Pasquotank River
Local Watershed Plan

December 2003

Ecosystem Enhancement
PROGRAM

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N.C. Ecosystem Enhancement Program
Local Watershed Planning: An Overview

The N.C. Ecosystem Enhancement Program (EEP) was initiated in July 2003 by Memorandum of Agreement among the N.C. Department of Environment and Natural Resources, N.C. Department of Transportation (NCDOT) and the U.S. Army Corps of Engineers. The functions of the N.C. Wetlands Restoration Program (NCWRP), a statewide, nonregulatory program intended to improve watershed functions through the restoration of wetlands, streams and riparian buffer areas, transferred over to the EEP upon its inception.

The programmatic philosophy driving EEP is two-fold: a desire to have appropriate projects identified in advance of impacts permitted under Clean Water Act Section 401/404 provisions; and the recognition that comprehensive local watershed assessment and planning, based on a collaborative stakeholder process, will provide the best framework for selecting and implementing effective watershed improvement projects. The projects identified are likely to include "traditional" compensatory mitigation efforts (stream, wetlands and riparian buffer restoration or enhancement projects) as well as less conventional watershed projects such as urban and agricultural stormwater best management practices (*BMP*s), greenways establishment, preservation/protection areas and possibly other policy based recommendations. The EEP seeks to improve the ecological effectiveness of restoration projects and to identify projects where they most benefit local ecology for watershed protection and improvement prior to construction impacts.

Local Watershed Plans provide a framework for utilizing various management tools and financial resources to implement solutions for watershed improvement and protection. While much of the Local Watershed Planning began under NCWRP, the staff and resources will be referred to as EEP throughout this report.

By developing a list of priorities and potential project opportunities to address degradation issues and areas which merit protection, the Local Watershed Planning carefully evaluates the condition of watershed functions. Key steps of the planning and assessment process are:

Inventory available information concerning the watershed conditions.

Involve local stakeholder and environmental resource professionals to verify inventory and assessment products and identify current local watershed concerns.

Identify a full complement of needed solutions to address issues identified.

Implement multiple strategies for improving and protecting water quality, habitat, etc.

The EEP accomplishes the technical assessment of watershed conditions by contracting private sector consultants. Local stakeholders representing various interests in the watershed are invited to participate in the planning process and work to review and provide feedback on scientific information collected by the consultant. The end products are compiled and results are summarized to develop a Local Watershed Plan. For more information about the EEP, the NCWRP and Local Watershed Planning process, please refer to: http://www.nceep.net/pages/lwplanning.htm.

The Shift to Functional Assessment

The EEP is refocusing Local Watershed Plan development to reflect a true concentration on ecological functions based on watershed needs and opportunities. Under the previous direction of NCWRP, Local Watershed Plans (LWP) were primarily based on individually identified issues with a focus on water quality. Today, LWPs are designed to comprehensively identify watershed functional deficits and assets along with solutions that have the highest potential to improve and protect watershed functions. The development of the LWP from this perspective is important for watershed restoration and rehabilitation because wetland and riparian restoration projects alone cannot provide the level of functional improvement needed within a watershed. LWPs are designed to guide EEP restoration, enhancement and preservation expenditures to ensure that restoration and protection goals are achieved and measurable results can be obtained. However, the strategies identified in a watershed plan will include not only wetlands, stream and riparian buffer restoration, enhancement and preservation projects, but also strategies that may be initiated through collaboration with other local, state and federal programs as well as the private sector initiatives to enhance the success of any single strategy. This approach is also being embraced by certain regulatory programs such as the U.S. Army Corps of Engineers as articulated in Regulatory Guidance Letter 02-2 *(*Appendix A of the *Revised Pasquotank Local Watershed Characterization Report*).

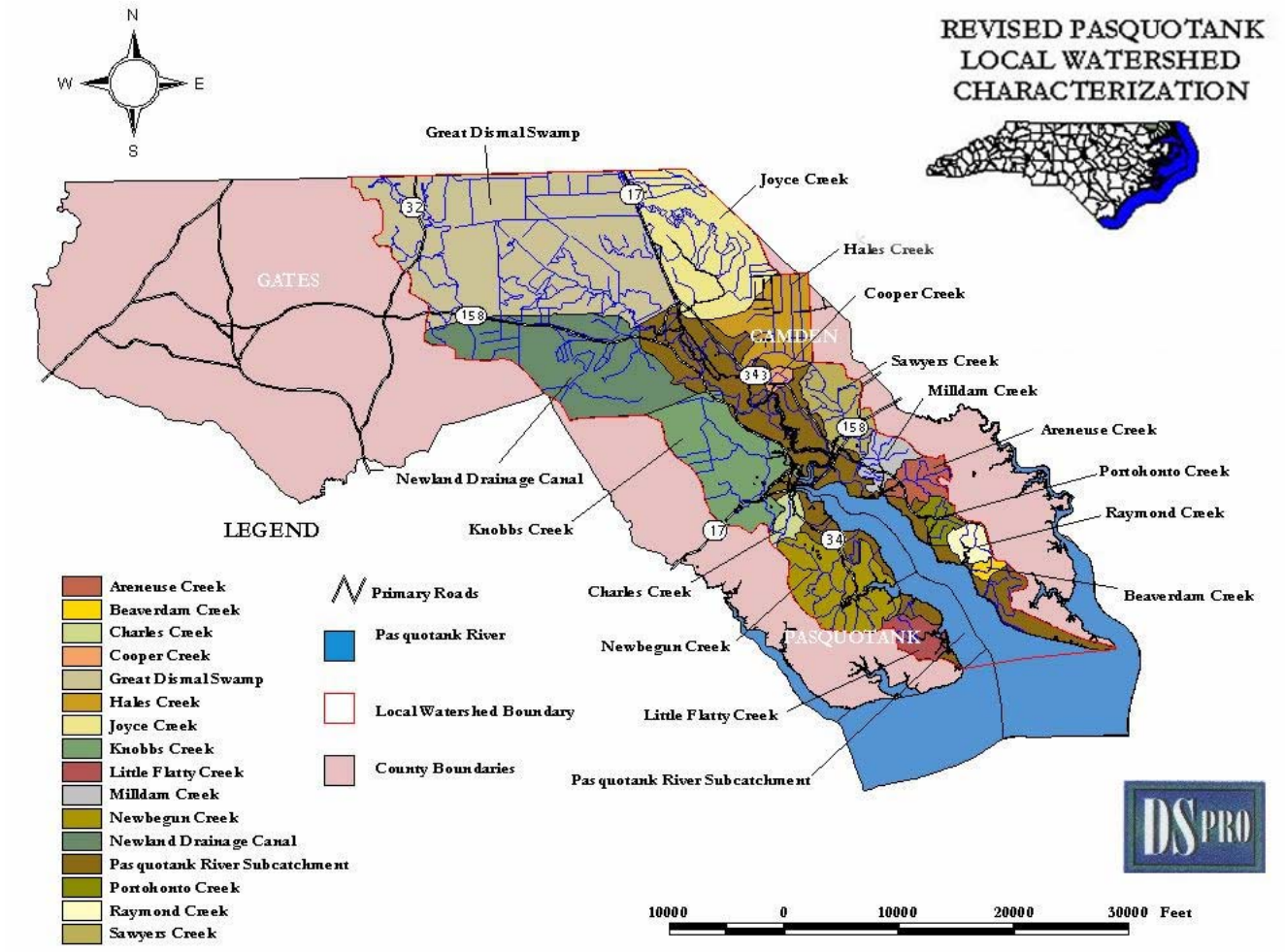
The Link to Basinwide Watershed Restoration Planning

Each river basin in North Carolina is made up of smaller 14-digit hydrologic units, or component watersheds, that together contribute to the overall watershed function of the basin. The EEP targeted specific 14-digit hydrologic units, or local watersheds, within each of the 17 major river basins through basinwide Watershed Restoration Planning. The Targeted Local Watersheds in these plans are selected based on restoration need (water quality, habitat, sensitive resources and impact information) and opportunity based on land-use information. The EEP has targeted 14-digit hydrologic units 03010205010020, 03010205050010, 03010205040010 for the Pasquotank River Local Watershed Planning initiative, herein referred to as the Pasquotank River Local Watershed Planning Area.

The map noted as Figure 1 on page 5 is from the *Revised Pasquotank Local Watershed Characterization Report* and depicts the Local Watershed Planning area. The targeted local watersheds within the watershed planning area also make up Subbasin 50 of the Pasquotank River Basin (Pas 50) as defined by the N.C. Division of Water Quality (DWQ) basinwide assessment report and water quality plans for the Chowan and Pasquotank River basins (http://h2o.enr.state.nc.us/basinwide/).

Additional information about the EEP Targeted Local Watersheds and the watershed restoration plan for the Pasquotank River basin is online at http://www.nceep.net/pages/lwplanning.htm.

Figure 1: Pasquotank Local Watershed Planning Area



Selection of the Pasquotank River Local Watershed Planning Area

The Pasquotank River drainage area was selected for a Local Watershed Planning Initiative due to:

- Increasing growth and development trends, particularly in the northern portion of the watershed
- Observed sedimentation, stream bank erosion, nutrient input and drainage issues
- Aquatic habitat degradation and N.C. Natural Heritage Program Significant Natural Heritage Areas, which merit protection due to unique habitat qualities
- Impacts expected from constructing the proposed Highway 17 By-Pass
- Interest, government support and concerns expressed locally about the watershed area

The Pasquotank River Drainage: Background Information

Watershed History

The Dismal Swamp Canal, located within the Pasquotank River drainage area, was completed in 1825 and is one of the nation's oldest operating canals. The word Pasquotank is an Algonquian Indian term meaning "divided tidal river." English settlers originally came to this area because of its rich soil and timber resources.

Located at the "Narrows of the Pasquotank," Elizabeth City became a harbor for commerce activities. With the advent of railroad access in 1881, the city quickly became an industrial center for oyster canneries, shipyards, textiles manufacturing and two military installations. These industrial activities attracted and sustained area residents.

High commodity prices led to increased agricultural activity in the 1960s and 70s. Cypress harvesting up to the river's edge then led to channelized ditching of cut-over swamps to drain lands for farming activities. These activities led to significant hydrological alterations and a decline in spawning areas for fisheries within the river.

Downtown Elizabeth City

Prior to the Clean Water Act of 1972 requiring permits for the discharge of wastewater into navigable waters, "large quantities of untreated domestic sewage and industrial wastes were being dumped directly into rivers and creeks. Metal-plating operations discharged copper, chromium, and cyanide ... Sewage sludge lined the banks and water was colored dark gray, with oil slicks, fish offal and other debris. After storms, a distinct odor of sewage pervaded Elizabeth City" (Albemarle Environmental Association).

Because of limited topography within this area, waters did not flush quickly allowing pollutants to remain in water systems for long periods of time. Based on water quality sampling and testing in the 1950s, the river was considered a "public health hazard for swimming and other water sports" (http://members.inteliport.net/~aea/pasquriv txt.htm). Low dissolved oxygen levels and pollutant inputs also caused a major fish kill in 1956.

Due to significant alterations of the Pasquotank River, tributaries feeding the river and the land surrounding its banks over the years, Local Watershed Planning efforts will never reinstate the river's original functions. The goal is to improve and protect watershed function related to water quality, hydrology and habitat within the confines of the larger hydrological alterations that exist today. Ultimately, an appropriate balance of land use planning and watershed protection and improvement measures must be employed to maintain the river's watershed health and vitality.

Watershed Planning Area Location and Subcatchments

The Pasquotank River Local Watershed Planning Area covers 454.5 square miles and is located in the Coastal Plain of northeastern North Carolina. It flows south-southeast from the Great Dismal Swamp in Virginia to the Albemarle Sound. The Pasquotank River is a part of the larger Albemarle-Pamlico Estuarine System, the second largest estuarine system in the

United States. The Pasquotank River drains portions of Suffolk and Chesapeake, Virginia, and is connected to Lake Drummond in southeast Virginia by the Great Dismal Swamp Canal. The Great Dismal Swamp comprises a large portion of the Pasquotank River headwaters. Forested swamp wetlands are also prominent along the main stem of the Pasquotank River. The watershed drops from an elevation of five feet above sea level near the Virginia state line to sea level at the mouth of the Pasquotank River.

The Local Watershed Planning Area includes: Areneuse Creek, Beaverdam Creek, Charles Creek, Cooper Creek, the Great Dismal Swamp, Hales Lake, Joyce Creek, Knobbs Creek, Little Flatty Creek, Milldam Creek, Newbegun Creek, Newland drainage canal, Portohonto Creek, Raymond Creek and Sawyer's Creek which all drain to the Pasquotank River. Based on these major drainages, the watershed area has been subdivided into subcatchments, or subwatershed drainage areas, for the development of planning information and recommendations. For more specific information on the methods used for subcatchment delineation, refer to the *Revised Pasquotank Local Watershed Characterization Report* summarized on page 15.

Joyce Creek 1

Newbegun Creek 1

Local Jurisdictions Encompassed in the Planning Area

The Local Watershed Planning Area encompasses portions of Pasquotank, Camden and Gates Counties as well as Elizabeth City and the Township of South Mills. Prior to initiating the Local Watershed Planning effort, EEP staff obtained Memorandums of Agreement from each jurisdiction supporting the planning effort. Local governments agreed to supply available data and information, at little or no cost to them, and to receive the recommendations indicated in the complete plan. Local government entities also agreed to designate a representative as a point of contact for the EEP and to participate on the Local Watershed Planning Team.

The Pasquotank River Local Watershed Planning Team

In early 2001, the EEP worked with local governments and resource professionals to identify key interests within the Pasquotank River drainage area. In this application, the term "interest" refers primarily to what key activities or resources being utilized by local stakeholders within the watershed area (i.e., agricultural, economic growth, municipal and county, timber industry, recreational, fishery and academic interests all have representation within the watershed and therefore an interest in how the watershed currently functions). Because local residents have specific historical and current knowledge about a watershed, they are vital to the planning process.

The Pasquotank River Local Watershed Planning Team was convened on December 11, 2001, with the following members:

Rodney Bunch
Assistant County Manager and County Planner, Pasquotank County

Carl Classen
County Manager, Camden County

JC Roundtree
Camden County Commissioner and Camden County farmer

Tom Morgan
Gates County appointed representative and private forestry consultant

Columbus Grant
Public Works
City of Elizabeth City

Debbie Hobbs
Chief Supervisor, Public Works
City of Elizabeth City

David Lane
District Forester Elizabeth City Office
N.C. Forest Service

Kent Luton
JW Jones Lumber Company

Maurice Berry, Jr.
Farmer

James Fletcher
Weeksville Farmer, crop duster and timber owner

Yates Barber
Pasquotank River Basin Council and Elizabeth City resident

Carolyn R. Mahoney
Dean, School of Mathematics, Science and Technology
Elizabeth City State University

Liz Noble
Elizabeth City State University

Bobby Brothers
Commercial fisherman

Wayne Matthews
Pasquotank River Yacht Club

Bill Prince
Albemarle Economic Development Council representative

Ted Sampson
N.C. Division of Coastal Management

Dwane Hinson
District Conservationist, Natural Resources Conservation Service

Lloyd Culp
U.S. Fish and Wildlife Service, Great Dismal Swamp National Wildlife Refuge

Dave McHenry and Chad Thomas
N.C. Wildlife Resources Commission

Mike Bell and Bill Biddlecome
U.S. Army Corps of Engineers, Washington Regional Office

Travis Burke
Executive Director, N.C. Cooperative Extension Service, Pasquotank County

Freddie O'Neal
Executive Director, N.C. Cooperative Extension Service, Camden County

Leland Heath
Ducks Unlimited, Edenton Office

Lee Leidy
Northeast N.C. Land Trust Initiative coordinator

NCWRP planning project manager for this initiative was Bonnie Mullen Duncan, who currently serves the EEP as the Eastern Planning Supervisor. Throughout the planning process support was also provided by Suzanne Klimek, who currently serves the EEP as Planning Supervisor, and Larry Hobbs, Implementation Specialist for the area, who retired from the State of North Carolina after completion of this effort. Steve Smutko and Christy Perrin of N.C. State University's Cooperative Extension Service Watershed Education for Communities and Officials program provided initial stakeholder training. Technical assessment support services were provided by Landmark Design Group, Inc., based out of Virginia Beach, Virginia, for contributions to the *Pasquotank Local Watershed Characterization Report*, and by Decision Support Professionals, Inc., (DSPro), based out of Kill Devil Hills, North Carolina, for the full delivery of the technical watershed assessment including the *Revised Pasquotank Local Watershed Characterization Report, the Pasquotank River Local Watershed Functional Assessment Report, Pasquotank River Local Watershed Functional Rehabilitation Model Report* and *the Pasquotank River Local Watershed Restoration Opportunities Report*. These reports, together with this document, comprise the Pasquotank River Local Watershed Plan. Decision Support Professionals subcontracted with CH2MHill, Inc. and McDowell and Associates, P.A., to conduct watershed modeling and hydrologic analysis for the technical watershed assessment.

The Pasquotank River Local Watershed Planning Team convened approximately once every two months from December 2001 through December 2003. The team's primary purpose was assisting in the development of data concerning current watershed conditions and watershed improvement and protection recommendations specifically for the Pasquotank River watershed area. To help develop these recommendations, the group provided input and feedback at integral points in the watershed assessment process. Minutes of the team's meeting are in Appendix A.

Pasquotank River Local Watershed Goals and Objectives

During the watershed planning process, the main goal for the Pasquotank River Local Watershed Plan was:

> ***To measurably improve and protect the watershed functions within the Pasquotank River Local Watershed Planning Area. Accomplishing this goal would involve addressing water quality, hydrological and habitat functions within the Local Watershed Planning Area.***

A detailed description of watershed functions can be found in Appendix M of the *Revised Pasquotank Local Watershed Characterization Report.*

Specific objectives and general management strategies were initially developed for the entire watershed planning area based on each main watershed function: water quality, hydrology and habitat. More specific potential strategies were also initially developed based on data and information presented in the *Revised Pasquotank Local Watershed Characterization Report* for each delineated subcatchment.

