; banks moderately unstable and partially fabriform; partial riparian buffer.
  Restoration Concept: Establish woody vegetation in riparian zone; bank stabilization; remove fabriform; restore natural channel dimension, plan and profile.
  Site Location: The proposed stream restoration site is a 943-foot reach of Burnt Mill Creek located in the central part of the Burnt Mill Creek subcatchment. The segment begins just downstream from where Burnt Mill Creek crosses Colonial Drive and where the Thomas Lilley Park and Forest Hills Elementary School are located. This site drains a watershed of approximately 2,720 acres.
  2-14-02 Field Comments: Good project and has potential for improving Burnt Mill Creek. Biggest obstacles are stormwater outfalls, asphalt access road, housing units and confined space along some stream segments.

- Stream Restoration Opportunity (BMSRO 301 & 302)

  Site Description: Second order stream; straightened, unstable channel; confined by apartment housing and parking lots; broken concrete walls in stream; very poor riparian vegetation; stormwater and sewer pipes in channel; areas of bank failure.

Restoration Concept: Stabilize banks and control localized bank erosion; establish woody vegetation in riparian zone; remove concrete debris.
Site Location: The proposed stream restoration sites occupy approximately a 1900-foot section of Mineral Springs Branch, a tributary to Burnt Mill Creek located in the central portion of the Burnt Mill Creek subcatchment. BMSRO 302 begins just north of the intersection with Wrightsville Avenue and continues downstream (north) to Confederate Drive, where the BMSRO301 reach begins. BMSRO301 begins upstream where Mineral Springs Branch crosses under Confederate Drive and ends downstream at its confluence with Burnt Mill Creek. BMSRO301 enters Burnt Mill Creek from the south about midway between Thomas Lilley Park and Wallace Park. Site BMSRO301 is located between BMSRO302 and BMSRO106C. The BMSRO301 site drains a watershed of approximately 278 acres.
02-14-02 Field Comments: Good project and has potential to improve Burnt Mill Creek. Biggest obstacle is sewer line running through creek and touching creek bed, and City maintained road in apartment complex which runs parallel to Burnt Mill Creek and perpendicular to Mineral Springs Branch. Several cats and raccoon paw prints were noted along the creek and on the creek banks – could be a source of fecal. Concrete wall debris along with other household and equipment debris were evident in the creek (air conditioners, car batteries, propane tanks, furniture, tires).

- Best Management Practice Opportunity (BMBMPRO-2)
  Site Description: Rugby / football playing field owned by the Rugby Club.
  Restoration Concept: Implement new wet detention basin near urban stream bordered by residential properties and open land.
  Site Location: Near Chestnut Street.
  Field Comments: The recommended BMP would be difficult to implement given the space constraints associated with the on site rugby field. The parcel in its entirety has the potential to be a good wetlands restoration site, however landowners may not be interested in giving up their only rugby field. A property "swap" should be considered with the rugby team if this project is pursued further.

- Best Management Practice Opportunity in City of Wilmington, Stormwater Wetland at Wallace Park:
  Site Description: Wallace Park is a City owned park adjacent to Burnt Mill Creek. The City is installing a new drainage system down Perry Avenue. to mitigate a flooding problem on Market Street at the intersections of 18th and 19th Streets. The City has designed a storm water wetland to treat runoff from the first one inch of rain which will be located amongst the cypress trees in the park.
  Restoration Concept: Install 0.2 acre wetland to treat runoff from 25 acres of fully developed residential area. Runoff has been receiving no treatment prior to discharge into Burnt Mill Creek. This project also has the potential to reduce peak storm flows.
  Site Location: The proposed wetland will treat runoff from an approximate drainage area of 25 acres that has historically been discharged directly into Burnt Mill Creek. The location is directly adjacent to the Market Street culvert crossing of Burnt Mill Creek.

LOWER SMITH CREEK

- Stream Restoration Opportunity (LSSRO 703)
  Site Description: Second order stream; straightened, unstable channel; large amounts of sand in streambed; flows through a residential area and ends in a swamp in Maides Park.
  Restoration Concept: Restore natural stable dimension, plan, and profile; control stormwater and associated erosion on banks; establish woody vegetation on banks and in riparian zone.
  Site Location: The proposed stream restoration site is located along a tributary to Smith Creek, beginning at Barclay Hills Drive, in the southeastern portion of Lower Smith Creek subcatchment. The length of the

site is 3,718 feet, and the site ends in a swamp below Maides Park. The approximately 750-foot tributary to the site appears to be routed through storm sewer. The site drains a watershed of approximately 234 acres.

02-14-02 Field Comments: Stormwater outfalls onsight would require the City's involvement. In Maides Park, loads of trash in the stream and along the stream banks, needs clean up desperately. Across from Maides Park and the creek an old channel bed was noted which could help move away from the City's sewer lines and have even greater restoration potential. Muskrats were noted on site.

- Wetland Restoration Opportunity (LSWRO 5)

  Site Description: Part of the property is currently under a City utility easement. Site is dominated by herbaceous grass and wetland vegetation (cattails in particular).

  Restoration Concept: Restrict flow off site to allow shallow flooding.

  Site Location: The proposed site is located northwest of Castle Hayne Road (Highway 133-117), southwest of Brentwood Drive, and north of Smith Creek, shortly before it flows into the Northeast Cape Fear River. The proposed, approximately 90-acre wetland restoration site is located in the northwestern portion of the Lower Smith Creek subcatchment. This site drains a watershed of approximately 304 acres.

  02-14-02 Field Comments: This site is not a good wetlands restoration site – since it's already a wetland (cattail marsh) and the tide and water table would make it extremely difficult. In addition, channels would require a lot of fill. However, across Castle Hayne Road from the site, the Department of Transportation may have some residue property available for restoration along the sides of where Smith Creek Parkway new construction is currently going on.

PRINCE GEORGES CREEK

Wetland Restoration Opportunity (PGWRO 11 and PGSRO 905)

Site Description: proposed site is located near the headwaters of the unnamed tributary to Prince George Creek. Land is currently in agricultural use with evergreen forest around the perimeter.