Watershed Objectives and Potential Strategies

1. ***Protect and rehabilitate the water quality function within the Pasquotank River Local Watershed Planning Area by reducing the nitrogen, phosphorous, sediment and other nonpoint sources of pollutants.***

   Potential Management Strategies:

   Sediment Input

   - Work with local governments and landowners to implement land use practices that will reduce sources of nonpoint source pollution. Various strategies can be utilized including promotion of education and economic incentives; reduction of sediment runoff by practicing no-till farming; and local government consideration of Low-Impact Development (LID) design strategies.
   - Reduce nutrients and sediment that are the result of land use practices and other nonpoint sources from reaching the water by implementing projects that will revegetate converted wetlands, restore forested riparian buffers and stabilize eroding shorelines.
   - Involve local governments, conservation groups and landowners in identifying and protecting intact resources.

2. ***Improve the hydrological function of the Pasquotank River Local Watershed Planning Area by implementing projects that restore surface runoff retention, flood water storage and shoreline stabilization.***

   Potential Management Strategies:

   - Implement projects that use detention ponds, bioretention areas, constructed wetlands and riparian buffers to restore hydrological functions to retain and treat surface water runoff.
   - Revegetate converted wetlands and forested riparian buffers within the watershed floodplain to reestablish floodwater storage resulting in a gradual release of water from storms and flood events.
   - Undertake projects to provide vegetative shoreline stabilization along eroding shorelines.

3. ***Restore and protect terrestrial and aquatic habitat***

Potential Management Strategies:

- Remove impediments to balance the need for flood management with preservation of instream habitats.

- Implement projects that restore and protect submerged aquatic vegetation and other sensitive marine habitats.
- Provide incentives to maintain vegetative field corridors for wildlife migration and cover.
- Promote land use planning that prevents segmentation of large tracts, which are used by wide ranging wildlife.
- Support incentives to plan for and implement urban greenways.

4. ***Promote recognition that functional rehabilitation of the Pasquotank River Local Watershed Planning Area must be accomplished through a collaboration of local, state and federal initiatives.***

Potential Management Strategies:

- Provide information from functional modeling that demonstrates the positive impact on watershed function derived from traditional and non-traditional restoration and rehabilitation practices.
- Produce public relations information regarding implementation of projects identified, funded or promoted by the Pasquotank River Local Watershed Restoration Plan.
- Promote collaboration of funding sources to accomplish projects that address numerous functional rehabilitation goals.

- Provide incentives and support for local governments to learn and utilize the Watershed Functional Rehabilitation Model.
- Continue to support the Pasquotank River Watershed stakeholders to ensure that priority projects are identified, funded and implemented.
- Provide contact information for funding sources of identified projects or initiatives in the Pasquotank River Local Watershed Restoration Plan.

Measurable Watershed and Subcatchment Reduction Targets

In order to achieve measurable results through functional rehabilitation, it is necessary to provide pollutant reduction targets and specific recommendations on nutrient/sediment reduction goals for each subcatchment. Nutrients and sediment impact water quality and aquatic habitat. They are influenced by hydrologic dynamics, which capture the three key functions under evaluation through the Local Watershed Planning assessment process. Studies from both the U.S. Environmental Protection Agency (USEPA) and DWQ link improvements to less easily measured functions (hydrology and habitat functions) with reductions in nutrients and sediment. Ideally, reduction of these pollutants will involve some aspect of each watershed function; thus we assume that these reduction targets will work to improve all watershed functions.

Sawyers Creek 1

Nutrients and sediment were the chosen measurable indicator pollutants as one component of determining the condition of watershed functions. These indicators were chosen because there is evidence in the watershed to suggest that they are a problem and because monitoring has provided baseline data for these functions. Anticipated reduction rates for these parameters are based on specific restoration/rehabilitation practices.

The Pasquotank River Watershed has not been the subject of a process to develop a nutrient reduction strategy such as those developed for the Tar-Pamlico and Neuse River basins, which both contain designated Nutrient Sensitive Waters. However, because of their similar nature and geographic proximity to the Pasquotank River Basin, reduction goals identified in the Tar-Pamlico and Neuse Nutrient Reduction Strategies will be applied to this Local Watershed Planning Area. The nutrient/ sediment reduction goals for the watershed and each subcatchment in the Local Watershed will be based on a target 30 percent reduction of nitrogen influx levels. Both phosphorus-loading levels and sediment level reduction are a problem in the in the Pasquotank River Watershed as documented in Section 10.3 of the *Revised Pasquotank Local Watershed Characterization Report.* The restoration/ rehabilitation strategies identified for the Pasquotank Local Watershed Planning Area will help reduce the introduction of phosphorus and sediments; therefore, as specific removal targets are identified for nitrogen, reduction of sediment and phosphorus will result by implementation of restoration/rehabilitation practices.

There are five major categories of restoration/rehabilitation practices available to address the issues identified by the Stakeholders and the Watershed Characterization Report Goals and Potential Management Strategies. The restoration and rehabilitation practices and associated removal efficiencies were derived from the DWQ *Neuse River Basin: Model Stormwater Program for Nitrogen Control,*

which is available online at: http://dem.ehnr.state.nc.us/su/PDF_Files/Neuse/FinalModel_Plan.pdf; the USEPA Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (http://www.epa.gov/owow/nps/MMGI/index.html); and other sources referenced in the *Revised Pasquotank Local Watershed Characterization Report*.

These efficiencies will be utilized to calculate the reduction of nutrients and sediment based on the quantities (acres) of proposed restoration and rehabilitation practices. The quantities of restoration/rehabilitation practices necessary to achieve the watershed goals are determined by the *Pasquotank River Local Watershed Functional Rehabilitation Model Report* and are documented in the *Pasquotank River Local Watershed Functional Assessment Report.* The percent of removal for sediment and phosphorus reflects the benefits derived from the implementation of the restoration/rehabilitation practices for nitrogen removal, which also affects phosphorous and sediment removal. The Pasquotank River Local Watershed stakeholders and DSPro should utilize this information in identifying potential projects necessary to meet the reduction goal for the Local Watershed Planning Area.

Based on the *Revised Pasquotank Local Watershed Characterization Report,* other data and information were analyzed and field verified to develop components of the technical watershed assessment, which ultimately lead to more specific watershed improvement opportunities and recommendations in the *Pasquotank River Local Watershed Opportunities Report*. This process is detailed in the next section.

Watershed Assessment Components and Summarized Results

The Pasquotank River Local Watershed Restoration Plan embodies a functional assessment approach focused on defining and achieving measurable results for the protection and improvement of watershed functions including water quality, flood control, and wildlife and fisheries habitat. The assessment approach includes a series of interconnected reports accomplished by successive tasks, which allows for decisions to proceed with a finer degree of resolution (Figure 2).

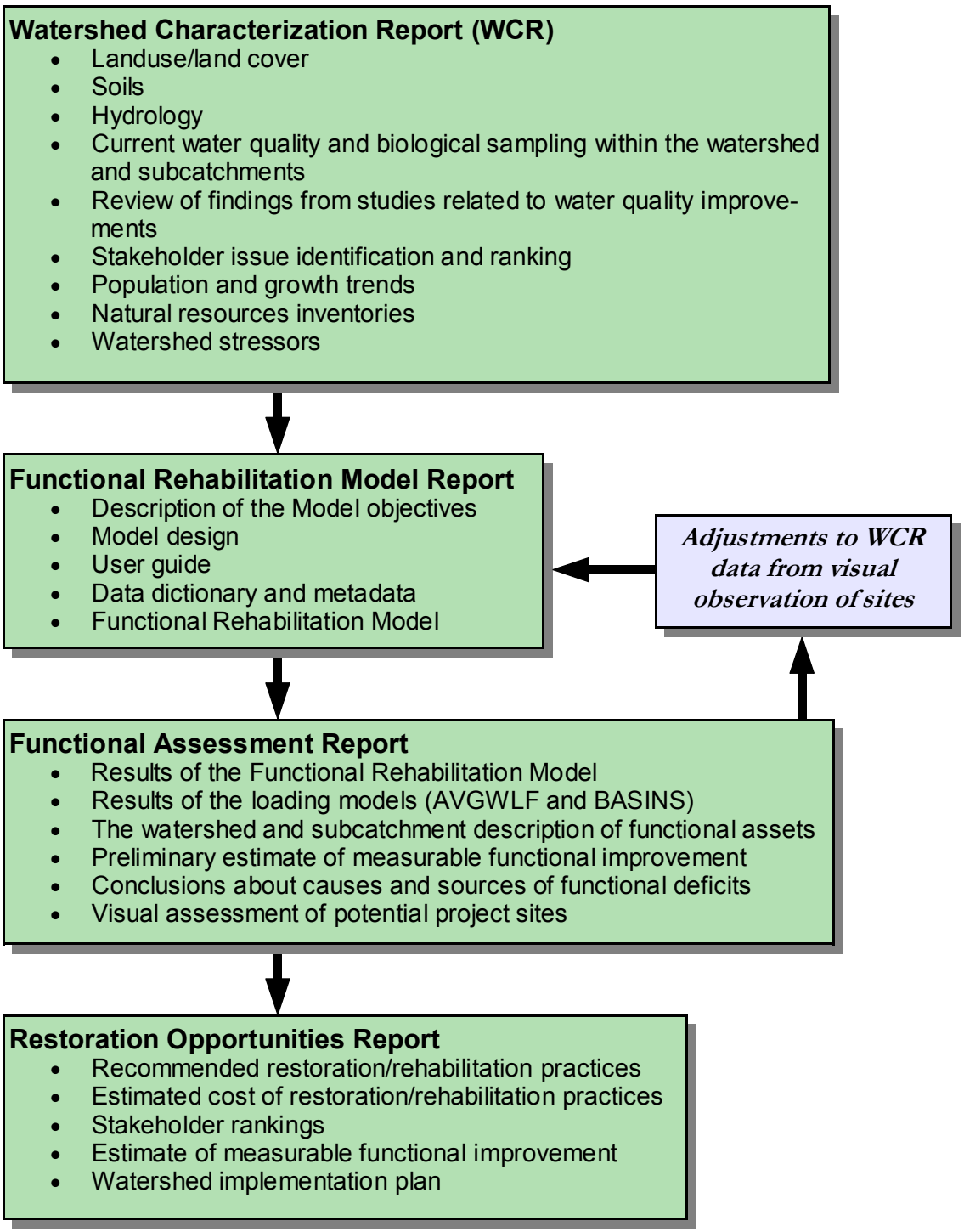
Those steps and plan components are:

- Pasquotank River Local Watershed Plan Summary
- Revised Pasquotank Local Watershed Characterization Report
- Pasquotank River Local Watershed Functional Rehabilitation Model Report
- Pasquotank River Local Watershed Functional Assessment Report and the
- Pasquotank River Local Watershed Restoration Opportunities Report

Collectively, these reports make up the *Pasquotank River Local Watershed Restoration Plan*. The contents of each are described in greater detail later in this report. These reports are available in their entirety at http://www.nceep.net/services/lwps/Pasquotank/plan/pasquotank.pdf.

Figure 2: Pasquotank River Watershed Restoration Plan Organization

These reports are collectively the Pasquotank River Local Watershed Restoration Plan



Revised Pasquotank Local Watershed Characterization Report

Elizabeth City

The *Revised Pasquotank Local Watershed Characterization Report* (WCR) provides a general overview of current watershed and delineated subcatchment conditions based on available data and stakeholder team input. The WCR includes information regarding trends in land use, water quality degradation and potential future impacts. The report also summarizes the results of other efforts applicable to the watershed area including: ongoing DWQ sampling programs; river basin modeling programs used to evaluate water quality management; and ecosystem restoration programs that will become part of the Pasquotank River Local Watershed Restoration Plan. This report provides the foundation for all future assessment work to be completed through the planning process, outlining areas requiring further investigation, monitoring and analysis.

Key information the *Watershed Characterization Report* includes:

- General physical description, which defines the limits of the study (the watershed boundaries)
- Land use/land cover, which assists in understanding potential causes of degradation and opportunities for rehabilitation
- Watershed soils defining the range of soils and their uses
- Watershed hydrology
- State designated uses, water quality and biological sampling data (including current water quality monitoring data collected specifically within the watershed and subcatchments)
- A summary of other initiatives and studies conducted within the watershed
- Specific comments from stakeholders of the Pasquotank Local Watershed Planning team
- Demographics and infrastructure (including projected NCDOT impacts)
- Natural resources inventories
- A summary of conditions for each of the subcatchments
- Analysis of need for restoration/rehabilitation
- Goals and management strategies for watershed and subcatchment rehabilitation
- Watershed stressors

The watershed characteristics are also provided as a series of data resources in a geospatial format developed using a geographic information system (GIS). Future data sets collected during the development of the Pasquotank River Local Watershed Restoration Plan will enhance the overall knowledge of the conditions within the watershed.

Based on all this information, the WCR describes and illustrates the existing condition of the watershed, need for restoration and protection, goals for rehabilitation and/or restoration and potential strategies to achieve those goals. The broad goals and potential strategies identified

in this report are supported by local stakeholder input including ranking of functional significance and priorities for restoration and/or rehabilitation practices for each subcatchment and the watershed. The information garnered at this stage of the assessment process was directly integrated into the *Pasquotank River Local Watershed Functional Rehabilitation Model Report* for further analysis.

The final version of the WCR was updated by DSPro and the EEP in December 2003. These updates were integrated into an existing draft Watershed Characterization Report completed by Landmark Design Group (Landmark) and CH2M HILL in July 2002. The updates reflect the approach that the EEP is undertaking to provide higher quality, more cost-efficient and sustainable strategies by utilizing a functional assessment approach to achieve measurable strategies for the watershed restoration plan.

Watershed Characterization Key Findings

Key findings demonstrating the need for further watershed functional assessment and ultimately rehabilitation of degraded functions within the Pasquotank River Local Watershed Planning Area include:

- Within the watershed, 42 percent of the streams are unbuffered, and seven of the 16 subcatchments have at least 50 percent of their streams unbuffered (Section 6.2 of WCR).
- Because of extensive farming activities in the hydric soils of the watershed, prominent restoration areas exist, which could reduce sediment and nutrient inputs and enhance water quality (Section 5.1 of WCR).
- Algal blooms have been noted within some subcatchments indicating nutrient inputs.
- All waters within Subbasin 50 are considered Impaired for the Fish Consumption Use Support Category (Section 7.2 of WCR).
- The Pasquotank River Local Watershed Planning Area contains prohibited shellfish harvesting areas; however these areas did not receive a rating of Not Supporting shellfish harvesting because there is not a commercially harvested shellfish species in the area (Section 7.2 and 7.6 of WCR).

Algae Bloom

- Development has reduced the stormwater storage capacity of several subcatchments in the watershed, but most notably in the subcatchments incorporating Elizabeth City (Section 8.1 of WCR).
- Existing watershed functions within the Local Watershed Planning Area may be impacted by projected residential and commercial development and NCDOT projects.
- The area contains wetlands classified as Exceptional in N.C. Division of Coastal Management, N.C. Coastal Region Evaluation of Wetland Significance (NC-CREWS) which merit protection. Some wetland areas rated Substantial and Beneficial in ecological value, which could merit enhancement and/or restoration (Section 5.1 of WCR)

- The N.C. Division of Parks and Recreation, N.C. Natural Heritage Program, identified several Significant Natural Heritage Areas that should be protected (Section 5.6 of WCR).
- Although the Elizabeth City stormwater sampling did not use methodologies approved by the DWQ, the data does reveal elevated levels of fecal coliform, nitrogen and phosphorous above the North Carolina Surface Water Standards (Section 7.5 of WCR).
- A greenway study for Elizabeth City identified potential wildlife corridors, but the plan is currently unfunded (Section 8.1 of WCR).
- The N.C. Coastal Land Trust identified the Pasquotank River as a prime opportunity for protection of riparian buffers in *The Pasquotank River Riparian Corridor Conservation Design* (Section 8.2 of WCR).

Pasquotank River Local Watershed Functional Rehabilitation Model

The rehabilitation model provides a description of the data, model, software, assumptions and users guide developed for the Pasquotank River Local Watershed Functional Rehabilitation Model, herein referred to as the Model. The Model is used to identify and analyze locations in the Local Watershed Planning Area for potential restoration and/or rehabilitation practices that will yield the highest watershed benefits and ultimately help determine the most suitable and efficient restoration/ improvement practices to pursue within the watershed.

The Model considers the array of water quality, hydrological and habitat functions provided by natural wetland and riparian areas and builds these functions into a set of recommendations that can be used by local decision makers, developers and homeowners to avoid or minimize adverse effects of new development, agricultural and forestry practices, roadway and other infrastructure improvements. The Model is designed to support nonpoint and point source water quality, hydrological and ecological (habitat quality) investigations, assess present watershed conditions relative to locally identified issues and simulate responses of wetlands and riparian areas within the watershed to various measures that could improve and/or rehabilitate natural functions. The focus of the Model is on the natural ability of wetlands and riparian areas to interrupt overland stormwater flows and protect streams by acting as filters for sediment and nutrient pollution that could lead to eutrophication and degradation of surface waters. The Model was created in a GIS environment that allows the user to visualize, as well as measure, the effects of alternative management scenarios that pertain to various issues identified by stakeholders and data for watershed locations.

The Model incorporates data contained in the *Revised Pasquotank Local Watershed Characterization Report*, NC-CREWS model, stakeholder issues and ranking results as well as other state and federal data sources.

The NC-CREWS model provides a quantitative and qualitative assessment tool, evaluating 39 watershed functions under the categories of water quality, hydrology, wildlife habitat and risk of loss as related to wetlands. Although the CREWS model was developed to evaluate wetlands specifically, the same functions and model criteria were

used to evaluate and rank stream, riparian and habitat areas in close proximity to wetland areas and the watershed functions they provide for the Pasquotank River Functional Rehabilitation Model. Because the CREWS model is the only functionally based model available for North Carolina, the EEP felt its use and these assumptions were very important in completing a functional assessment for the Pasquotank River Local Watershed Planning Area. For more information about the NC-CREWS model visit: http://dcm2.enr.state.nc.us/Wetlands/wetlands.htm.

The Pasquotank River Local Watershed Functional Rehabilitation Model operates in the *CommunityViz* software framework, a commercial off-the-shelf based planning and decision support application. The software uses data handling and visualization capabilities of GIS to enhance decision maker insight and create scenario driven analyses to evaluate the implications and opportunities of alternative strategies. For more information about this software framework, see Sections 7.0-7.2 of the *Pasquotank River Local Watershed Functional Rehabilitation Model Report*.

The objectives of the Model are threefold:

1. Provide an overview of the basic functions provided by the natural wetland and riparian areas within the watershed.
2. Review of alternative restoration and rehabilitation practices that may be considered for reduction or mitigation.
3. Develop a GIS-based model that provides a visualization of different management strategies to restore or rehabilitate sites at various locations within subcatchments and the watershed.

The Model accounts for restoration and rehabilitation practices such as wetlands, vegetated filter strips, detention ponds, vegetated buffers and revegetation along with the pollutant removal efficiencies each practice provides. This information will help estimate which practice would yield the highest removal and benefit for a given location in the watershed.

Three watershed indicators used by the Model are total nitrogen, total phosphorus and sediment which are measurable components of water quality, hydrology and habitat functions, and potential improvement based on various improvement practices.

Step-by-step instructions for using the model application is provided in Appendix A of the *Pasquotank River Local Watershed Functional Rehabilitation Model.*

Pasquotank River Local Watershed Functional Assessment Report

The *Pasquotank River Local Watershed Functional Assessment Report* provides information about subcatchment and watershed functions and the potential causes of degradation. The report also identifies watershed asset areas which should be protected. The results of the Pasquotank River Local Watershed Functional Rehabilitation Model are also a component of this report. Results from the report will be used to identify the solutions that yield the greatest benefits for the watershed based on identified pollutant removal parameters and other information.

This report describes the process and procedures used to develop results for this component of the assessment including:

- The results of the *Pasquotank River Local Watershed Functional Rehabilitation Model*
- The results of the DWQ monitoring and watershed loading models
  - Results of the Arc View Generalized Watershed Loading Function (AVGWLF)
  - Results of USEPA Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) Model 3.0
- Description of watershed and subcatchment functional assets
- Description of functional deficits within the watershed and subcatchments and potential causes and sources
- Visual observations verifying functional assets and deficits
- Description of watershed functions where there are anticipated NCDOT impacts

Summary Watershed Loading Model Results

Joyce Creek 6

The AVGWLF Model was used to assess nutrient loading and erosion for each of the 16 delineated subcatchments. Results from this exercise indicate that the Great Dismal Swamp, Newland drainage canal, Knobbs Creek, Joyce Creek and Pasquotank River subcatchments possess the highest total sediment delivery and nutrient loading of all the subcatchments evaluated. Subcatchments were evaluated individually for sediment, nitrogen and phosphorus pollutants. Those with the highest sediment delivered (pound per acre) were Portohonto Creek (40 percent) and Cooper Creek (23 percent). For total nitrogen, Portohonto Creek, Areneuse Creek, Knobbs Creek, Milldam Creek and Cooper Creek subcatchments maintain the highest loading rates (all greater than 5.5 pounds per acre per year). Cropland makes up 60 percent or greater land use in each of these subcatchments. Total phosphorus loading rates were highest in Portohonto Creek, Areneuse Creek, Milldam Creek, Cooper Creek and Beaverdam Creek subcatchments (greater than 1.3 pounds per acre per year).

The EPA BASINS Hydrological Simulation Program Function (HSPF) Model was also applied in this watershed area using Light Detection and Ranging (LIDAR) data, land use, soils, river reach riles, permit compliance system, water quality stations, U.S. Geological Survey gage station, bacteria stations and weather data stations information. There were a number of problems applying this model as originally planned. See Section 2.2.3 of the *Pasquotank River Local Watershed Functional Assessment Report* for a detailed explanation.

N.C. Division of Water Quality Summary Monitoring Results
DWQ staff collected chemical, physical and biological sampling data for the Pasquotank River Local Watershed Planning Area based on the three dominant land use types within the area: urban (Elizabeth City area), agriculture and undeveloped (swamp).

Chemical and physical monitoring samples were collected in:

- **Swamp**: Great Dismal Swamp
- **Agriculture**: Newbegun Creek, Areneuse Creek, Sawyers Creek, Hales Lake, Joyce Creek and Newland drainage canal
- **Urban**: Charles Creek and Knobbs Creek

Both baseflow and storm samples were collected over the course of a year during 2002 to 2003.

Summary results:

- **Dissolved Oxygen** – As with most slow moving coastal streams, dissolved oxygen (DO) levels varied greatly during the course of a day. In this study, most readings were taken during the afternoon hours when DO should have been the least biologically limiting. No particular site had regularly documented chronic DO problems.

- **Salinity** – During the 2002 drought period, lunar tidal influence was exaggerated in the Pasquotank River tributaries and as far up as the US 17 bridge crossing. High salinity readings were captured for 10 of the 13 sampling points. With the exception of Charles Creek (which is very close to the wide tidal portion of the river), salinity returned to background levels in 2003 as rains increased the level of flow in creeks and raised the water table. Because benthic macroinvertebrate sampling was done during the drought period, salinity no doubt played a role in shaping the community.


Newland Drainage Canal 5

- **PH Levels** – PH is naturally low (acidic) throughout this system which is dominated by swamp waters. The Great Dismal Swamp and Newland drainage canal were particularly noted for acidity; the remaining sites were approximately neutral. Acidity in the water likely reduces the overall benthic species prevalence in the northern part of the watershed planning area, especially for pH sensitive groups like mayflies.

- **Nutrients** – Nitrogen and Phosphorus levels in the Pasquotank River Local Watershed Planning Area were consistently higher than DWQ screening levels. Swamp waters such as these typically have higher levels of nutrients often bound to organic matter that is recycled slowly through the system.

- **Metals** – A suite of metals was analyzed at seven selected sites and no concentrations above laboratory detection limits were found for arsenic, cadmium, chromium, lead, mercury, nickel and silver. Aluminum, copper, iron, manganese and zinc were detected at all seven sites. The levels of dissolved salts in the water from salinity intrusion and background salt levels served to buffer the detrimental affects of the metals.

More specific information and data pertaining to monitoring strategies and results can be found in Section 2.3 of the *Pasquotank River Local Watershed Functional Assessment Report* and its Appendix H.

Functional Assets

Functional assets within the watershed and subcatchments include areas that are currently providing High levels of watershed function in relation to water quality, hydrology and/or habitat. Functional assets also exist in areas that contain unique or rare systems that if lost, could not be easily replaced. The following is a list of functional assets within the Pasquotank River Local Watershed Planning Area:

- Watershed areas identified by NC-CREWS as being Exceptional Ecological Significance
- Watershed areas identified by NC-CREWS as being Substantial Ecological Significance
- Watershed areas identified by NC-CREWS as being Beneficial Ecological Significance
- Federal and state park lands present in the watershed
- N.C. Coastal Land Trust sites along the main stem of the Pasquotank River
- Fish spawning areas that have been identified in the watershed
- Buffered streams (58 percent of the streams located within the Pasquotank River Local Watershed Planning Area are currently buffered)
- Forested areas (excluding open water, approximately 26 percent of the watershed contains forested non-wetlands and 29 percent forested wetlands)
- Low percentage of impervious areas (currently, only 3 percent of the watershed is impervious)
- Pristine areas as identified by the stakeholders
- Rare wetland types and/or unique ecosystems
- Areas containing threatened and/or endangered species
- Natural Heritage Areas within the watershed

Table 2 in the *Pasquotank River Local Watershed Functional Assessment Report* illustrates the above referenced functional assets by subcatchment. Based upon that table, the Great Dismal Swamp, Little Flatty Creek and the Pasquotank River subcatchments contain the most functional assets within the watershed planning area. Knobbs Creek and Newbegun Creek subcatchments have also been identified as having a high number of functional assets. Functional assets that address causes and sources of functional deficits are equally important. Buffered streams within the vicinity of agricultural lands provide essential nonpoint source cleansing to the watershed, while unique ecosystems such as submerged aquatic vegetation beds or areas containing threatened or endangered species provide rare habitat and other watershed functions that would be lost if the watershed function was removed. Appendix B of the *Pasquotank River Local Watershed Functional Assessment Report* includes photographs illustrating functional assets observed during visual assessments of the various subcatchments. The photos represent existing

watershed functions (water quality, hydrology and habitat) that are currently present within the watershed planning area. Identification of these areas will aid in determining opportunity sites for preservation, enhancement and creation.

Functional Deficits Within the Watershed and Subcatchment

Watershed and subcatchment functional deficits include areas that have been designated as Low or Moderate function based on NC-CREWS criteria (39 parameters), results from the *Revised Pasquotank Local Watershed Characterization Report* and from applying the Functional Rehabilitation Model, watershed loading models, DWQ monitoring and visual assessments of existing conditions.

A number of land uses or practices (including residential and infrastructure development, forest management, percent of impervious surfaces, agricultural practices, and influences from wastewater treatment facilities and septic tanks) have been identified as the potential causes and sources of functional deficits within the Pasquotank River Local Watershed Planning Area. In addition, although many agricultural BMPs and forest BMPs are already utilized in the watershed planning area, the lack of buffers to the receiving water bodies within the watershed and subcatchments allows for increased nutrient and sediment loading. Appendix C of the assessment report includes photographs of causes and sources of functional deficits observed during visual assessments of the watershed planning area. Nonpoint source pollution and surface water runoff are the largest identified contributors to functional deficits in the watershed in both developed (high and low intensity), agricultural and logging areas.

The following outlines the causes and sources of functional deficits identified within various subcatchments:

- High and low intensity development
    - Charles Creek, Knobbs Creek, Newland drainage canal, Joyce Creek and Newbegun Creek subcatchments have the greatest potential to continue this trend
- Agricultural land use is dominant in most of the Pasquotank River Local Watershed Planning Area
    - Camden County subcatchments and the central and southern portions of the Pasquotank County subcatchments contain the greatest amount of agriculture
- Absence of natural buffers
    - 42 percent of the watershed streams are currently unbuffered
    - Cooper Creek, Charles Creek and Beaverdam Creek Subcatchments contain the highest percentage of unbuffered streams
- High levels of agricultural nonpoint loading

Charles Creek 1

- The subcatchments with the highest loading levels of pollutants include Areneuse Creek, Portohonto Creek, Cooper Creek, Knobbs Creek and Milldam Creek subcatchments

- Increase logging practices throughout the watershed planning area
  - Visual observations of logging were noted in Joyce Creek, Milldam Creek and the Great Dismal Swamp subcatchments

N.C. Department of Transportation Projected Functional Impacts

The Pasquotank River Local Watershed Planning Area is within Division 1 of the NCDOT, Transportation Improvement Program (TIP). The TIP contains funding information and schedules for various transportation projects including: highways, aviation, enhancements, public transportation, rail, bicycle and pedestrians, and the Governor's Highway Safety Program. In the Pasquotank River Local Watershed Planning Area, several transportation projects are scheduled and include urban and rural roadway improvements, bridge replacements, enhancement and public transportation projects. Appendix D of the *Pasquotank River Local Watershed Functional Assessment Report* includes information regarding the proposed TIPs for the watershed planning area and a map depicting the location of the urban and rural TIP projects. Additional information is available online at: http://www.ncdot.org/planning/development/TIP/.

A breakdown of the urban and rural TIP roadway projects scheduled for the watershed planning area and corresponding potential functional impacts to the watershed follows. The functional impacts were determined by reviewing the Watershed Functional Screening Map developed for the Model, the N.C. Division of Coastal Management (NCDCM) Wetland Type (Wtype) GIS data layer and the NC-CREWS Wetlands of Ecological Significance GIS data layer. Information from the NCDCM Potential Wetland Enhancement and Restoration Category (WERC), including Potential Restoration Types (Rest-Type), GIS data set, was reviewed to determine what types of restoration and/or rehabilitation were available in the vicinity of the proposed TIP, as well as within other areas of the watershed, that could potentially replace the functions impacted by the projects. Although the NCDCM and NCCREWS GIS data layers discuss wetland functions, information about watershed functions as a whole, including hydrology and habitat functions, are incorporated into the impact analysis. Information regarding the Watershed Functional Screening Map can be found in the *Pasquotank River Local Watershed Functional Rehabilitation Model Report*. Information regarding the NCDCM and NC-CREWS GIS data sets can be found in Section 5 of the *Revised Pasquotank Local Watershed Characterization Report*. Figure 4 of the *Revised Pasquotank Local Watershed Characterization Report* depicts the location of the NCDOT TIP projects within the Pasquotank River Local Watershed Planning Area.

TIP Project: Rural(R)-2579

The TIP project R-2579 is located within Pasquotank and Gates Counties and involves widening of NC 158 to a multi-lane road from NC 32 in Sunbury eastward until US 17 at Morgan's Corner. The TIP project is approximately 16 miles in length and runs through the Newland drainage canal subcatchment and parts of the Great Dismal Swamp subcatchment.

Potential Functional Impacts

The proposed TIP project R-2579 will primarily impact areas that are currently providing Moderate watershed functions as described by the Watershed Functional Screening Map. The types of NCDCM wetlands and associated watershed functions that would be impacted include portions of Hardwood Flats within Newland drainage canal subcatchment, along the southwest portion of the TIP and Swamp Forest wetlands along the northwest portion of the TIP within the Great Dismal Swamp subcatchment. Smaller portions of Managed Pinelands would also be impacted. The NC-CREWS Wetlands of Ecological Significance GIS data layer indicates that wetlands of Exceptional Ecological Significance would be impacted along the northern portion of the TIP project, while wetlands of Substantial Ecological Significance would be impacted on both sides of the proposed TIP project.

Functional Restoration/Rehabilitation Potential

In order to address the watershed functions impacted by the proposed TIP project, opportunity sites that could restore and/or rehabilitate the above listed impacts are required. These opportunity sites should target areas that could be restored/rehabilitated to Hardwood Flats, Swamp Forest and/or Managed Pinelands.

Review of the NCDCM WERC indicates that altered wetlands, which may be potential enhancement/restoration areas adjacent to the proposed TIP, include:

- Prior Converted (PC) farmland (WERC-1)
- Managed Pinelands (WERC-5)
- Enhancement (WERC-9)

Potential Restoration types (Rest-Types) in the vicinity of the TIP project include:

- Swamp Forest and Bottomland Hardwood Forest (Rest-Type 4)
- Bottomland Hardwood/Headwater Forest (Rest-Type 5)
- Wet Flat (Rest-Type 6)

Based upon the results of the GIS data sets, areas that could potentially address the watershed functions impacted from the TIP project exist within the vicinity of the proposed TIP.

TIP Project R-2515

The TIP project R-2515 is located within Pasquotank County and includes construction of the US-17 Bypass around Elizabeth City that was completed in 2003. A review of the watershed functions impacted from this roadway project is included in this report. The TIP project runs through Knobbs Creek subcatchment from US 17 North, southward to US 17 South to the west of Elizabeth City.

Functional Impacts

The completed TIP project R-2515 produced little impact to watershed functions as depicted by the Watershed Functional Screening Map. The types of DCM wetlands that were impacted include minor impacts on Managed Pinelands and Hardwood Flats along the southeastern portion of the roadway project. The NC-CREWS Wetlands of Ecological Significance GIS data layer indicates that limited areas of Substantial Ecological Significance were impacted.

Functional Restoration/Rehabilitation Potential

Although the TIP project did not appear to impact significant areas that provide watershed functions, opportunity sites should address areas that could restore/rehabilitate watershed functions found within Hardwood Flats and/or Managed Pinelands. Review of the NCDCM WERC indicates that potential enhancement/restoration areas adjacent to the TIP include PC farmland (WERC-1).

Potential Restoration types (Rest-Types) in the vicinity of the TIP project include:

- Swamp Forest and Bottomland Hardwood Forest (Rest-Type 4)
- Wet Flat (Rest-Type 6)

Based upon the results of the GIS data sets, areas that could potentially address the watershed functions from the TIP project exist within the vicinity of the roadway. Review of the entire watershed planning area also indicates that opportunities exist that could address the watershed functional impacts from the completed TIP project.

TIP Project Urban (U)-3420

The TIP project U-3420 is located within Pasquotank County and includes upgrades to State Road (SR) 1309 Main Street Extension. The proposed upgrades would create a bypass from Hughes Boulevard westward to the US 17 Bypass. The TIP project runs through Knobbs Creek subcatchment.

Functional Impacts

The proposed TIP project U-3420 would primarily impact areas that are currently providing Low watershed functions as described by the Watershed Functional Screening Map, with some areas that currently provide High watershed functions along Knobbs Creek. Some of the Low functional areas include existing residential development areas.

The types of DCM wetlands and associated watershed functions that would be impacted include portions of Managed Pinelands, Bottomland Hardwood Forests and Swamp Forests. The NC-CREWS Wetlands of Ecological Significance GIS data layer indicates that wetlands of Exceptional Ecological Significance would be impacted along the southeast of the TIP project including fish spawning areas identified in the Model while smaller portions of Substantial Ecological Significance would be impacted on both sides of the proposed TIP project. Minor areas of Beneficial Ecological Significance were also identified.

Functional Restoration/Rehabilitation Potential
In order to address the watershed functions impacted by the proposed TIP project, opportunity sites that could restore and/or rehabilitate the above listed impacts are required. These opportunity sites should address areas that could restore/rehabilitate watershed functions provided by Managed Pinelands, Bottomland Hardwood Forests and Swamp Forests.