Restoration Concept: Discontinue agricultural production at the site. Fill drainage ditches and restrict flow off site and increase surface storage capability of the site. Rip land and create microtopography on the site. Plant with wetland species.

Site Location: The proposed site is located north of Blue Clay Road, southwest of the intersection with Highway 132, in the south central portion of the Prince George Creek subcatchment. The length of the proposed stream restoration at the site, a tributary to Prince George Creek, is 2,217 feet, and the stream drains a watershed of approximately 120 acres. The entire site including the wetland restoration site is approximately 124 acres and has a drainage area of 217 acres.

02-14-02 Field Comments: PGWRO 12 was originally a top proposed site for consideration, however based on field analysis and cost considerations, information was presented to the Group which encouraged them to pursue PGWRO 11 and PGSRO905 instead.

ADDITIONAL PROJECTS TO BE CONSIDERED

The following projects were identified since the technical assessment was completed and may be pursued for implementation following evaluation (some projects are currently being implemented)

Burnt Mill Creek

- Love Grove Landfill site – a potential location for future restoration / protection activities (currently being assessed by City of Wilmington)

Lower Smith Creek

- Potential wetlands creation opportunity partially included within and adjacent to site LSSRO703 (listed in the top 8 selected opportunities) within the Lower Smith Creek near Maid's Park

Upper Smith Creek

- Water quality stormwater improvements for the North Chase Community being investigated by Greg Walker with NRCS, RC&D.

- Black Swamp and Caney Branch stream restoration opportunity (located adjacent to Laney High School, New Hanover County School Board property).

- Randall Pond BMPs at Ann McCrary Park (being implemented by the City of Wilmington through cooperation with NCSU, NC Cooperative Extension Service and a 319 grant awarded).

- Potential restoration of FEMA buyout properties which the County currently owns. The County has demolished houses on these properties and the NCWRP has expressed an interest in restoring riparian wetlands along this corridor of Upper Smith Creek.

Prince George Creek

- Potential wetlands enhancement/preservation adjacent to the New Hanover County Juvenile Detention Center (New Hanover County owned property). The NCWRP has also expressed interest in investigating this opportunity further with the County.

IMPLEMENTATION OF PROJECTS

As of Summer 2002, the NCWRP, the New Hanover Local Watershed Planning Group, and WECO have taken steps necessary for moving towards implementation of the "short list" of restoration projects. Actions taken include:

- Developing and mailing letters to landowners of the potential project sites to inform them of the process and the opportunities for economic benefit, and to assess their interest in participating.

- Hosted a community meeting in the Burnt Mill Creek subcatchment in June 2002 to further involve landowners in discussions about a Burnt Mill Creek stream restoration opportunity. Approximately 30 landowners attended to learn more about the restoration project.

The NCWRP will continue to work with stakeholders, local governments as well as other state, federal and nonprofit programs to implement the recommendations identified in this watershed plan.

APPENDIX A: RESTORATION PROJECTS IDENTIFIED AND RANKED IN BURNT MILL, LOWER SMITH, AND PRINCE GEORGES CREEKS

The following tables depict the specific projects identified within targeted subcatchments of the watershed including: Burnt Mill Creek, Lower Smith Creek and Prince George Creek.

Each restoration opportunity noted in Tables 1-4 was given a unique descriptive identifier (i.e., BMWRO-4). The first two letters of the identifier indicate subcatchment (BM-Burnt Mill, LS-Lower Smith, PG-Prince George); the second series of letters indicates the type of restoration opportunity (BMPRO-Best Management Practice restoration opportunity, WRO-wetlands restoration opportunity, SRO-stream restoration opportunity); the last digit represents the discrete identification number for that opportunity (i.e. 1, 2, 3, 4, etc.). Thus, BMWRO-4 is Burnt Mill Wetland Restoration Opportunity 4.

Table of Restoration and BMP Opportunities Identified in Burnt Mill Creek

Opportunity I.D.	Watershed	Description	Water Quality	Flooding	Wildlife Habitat	Watershed Scale Factor*	N Removal (lbs)	P Removal (lbs)	Cumulativ Score
BMBMPRO-5	Burnt Mill	Re-establish channel and have an offline pond	High	High	Moderate	9	8825.7	5372.3	5.05
BMBMPRO-2	Burnt Mill	Install small water quality basin prior to stream	High	High	Moderate	8	25.4	25.2	4.49
BMBMPRO-1	Burnt Mill	Install forebay/shallow marsh detention area	High	High	High	7	5.1	2.5	4.26
BMBMPRO-10	Burnt Mill	Animal Waste Control	High	Low	Moderate	8			3.10
BMBMPRO-6	Burnt Mill	Shallow marsh	High	High	High	5	8.1	34.0	3.04
BMBMPRO-7	Burnt Mill	Convert linear pond to forebay, infiltration, or create a shallow marsh	High	Moderate	High	5	20.3	202.0	2.61
BMBMPRO-3	Burnt Mill	Retrofit existing pond	High	High	Low	5	64.0	63.5	2.57
BMWRO-2	Burnt Mill	Undeveloped cleared land	High	Moderate	High	4	1037.9	566.9	2.09
BMWRO-1	Burnt Mill	Low-medium quality wetland drying out	High	High	Low	4	381.4	204.4	2.06
BMBMPRO-4	Burnt Mill	Retrofit existing pond	High	High	Low	4	15.6	15.6	2.06
BMSRO-111	Burnt Mill	Stream restoration	Moderate	Low	High	4	50.7	41.2	1.30
BMBMPRO-8	Burnt Mill	Flood storage (dry retention)	Moderate	High	Low	3	48.6	18.0	1.21
BMBMPRO-9	Burnt Mill	Flood storage (dry retention)	Moderate	High	Low	3	35.9	13.3	1.21
BMSRO-112	Burnt Mill	Stream restoration	Low	Low	Moderate	4	42.1	34.2	0.67
BMSRO-602	Burnt Mill	Stream restoration	Low	Low	Moderate	4	30.8	23.5	0.67
BMSRO-303	Burnt Mill	Stream restoration	Low	Low	High	3	14.7	11.9	0.64
BMSRO-301	Burnt Mill	Stream restoration	Low	Low	High	2	27.4	22.2	0.43
BMSRO-502	Burnt Mill	Stream restoration	Low	Low	High	2	25.9	21.0	0.43
BMSRO-202	Burnt Mill	Stream restoration	Low	Low	Low	3	34.5	27.5	0.36
BMSRO-110A	Burnt Mill	Stream restoration	Low	Low	Low	3	33.5	27.2	0.36
BMSRO-603	Burnt Mill	Stream restoration	Low	Low	Low	3	13.6	9.8	0.36
BMSRO-106C	Burnt Mill	Stream restoration	Low	Low	Moderate	2	25.4	20.6	0.34
BMSRO-302	Burnt Mill	Stream restoration	Low	Low	Moderate	2	23.8	19.4	0.34

*Represents the value of opportunity to the watershed (1=lowest, 10=highest)NOTE: water quality scores were modified as follows: stream restoration opportunities were scored 5.00 (moderate) if they were initially ranked high, and exceeded 2000 ft in length. Otherwise, they were scored 1.66 (low).

Table of Restoration and BMP Opportunities Identified in Lower Smith Creek

Opportunity ID	Watershed	Description	Water Quality	Flooding	Wildlife Habitat	Watershed Scale Factor	N Removal (lbs)	P Removal (lbs)	Cumulative Score
LSBMPRO-1	Lower Smith	Install grass infiltration swales and have stormwater management	High	High	Moderate	8	3963.5	2158.8	4.49
LSWRO-5	Lower Smith	Palustrine Emergent and Forested Wetland on NWI	Moderate	Low	Moderate	7	318.5	145.1	1.95
LSWRO-7	Lower Smith	Palustrine Emergent and Forested Wetland on NWI	Moderate	Low	Moderate	7	118.2	56.2	1.95
LSSRO-703	Lower Smith	Stream Restoration	Moderate	Low	High	5	24.4	16.4	1.62
LSWRO-3	Lower Smith	Scrub/shrub herbaceous layer with OWV & FWW	Moderate	Moderate	Moderate	4	25.8	1.8	1.46
LSSRO-603	Lower Smith	Stream Restoration	Moderate	Low	Moderate	5	3.5	0.9	1.39
LSWRO-8	Lower Smith	Agriculture field with hydric soils	Low	Moderate	High	3	27.3	4.9	0.90
LSSRO-502	Lower Smith	Stream Restoration	Low	Low	Moderate	4	40.9	32.7	0.67
LSSRO-501	Lower Smith	Stream Restoration	Low	Low	Moderate	3	44.1	29.9	0.50
LSSRO-602	Lower Smith	Stream Restoration	Low	Low	Moderate	3	19.4	15.0	0.50
LSSRO-204	Lower Smith	Stream Restoration	Low	Low	Moderate	3	14.0	9.8	0.50

* Represents the value of opportunity to the watershed (1=lowest, 10=highest)
NOTE: water quality scores were modified as follows: stream restoration opportunities were scored 5.00 (moderate) if they were initially ranked high, and exceeded 2000 ft in length. Otherwise, they were scored 1.66 (low).

Coding for Opportunity Identification:

LS= **L**ower **S**mith Watershed
BMPRO= **B**est **M**anagement **P**ractice **R**estoration **O**pportunity
WRO= **W**etlands **R**estoration **O**pportunity
SRO= **S**tream **R**estoration **O**pportunity

Table of Restoration and BMP Opportunities Identified in Prince George Creek

Opportunity I.D.	Watershed	Description	Water Quality	Flooding	Wildlife Habitat	Watershed Scale Factor*	N Removal (lbs)	P Removal (lbs)	Cumulative Score
PGBMPRO-1	Prince George	Retrofit ponds with forebays or infiltration	High	High	Low	9	192.2	159.3	4.63
PGBMPRO-2	Prince George	Improve swales (bioretention)	Moderate	Moderate	Low	4	681.2	564.4	1.27
PGWRO-12	Prince George	Agriculture field with hydric soils	Low	Moderate	High	4	478.5	101.7	1.21
PGBMPRO-3	Prince George	Retrofit existing pond	High	High	Low	3	71.4	11.4	1.54
PGWRO-11	Prince George	Agriculture field with hydric soils	Low	Moderate	High	3	585.9	111.3	0.90
PGWRO-8	Prince George	Agriculture field with hydric soils	Low	Moderate	High	3	241.2	48.5	0.90
PGWRO-5	Prince George	Agriculture field with hydric soils	Low	Moderate	High	3	187.5	32.1	0.90
PGSRO-905	Prince George	Stream Restoration	Low	Low	High	4	16.2	7.9	0.86
PGSRO-1401	Prince George	Stream Restoration	Low	Low	Moderate	5	5.9	1.3	0.84
PGWRO-1	Prince George	Wetland grasses, high diversity	Moderate	Moderate	High	2	33.7	4.4	0.82
PGSRO-1201	Prince George	Stream Restoration	Low	Low	Moderate	4	4.0	0.8	0.67
PGWRO-7	Prince George	Agriculture field with hydric soils	Low	Moderate	High	2	51.4	9.6	0.60
PGWRO-4	Prince George	Agriculture field with hydric soils	Low	Moderate	High	2	17.0	2.9	0.60
PGWRO-10	Prince George	Mostly herbaceous coverage	Low	Moderate	Moderate	2	48.5	7.8	0.51
PGWRO-9	Prince George	Hydric soils with mostly FW grasses	Low	Moderate	Moderate	2	27.4	4.8	0.51
PGSRO-922	Prince George	Stream Restoration	Low	Low	Moderate	3	56.8	46.1	0.50
PGSRO-401	Prince George	Stream Restoration	Low	Low	Moderate	3	4.6	1.1	0.50
PGSRO-907&908	Prince George	Stream Restoration	Low	Low	Low	4	24.6	6.7	0.48
PGSRO-1106	Prince George	Stream Restoration	Low	Low	Low	4	7.6	2.1	0.48
PGSRO-212	Prince George	Stream Restoration	Low	Low	Moderate	2	13.2	3.5	0.34
PGSRO-402	Prince George	Stream Restoration	Low	Low	Moderate	2	3.2	0.4	0.34
PGSRO-210	Prince George	Stream Restoration	Low	Low	Low	2	3.8	0.7	0.24