Review of the NCDCM WERC indicates that potential enhancement/restoration areas adjacent to the proposed TIP include:

- PC farmland (WERC-1)
- Managed Pinelands (WERC-5)
- Minor areas of National Wetlands Inventory excavated areas (WERC-7)

Potential Rest-Types in the vicinity of the TIP project include:
- Swamp Forest and Bottomland Hardwood Forest (Rest-Type 4)
- Bottomland Hardwood/Headwater Forest (Rest-Type 5)
- Wet Flat (Rest-Type 6)

Based upon the results of the GIS data sets, areas that could potentially address the watershed functions impacted from the TIP project exist within the vicinity of the proposed TIP. Review of the entire watershed planning area also indicates that opportunities exist that could address the watershed functional impacts from the proposed TIP project.

TIP Project Urban (U)-3449
The TIP project U-3449 is located south of proposed TIP project U-3420 within Pasquotank County and includes upgrades to Halstead Boulevard including a bypass that will connect Halstead Boulevard to the US 17 Bypass. The TIP project runs through Knobbs Creek subcatchment.

Functional Impacts
The northern portion of the proposed TIP project U-3449 will primarily impact areas that are currently providing Low watershed functions as described by the Watershed Functional Screening Map, with some areas that currently provide High watershed functions along Knobbs Creek. The types of DCM wetlands that would be impacted include small portions of Managed Pinelands and Swamp Forests along Knobbs Creek. The NC-CREWS Wetlands of Ecological Significance GIS data layer indicates that wetlands of Exceptional Ecological Significance would be impacted along Knobbs Creek, while smaller portions of Substantial Ecological Significance would be impacted on both sides of the proposed TIP project.

Functional Restoration/Rehabilitation Potential
In order to address the watershed functions impacted by the proposed TIP project, opportunity sites that could restore and/or rehabilitate the above listed impacts are

required. These opportunity sites should address areas that could restore/rehabilitate the watershed functions provided by Managed Pinelands and Swamp Forests. Review of the NCDCM WERC indicates that potential enhancement/restoration areas adjacent to the proposed TIP include PC farmland (WERC-1). Potential Rest-Types in the vicinity of the TIP project include Wet Flat (Rest-Type 6).

Based upon the results of the GIS data sets, areas that could potentially address the watershed functions impacted from the TIP project exist within the vicinity of the proposed TIP. Review of the entire watershed planning area also indicates that opportunities exist that could address the watershed functional impacts from the proposed TIP project.

TIP Project Rural (R)-2414

The TIP project R-2414, located in Camden County, will widen US 158 into multilanes from the east side of the Pasquotank River eastward to NC 34 in Belcross. The TIP project runs through the Pasquotank River and Sawyer's Creek subcatchments.

Functional Impacts

The proposed TIP project R-2414 will primarily impact areas that are currently providing High watershed functions as described by the Watershed Functional Screening Map, with some areas that currently provide Moderate watershed functions. The types of DCM wetlands, and associated watershed functions that would be impacted include portions of Pocosin along the western portion of the TIP project and Swamp Forests. The NC-CREWS Wetlands of Ecological Significance GIS data layer indicates that portions of Exceptional Ecological Significance would be impacted along the western portion of the TIP project including fish spawning areas and endangered/threatened species within the Pasquotank River and Sawyer's Creek, as identified in the Model, while smaller portions of Substantial Ecological Significance would also be impacted.

Functional Restoration/Rehabilitation Potential

In order to address the watershed functions impacted by the proposed TIP project, opportunity sites that could restore and/or rehabilitate the above listed impacts are required. These opportunity sites should address areas that could restore/rehabilitate watershed functions provided by Pocosin and Swamp Forest environments.

Review of the NCDCM Wetland Enhancement/Restoration Types (WERC) indicates that potential enhancement/restoration areas adjacent to the proposed TIP include:

- PC farmland (WERC-1)
- Enhancement, NWI areas that overlap areas containing ditches (WERC-9)

Potential Restoration types (Rest-Types) in the vicinity of the TIP project include:

- Primarily – Wet Flat (Rest-Type 6)
- Minor areas – Swamp Forest and Bottomland Hardwood Forest (Rest-Type 4)
- Minor areas – Bottomland Hardwood/Headwater Forest (Rest-Type 5)

Based upon the results of the GIS data sets, areas that could potentially address the watershed functions impacted from the TIP project exist within the vicinity of the proposed TIP. Review of the entire watershed planning area indicates that opportunities exist that could address the watershed functional impacts from the proposed TIP project.

Additional Proposed TIP Projects

Along with proposed roadway projects within the watershed planning area, several other types of TIP projects are anticipated. Proposed bridge replacement projects could incorporate construction designs that would limit impacts to aquatic habitats. In addition, enhancement projects, such as a multi-use path along US 17 from the Virginia line to South Mills, could incorporate information campaigns on the current watershed functions present along the pathway for educational purposes. For more information, please refer to the *Pasquotank River Local Watershed Functional Assessment Report*.

The Pasquotank River Local Watershed Restoration Opportunities Report

The Pasquotank River Local Watershed Restoration Opportunities Report is the next step in the overall watershed restoration process following the *Pasquotank River Local Watershed Functional Assessment Report*. *The Pasquotank River Local Watershed Restoration Opportunities Report* provides a listing of the potential projects that provide opportunities to meet the targeted reduction goals set forth for the project. It was developed with input from a number of sources including *the Revised Pasquotank Local Watershed Characterization Report,* stakeholder input, *the Pasquotank River Local Watershed Functional Rehabilitation Model, the Pasquotank River Local Watershed Functional Assessment Report*, watershed modeling, DWQ monitoring and visual assessments. These resources were combined to confirm or refute potential opportunities for watershed improvement. The potential projects are organized by subcatchment and accompanied by aerial and site photography, as well as initial results for the reduction levels provided by *the Pasquotank River Local Watershed Functional Rehabilitation Model*.

The Pasquotank River Local Watershed Restoration Opportunities Report, when coupled with the capabilities of *Pasquotank River Local Watershed Functional Rehabilitation Model* and visual assessment, can provide a coherent and continuing listing of possible opportunity sites throughout the watershed area that will aid in restoring and rehabilitating watershed functions within the watershed.

Site Identification Procedures, Methodologies and Assessment

While most of the preliminary site selection process can be considered intuitive, several tools have been utilized to help determine potential opportunity sites for Restoration and/or Rehabilitation (R&R). A description of the various types of R&R practices and their estimated effectiveness can be found in Section 3.2.5 of the *Pasquotank River Local Watershed Model Report* (Model Report). Beginning with stakeholder input and continuing through active modeling in the Model, certain sites are identified that possess characteristics such as:

- Stakeholder identified issues
- USGS blueline streams
- Hydric soils
- Targeted functional levels and reduction goals referenced in *the Pasquotank River Local Watershed Functional Assessment Report*

Once an opportunity site has been identified, either through recommendation based on visual reconnaissance or a screening by the Model, the site is selected in the Model and a rapid assessment is performed to determine if (based on Model data only) that particular site contains any or all of the characteristics listed above. If the site provides a valid opportunity, information about that property is collected and recorded on the DSPro Visual Field Assessment Tool (VFAT).

Charles Creek Project Site

The opportunities listed in this report are discussed within three categories: Restoration/Rehabilitation Opportunities, Preservation Opportunities and BMPs. The sites discussed in Sections 4 through 18 refer to opportunities with a potential for restoration and/or rehabilitation. Preservation Opportunities are discussed in Section 19. Section 20 deals with the application of specific BMPs to the opportunities discussed throughout the report. Opportunities within the report are discussed by subcatchment and presented in the format of the DSPro VFAT, which includes the necessary assessment information and aerial photograph of the potential site. Available landowner contact information is listed in Appendix B.

Over 50 projects were identified including over 100,000 feet of stream and 100 acres of watershed improvement projects were identified in the *Pasquotank Local Watershed Restoration Opportunities Report.* The site names are derived from the name of the subcatchment followed by a number indicating the order in which the site was identified. For example, Site AR-1 indicates the first site located in the Areneuse Creek subcatchment, whereas Site SW-2 indicates the second site located in the Sawyer's Creek subcatchment. Opportunity sites are ranked and listed in this report in order of priority based on the potential level of reduction that can be achieved at each site.

Table 1: Total Restoration/Enhancement Length Recommended for Improvement and Pollutant Removal Expected by Subcatchment

Subcatchment	R&R Practice	Linear Feet	Sediment Removal lbs/acre	Nitrogen Removal lbs/acre	Phosphorus Removal lbs/acre
Areneuse	Restoration/ Enhancement	18,052	17,088	136.83	25.94
Beaverdam	Restoration/ Enhancement	2,674	2,288	16.128	3.143
Charles	Restoration/ Enhancement	1,970	2,000	10.275	2.047
Cooper	Restoration/ Enhancement	5,050	7,312	53.517	10.063
Great Dismal Swamp	Restoration/ Enhancement	1,739	1,280	12.681	-
Hales Lake	Restoration/ Enhancement	6,940	3,904	32.98	5.97
Joyce	Restoration/ Enhancement	41,950	17,744	289.94	46.15
Knobbs	Restoration/ Enhancement	12,350	9,504	117.56	20.36
Milldam	Restoration/ Enhancement	680	52.19	7.299	9.715
Newbegun	Restoration/ Enhancement	4,800	4,448	39.708	7.405
Newland	Restoration/ Enhancement	10,780	6,560	69.37	11.91
Pasquotank River	Restoration/ Enhancement	11,980	27,616	82.278	18.22
Portohonto	Restoration/ Enhancement	5,250	6,368	52.053	10.015
Raymond	Restoration/ Enhancement	6,480	4,016	27.13	5.391
Sawyers	Restoration/ Enhancement	12,430	11,104	75.054	14.838

Table 2: Other Best Management Practice Recommendations and Expected Pollutant Removal by Subcatchment

Subcatchment	BMP	Project Area (linear feet)	Sediment Removal lbs/acre	Nitrogen Removal lbs/acre	Phosphorus Removal lbs/acre
Knobbs	Bioretention Area	2,000 x 1,000	-	43.365	15.579
Knobbs	Biorentention Area	1,000 x 1,000	1,272	17.64	6.327
Pasquotank River	Shoreline Stabilization	2,000	-	.048	-
Newbegun	Shoreline Stabilization	9,500	1,066	20.164	1.88
Knobbs	Biorentention Area	500 x 600	72	1.145	.284
Charles	Shoreline Stabilization	425 x 25	-	0.096	.010
Pasquotank River	Constructed Wetland / Wet Detention Pond	120 x 120	-	.156	.070
Charles	Constructed Wetland / Wet Detention Pond	600 x 230	144	12.61	1.652
Charles	Constructed Wetland / Wet Detention Pond	120 x 180	-	0.065	0.028
Charles	Constructed Wetland / Wet Detention Pond	100 x 65	-	0.566	0.077
Knobbs	Constructed Wetland	550 x 300	52	6.82	0.505
Charles	Constructed Wetland / Riparian Buffer	100 x 550	-	6.09	2.175

While some of these projects appear to exhibit low pollutant removal efficiencies, they have other aquatic and terrestrial habitat and hydrological improvement values, which are discussed and described within the *Pasquotank River Local Watershed Restoration Opportunities Report*.

The EEP sponsored a Landowners Meeting on February 26, 2004, in partnership with the Pasquotank County Cooperative Extension Service and the N.C. Natural Resources Conservation Service. The EEP is working to target the projects identified within *the Pasquotank River Local Watershed Restoration Opportunities Report,* which would provide the maximum water quality, habitat and hydrological improvement benefits to the watershed initially and later will pursue other projects and other funding sources with the assistance of local stakeholders and interested parties. Projects referenced in *the Pasquotank River Local Watershed Restoration Opportunities Report* the EEP is initially focusing on include: CH-1, JC-1, JC-6, NB-1, NL-5 and SW-2. Photographs of these projects are included throughout this document.

The EEP has also been working with the City of Elizabeth City to implement a wetlands restoration/enhancement project on a portion of Charles Creek Park, off Dawson Street in the downtown area. Completion of this project expected in 2004.

Newland Drainage Creek 5

Funding Opportunities with Potential Application to the Watershed Area

Additional information about the programs and opportunities referenced below may be available on the EEP Web site: http://www.nceep.net in *A Guide for North Carolina Landowners*. In some cases, the following contact information is more current than listings in the online guide. Another resource that solely describes federal funding sources for watershed protection can be found on-line at: http://www.epa.gov/owow/watershed/wacademy/fund.html.

Best Management Practices

Conservation Reserve Program (only applies to cropland) and
Environmental Quality Incentives Program (only applies to agricultural or pasture lands)

U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)
Local Contact: **Dwane Hinson** (252) 482-4127 or ezrider@datlink.com
Web site address: http://www.nrcs.usda.gov

Pasquotank Basin Planning; N.C. Department of Environment and Natural Resources, Division of Water Quality, Water Quality Section

State Contact: **Jennifer Everett**, based out of Raleigh, (919) 733-5083 ext. 374
Web site: http://h2o.enr.state.nc.us/nps/

N.C. Clean Water Management Trust Fund

Eastern Regional Contact: **Damon Tatem**, based out of Kill Devil Hills, (252) 441-6672 or damon@cwmtf.net
Web site: http://www.cwmtf.net

Agriculture Cost Share Program (only applies to agricultural lands)
N.C. Department of Environment and Natural Resources, Division of Soil and Water Conservation

State Contact: **Sam Fields**, based out of Raleigh, (919) 715-6100; Sam.Fields@ncmail.net

Stream Restoration Opportunities

N.C. Ecosystem Enhancement Program, N.C. Department of Environment and Natural Resources

State Contact: **Deborah Amaral**, based out of Raleigh (919) 715-3466
Web site: http://www.nceep.net

Clean Water Management Trust Fund

Eastern Regional Contact: **Damon Tatem**, based out of Kill Devil Hills, (252) 441-6672 or damon@cwmtf.net
Web site: http://www.cwmtf.net

Wetlands Restoration Opportunities

N.C. Ecosystem Enhancement Program, N.C. Department of Environment and Natural Resources

State Contact: **Deborah Amaral**, based out of Raleigh (919) 715-3466
Web site: http://www.nceep.net

Wetlands Reserve Program, U.S. Department of Agriculture, N.C. Natural Resources Conservation Service

U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)
Local Contact: **Dwane Hinson** (252) 482-4127 or ezrider@datlink.com
Web site address: http://www.nrcs.usda.gov

Forestry Incentives Program
U.S. Department of Agriculture, N.C. Natural Resources Conservation Service and N.C. Department of Environment and Natural Resources (DENR), Division of Forest Resources (tree planting program which can aid in restoration of forested wetlands)

State Contact: **Mark Megalos**, DENR, Division of Forest Resources, based out of Raleigh, (919) 733-2162 ext. 254 or mark.megalos@ncmail.net

Preservation Opportunities

N.C. Coastal Land Trust

Local Contact: **Janice Allen** (252) 634-1927
Email: jlallen@cconnect.net
Web site: http://www.coastallandtrust.org/

Clean Water Management Trust Fund

Eastern Regional Contact: **Damon Tatem**, based out of Kill Devil Hills
(252) 441-6672
Web site: http://www.cwmtf.net

The Nature Conservancy

(919) 403-8558
Web site: http://nature.org/wherewework/northamerica/states/northcarolina/

Conservation Tax Credit Program, N.C. Department of Environment and Natural Resources

State Contact: **Bill Flournoy**, based out of Raleigh, (919) 715-4191
Web site: http://www.enr.state.nc.us/conservationtaxcredit/

Additional Habitat Protection – Restoration Programs

Partners for Fish and Wildlife, U.S. Fish and Wildlife Service

State Contact: State Private Lands Coordinator
John Ann Shearer (919) 856-4520, ext. 17 or john_ann_shearer@fws.gov
Web site: http://www.fws.gov/r3pao/marqette

Wildlife Habitat Incentives Program (WHIP)

U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)
Local Contact: **Dwane Hinson** (252) 482-4127 or ezrider@datlink.com
Web site address: http://www.nrcs.usda.gov

Forest Stewardship/Stewardship Incentive Program, U.S. Forest Service and N.C. Department of Environment and Natural Resources, Division of Forest Resources (*helps landowners protect and enhance their forest lands and associated wetlands*)

Mark Megalos, DENR, Division of Forest Resources, based out of Raleigh, (919) 733-2162 ext. 254 or mark.megalos@ncmail.net

Forest Nursery Program

(Produces a wide variety of forest tree and shrub seedlings for forest regeneration, wildlife habitat improvement, wetlands mitigation and research which it sells at cost to North Carolina landowners)

1 (888) NC-TREES

N.C. Natural Heritage Trust, N.C. Department of Environment and Natural Resources, Division of Parks and Recreation

State Contact: Jennifer Dennis, (919) 715-8703 or jennifer.dennis@ncmail.net
Web site: http://ils.unc.edu/parkproject/heritage/nhtf.html

N.C. Coastal Federation

Manteo Field Office: (252)473-1607 or hatteraskeeper@nccoast.org
Web site: http://www.nccoast.org/

Online Resources

Albemarle Environmental Association Web site:
http://members.inteliport.net/~aea/pasqurivtxt.htm

N.C. Department of Environment and Natural Resources (NCDENR), Division of Water Quality

Neuse River Basin: Model Stormwater Program for Nitrogen Control
http://dem.ehnr.state.nc.us/su/PDF_Files/Neuse/FinalModel_Plan.pdf

Basinwide Planning Program: http://h2o.enr.state.nc.us/basinwide/

NCDENR, Division of Coastal Management:
http://dcm2.enr.state.nc.us/Wetlands/wetlands.htm

NCDENR, Wetlands Restoration homepage: http:www.nceep.net

N.C. Department of Transportation, Transportation Improvement Program Unit:
http://www.ncdot.org/planning/development/TIP/

U.S. Environmental Protection Agency
Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters: http://www.epa.gov/owow/nps/MMGI/index.html

APPENDIX A

The Pasquotank River Local Watershed Planning Team Meeting Minutes

Pasquotank River Local Watershed Planning Team

MEETING SUMMARY

Tuesday, December 11, 2001 meeting held at the College of the Albemarle

Next Meeting scheduled for January 30, 2002 5:30-7:30 PM College of the Albemarle Small Business Center in Elizabeth City Room 121A

Agenda Items for our Next Meeting:

- Discussion about the Pasquotank River Local Watershed Planning Group Charter, Ground Rules, and the exact role of a stakeholder
- Consensus Building Training provided by Steve Smutko, with NC State University.