*Represents the value of opportunity to the watershed (1=lowest, 0=highest)

Coding for Opportunity Identification:

PG= **P**rince **G**eorge Watershed
BMPRO= **B**est **M**anagement **P**ractice **R**estoration **O**pportunity
WRO= **W**etlands **R**estoration **O**pportunity
SRO= **S**tream **R**estoration **O**pportunity

APPENDIX B: FUNDING OPPORTUNITIES FOR RECOMMENDED SOLUTIONS

More information about most of the programs and opportunities referenced below can be found at the NC Wetlands Restoration Program website: http://h2o.enr.state.nc.us/wrp/index.htm, then click on the "Landowners" button at the bottom of the screen, and then *A Guide for North Carolina Landowners* Please note that some local contact information provided below is more up to date than what is referenced in the *Guide for North Carolina Landowners* Another resource which solely describes federal funding sources for watershed protection can be found at the following website: http://www.epa.gov/owow/watershed/wacademy/fund.html.

BEST MANAGEMENT PRACTICES

- Conservation Reserve Program (only applies to cropland), US Department of Agriculture, Farm Services Agency
  Local Contact: Marilyn Meares Stowell (910) 259-9123 in Pender County, (910) 762-6072 in New Hanover County (this office may be moving soon)
  Website address: http://www.nrcs.usda.gov

- Environmental Quality Incentives Program (EQUIP, only applies to agricultural or pasture lands)
  Local Contact: Marilyn Meares Stowell (910) 259-9123 in Pender County, (910) 762-6072 in New Hanover County (this office may be moving soon)
  Website address: http://www.nrcs.usda.gov

- US Environmental Protection Agency's Cooperative Agreement Grant
  Website address: http://www.epa.gov/owow/watershed/wacademy/fund/wqagree.html

- Section 319 Program, administered by the NC Department of Environment and Natural Resources, Division of Water Quality, Water Quality Section
  State Contact: Sean Groom, NC Division of Water Quality based out of Raleigh, (919) 733-5393 ext. 582, website address: http://h2o.enr.state.nc.us/nps/

- NC Clean Water Management Trust Fund
  Eastern Regional Contact: Damon Tatem, based out of Kill Devil Hills, (252) 441-6672
  Website address: http://www.cwmtf.net

- Agriculture Cost Share Program (only applies to agricultural lands)
  State Contact: David Williams, Department of Environment and Natural Resources, Division of Soil and Water Conservation, based out of Raleigh, (919) 733-2302

STREAM RESTORATION OPPORTUNITIES

- NC Wetlands Restoration Program
  State Contact: Bonnie Duncan, Department of Environment and Natural Resources, based out of Raleigh (919) 733-5315
  Website address: http://h2o.enr.state.nc.us/wrp/index.htm

•Clean Water Management Trust Fund
Eastern Regional Contact: Damon Tatem, based out of Kill Devil Hills, (252) 441-6672
Website address: http://www.cwmtf.net

WETLANDS RESTORATION OPPORTUNITIES

•NC Wetlands Restoration Program
State Contact: Bonnie Duncan, Department of Environment and Natural Resources, based out of Raleigh (919) 733-5315
Website address: http://h2o.enr.state.nc.us/wrp/index.htm

•Wetlands Reserve Program, US Department of Agriculture, NC Natural Resources Conservation Service
Local Contact: Marilyn Meares Stowell (910) 259-9123 in Pender County, (910) 762-6072 in New Hanover County (this office may be moving soon)
Website address: http://www.nrcs.usda.gov

•Forestry Incentives Program, US Department of Agriculture, Natural Resources Conservation Service and NC Department of Environment and Natural Resources, Division of Forest Resources (tree planting program which can be used to restore forested wetlands)
State Contact: Mark Megalos, Department of Environment and Natural Resources, Division of Forest Resources, based out of Raleigh (919) 733-2162 ext. 254

PRESERVATION OPPORTUNITIES

•NC Coastal Land Trust
Local Contact: Bruce Watkins (910) 790-4524
Website address: http://www.coastallandtrust.org/

•Clean Water Management Trust Fund
Eastern Regional Contact: Damon Tatem, based out of Kill Devil Hills, (252) 441-6672
Website address: http://www.cwmtf.net

•The Nature Conservancy
Program Contact: Jennifer Johnson, based out of Durham, (919) 403-8558 ext. 32
Website address: http://nature.org/wherewework/northamerica/states/northcarolina/

•Conservation Tax Credit Program, NC Department of Environment and Natural Resources
State Contact: Bill Flournoy, based out of Raleigh, (919) 715-4191
Website address: http://www.enr.state.nc.us/conservationtaxcredit/

ADDITIONAL HABITAT PROTECTION / RESTORATION PROGRAMS

•Partners for Fish and Wildlife, US Fish & Wildlife Service
State Contact: State Private Lands Coordinator (919)856-4520, ext. 17
Website address: http://www.fws.gov/r4eao/pfwndx.html ***or http://www.fws.gov/r3pao/marqette***

•Wildlife Habitat Incentives Program (WHIP, US Department of Agriculture, Natural Resources

Conservation Service).
Local Contact: Marilyn Meares Stowell (910) 259-9123 in Pender County, (910) 762-6072 in New Hanover County (this office may be moving soon)
Website address: http://www.nrcs.usda.gov

- Forest Development Program, NC Department of Environment and Natural Resources, Division of Forest Resources (provides financial resources for reforestation)
  Local Contact: in Whiteville, (910) 642-8484,
  e-mail address: d8opsrm@mail.enr.state.nc.us

- Forest Stewardship / Stewardship Incentive Program, US forest Service & NC Department of Environment and Natural Resources, Division of Forest Resources (helps landowners protect and enhance their forest lands and associated wetlands)
  Local Contact: in Whiteville, (910) 642-8484, or call 1-888-NCTREES
  e-mail address: d8opsrm@mail.enr.state.nc.us

- Forest Nursery Program (produces and sells at cost to NC landowners a wide variety of forest tree and shrub seedlings for forest regeneration, wildlife habitat improvement, wetlands mitigation and research)
  Local Contact: in Whiteville, (910) 642-8484, or call 1-888-NCTREES
  e-mail address: d8opsrm@mail.enr.state.nc.us

- NC Natural Heritage Trust, NC Department of Environment and Natural Resources, Division of Parks and Recreation
  State Contact: based out of Raleigh, (919) 715-8697
  Website address: http://ils.unc.edu/parkproject/heritage/nhtf.html

- NC Coastal Federation
  Local Contact: Tracy Skrabal (910) 790-3275
  Website address: http://www.nccoast.org/

APPENDIX C: PRESERVATION FOCUS AREA RECOMMENDATIONS & JUSTIFICATIONS

The following information was prepared by the NC Wetlands Restoration Program based on documents and feedback supplied by the NC Natural Heritage Program
and the NC Coastal Land Trust.

1. SLEDGE FOREST

Location Information: Located in the northwest corner of New Hanover County, west of Castle Hayne and northwest of Wrightsboro, bounded on the west, north and northeast by the Northeast Cape Fear River, and on the east by Prince George Creek. Access northwest from Highway US 117, 2.1 miles south of junction with NC132. This property is entirely located within the New Hanover Local Watershed Planning Team's watershed area.

Property Qualifications for Preservation:
Summary Information

-NC Natural Heritage Program Significant Natural Heritage Area
-Site Significance: regional
-Size: 4,068 acres
-Ownership: Private

Significant features-The Sledge Forest area lies within the Northeast Cape Fear River floodplain natural area, a high quality natural area of 4,068 acres that the North Carolina Natural Heritage Program considers of National Significance. The Sledge Forest area contains one of the largest occurrences of the Peatland Atlantic White Cedar Forest in southeastern North Carolina, with mature canopy trees up to 60 feet tall and diameters reaching 16 inches. Pond Pine Woodland also occurs at the Sledge Forest area. This community occupies the majority of the habitat surrounding the longleaf pine uplands at Sledge Forest. A rare old-growth occurrence of the Nonriverine Swamp Forest natural community, one of several communities found only at Sledge Forest in the Northeast Cape Fear River floodplain, contains cypress trees dated to more than 350 years of age and estimated to be 500 years, and loblolly pine dated to more than 300 years. Isolated sandy ridges at Sledge Forest support three longleaf pine community types. Old-growth canopies occur within several of these longleaf communities, with pines reaching 18-25 inches in diameter, and the largest having been aged to over 300 years. The uncommon Coastal Fringe Evergreen Forest community occurs in the Sledge Forest also. Canopy trees found at this site are large, reaching 3 feet in diameter.

The Northeast Cape Fear River floodplain serves as one of the largest and most important landscape connections in the southeastern part of the state. Floodplain habitat is used by many neotropical migrant and breeding birds, and is primary habitat for the rare southeastern bat. Aquatic habitat supports many species of waterbirds, fish, and reptiles, including the Federally and State and Threatened American alligator. The significance of the Northeast Cape Fear River floodplain comes from a number of natural features. Northeast Cape Fear River Floodplain natural area contains one of the best examples anywhere of the Tidal Cypress–Gum Swamp community. This high quality swamp is extensive and possesses outstanding scenic values. Upland rises within the swamp contain some of the oldest known stands of longleaf pine, with trees dating to more than 300 years of age. Overall, the site contains nine natural community types, including the previously mentioned rare Peatland Atlantic White Cedar Forest and old-growth Nonriverine Swamp Forest.

-Consists of lands with high quality (intact) riparian area along one of the NC Coastal Land Trust's high priority watersheds, the Northeast Cape Fear River.

-The property covers 4,068acres, some of which is currently enrolled in the NC Forest Service's Forest Stewardship Program. From the standpoint of protecting habitat and intact sensitive resources the size of this property lends to its attractiveness for preservation.

-Properties directly across the Northeast Cape Fear River from this parcel are currently under conservation protection.

-Federal listed or endangered species: No, the emphasis really is on the high quality natural communities present

2. Angola Bay / Bear Gardens (30,000 ac. potentially acquired by The Nature Conservancy)

Location Information: The sites are located in Pender County east of I-40. Both sites encompass a large portion of the headwaters area for the Northeast Cape Fear River. The Bear Gardens property also abuts the Holly Shelter State Game Management Area.

Property Qualifications for Preservation:

BEAR GARDEN

Summary Information

-NC Natural Heritage Program Significant Natural Heritage Area
-Site significance: regional
-Size: 3,710 acres
-Quadrangle: Maple Hill SW
-Ownership for both Angola Bay and Bear Gardens: Private

-Significant Features: Bear Garden supports good examples of the Wet Pine Flatwoods Wet Spodosol Variant, Pine/Scrub Oak Sandhill Mixed Oak Variant, Pond Pine Woodland, and High Pocosin natural communities, and an unusual example of the Mesic Pine Flatwoods Coastal Plain Variant. The Pine/Scrub Oak Sandhill and Mesic Pine Flatwoods communities are regionally uncommon. The site also supports populations for three rare plants, including the Federal Species of Concern and State Endangered Carolina goldenrod (*Solidago pulchra*).