Group Members/alternates present:

- Yates M. Barber, Pasquotank River Basin Council Member
- Mike Bell, US Army Corps of Engineers, Washington Reg. Office
- Maurice Berry, Jr., Weeksville Farmer
- Rodney Bunch, Pasquotank County Planner & Asst. County Mgr.
- Travis Burke, Pasquotank County Coop. Extension Service Dir.
- Lloyd Culp, Great Dismal Swamp National Wildlife Refuge
- James Fletcher, Weeksville Farmer & Crop Duster
- Dwane Hinson, Natural Resources Conservation Service
- Marie Jenkins, Keep Pasquotank Beautiful
- Randy Keaton, Pasquotank County, County Manager
- Bob Kerr, Landmark Design Group, Watershed Assessment Contractor
- Kent Luton, JW Jones Lumber Company
- Dean Carolyn Mahoney, Elizabeth City State University
- J. Tom Morgan, Gates County Representative
- Liz Noble, Division of Marine Fisheries, Coastal Habitat Protection Planner
- Freddie O'Neal, Camden County Coop. Extension Service Dir.
- Bill Prince, Albemarle Economic Development Commission, Executive Director
- J.C. Roundtree, Camden County Commissioner & South Mills Farmer
- Ted Sampson, Division of Coastal Management, Elizabeth City

Group members not present:

Debbie Hobbs / Steve Harrell, Elizabeth City
Carl Classen, Camden County Manager
Chad Thomas, Wildlife Resources Comm., Fisheries Biol.

Support staff & guests present:

- Christy Perrin, NCSU, Watershed Education for Communities & Local Officials
- Bonnie Duncan, NC Wetlands Restoration Program
- Larry Hobbs, NC Wetlands Restoration Program
- Suzanne Klimek, Wetlands Restoration Program
- David Lane, NC Forest Service, District Forester
- Carolyn Mullen, Elizabeth City Resident

Meeting Minutes for Dec. 11, 2001

Ice-breaking with Christy Perrin, Watershed Education for Communities and Local Officials

Meeting participants enjoyed a barbecue dinner supplied by the Barbeque Barn of Elizabeth City as they registered and the meeting got started. Christy then introduced the group to the concept of a *watershed* with a paper exercise designed to physically show the participants what watershed boundaries look like.

Introduction to the Wetlands Restoration Program and Local Watershed Planning, Bonnie Duncan & Larry Hobbs

Members of the first official Pasquotank River Local Watershed Planning Stakeholders meeting, were introduced to the NC Wetlands Restoration Program, the concepts of Local Watershed Planning, and a little about the types of projects the NC Wetlands Restoration Program works to implement. A copy of the slide presentation given by Bonnie Duncan and Larry Hobbs was distributed at the Dec. 11th meeting.

Some of the key points of the presentation focused on a brief background introduction to the program and its emphasis on improving water quality, floodwater retention and wildlife and aquatic habitat for overall watershed restoration and protection. The Wetlands Restoration Program works to accomplish these goals through restoration, creation, enhancement, preservation and other water quality improvement activities in wetlands, streams and riparian

Continued on Page 2

buffer areas. The Wetlands Restoration Program works to target its resources and projects where both significant ***restoration needs*** (i.e. water quality, pollution sources, permitted impacts, habitat & sensitive resources, etc.) and ***restoration opportunities*** (i.e. land use pressures / changes and restoration / protection feasibility) exist.

The Wetlands Restoration Program works to investigate specific restoration needs and opportunities through Local Watershed Planning. A Local Watershed Plan is developed through a stakeholder driven process for a small, local watershed (in this case the Pasquotank River) and works to accomplish two primary goals:

1. Identifies all factors contributing to water quality degradation.
2. Provides specific strategies to address nonpoint sources of pollution within the Local Watershed.

Resources for Local Watershed Planning come from a Memorandum of Understanding between the Department of Transportation (DOT) and the Department of Environment and Natural Resources. The Local Watershed Planning process allows the Wetlands Restoration Program to work with DOT it identify *future* impacts and compensatory mitigation needs. This agreement will allow local communities to help put projects where the greatest needs exist ahead of impacts occurring.

Projects which may count toward compensatory mitigation for DOT's future impacts are only one facet of the Local Wateshed Planning process. This process works to identify and implement numerous projects to restore the watershed which include project activities like best management practices, preservation, stormwater strategies, local growth management initiatives and so on.

The three "I's" of the Local Watershed Planning process are:

1. ***Inventory*** available information concerning the watershed and interests within it.
2. ***Identify*** a full complement of needed solutions to address issues identified.
3. ***Implement*** multiple strategies for improving and protecting water quality, habitat, etc.

Bonnie also mentioned that Landmark Design Group had been contracted to conduct the technical watershed assessment for the Pasquotank River Local Watershed Plan.

The importance and role of local governments was also discussed and Bonnie spoke about Elizabeth City, Pasquotank, Camden and Gates Counties signing Memorandums of Understanding in support of the Local Watershed Planning process. These local government entities committed to provide a representative for the stakeholder team, to supply any available and necessary information for the watershed assessment at little or no cost, and to hear the final recommendations of the group.

The importance and role of stakeholders in the Local Watershed Planning process was also briefly described. This process allows local citizens to help direct state resources. Local expertise and experiences provided by the stakeholders will help identify degradation issues and provide recommendations for solutions through the consensus building process.

Larry Hobbs also went over numerous types of projects the Wetlands Restoration Program looks for and examples of implemented projects. Larry also mentioned that the Program was currently working with Elizabeth City to implement a wetland and stream restoration project at Charles Creek Park. A feasibility report is currently being developed for this particular project.

For more information about the Wetlands Restoration Program or the Local Watershed Planning process please contact Bonnie Mullen Duncan at (919) 733-5315. The Wetlands Restoration Program's website address is http://h2o.enr.state.nc.us then select Wetlands Restoration Program.

Christy Perrin, WECO and Suzanne Klimek , Wetlands Restoration Program Stakeholder Brainstorming Session about Watershed Concerns

Christy asked the stakeholders the following question: ***"What concerns and information should we consider in developing a plan for the Pasquotank River watershed?*** " She then gave everyone a stack of post-it notes and asked that each stakeholder participant jot down some ideas. She gave stakeholders time to think and prepare ideas and then asked that the stakeholders group their common ideas together under various categories. The idea, concerns and recommendations provided by category are presented below in no particular order of importance.

•Prioritization

-Time of program start-up
-Prioritization of Local Watershed Planning areas

•Nonpoint Source Pollution

-Address comprehensive ways to address nonpoint source pollution (stormwater drainage).
-Effect of developments on nonpoint source pollution.
-Storm drains take road run-off directly to water by-passing buffers
-Eutrophied agricultural ditches feed directly into Knobbs Creek and Upper Pasquotank

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•Highway Effects

-What future highway projects are projected for the area?
-Culvert replacement in state roads is permitted, but methods do not restore previously restricted water flows.
-US 158 cuts off or diverts historical flow into watershed.
-A bridge has been proposed across the lower Pasquotank and North Rivers to feed traffic to Dare County faster which could have impacts.

•Erosion

-Reduce erosion along river banks, Lower Salem Township especially.
-Areneuse River in Camden has naturally eroding banks.
-Need a plan for long term integrity of waterfront properties
-Natural drainage areas are spreading out along Mill Ditch in South Mills

•Public Education / Awareness

-Ideas on how the general public can really understand how the Local Watershed Plan can benefit citizens
-Develop education and public awareness components so public has buy-in.

•Recreation

-Consider recreational usage for area rivers and creeks
-Boat ramp designs cause large parking areas to drain directly into water

•Ecological Concerns

-How will the plan and projects effect wildlife?
-Concerned that aesthetics may override "nature's needs"

•Research

-Make sure projects are developed with sound science supporting each decision.
-Utilize studies which have already identified problem areas.
-Any research efforts related to water quality at ECSU and other places should be considered.

•Flooding / Hydrologic Modifications

-Improve drainage in the watershed area -- within residential developments and especially in the Knobbs Creek area.
-Incorporate flooded areas into stream restoration priority list.
-Flooding is occurring in Newland and in the lower end of Camden area.
-Highway 158 disrupts natural drainage – causing lands north of the road to flood more often.
-Consider restoration of the natural flow of the Dismal swamp across NC 158 to Perquimans River.
-Farmland is flooding due to poor drainage in creeks and streams.
-Folly Ditch drainage project needs to be modified to improve retention.
-Increase water storage
-Consider groundwater (i.e. first 3-5 feet from surface) losses from extensive drainage for agriculture and forestry.

•Property Rights

-How will the plan affect farmers and their farmland?
-Consider and protect the property rights of landowners that are affected.
-Landowner concerns about restrictions on their land.
-Economic impacts on landowners after plan has been implemented.

•Development

-Protect existing wetlands from development
-Steadily increasing development near waterbodies is causing loss of freshwater wetlands and associated habitats.
-What impacts are subdivisions having on streams and creeks?
-Septic systems associated with developments/ subdivisions are not working properly.
-Determine current development initiatives underway
-Prior-converted farmlands are under more development pressure
-Maintain good land management when implementing new projects.
-Want to see balance between opportunity for wildlife and human interests
-What effect will this study and plan have on development and specifically in Camden?

•Forestry Activities

-Concern about timber harvesting in low areas
-Need to follow BMPs in harvesting timber, i.e. leaving buffer strips next to rivers and streams
-Will chip mills have affect on swamps in this area?

•Agriculture

-Consider nutrient runoff from agriculture and the need to reduce these nutrients

•Aquatic & Fisheries Resources

-What are the historic fish migration patterns in the Pasquotank?
-Need aquatic habitat (stream bottom) restoration
-Concerns about instream woody debris removal
-Improve fish habitat
-Protect resident and anadromous fish spawning and nursery area habitats.
-Increase extent of Division of Water Quality sampling in swamp waters and estuarine waters
-Concerns about reverse osmosis and resulting salinity changes which could have effects on fisheries
-Consider WRC's study on how shoreline modification practices along the Pasquotank River affect habitat (see Chad Thomas with WRC for more information)

•Government / Private Partnerships

-Form special use water management districts
-Consider cumulative effects in watershed evaluations
-Land conservation and conservation easements needed
-What is the Land Preservation Trust doing in this area?
-Regulations / legal concerns
-Effects of inter-basin diversions on water quality and quantity
-Consider Pasquotank River Riparian Corridor Study done by the Coastal Land Trust in 2001.

•Baseline Inventory

-How many miles of stream have been ditched?
-Where were the historic wetland areas?
-How will altering water flow affect drainage from farms and woodlands?
-What are the main sources of pollution?
-Is clear water important to the local community?
-How will the plan and projects affect access across refurbished streams?
-Consider using remotely sensed data (satellite imagery) in your land use/cover/change analysis.

These responses will provide some preliminary information to Landmark Design Group (our watershed assessment consultant) to consider as they begin the first phase of the watershed assessment, the "Watershed Characterization". The Watershed Characterization will be a compilation and summary of all available information related to the Pasquotank River Drainage. The responses provided during the Dec. 11th meeting also help the stakeholder team members learn what each other's concerns and interests are as they go into the watershed planning process.

Thanks to all of you for your valuable comments! Hope all of you had a wonderful holiday season and got to enjoy the snow!!! Look forward to seeing all of you on January 30th!

For more information about the Pasquotank River Local Watershed Planning Team, contact Bonnie Duncan at 919-733-5315

Pasquotank River Local Watershed Planning Team

MEETING SUMMARY

Wednesday, January 30, 2002 meeting held at the College of the Albemarle

Next Meeting scheduled for March 26, 2002 5:30-7:30 PM Camden County Senior Center

117 N. 343 Camden, NC

Directions to Camden County Senior Center:
From North of Elizabeth City:
Follow Highway 17 By-Pass heading South into Elizabeth City and make a left on Elizabeth Street (Hwy 158 E). Follow Elizabeth Street (Hwy 158) over the bridge (over the Pasquotank River) into Camden. After crossing over the bridge, at the next stoplight Camden High School will be on your right and you will need to make a left onto Highway 343 N. The Camden County Senior Center is just behind the Camden County Courthouse on your left about ¼ mile down 343 N from your turn. Parking is available immediately beside the Senior Center. If traveling from the South Mills area, you can follow 343 S into Camden toward the high school and the Courthouse and Senior Center will be on your right.

Agenda Items for our Next Meeting:

- Continue Brief Discussion about Charter
- Brief Presentation of Watershed Assessment Components
- Presentation of Initial Watershed Characterization Information– Landmark Design Group

Group Members/alternates present:
- Steve Harrell, City Manager, Elizabeth City
- Mike Bell, US Army Corps of Engineers, Washington Reg. Office
- Maurice Berry, Jr., Weeksville Farmer
- Rodney Bunch, Pasquotank County Planner & Asst. County Mgr.
- Travis Burke, Pasquotank County Coop. Extension Service Dir.
- Lloyd Culp, Great Dismal Swamp National Wildlife Refuge
- Dwane Hinson, Natural Resources Conservation Service
- Marie Jenkins, Keep Pasquotank Beautiful
- Bob Kerr & Curtis Hickman, Landmark Design Group, Watershed Assessment Contractor
- Kent Luton, JW Jones Lumber Company
- Liz Noble, Division of Marine Fisheries, Coastal Habitat Protection Planner
- Freddie O'Neal, Camden County Coop. Extension Service Dir.
- J.C. Roundtree, Camden County Commissioner & South Mills Farmer
- Ted Sampson, Division of Coastal Management, Elizabeth City
- Lee Leidy, Northeast NC Land Trust Initiative

Support staff & guests present:
- Christy Perrin & Patrick Beggs, NCSU, Watershed Education for Communities & Local Officials
- Steve Smutko, NCSU, Natural Resources Leadership Institute
- Bonnie Duncan, NC Wetlands Restoration Program
- Larry Hobbs, NC Wetlands Restoration Program
- David Lane, NC Forest Service, District Forester

Meeting Minutes for January 30, 2002

Update on New Participants from Bonnie Duncan

NC Wetlands Restoration Program staff worked to identify and recruit two new members for the Local Watershed Planning Team with experience and expertise pertinent to the watershed. Chad Thomas, a District Fisheries Biologist for the Wildlife Resources Commission, was mentioned as an agency representative on the Team. Lee Leidy was also introduced as an Agency / Program Technical Advisor. Mrs. Leidy is employed by Hornthal, Riley, Ellis and Maland and serves as the coordinator for the Northeast NC Land Trust Initiative.

Team Receives Consensus Building / Collaboration Training from Steve Smutko, NCSU Natural Resources Leadership Institute

Steve got the group started with the orange auction exercise to demonstrate some key points about collaboration. Participants enjoyed the exercise and some got pretty competitive about having the most oranges! The moral of conducting this exercise was to show how collaboration can work to achieve multiple objectives (i.e. different uses for the orange) through negotiation among various interests (i.e., varied stakeholder team representation).

Steve then passed out some information sheets and led into the principles of collaborative problem solving. Collaboration is an inclusionary process that promotes lateral communication and shared decision-making. The principles describe that collaboration needs to be:

- Purpose Driven
- Inclusive, Not Exclusive
- Educational
- Voluntary
- Self-Designed
- Flexible

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- Egalitarian
- Respectful
- Accountable
- Time Limited
- Achievable

Consensus is the decision rule that allows collaborative problem solving to work. Consensus prevents the decision from being driven entirely by power politics. It allows people to build trust and share information, especially under conditions of conflict. Consensus does not mean that everyone will be equally happy with the decision, but rather, all will accept the decision. It is not realistic for groups to require that all decisions be made by consensus. Groups that require unanimous agreement risk being held hostage by a demanding member. Instead, groups should seek consensus; they should go the extra mile to find solutions that meet the interests and concerns of everyone. If an agreement cannot be reached – if consensus cannot be achieved – each participant is free to exercise his or her next best alternative to a negotiated outcome.

Steve then spoke about negotiation and the book Getting to Yes, by Roger Fisher and William Ury. The art of negotiation focuses on:

1. Separating the people from the problem
2. Focusing on interests not positions
3. Inventing options for mutual gain
4. Evaluating options using objective criteria

Next Steve discussed the negotiation process which entails:

1. Establishing procedures
2. Educating each other
3. Defining the problem
4. Specifying information needs
5. Educating each other
6. Generating options
7. Developing criteria for option evaluation
8. Evaluating options
9. Reaching agreements
10. Develop a written plan

Lastly, Steve covered the various levels of consensus:

1. Endorsement
2. Endorsement with minor points
3. Agreement with reservations
4. Abstain
5. Stand aside
6. Formal disagreement but willing to go with the majority
7. Formal disagreement with request to be dissolved of responsibilities for implementation
8. Block

To make this process a little more simple, our group will utilize the 5-finger scale:

1 finger means – Endorsement (I like it)

2 fingers means – Endorsement with minor points (basically I like it)

3 fingers means – Agreement with reservations (I can live with it)

4 fingers means – Stand aside

(I don't like it but I don't want to hold up the group)

5 fingers means – Block
(I will not support the proposal)

Presentation of the DRAFT Group Charter & Ground Rules – Bonnie Duncan

After hearing Steve's presentation on consensus building and negotiation – Bonnie presented a draft formalized charter for the group to consider. Bonnie discussed the background and purpose of the charter and led right into the group's purpose and tasks. Several questions / comments were raised by stakeholder participants including:

Q: What do you mean by "watershed improvement" in the group's purpose?