-Landscape Relationships: This site is located in eastern Pender County along the north side of Holly Shelter Game Land and the Holly Shelter Macrosite. It lies in the central-western portion of one of the most important natural ecosystems on the Atlantic Coast: the CampLeJeune/Holly Shelter Megasite. The southern boundary of the site is contiguous with Holly Shelter Game Land, and it is directly connected northeastward to highly significant savanna, flatwoods, and pocosin habitat, and northward by timberlands and a narrow stream floodplain landscape connection to Angola Bay Game Land. Westward, it is connected by timberlands to Southwest Ridge Savanna.

-Site Description: Bear Garden is a complex of large Carolina bays, wetland flats, and elongate upland ridges on an interstream terrace. Carolina bays are elliptical wetland basins surrounded by arcuate, usually dry sand ridges called bay rims. The wetland flats and Carolina bay basins support two pocosin communities: Pond Pine Woodland and High Pocosin. The upland ridges support three longleaf pine

communities: Wet Pine Flatwoods Wet Spodosol Variant, Mesic Pine Flatwoods Coastal Plain Variant, and Pine/Scrub Oak Sandhill Mixed Oak Variant. The majority of the upland ridges are bay rims surrounding the large Carolina bays, but others are isolated upland rises within large areas of pocosin habitat. Some of these uplands have been converted to pine plantation, but the majority are dominated by natural communities.

Wet Pine Flatwoods Wet Spodosol Variant occurs on wet sandy spodosol soil that typically dries out later in the growing season. Canopy conditions are variable, ranging from cleared or open to moderately dense. Slash pine (*Pinus elliottii*) and longleaf pine (*P. palustris*) are variously dominant, with longleaf pine most common on isolated ridges. The sparse to moderate and often patchy shrub layer is dominated by dwarf huckleberry (*Gaylussacia dumosa*) and inkberry (*Ilex glabra*), with staggerbush (*Lyonia mariana*) a patch dominant, and dwarf indigo-bush (*Amorpha herbacea*), persimmon (*Diospyros virginiana*), and southern blueberry (*Vaccinium tenellum*) prominent. The dense to moderate ground layer is dominated by wiregrass (*Aristida stricta*) and creeping blueberry (*Vaccinium crassifolium*), with bracken (*Pteridium aquilinum* var. *pseudocaudatum*) and deer's-tongue (*Carphephorus odoratissimus*) prominent. Although slash pine is an introduced tree in North Carolina, it responds well to controlled burning, and the structure and composition of slash pine-dominated flatwoods habitat at Bear Garden are otherwise very similar to the sites dominated by longleaf pine.

Mesic Pine Flatwoods Coastal Plain Variant occurs on mesic sandy soil on an elevated ridge surrounded by pocosin habitat. The open to moderately dense canopy is dominated by slash pine with some longleaf pine; an understory is absent. The patchy to open shrub layer is dominated by dwarf huckleberry, with dwarf indigo-bush prominent. Wiregrass and creeping blueberry are codominants in the moderately dense to dense ground layer, and bracken is prominent. Herbs typical of mesic sites are present, along with some drier sandhill species, but overall diversity is low for mesic habitat, possibly due to past disturbance, or to the ridge's isolation.

Pine/Scrub Oak Sandhill Mixed Oak Variant occurs on dry sandy soil of an elevated ridge. It has an open canopy dominated by slash pine, with bluejack oak (*Quercus incana*) dominating the open to moderate understory. The shrub layer is moderately open to moderately dense, with dwarf huckleberry and southern blueberry patch dominants. The moderate to moderately dense ground layer is dominated by wiregrass, with deer's-tongue and bracken prominent. This community contains the only known Pender County occurrence of secund blazing-star (*Liatris secunda*).

Pond Pine Woodland occurs on shallow saturated peats over mineral soil. It is most frequent around the outer portions of large pocosin basins, and in swales between upland ridges. The dense to moderately open canopy is variously dominated by pond pine (*Pinus serotina*) and loblolly bay (*Gordonia lasianthus*). The dense shrub layer is dominated by gallberry (*Ilex coriacea*) and blaspheme-vine (*Smilax laurifolia*), with titi (*Cyrilla racemiflora*) prominent. High Pocosin occurs on deeper saturated peats, and dominates the interior of large pocosin features. Trees are small, and scattered to sparse. The shrub layer is dense, with titi, fetterbush (*Lyonia lucida*), blaspheme-vine, and sweetbay (*Magnolia virginiana*) dominant, and gallberry prominent. Herbs are sparse to absent in both pocosin communities.

-**Rare Plants:** twig-rush (*Cladium mariscoides*), southern bogbutton (*Lachnocaulon beyrichianum*), Carolina goldenrod (*Solidago pulchra*).

-These properties consist of high quality and somewhat degraded riparian areas in the headwaters of the Northeast Cape Fear River.

-The properties cover more than 30,000 acres which attributes to their attractiveness as habitat restoration / preservation areas.

-The properties are both Natural Heritage Program Significant Areas for habitat protection due to longleaf pine and pocosin ecological reserves. According to the Natural Heritage program, these reserves provide habitat protection for neotropical migrant birds and large game species, and will conserve red-cockaded woodpecker habitat and numerous rare plant species.

-The ever increasing pressure of development makes game land expansion vital to continued ecosystem function.

APPENDIX D: NEW HANOVER COUNTY WATERSHED ASSESSMENT COMPONENTS 2000-2002

Throughout the watershed planning process, KCI Inc. produced a number of supporting documents as part of their watershed assessment. These documents are available for viewing through at NC Wetlands Restoration Program in Raleigh, at the Cape Fear Riverwatch Educational Center in Wilmington, NC, and the New Hanover County Public Library.