Bonnie answered that the NCWRP's goals include working toward water quality, wildlife habitat and floodwater retention improvements, however watershed restoration can accomplish much more. The group may want to receive some of the preliminary information collected by Landmark Design Group before developing other goals for watershed protection and restoration.

Q: Where are we going with this group? Are we charged with identifying projects or broadly looking at recommendations for policy changes?

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Bonnie answered this was spelled out under "Group Tasks" within the charter and proceeded to review those tasks with the stakeholder team.

Comment: As we go through this process we need to look out for things that will cripple the economic development of this area for the sake of "hugging trees."

This comment was received and duly acknowledged by the NCWRP staff and stakeholders.

The discussion then turned to participants and participant responsibilities. Questions stakeholders asked included:

Q: There seems to be a small number of local economic development interests represented – do we need more?

Bonnie responded saying that more than one developer had been contacted to participate on the team with no response.

Stakeholders recommended that Bonnie contact the Elizabeth City Chamber of Commerce to recruit Ronda Twiddy.

Q: Do we need commercial fisherman & recreational boating community representation?

The stakeholders came up with ideas to include representatives from the Pasquotank County Yacht Club, Elizabeth City Chamber of Commerce and the local Bass Fishing Chapter. Bonnie agreed to contact these folks to determine their interest in participating.

Q: What if stakeholders miss meetings?

Bonnie answered that it was the stakeholders responsibility to identify an alternate – and that the group would not revisit issues and points where consensus had been reached. Everyone's time is extremely valuable and we want to maximize the time and effort we put into getting together.

The charter discussion was not finished by 7:30pm and the group agreed to provide Bonnie with other suggestions before the next meeting. Bonnie also agreed to revisit the charter discussion for a few brief minutes before Landmark's presentation of the Watershed Characterization information. To help save time at the next meeting, Bonnie also agreed to prepare something in writing discussing the components of the watershed assessment being conducted by Landmark Design Group.

Your Homework:

Please see the enclosed attachment for an overview of the technical Watershed Assessment components being conducted by Landmark. We will not have much time to discuss this so please read it carefully prior to our March 26th meeting. If you have questions prior to the 26th, please feel free to e-mail me at Bonnie.Duncan@ncmail.net or call me directly at (919) 733-5315.

Thanks & look forward to seeing you all on March 26th from 5:30-7:30pm at the Camden County Senior Center

Pasquotank River Local Watershed Planning Team

Meeting Announcement & Summary

Tuesday, May 21, 2002 meeting held at the Camden County Senior Center

Next Meeting scheduled for July 30, 2002 5:30-7:30 PM College of the Albemarle Small Business Center, Room 121 B& C

Elizabeth City, NC

Agenda Items for our Next Meeting:

- Introduction of Decision Support Professionals, Inc. represented by Mr. George Wood and Ms. Helen Mattioni
- Review of steps to create the Pasquotank River Watershed Plan and discussion regarding some assessment framework shifts
- Review of the Pasquotank River Watershed Characterization and information presented at the May 21st meeting.

Group Members/alternates present:

- Rodney Bunch, Pasq. Co. Planner & Asst. County Mgr.
- Tom Campbell, Pasquotank County Coop. Extension Service Dir.
- Marie Jenkins, Keep Pasquotank Beautiful
- Kent Luton, JW Jones Lumber Company
- Liz Noble, Division of Marine Fisheries, Coastal Habitat Protection Planner
- Freddie O'Neal, Camden County Coop. Extension Service Dir.
- J.C. Roundtree, Camden County Commissioner & South Mills Farmer
- J. Wayne Matthews, Pasquotank River Yacht Club
- Maurice Berry, Jr., Pasquotank Co. Farmer
- Dwane Hinson, NRCS
- David Lane, NC Forest Service
- Tom Morgan, Gates Co. Representative
- Columbus Grant, Public Works, Elizabeth City
- Dean Carolyn Mahoney, Elizabeth City State University
- Bill Prince, Albemarle Economic Development Council

Members Absent:

- James Fletcher, Weeksville Farmer
- Yates Barber, Pasquotank River Basin Council
- Carolyn Mahoney, ECSU
- Bobby Brothers, Commercial Fisherman
- Ted Sampson, DCM
- Lloyd Culp, USFWS
- Chad Thomas, Wildlife Resources Commission
- Mike Bell, US Army Corps of Engineers
- Travis Burke, NC Coop. Ext. Service, Pasquotank Co.

Support staff & guests present:

- Pat McDowell, Private Consultant for Elizabeth City
- Bonnie Duncan, NC Wetlands Restoration Program
- Bob Kerr & Curtis Hickman, Landmark Design Group

GROUP MEMBERS ABSENT – WE MISSED YOU! PLEASE SEE BONNIE FOR MISSED MEETING MATERIALS

Meeting Minutes for May 21, 2002

Presentation Provided by NC Department of Transportation (DOT) on Future Road Projects within the Watershed Area & an Overview of the Road Building Process

A presentation provided by DOT staff members, Alexis Baker and David Schiller covered NC DOT's Planning and Mitigation Program within the Project Development and Environmental Analysis Brach. Alexis provided an overview of the Transportation Improvement Program (TIP). The TIP is a statewide seven year program which outlines a construction and funding schedule for all new transportation projects. Alexis also covered how public input is integrated in the TIP Program and process. David Schiller then presented more specific TIP information regarding Division 1 (which includes the Pasquotank River Local Watershed Planning area). David outlined the projected impacts for the Local Watershed Planning area specifically including a potential for 68 acres of wetlands impacts and 7,000 feet of stream impact. These projects are described in more detail within the slide presentation handout which will be available at our July 30 meeting. An enlarged map of the projected road impacts within our Local Watershed Planning area will also be available at this meeting.

In many cases, road construction creates unavoidable impacts which must be mitigated. David discussed DOT's "mitigation methodology" and described what options were available to the agency. Dave discussed how these impacts were identified and what options were currently available to DOT for addressing mitigation requirements:

- DOT has an in-house program;
- DOT works with consultants through contracts; and
- DOT makes payments to the NC Wetlands Restoration

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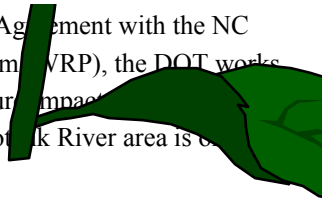
Through a Memorandum of Agreement with the NC Wetlands Restoration Program (WRP), the DOT works with the WRP to address future impacts in watershed areas. The Pasquotank River area is one such areas.



Presentation of Existing Conditions Model – Uses and Implications (Peter Elkan, CH2MHILL)

Peter discussed and presented the existing conditions model for the watershed area. The model selected for this level of analysis was the Arc View Generalized Watershed Loading Function Model, which is a planning level model that simulates natural processes associated with different types of land use within the watershed area. Peter presented the modeling objectives as:

- Quantifying pollutant loading
- Describing relative contribution of loading (based on subwatersheds delineated)
- Evaluating future development scenarios and best management practice alternatives

The features of the model selected include:

- its appropriateness for rural and urban watersheds
- simulates hydrologic rainfall and runoff
- quantifies sediment erosion with Universal Soil Loss Equation
- calculates Nitrogen and Phosphorus Loading (point and nonpoint source)
- GIS interface (for graphical depiction)
- estimates water quality response to future land use scenarios
- the model is user friendly and relatively simple

Peter also provided more explicit details about how the model works which are included in the slide presentation handout distributed at the 5-21-02 meeting (see Bonnie for a copy if you missed the meeting).

The results of the model indicated that the top three subwatersheds with the highest Total Nitrogen inputs (in lbs./acre) were: Portohonto Creek, Cooper Creek and Knobbs Creek. Top three subwatersheds for Total Phosphorus (lbs./acre) inputs included: Portohonto Creek, Areneuse Creek and Cooper Creek. Top three subwatersheds with highest sediment delivery (lbs./acre) included: Portohonto Creek, Areneuse Creek and Milldam Creek.

In summary, the model established a baseline regarding nutrient loading and erosion results appropriate for planning level evaluation within the Pasquotank River watershed. In addition, the predominant nonpoint source loading of Total Nitrogen and erosion surface runoff appeared to be coming from agricultural and pasture lands. Total Phosphorus loading was driven by groundwater and agricultural lands.

Sources of uncertainty associated with the model include:

- Hydrology (hard to determine due to such flat slopes)
- Bio / geochemical processes in anaerobic conditions (associated with swamp waters)
- Groundwater Phosphorus
- Variances in irrigation, drainage and fertilization practices.

Questions asked by stakeholder members included:

Q: Does the model tell us what is going into the Albemarle Sound or does it tell us specific stream loading.

A: The model generalizes loading by subwatershed.

Q: Does the model account for the rate at which rain falls?

A: Not really. We used daily rainfall totals in Elizabeth City over the last 10 years to run the model. The model does not evaluate specific storm events, instead it uses average annual totals over a long period of time.

Q: How does the model account for topography and how much appears to be there?

A: Peter Elkan with CH2MHILL answered, we referenced a Digital Elevation Model which uses USGS information and models slope. Sediment erosion appears to be low here because of the slopes being so gradual.

Q: Under "Information Sources for Nutrient Loading" what does "Land Application" refer to?

A: Manure – permitted application.

Q: Are you just capturing animal waste and no sludge or other by-products?

A: Just applied hog waste in this case, we don't know how it Was applied, but we do know approximately what concentration of pollutants will go into runoff. In using this

Continued on Page 3

model we wanted a general sense of nutrient / pollutant loading within each subwatershed.

Q: Under the GIS Land Use Categories used which evaluate dissolved nutrient concentrations in surface water runoff does "row crops" account for conventional till?

A: Most crops here don't require conventional till, except potatoes and cabbage. These crops made up approximately 2% of this watershed. The majority of the crops noted within the watershed were wheat and beans. Landmark staff tried to build tillage types into the GIS land use categories developed for the model.

Q: How were the nutrient concentrations linked to specific land use categories identified by Landmark?

A: Landmark used NC State University studies and USGS field investigation references to develop reasonable median values for nutrient concentrations associated with each land use category. For the category "undeveloped" estimated runoff and groundwater concentration was used to develop a value. In addition, for the "developed" category, nutrient concentrations were based on an empirical deviation of the SWIM model, used frequently in urban areas.

Q: Does the model account for atmospheric deposition of pollutants?

A: No, the model does not account for atmospheric deposition specifically, but it does indirectly account for it because it takes everything into account at specific points with other types of input.

Q: Shouldn't runoff concentrations be different for different pollutants?

A: Runoff coefficients should be close to the same. If someone grossly over applies fertilizer, etc. that's when it would make a difference.

Q: How do you confirm your assumptions are realistic?

A: We can't calibrate the model, but we can look at where the watershed has been studied via, rainfall, edge of field, etc. data available. We applied certain assumptions based on the data available. In addition, the NCWRP is working with the Division of Water Quality to have site specific monitoring samples taken. This information will allow us to compare results with the model to verify or reject what we're finding at this time. After a year we may be able to refine our assumptions when we have better data to consider.

Q: Is it your gut feeling that contributions on a percentage basis present a sort of sensitivity analysis for subwatersheds within the watershed?

A: Yes, the exact number is less important, the numbers are for relative comparison among many subwatersheds.

Q: So, if you're not sure of absolute numbers and look at percentages instead, then that gives you an indication of impacts to the whole watershed verses absolute numbers for each subcatchment.

A: Yes, that's how we're using this information.

Comment made by Peter Elkan: Groundwater concentrations of Phosphorus in this area are high. Local studies suggest that upwelling of groundwater may be contributing phosphorus and thus skewing some of our initial results.

The results of this model will be verified or refuted by Division of Water Quality monitoring which is currently underway. The modeling information lays the groundwork for identifying potential focus areas in which to concentrate further and more detailed assessment efforts on.

Presentation of Draft Focus Area Identification Based on Initial Results
(Bob Kerr of Landmark Design Group)

Next, Bob Kerr gave a brief account of information considered to identify Focus Areas. Focus Areas were identified and presented to the stakeholders as suitable areas for further investigation based on the need to identify water quality and/or habitat restoration projects. Information considered in identifying these draft focus areas included: stakeholder input, watershed characterization data, the existing conditions model, ground truthing, new growth and development threats and existing initiatives going on within the watershed. Due to the limited amount of time to discuss the focus areas Landmark initially recommended, Bonnie promised to revisit these selections at the beginning of the next stakeholders meeting.

In light of our next meeting (July 30) agenda topic regarding a discussion of how the framework of the assessment may shift. The information presented by Landmark may only be briefly revisited, although copies of the presentation will be available at the July 30th meeting if you missed getting a copy.

Pasquotank River Local Watershed Planning Team

Meeting Announcement & Summary

Our next meeting is <u>extremely important</u>, please do you best to attend!

Next Meeting scheduled for

<u>October 23, 2002</u>

5:30-7:30 PM

Camden County Senior Center

Camden, NC

<u>Agenda Items for our Next Meeting</u>:

- **Review of Watershed Assessment Tweaks to Focus on Watershed Functions**
- **Present NC-CREWS Classifications and Functional Significance (see Homework)**
- **Identify Functional Threats**

Refreshments will be served!

Group Members/alternates present:

- Yates Barber, Pasquotank River Basin Council
- Lloyd Culp, USFWS
- Steve Harrell, City Manager, Elizabeth City
- David Lane, NC Forest Service
- Tom Morgan, Gates Co. Representative
- Liz Noble, ECSU
- Ted Sampson, DCM

Members Absent:

- Mike Bell, US Army Corps of Engineers
- Maurice Berry, Jr., Pasquotank Co. Farmer
- Bobby Brothers, Commercial Fisherman
- Rodney Bunch, Pasq. Co. Planner & Asst. County Mgr.
- Travis Burke, NC Coop. Ext. Service, Pasquotank Co.
- Dwane Hinson, NRCS
- James Fletcher, Weeksville Farmer
- Columbus Grant, Public Works, Elizabeth City
- Kent Luton, JW Jones Lumber Company
- Marie Jenkins, Keep Pasquotank Beautiful
- Carolyn Mahoney, ECSU
- J. Wayne Matthews, Pasquotank River Yacht Club
- Freddie O'Neal, Camden County Coop. Extension Service Dir.
- Bill Prince, Albemarle Economic Development Council
- J.C. Roundtree, Camden County Commissioner & South Mills Farmer
- Chad Thomas, Wildlife Resources Commission

GROUP MEMBERS ABSENT – WE MISSED YOU!
PLEASE SEE BONNIE FOR MISSED MEETING MATERIALS

Support staff & guests present:

- George Wood & Helen Mattioni, Decision Support Professionals (Kill Devil Hills)
- Pat McDowell, Private Consultant for Elizabeth City
- Bonnie Duncan, NC Wetlands Restoration Program

<u>Meeting Minutes for July 30, 2002</u>

Organizational Change for NC WRP, Bonnie Duncan

At the July 30th meeting, Bonnie explained that the NC Wetlands Restoration Program had been moved out of the Division of Water Quality and is now directly under the Secretary of the Department of Environment and Natural Resources Office. This doesn't really change anything for the Local Watershed Planning Team- but it does help further expand the Wetlands Restoration Program's focus beyond water quality, although of course, water quality is still extremely important to the Program and Local Watershed Planning effort. This is really just an organizational change for the Wetlands Restoration Program.

Working with New Consultants, Bonnie Duncan

Bonnie also announced that the NC Wetlands Restoration Program had hired a new consultant to complete the development of a technical watershed assessment for the Local Watershed Planning effort. Bonnie introduced Mr. George Wood and Helen Mattioni of Environmental Professionals and Decision Support Professionals based out of Kill Devil Hills. Bonnie further explained that we will no longer be working with Landmark Design Group on the watershed assessment and Bonnie requested that members not contact Landmark Design Group's staff with questions or for information at this point in time. All questions regarding the assessment or Local Watershed Planning effort should be directed to Bonnie Duncan, with the NCWRP at (919) 733-5315.

Continued on Page 2

"Changes in the Tides": Shifting the Focus of our Local Watershed Plan Assessment, Bonnie Duncan, NCWRP & George Wood, DSPro

Bonnie explained that due to changes in the NCWRP's organization and broader focus on holistically identifying watershed functional losses, that George Wood, of DSPro, would be tweaking the work completed by Landmark Design Group to focus more on watershed functions and functional deficits.

Bonnie started the discussion by emphasizing that our ultimate goal, to assess and restore the watershed will remain the same - we'll just be packaging our product (the assessment) differently.

Bonnie reviewed what work had been done thus far by Landmark Design Group through completion of a draft Watershed Characterization and explained that based on this initial information, George Wood's staff will be augmenting the characterization with additional information.

Bonnie then introduced George Wood, who presented the concept of focusing on functions using oranges. George gave the example of the Department of Transportation (DOT) building a road within a watershed. George explained that if DOT impacts a certain acreage or footage of a watershed feature (i.e. a wetland or stream), the state and federal regulatory agencies may require DOT to replace double the amount of acreage or footage impacted to compensate for losses. Whereas, much like an orange, a watershed has multiple functions. George explained that it may be more important and useful to evaluate the types of watershed functions lost, verses acre to acre or foot to foot losses. For example, if impacts affect and negatively impact the juice of the orange, do we really want to replace the fragrance or peeling of the orange? Or do we want to focus on the nutritional content of the juice and replacing that loss? George used the oranges to point out that it will be important to clue in on what watershed functions are being impacted currently, and could be impacted prospectively by future development within the watershed.

George went on to describe the revised assessment components which will include:

- Subcatchment functional assessment
- Functional Rehabilitation Modeling
- Implementation Plan.

Monitoring efforts will also continue throughout the assessment period and will be used to calibrate models utilized.

For more detailed information regarding George Wood's presentation, please see Bonnie for a hardcopy of the slides presented.

Bonnie explained that the biggest difference between the assessment approach originally taken and what was being presented at the July 30 meeting was that the group would not be prioritizing specific subwatersheds at this stage for field investigation. Rather, George Wood and his staff, utilizing stakeholder input, would be concentrating on all the subwatersheds and which functions are supporting the watershed as they should be and which ones need rehabilitation/restoration. Bonnie explained that the NCWRP feels that this is a more holistic approach and are happy to have the opportunity to work through it with all the stakeholders and George Wood and his expert staff.

Bonnie emphasized that this adjustment will NOT require the Group to start over or reinvent any wheels. Time and input put into the process has been extremely valuable to the development of current products and we will not lose that in this new approach. Information previously generated will absolutely and 100% be integrated into our revised and new assessment products.

In closing, George Wood mentioned that the next steps would include:

- A presentation of the North Carolina CREWS Wetland Classification and functional significance modeling approaches developed by the Division of Coastal Management
- Identifying and refining target watershed functions for each subcatchment
- Prioritizing threats to watershed functions
- Identifying preliminary strategies for watershed rehabilitation and ultimately an implementation plan.

A few comments / questions from the stakeholders surfaced following Mr. Wood's presentation including:

- One stakeholder expressed concern that functions could cross subcatchment boundaries. Need to account for this in the assessment or come up with a new watershed unit to eliminate confusion.
- Another stakeholder asked: "What is a "target function?"

George Wood responded, a "target function" is something realistic to strive for within the watershed. Watershed functions could include water quality, hydrology, habitat, and other functions.

Continued on Page 3

- What is the NC CREWS model and how does it work?

George Wood and Bonnie agreed to provide the stakeholders with some general information explaining the NC CREWS models and how they would be applied through the watershed assessment work.

Please do not hesitate to call or contact Bonnie Duncan if you have any questions about the changes presented at the July 30th meeting. Bonnie's direct phone number is (919) 733-5315 and e-mail address is: Bonnie.Duncan@ncmail.net.

HOMEWORK

Please review the attached summary regarding the NC Division of Coastal Management's NC CREWs model prior to our next meeting.

Our next meeting will not be until **October 23rd and it will be from 5:30-7:30pm at the Camden County Senior Center.** Look forward to seeing you all there!

Pasquotank River Local Watershed Planning Team

Meeting Announcement & Summary

This will be our last meeting of the year, please do your best to attend!

Next Meeting scheduled for

December 3, 2002

5:30-7:30 PM

Camden County Senior Center

Camden, NC

Agenda Items for our Next Meeting:

- **Review of Watershed Functions**
- **Discuss Pictures Taken by Stakeholders (from Homework)**
- **Identify Functional Targets and Threats**

Refreshments will be served!

Group Members/alternates present:

- Yates Barber, Pasquotank River Basin Council
- Maurice Berry, Jr., Pasquotank Co. Farmer
- Rodney Bunch, Pasq. Co. Planner & Asst. County Mgr.
- Travis Burke
- Lloyd Culp, USFWS
- Dwane Hinson, NRCS
- Frank Jennings, DCM
- J. Wayne Matthews, Pasquotank River Yacht Club

Members Absent:

- Mike Bell, US Army Corps of Engineers
- Steve Harrell, City Manager, Elizabeth City
- David Lane, NC Forest Service
- Tom Morgan, Gates Co. Representative
- Liz Noble, ECSU
- Ted Sampson, DCM
- Bobby Brothers, Commercial Fisherman
- James Fletcher, Weeksville Farmer
- Columbus Grant, Public Works, Elizabeth City
- Kent Luton, JW Jones Lumber Company
- Marie Jenkins, Keep Pasquotank Beautiful
- Carolyn Mahoney, ECSU
- Freddie O'Neal, Camden County Coop. Extension Service Dir.
- Bill Prince, Albemarle Economic Development Council
- J.C. Roundtree, Camden County Commissioner & South Mills Farmer
- Chad Thomas, Wildlife Resources Commission

GROUP MEMBERS ABSENT – WE MISSED YOU!
PLEASE SEE BONNIE FOR MISSED MEETING MATERIALS

Support staff & guests present:

- George Wood & Helen Mattioni, Decision Support Professionals (Kill Devil Hills)
- Bonnie Duncan, NC Wetlands Restoration Program

Meeting Minutes for October 23, 2002

Review of Watershed Assessment Shifts to Focus more on Watershed Functions

To begin the October meeting, George Wood reminded stakeholders that the new approach for the watershed assessment entails a more in depth analysis of the intact, threatened and degraded watershed functions, across the watershed. Traditionally, the focus has been to replace acreage for acreage, for example, an acre of wetland impact yielded one to two acres of replacing the same type of wetland. Our focus has now turned to more precisely evaluate what functions within that wetland acre are being impacted, and how to best replace them. This provides us with a more holistic view of the watershed. In addition, this approach allows us to be more creative in identifying opportunities for improving and protecting the Pasquotank River Watershed.

As we begin this shift in focus, George Wood and his staff will be working to augment the Division of Coastal Management's NC CREWS model. This approach will take us from understanding general functions within the watershed (abstract) to specific places these functions exist within the watershed (specific), or where functions are currently threatened or degraded.

Continued on Page 2

Introduction to the NC CREWS Model and Its Significance in the Watershed Assessment Process (George Wood)

There are three primary functions associated with the NC CREWS Model developed by the NC Division of Coastal Management: water quality, hydrology, and wildlife habitat. Each of these functions has defined subfunctions under each one:

Water Quality: Nonpoint Source, Floodwater Cleansing

Hydrology: Surface Runoff, Floodwater Storage, Shoreline Stabilization

Wildlife Habitat: Terrestrial Wildlife, Aquatic Life

Each of these functions and subfunctions is subject to a series of identified threats or risks which could influence the function's integrity, thus influencing the entire watershed. These threats fall under three key categories: landscape character (meaning land use based degradation or physical land features influencing the watershed), water characteristics (meaning, water quality degradation), and replacement difficulty (how replaceable / restorable is the function if lost of degraded?). The follow up actions based on this analysis will lead us to discuss restoration potential (i.e. what actions could be applied to address degradation, or to protect existing resources?).

George then asked stakeholders about the three key functions and what potential threats / risks may already exist within the watershed. Several stakeholders provided input which included:

- Houses are cropping up in areas which were originally farm fields. Some of these housing developments were developed within floodplain areas, causing several of the houses to flood.

- The sources of water feeding into the river should be considered. In 1793, when the canal was dug it significantly affected the discharge of the swamp. Since the Corps rebuilt segments of the canal (including 2 locks, one in and one out) considerable water from Lake Drummond, surface waters, and stormwater have been affected. Chesapeake originally wanted water from the canal to treat for their municipal supply. There are discharge gates now at each lock. How much water is going into the Pasquotank and how much is going into the Elizabeth River? The Corps supervisor watches the locks and operates the discharge gates when opened and closed. Supposedly a "fair amount of water" is discharged at each end – contributing to the Elizabeth River and to the Pasquotank River. Agencies have been struggling for years to improve Norfolk Harbor, so they want all the water they can get to flush it out (via the Elizabeth River). The overriding concern is that water from the canal may be being diverted, influencing the hydrology within the Pasquotank River.

- The canal served to collect much of the surface runoff which takes water out more quickly and diminishes some of the floodwater storage capacity of the wetlands and surrounding swamp.

- Subdivisions going up on Creek Road have no buffers along Knobbs Creek. No silt fences in place and the water in the creek is muddy in this location, as construction continues. It is likely that these subdivision properties will be fertilized, which could contribute even more pollution to the creek. These developments will increase impervious surfaces, potentially enhancing nonpoint source pollutant delivery.

- The reverse osmosis plant Camden County just opened may impact the Pasquotank River. The plant's raw water is from wells, but its output will be brine into the river.

- At Hales Lake, a large area was impounded to collect rainwater to use for irrigating farm fields (in addition to water from drainage ditches). This could be providing a floodwater storage function.

- Wildlife functions can create water quality degradation. Are impacts to wildlife habitat good or bad? It's case specific, depends on location and species being affected.

- Watershed impairment may be a function of landscape position – i.e. beavers, the beavers were here before us.

- As adjacent forest lands are lost around the 100,011 acres of the Wildlife Refuge, it hems the bears into the refuge, preventing them from coming and going, which will stifle their genetic diversity.

- As more land is cleared for farm land, swan and geese populations dramatically increase, but with more development and subdivisions, we're going to lose waterfowl and these populations.

- Canada geese are a real problem (especially with regard to fecal coliform bacteria inputs), and they love fertilized yards, developments and especially golf courses – this could be where we're headed within our watershed. Would be good for these local governments experiencing rapid subdivision and development growth to consider an ordinance to NOT feed the geese, so resident populations are less likely to establish.

- Lots of land within the watershed gets logged out and not replanted – this is a big problem everywhere.

Continued on Page 3

Each of the comments provided will be catalogued under water quality, hydrological and /or wildlife habitat functions and evaluated based on any threats or risk factors which were mentioned by the stakeholders (i.e. landscape, water characteristics, and replacement difficulty). Comments provided by stakeholders from previous meetings will also be catalogued.

HOMEWORK

Stakeholders attending the Oct. 23rd meeting were each given a disposable camera to take pictures of intact, threatened and degraded watershed functions within the watershed. These camera are due on November 22nd with the photo journal pages at Law Offices of HT Mullen, Jr. located at 101 E. Elizabeth Street in Elizabeth City. Please be sure to get your camera in on time so we can prepare for our Dec. 3rd meeting!

The catalog / matrix of water shed functions and threats / risks started at our Oct. 23rd meeting will be completed at our next meeting, based on the photographs taken by stakeholders.

Thanks to you all and hope you each enjoy the Thanksgiving Holidays! Look forward to seeing you each in December!!!

Bonnie

Pasquotank River Local Watershed Planning Team

Meeting Announcement & Summary

Next Meeting scheduled for
February 11, 2003
5:30-7:30 PM
Camden County Senior Center
Camden, NC

Agenda Items for our Next Meeting:
- **Reviewing & discussing remaining pictures taken by Stakeholders**
- **Rank / prioritize identified risks**

Refreshments will be served!

Group Members/alternates present:
- Yates Barber, Pasquotank River Basin Council
- Maurice Berry, Jr., Pasquotank Co. Farmer
- Bill Biddlecome, US Army Corps, Wilmington District
- Rodney Bunch, Pasq. Co. Planner & Asst. County Mgr.
- Travis Burke
- Lloyd Culp, USFWS
- Dwane Hinson, NRCS
- Ted Sampson, DCM
- Dave McHenry, NC Wildlife Resources Commission
- Cindy Lane, USFWS, Great Dismal Swamp NWR

Members Absent:
- Steve Harrell, City Manager, Elizabeth City
- David Lane, NC Forest Service
- Tom Morgan, Gates Co. Representative
- Liz Noble, ECSU
- Bobby Brothers, Commercial Fisherman
- James Fletcher, Weeksville Farmer
- Columbus Grant, Public Works, Elizabeth City
- Kent Luton, JW Jones Lumber Company
- J. Wayne Matthews, Pasquotank River Yacht Club
- Freddie O'Neal, Camden County Coop. Extension Service Dir.
- Bill Prince, Albemarle Economic Development Council
- J.C. Roundtree, Camden County Commissioner & South Mills Farmer

Support staff & guests present:
- George Wood & Helen Mattioni, Decision Support Professionals (Kill Devil Hills)
- Pat McDowell, McDowell & Associates on behalf of Elizabeth City
- Rob Breeding, NC Division of Water Quality
- Bonnie Duncan, NC Wetlands Restoration Program

Meeting Minutes for December 03, 2002

New Introductions

The December meeting began with introducing some new stakeholder participants. Bill Biddlecome a Regulatory Project Manager within the Washington Regulatory Field Office of the US Army Corps of Engineers will be replacing Mike Bell on the stakeholders team. In addition, Dave McHenry will be attending stakeholder meetings representing the NC Wildlife Resources Commission, as Coastal Region Coordinator, Habitat Conservation Section Division of Inland Fisheries.

Rob Breeding of the NC Division of Water Quality was also introduced. Rob has collected and will continue to collect water quality samples throughout the watershed to help us identify water quality concerns as part of the technical watershed assessment.

Review & Discussion of Watershed Functions, Subfunctions and Threats Related to Photographs Taken by Stakeholders

At the Oct. 23, 2002 stakeholders meeting, team members were provided with disposable cameras and asked to photograph locations within the watershed which appeared to be functioning properly and locations which seemed to be threatened or degraded related to water quality, habitat or hydrological functions. The cameras were collected at the end of November and developed into a power point presentation.

At the December 3, 2002 meeting, the stakeholder team reviewed and discussed half of the photographs received. Prior to this discussion, stakeholders were reminded that the review and discussion of the photographs taken, along with the Watershed Characterization clean up work being done by Decision Support Professionals, would help establish broad goals and objectives to proceed with the watershed assessment. The information garnered from the December meeting and the January 2003 meetings will also be used to help guide further investigation and monitoring efforts which need to occur within the watershed.

George Wood then proceeded to review the watershed functions, subfunctions and risks framework to assist stakeholders with categorizing individual photographs.

FUNCTIONS AND SUB-FUNCTIONS

The subfunctions defined and described below under each main watershed function will help us categorize and evaluate the health and status of watershed features and characteristics at various representative locations within the watershed. Watershed features can include intact wetlands, streams, riparian buffer areas, and existing Best Management Practices.

1. **WATER QUALITY FUNCTION**

SUBFUNCTIONS

A. **NON-POINT SOURCE** – as water flows over the land surface (during rain events and storms) water quality degradation can occur as water picks up particulates (such as sediment) and nutrients ultimately flowing into our creeks, streams and rivers. Improvement of water quality can mean removal of particulates and nutrients as water flows over the land surface.

1. **Nutrients** – Addition of nutrients as water moves across land into a water body.

2. **Sedimentation** – Addition of sediment as water moves across land and into a water body.

B. **POINT SOURCE** – as water enters a water body from a distinct source degradation can occur. Addressing this degradation may indicate the need to address the point source. Addressing, evaluating, and monitoring point source discharges is a regulatory function of the NC Division of Water Quality. The NC Wetlands Restoration Program (NCWRP) is a nonregulatory program of the NC Department of Environment and Natural Resources. Although the NCWRP will work with the stakeholder team to identify and generally assess these problems, the NCWRP cannot address these issues with program resources.

C. **FLOODWATER CLEANSING** – ability of a watershed feature (i.e. wetland, BMP, etc.) to remove sediments, nutrients, and toxins which have already entered surface water. These pollutants may have entered the feature by overbank flow from a flooding stream. Size of a watershed feature and surrounding land use type (i.e. urban / rural) could influence this subfunction.

2. **HYDROLOGICAL FUNCTION**

A. **SURFACE RUNOFF STORAGE** – Ability of an existing wetland / BMP to reduce peak high and low stream flows due to storage and slow release of water.

B. **FLOODWATER STORAGE** – Ability of a watershed feature (i.e. wetland or BMP) to temporarily store floodwater to alleviate downstream flooding.

C. **SHORELINE STABLIZATION** – Ability of a shoreline (river bank) to stabilize sediments or dissipate erosive forces.

3. **HABITAT FUNCTION**

A. **TERRESTRIAL** – Ability of a watershed feature (i.e. riparian corridor, wetland, etc.) to provide habitat for terrestrial wildlife species in relationship to its surrounding landscape.

B. **AQUATIC** – Ability to provide in stream and in water habitat for spawning, feeding or predator avoidance for aquatic life in relationship to its surrounding landscape.

RISKS:

1. **LANDSCAPE CHARACTERISTIC:** A risk in which land use affects a watershed feature's ability to function properly.

2. WATER CHARACTERISTIC: A risk in which waters may be subject to high pollutant or nutrient concentrations.

REPLACEMENT/RESTORATION POTENTIAL:

Question to think about: How easy is it to replace or restore the lost function?

Continued on Page 3

Stakeholders were then asked to consider three basic questions as each photograph was reviewed during the power point presentation:

1.What "watershed features" are represented in the photograph (i.e. risks / problems, degradation, threats or pristine setting?)

2.What functions are evident within the photograph? Are they manmade or natural?

3.Do you feel the risk can be addressed? Yes, No or Maybe

Stakeholders worked with George Wood, resource professionals and other stakeholders to answer these questions for each photograph. For each photograph reviewed discussion and comments are summarized below.

Pasquotank Stakeholder Comments 12-03-02
Camden County Senior Center

Picture 1: Located in Pine Lakes near Charlie Brown's property. Heat pump drainage input – could be causing water quality problems, thermal habitat impacts, salinity impacts. Bulkheading in the picture also indicates a habitat impact. Lawn in photo is obviously fertilized, could be a water quality NPS problem. One question, would erosion threaten the integrity of these banks without the bulkheading?

Picture 2: Palin Creek – intake from old Naval Base; tributary of New Begun Creek. Evident loss of NPS pollution control, adjacent to a superfund site, habitat impacts. Impacts appear to be manmade and fixable. A subdivision is planned for this area where there is currently an agricultural field. Manmade. Can the risk be fixed? Possible vegetated buffers, land use controls and remediation of PCBs.

Picture 3: Downspout in a gravel bed, located near the Pasquotank Co. line. Addressing sediment and NPS inputs / impacts. Structure is manmade. Cuts down on erosive forces. Good BMP.

Picture 4: Flooding, stormwater, NPS pollution impacts. Water quality issue. Manhole at this location gets submerged and drop inlets appear to be potentially undersized. Elizabeth City maintains these structures. Backwater from the river floods the streets occasionally. Impervious surface and curb and gutter exacerbate flooding and NPS impacts. City of Washington has a system where city stormwater is diverted and directed to a wetland treatment system. Problems are fixable and manmade via grass swales and water tight man-holes. The issues represented in this slide are City-wide. Influence new development to have better designs for temporary water storage.