March 2001 Watershed Characterization Report HU 03030007140010

Summary of Contents: Baseline and general background information pertinent to hydrologic unit (hu) 03030007140010 within New Hanover County is compiled within the Watershed Characterization Report. Subcatchments (sub-units of hu 03030007140010) are delineated within the report and include: Burnt Mill Creek, Dock Creek, Lower Smith Creek, Ness Creek, NE Cape Fear 1, NE Cape Fear 2, NE Cape Fear 3, Prince George Creek, Spring Branch, Sturgeon Creek, Unnamed Tributary 1, Unnamed Tributary 2, and Upper Smith Creek. In addition, information including historical land use trends, water quality, riparian condition, land use, soils, habitat, flooding, and specific stakeholder comments are compiled by individual subcatchment. This document also contains stakeholder issue and subcatchment rankings and an explanation of the methods used to prepare these rankings. Preparation of this document led to ranking the Burnt Mill Creek (urban / developed watershed), Lower Smith Creek (urban / transitional watershed) and Prince George Creek (fairly undeveloped watershed) for further analysis and investigation.

Water Quality Model Development and Application

Summary of Contents: Contains a detailed description of the water quality model utilized for the assessment. The model selected provides a general accounting of nitrogen and phosphorus loadings within each subcatchment and watershed wide.

Nitrogen and Phosphorus Loading Spreadsheets for Burnt Mill Creek, Lower Smith Creek, and Prince George Creek

Summary of Contents: This document contains detailed subcatchment maps, tabular and graphical depictions of nitrogen and phosphorus loading, and removal calculations within the Burnt Mill Creek, Lower Smith and Prince George Creek subcatchments.

Stream Inventory Data for Burnt Mill Creek, Lower Smith Creek, and Prince George Creek February 2002

Summary of Contents: Contains subcatchment maps depicting stream segments which were field investigated and *Stream Corridor Evaluation Channel Condition Survey, Bank Condition Survey, and Riparian Condition Survey worksheets*, along with photos of noted degradation issues.

Stream Corridor Evaluation Pipe, Culvert, and Drainage Ditch Inventory Data for Burnt Mill Creek and Lower Smith Creek

Summary of Contents: This document contains vicinity maps and pipe, culvert and drainage ditch inventory worksheets with sited problem photographs. The results of these efforts are summarized in the Causes and Sources of Water Quality Degradation report.

Causes and Sources of Water Quality Degradation in Burnt Mill, Lower Smith and Prince George Creeks

Summary of Contents: Contains a summary of the inventoried local conditions within thesubcatchments to aid in determining the causes of watershed degradation in the selectedsubcatchments. Information in the document includes: land use / land cover mapping, delineation ofsubdrainage patterns, steam/riparian zone inventories, water quality sampling and modeling, and culvert and drainage ditch inventories.

Assessment and Evaluation of Long Term Impacts to Water Quality in HU 03030007140010

Summary of Contents: Within this document, four different development scenarios are presented to summarize predicted increases in pollutant loading over time and the amount of Best Management Practice treatments which may be necessary (assuming a 10% improvement in water quality) to maintain and improve water quality in the future.

Restoration Opportunities, Burnt Mill, Lower Smith and Prince George Creeks

Summary of Contents: After causes and sources of watershed degradation were identified, strategies to improve the watershed were identified. These strategies include restoration, best management practices and some policy / public education recommendations. Using previously collected information, a watershed scale factor and a cumulative score ranking formula, potential projects were identified and ranked according to how much they would improve or affect water quality, flooding and wildlife habitat. A detailed description of each potential project including a vicinity map, an aerial photograph and parcel information is included within this document. It should be noted that not all projects identified within this document are feasible for implementation by the NC Wetlands Restoration Program, although other potential sources for implementation may be possible

APPENDIX E: RECOMMENDED WATER QUALITY IMPROVEMENT STRATEGIES BASED ON KCI'S WATER QUALITY MODELING RESULTS

Specific BMP Recommendations, based on Water Quality Model Results:

In order to achieve the goal of 10% nitrogen reduction from 1998 levels for the 2010 build outadditional BMPs need to be implemented throughout the HU. The land uses on which efforts should be focused include: urban low density, urban high density, agriculture, and barren land. Specific recommendations for each land type follow.

- *Urban low density* – It is recommended that of the urban low density land use within the entire HU, water running off 25% of that area be directed to wet ponds, 25% be directed to wetlands, 5% be directed to bioretention filtration areas, 2% be directed to riparian buffers, and 20% be directed to grass channels for treatment before being introduced into local waterways.
- *Urban high density* – It is recommended that of the water running off urban high density land use areas within the HU, that 25% be directed to wet ponds, 10% be directed to wetlands, 10% be directed to bioretention filtration areas, and 10% be directed to grass channels for treatment before being introduced to local waterways.
- *Agriculture* – It is recommended that of the water running off agricultural areas in the HU, that 10% be directed to wetlands, 5% be directed tobioretention filtration areas, 5% be directed to riparian buffers, and 20% be directed to grass channels for treatment before being introduced to local waterways.
- *Barren land* – It is recommended that of the water running off barren lands in the HU, that 10% be directed to wet ponds and 40% be directed to wetlands for treatment before being introduced to local waterways.

Additional suggestions to achieve above stated goals:

- *Mandatory first flush stormwater containment and/or treatment for all new urban development*
  The first flush of a storm—that runoff occurring during the first half-inch of a rain event—usually contains the highest concentration of pollutants because it carries most of the chemicals and debris that accumulated on the ground surface since the previous event. A common method for treating the first flush is with detention ponds or stormwater wetlands.

- *Conduct stream restoration activities along streams within the HU.*
  Correct areas of localized bank and channel erosion; restore sinuosity; vegetate banks.

- *Maintain current riparian buffers and create additional buffers along HU streams.*
  Riparian buffers are generally lacking in areas of urban development, and should be created or enhanced where possible. Riparian buffers in less developed areas should be protected to ensure that they are not lost to urbanization.

- *Develop a schedule of BMP inspection and maintenance.*
  For optimal efficiency, BMPs should be regularly inspected and maintained / improved where necessary. Sediment should be dredged from detention ponds at least once every seven to ten years.

- *Promote public awareness of water quality protection.*
  Topics about which the public should be educated include: proper disposal of yard waste, pet waste, and other organic substances, and proper use of lawn fertilizers and pesticides. Encourage and facilitate the formation of grassroots community groups that are concerned about the protection of local water resources.

- *Convert roadside ditches to vegetated swales.*
  This relatively simple modification of stormwater conveyance will reduce nutrient and sediment loading in streams.

- *Remove trash from streams and areas exposed to stormwater flow.*
  This can be accomplished through prison work-release programs and/or community involvement.

APPENDIX F: HOW NCDWQ RATES WATERS FOR SUPPORTING AQUATIC LIFE AND SECONDARY RECREATION

The *aquatic life and secondary recreation* use support category is an ecosystem approach to assess whether aquatic life (benthic macroinvertebrates and fish) can live and reproduce in the waters of the state and whether waters support secondary recreation (i.e., wading, boating and minimal human body contact with water). This category is applied to all waters of the state. Biological data, ambient monitoring data and NPDES discharger data are all considered in assessing the aquatic life and secondary recreation use support category. Thefollowing is a description of each data type and methods used to assess how well a water is meeting the criteria for aquatic life protection and secondary recreation. Until bacteriological standards are established using *E. coli* and enterococci, interim methods will used to assess secondary contact recreation.

Biological Data

There are two main types of biological data used in this assessment: benthic Macroinvertebrate (bug) and fish community. Where recent data for both benthic macroinvertebrates and fish communities are available, both are evaluated in assessing use support. It is important to note that where both ambient chemical/physical monitoring data and biological data are available, biological data are generally given greater weight. This is particularly true when ambient chemical and biological data are conflicting. When these two indicators conflict, additional information is gathered (e.g., land use and land use changes, aerial photographs, etc) and best professional judgment is used to determine an appropriate use support rating.

In special situations, where there are currently insufficient biological data available, the basinwide planner will make a request of the DWQ Environmental Sciences Branch to determine whether a biological survey is appropriate. If a biological survey is appropriate, the use support rating will be determined by the bioclassification resulting from the survey. If a biological survey is not appropriate, then the stream will receive a not rated (NR) rating.

Benthic Macroinvertebrate Bioclassifications

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to most benthic macroinvertebrate samples based on the number of taxa present in the pollution intolerant (BI), which summarizes tolerance data for all taxa in each collection. The benthic macroinvertebrate bioclassifications are translated into use support ratings according to the following scheme:

Bioclassification Use Support Rating
Excellent Fully Supporting (FS)
Good Fully Supporting (FS)
Good-Fair Fully Supporting (FS)
Fair Partially Supporting (PS)
Poor Not Supporting (NS)

In order to establish confidence in Fair bioclassifications and the borderline nature of some bioclassification scores, a second biological sample is collected. Sites are resampled within 12-24 months after a Fair rating is obtained if this Fair rating will result in a lower use support rating or if data are from a site never sampled before. This procedure began in 1999 and is used to validate the Fair bioclassification. Such sites will not be given a use support rating until the second sample is obtained.

The benthic macroinvertebrate data are a robust measure of stream integrity. Loss of canopy, increase in stream temperature, increased nutrients, toxicity and increased sedimentation will affect the benthic macroinvertebrate and fish communities (Department of Environment and Natural Resources, Division of Water Quality, Water Quality Section – Planning Branch, *Public Review Draft of the NC Water Quality Assessment and Impaired Waters List (2002 Integrated 305(b) and 303(d) Report*. June 2002.

In the case of the coastal plain of the Cape Fear River basin, benthic macroinvertebrate bioclassification ratings were used independently, due to lack of fish community data, to determine that Burnt Mill Creek (sampled at Metts Ave.) was "biologically impaired" based on a "Poor" bioclassification rating recorded in 1998 (Department of Environment and Natural Resources, Division of Water Quality, Water Quality Section, Environmental Sciences Branch, *Basinwide Assessment Report for the Cape Fear River Basin.* June 1999, p.173).

APPENDIX G: WATERSHED CONCERNS BRAINSTORMING

Early in the watershed planning process, the group participated in a brainstorming session to generate potential concerns they may want to address in the watershed. They answered the question *What are your concerns in this specific watershed?* The group then categorized their answers. The results follow.

Flooding

- Consistent flooding
- Flood plain impacts
- How well do wetlands control flooding?
- Increasing impervious surfaces
- Increased volume of flooding
- Flooding/property damage
- Increased frequency of flooding

Growth and Development

- Loss of wetlands due to development
- Control urban sprawl
- Orderly development- is it in the right area
- Drainage without or with limited stream damage
- Protect remaining wetlands from development
- Transportation congestion- alternatives

Wildlife Habitat

- Help increase wildlife habitat
- Ensure wildlife diversity
- Loss of wildlife habitat

Education and Community

- Increase public awareness of the importance of wetlands
- Demonstrate wetland functions with "hands on" projects
- Influence private landowners to have self-initiated wetland restoration projects
- Informing public about nonpoint source pollution and reducing it
- The community must be involved in and aware of watershed issues
- Improve community efforts to work together to curtail wetland losses
- Be a model community for other municipalities to follow on wetland appreciation

Quality of Life

- Clean up Burnt Mill Creek
- Increased pet waste
- Promote economic opportunity
- All wetlands are not equal. Should all wetlands be treated equally?
- If wetlands are so valuable, they should be purchased at a premium
- Stream impairment
- Protect quality of life
- Lower quality of life in neighborhoods
- Natural resource quality is tied to our quality of life
- Lack of concern by communities in watershed
- Increased load of trash (plastics)
- Provide alternatives to automobile transportation
- Preserve valuable open space

Water Quality

- Improve impaired waters
- Reduce polluted runoff into watershed creeks
- Increasing sedimentation
- Degraded quality due to E.Coli bacteria
- Is there a strong cause & effect between wetland drainage and water quality?
- People feeding waterfowl in McCrary pond
- Reduce water/air pollution
- Nonpoint source pollution