Picture 5: Ditches are sloped and culverts appear to be filled – causes stormwater flooding. Grass swales do allow for some NPS pollution filtering and dissipate storm water energy. Pasquotank County does require that ditches be designed for clean-out – but the County currently lacks maintenance requirements for these systems.

Picture 6: Aquatic weeds, in Pine Lakes. Indication of nutrient issue. Provides some aquatic habitat. The problem here may depend more on the type of weed depicted in the photo. Is it noxious i.e. Alligator weed? Couldn't tell from the photo. Natural?

Picture 7: Prior-converted (PC) agricultural land appears to have good riparian buffer. Location is Raymond's Creek on Camden side. Development in photo appears to have drainage issue. Terrestrial habitat in terms of wildlife corridors appears to be intact on both the development and agricultural sides of the creek. Allows for good floodwater storage. Good example of what other new development should do in regards to buffers/wildlife corridor, etc.

Picture 8: Continuation of Pictures 1 & 2, Elizabeth City pump station. Floodwater control structure. Could be upstream restoration potential by enlarging upstream areas to allow for more volume. Non-point pollutants. Possible monitoring location?

Picture 9: Water Street, Hurricane Floyd. Floodwater storage. A study was conducted on Water Street and whether or not flooding could be fixed.

Picture 10: Water Street, sanitary sewer issue, WWTP flooded. Point source. Manmade and could be fixed.

Picture 11: Sediment erosion control fence, allowing NPS to escape site. This picture was taken in Norfolk, VA. Promote BMPs to help remediate issue.

Picture 12: Pasquotank County High School. BMP addressing NPS, innovative over traditional stormwater ponds because of maintenance headaches and risks.

Picture 13: Outfall to address first flush – has maintenance issues. Need an entity to take care of these watershed features and requirements i.e. via stormwater utility resources.

Picture 14: Drop inlet, fixable problem. Has overgrown vegetation and sedimentation issues. Could raise drain system.

Picture 15: Coast Guard Base, contact Joe LeMoth. Photo shows a channelized drainage used to drain airfield. Loss of floodwater storage. Restoration potential. On photo log description indicates photo was

taken on Consolidated Road. Debate is currently going on about how to re-route stream.

Picture 16: Beginning of stormwater management pond on the Virginia/NC line off Hwy 17 N**.** and RT 104. Floodwater and surface water runoff issue. Large retention ponds vs. smaller ponds.

Picture 17: Ag. Land – may be PC land. Stormwater storage. Possible restoration potential?

Picture 18: Subdivision location. Developer obviously placed fill material on site to meet requirements. When storms occur, and swamp floods, house will have a mote around it. Houses are very likely located within the floodplain. Photo was taken along Creek Road, Knobbs Creek subwatershed, however, due to flow restrictions this may not be Knobbs Creek subwatershed anymore. Better planning to prevent subdivision from being developed in floodplains is needed. Mitigate restriction to flow – through requiring better culverts. Mitigate before development.

Picture 19: Snagging project in the Upper Pasquotank River Drainage District project and location. Aquatic habitat impacts. De-snagging can negatively affect DWQ's ability to assess water quality, since analysis is heavily dependent on insect larvae that live under fallen trees and logs within watershed systems. Partner with Drainage District possible? Balance is needed between drainage and habitat.

Picture 20: Floodwater storage area, shoreline stabilization – cypress trees, excellent location. Cypress trees good for stabilization. Wildlife habitat. Possibly look at cypress tree plantings at other locations.

Picture 21: Bulkhead – potential runoff and sediment problem. Reduction of floodwater storage capabilities. Shoreline stabilization.

Picture 22: Area serviced by the City, which needs maintenance. Chinese privet are prevalent which is an invasive species. Good habitat. Location of photo is close to Gaither Pond (upstream), headwaters of this system are located on ECSU's campus (Pond House – it's the Gaither Pond House?).

Picture 23: Riprap, bulkheading has sediment/erosion control features. Located on Riverside. Riprap is better than bulkheading for habitat. See study being completed by Chad Thomas, District Fish Biologist for WRC.

Picture 24: Charles Creek, bulkheading / highly altered. Stormwater storage. Upstream NCWRP restoration site from Charles Creek Park, along Dawson Street (on one side of creek).

Picture 25: Gates Co. / Pasquotank County location. USFWS Refuge off Hwy 158. Habitat functions are evident, and possible impacts attributable to the road.

Picture 26: Beaver dam – near Russell Hull's property along Joyce Creek in South Mills. Habitat versus drainage issues. channelized stream.

Picture 27: Little Flatty Creek – vegetated undisturbed area. Habitat functions. Houses moving into this area – could threaten existing functions. Opportunity for conservation.

The remaining photographs will be reviewed and discussed at the February 2003 meeting. Stakeholders will also be asked to help rank and prioritize watershed risks / threats based on the information and photographs reviewed up to the Feb. 2003 meeting. Look forward to seeing you all there!

Wishing you a warm and flu-free season until we meet again February 11th!!!

Bonnie

Pasquotank River Local Watershed Planning Team

Meeting Announcement & Summary

Next Meeting scheduled for
<u>March 25, 2003</u>
5:30-7:30 PM
Camden County Senior Center
Camden, NC

<u>Agenda Items for our Next Meeting</u>:
- **Rank watershed issues and function for each subcatchment**
- **Community Viz demonstration (compiles all information / data recruited through the assessment process thus far)**

Refreshments will be served!

Group Members/alternates present:
- Heather Allen for Liz Noble, ECSU
- Maurice Berry, Jr., Pasquotank Co. Farmer
- Bill Biddlecome, US Army Corps of Engineers
- Rodney Bunch, Pasq. Co. Planner & Asst. County Mgr.
- Travis Burke, Pasq. Cooperative Exten.
- Lloyd Culp, USFWS
- David Lane, NC Forest Service
- J. Wayne Matthews, Pasquotank River Yacht Club
- Dave McHenry, Wildlife Resources Commission
- Tom Morgan, Gates Co. Representative
- Ted Sampson, DCM

Members Absent:
- Yates Barber, Pasquotank River Basin Council
- Bobby Brothers, Commercial Fisherman
- James Fletcher, Weeksville Farmer
- Columbus Grant, Public Works, Elizabeth City
- Dwane Hinson, NRCS
- Kent Luton, JW Jones Lumber Company
- Freddie O'Neal, Camden County Coop. Extension Service Dir.
- Bill Prince, Albemarle Economic Development Council
- J.C. Roundtree, Camden County Commissioner & South Mills Farmer

GROUP MEMBERS ABSENT – WE MISSED YOU!
PLEASE SEE BONNIE FOR MISSED MEETING MATERIALS

Support staff & guests present:
- George Wood, Helen Furr & Rob Sawyer, Decision Support Professionals (Kill Devil Hills)
- Bonnie Duncan, Jason Guidry, Deborah Sawyer, and Suzanne Klimek NC Wetlands Restoration Program
- Rob Breeding, NC Division of Water Quality

<u>Meeting Minutes for February 11, 2003</u>

Continued Review of Watershed Photographs Taken by Stakeholder Team Members

The stakeholder team continued to review the watershed photographs (started review at the 12-03-02 meeting) and worked to discuss and comment on three basic questions related to these photographs including:

1. What "watershed features": are represented in the photograph (i.e. risks, problems, degradation, threats or does the photo depict a pristine setting)?
2. What functions are evident within the photograph? Are they manmade or natural?
3. If a risk, problem or degradation issues is depicted in the photograph, do you feel the risk can be addressed? Yes, No or Maybe?

Stakeholder discussion and comments regarding each photograph follow:

Photo1: Charles Creek subcatchment, at Tuscarora and Hunter Street. Water quality issues are evident. Creek could be receiving contaminants from the roadway, imperviousness is contributing to the speed of stormwater getting to the creek. Fertilizer inputs could also be a problem at this location.

Photo 2: Little Flatty subcatchment, water quality, habitat and hydrological functions (including floodwater storage and shoreline stabilization) all seem to be evident at this location. Good example of stormwater storage. Cropland in the distance does not provide good stormwater storage because of ditching.

Continued on Page 2

Photo 3: US 158 edge of the Dismal Swamp. Duckweed bloom is evident. Five-six years ago the was a fertilizer truck spill which occurred on 158 due to an car accident – these nutrients could still be affecting this system. In addition, it appears that habitat and hydrological issues seem to be a problem. Water is trapped on one side of Hwy 158 (acts like a dam) and is impacted by the roadway and related land uses. One stakeholder noted 100+ ducks in this area in early February.

Photo 4: Newland Drainage Canal subcatchment, has hydrological issues and is a channelized ditch / stream. The right side buffer strip helps filter excess nutrients and sediment. Farmers enroll in NRCS programs to implement these buffer strips and receive "reward reimbursement" for doing so. Farmers find out about such programs from Soil and Water Conservation Districts and sometimes governmental offices call them. Farmers implement these buffers to help improve water quality and habitat. These buffers provide good wildlife habitat which is important for hunting to many local landowners in the area. Farmers also use soil tests to minimize the amount of fertilizers used to best manage crop production and to maximize cost savings. Through Cooperative Extension Service training, farmers in the area are getting better information about what to use depending on crops. These meetings are on Tues. and Thurs. nights and are focused on various agricultural topics. NC Forest Service also has a cost share program to protect SMZs and for BMPs (Forest Practices Guidelines = law)– helps foresters stay legal. For residential development, there is no concerted effort to manage fertilizer application to land appropriately. This is a key educational issue.

Photo 5: Sawyers Creek subcatchment, photo depicted a bottomland hardwood swamp, old fishing hole. This subcatchment receives a lot of drainage from upstream agricultural areas. Further up Highway 343 (north) is farmland. This location should have good water quality and habitat. The biggest impact here is the boat ramp. This drainage does not pull water from Hales Lake. After Hurricane Floyd, there was loads of algae in this system.

Photo 6: Portohonto Creek (near Shiloh / 343), lots of farmland in this area. Channelized stream, culverts here are cutting off fish migration. How does light affect fish? Mike Street with Division of Marine Fisheries has a study stating that alternative culverts can influence migration and culvert size influences habitat. There is a sand mine near by that discharges into Portohonto – could mean a water quality degradation issue is present. This photo demonstrates the need to show habitat / spawning habitat improvements. Cheap investments for maximum benefits - i.e. culvert alternatives could have huge impacts in this area. Need to go after DOT mitigation dollars to pursue these alternatives.

Photo 7: Cooper Creek subcatchment, creek is channelized with no buffer. Water quality may be good, good crop cover here which years ago would've been tilled. No till practices are really catching on, can plant in field stubble – so one farmer can cover more land. This process may require more chemicals, but allows farmers to cover more land. Leaving stubble 6 or 12 inches higher can provide cover for wildlife to make better habitat. State/federal government offers money to try no till practices and for long term no till commitments. Often times the landowner wants ditches cleaned by leasees – everyone needs educating regarding benefits of participation in these programs. Ultimately, wildlife corridor pockets are hard to connect – they don't provide enough cover. Need more, wider buffers and incentives for them. There is a loss of farmland which is cleared to move booms and so farmers can turn equipment in field. Are woody stems a problem for farmers? No, the mostly use low, shallow root vegetation for stubble. Flash board risers could be used through cost share money – would be popular among farmers. Tilling in ditches from the road to the river leaves a large plume in the water. Soil and Water Conservation and Cooperative Extension Service have been talking more about sloped ditches causing less erosion. This is another key educational issue.

Water Quality Sampling Locations

Following the photograph discussion, Rob Breeding with the NC Division of Water Quality was introduced. Rob asked if there were additional location recommendations where the Division could get permission to pursue sampling – particularly in pristine settings. Rob indicated the need for a "reference reach" in the southern and northern portions of the watershed. Creeks of particular interest were: Newbegun, Little Flatty, Areneuse, Hales Lake, Joyce Creek, Knobbs Creek and Charles Creek. Ted Sampson of DCM, invited Rob Breeding to fly the watershed the next time his agency flew to do reconnaissance work.

See you all next week!

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Pasquotank River Local Watershed Planning Team

Meeting Announcement & Summary

Next Meeting scheduled for

June 3, 2003

5:30-7:30 PM

Camden County Senior Center

Camden, NC

Agenda Items for our Next Meeting:

- **Update on APNEP Grant Application**
- **Presentation of the Draft Community Viz Functional Rehabilitation Model for the Pasquotank River Watershed**
- **Discussion of measurable goals and objectives**

Refreshments will be served!

Group Members/alternates present:

- Heather Allen for Liz Noble, ECSU
- Bill Biddlecome, US Army Corps of Engineers
- Rodney Bunch, Pasq. Co. Planner & Asst. County Mgr.
- Travis Burke, Pasq. Cooperative Exten.
- Carl Classen, Camden Co. Manager
- Lloyd Culp, USFWS
- David Lane, NC Forest Service
- J. Wayne Matthews, Pasquotank River Yacht Club
- Dave McHenry, Wildlife Resources Commission
- Tom Morgan, Gates Co. Representative
- J.C. Roundtree, Camden County Commissioner & South Mills Farmer
- Ted Sampson, DCM

Members Absent:

- Yates Barber, Pasquotank River Basin Council
- Maurice Berry, Jr., Pasquotank Co. Farmer
- Bobby Brothers, Commercial Fisherman
- James Fletcher, Weeksville Farmer
- Columbus Grant, Public Works, Elizabeth City
- Dwane Hinson, NRCS
- Kent Luton, JW Jones Lumber Company
- Freddie O'Neal, Camden County Coop. Extension Service Dir.
- Bill Prince, Albemarle Economic Development Council

GROUP MEMBERS ABSENT – WE MISSED YOU!
PLEASE SEE BONNIE FOR MISSED MEETING MATERIALS

Support staff & guests present:

- George Wood, Helen Furr & Rob Sawyer, Decision Support Professionals (Kill Devil Hills)
- Jim Roberts, Decision Support Professionals (California)
- Jeremiah Asher & Sara Felker, Decision Support Professionals (Michigan)
- Bonnie Duncan, NC Wetlands Restoration Program
- Rob Breeding, NC Division of Water Quality

Meeting Minutes for March 25, 2003

At the start of the meeting, Dr. Jim Roberts with the Decision Support Professionals team was introduced. Jim has diverse experience as an international environmental planning consultant, and is based out of California. Understanding the significance of the stakeholder process as part of the Local Watershed Planning effort underway, he worked with DS Pro Staff and the NC Wetlands Restoration Program to develop what is called a modified Delphi process, which in simple terms is a tool for recruiting stakeholder preferences / priorities for the watershed area as a whole and for various subcatchments identified. This information along with the rankings generated will be used and directly linked to the Community Viz model which will provide the basis for watershed recommendations to come as the planning process continues.

The Community Viz model is a GIS tool which allows multiple data sets to be viewed geographically and will help rank the top issues and potential solution scenarios within each subcatchment based on stakeholder rankings and watershed data collected.

To ultimately feed the Community Viz model, Jim needed to recruit stakeholder rankings concerning watershed issues identified up to this point in the planning process. To accomplish this, Jim passed out a couple of worksheets for stakeholders and provided instructions. The first sheet listed all the issues presented by stakeholders and the data up to now and listed the individual subcatchments delineated. Stakeholders were then asked if any issues were missing from the list. One recommended addition was "logging road removal" but stakeholders agreed that this issue went under the existing "Logging practices" issue. Each issue was briefly defined and stakeholders were asked which specific subcatchments those issues pertained to. Dr. Roberts

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noted which issues pertained to specific subcatchments based on stakeholder responses.

Following this exercise, stakeholders were asked to change gears with regard to their focus on issues within individual subcatchments and were asked to rank all the issues identified for the watershed as a whole (1-25) on a second worksheet. The result, ranked issues in priority order for the entire watershed, were:

1. Residential development
2. Agricultural drainage (includes drainage ditches)
3. Flooding
4. Sedimentation
5. Impervious Surfaces
6. Dike effects
7. Absence of buffers
8. Channelized streams
9. Poor drainage
10. Lawn practices
11. Shoreline stabilization / Erosion
12. Algal blooms
13. Culvert sizing
14. Bulkheading
15. Snagging
16. Beaverdams
17. Logging practices
18. PCB / Allum contamination
19. Invasive species
20. Streambed non-filtering
21. Roadbed stability
22. Drop inlets
23. Brine output
24. Sandmine
25. Heat pump drainage

These ranked issues for the whole watershed were then depicted with the individual issues identified for each subcatchment in table format. Based on this outcome, stakeholders were then asked to rank issues for each subcatchment in numeric order, with the number 1 indicating the greatest significance. Stakeholders were asked to do this exercise for homework and were provided self-addressed stamped envelopes by Decision Support Professionals. This information was due to the Decision Support Professionals office in Kill Devil Hills by April 25, 2003.

The results of this effort will yield a numeric weight for each issue within each subcatchment as well as a weight for the entire watershed area which will be used by the Community Viz model to develop issue and solution priorities for each subcatchment and the watershed area as a whole. This approach will allow stakeholders and the NC Wetlands Restoration Program to focus on the most pressing issues and compromised functions within individual subcatchments, and the watershed as a whole, to purse solutions accordingly. The Community Viz data up to this point will be augmented with on the ground field information currently being collected by Decision Support Professionals staff.

Following these exercises, Jeremiah Asher and Sara Felker were introduced as the designers of the Pasquotank Local Watershed Community Viz modeling effort as part of the Decision Support Professionals team. Sara Felker initiated the demonstration showing how the model would organize data geographically and use data and issue rankings / weightings. Sara explained that Community Viz is to be used as a tool to make decisions but the tool itself will not make decisions for us. Some of the benefits of using this tool include the ability to identify constraints and opportunities, to challenge decisions, and to continue to add new information into the model at any step of the process.

Sara also explained that while this model does account for land use changes, it will not provide development specific decision making power for the local governments. The emphasis for this model is on watershed restoration – not development specifically – which integrates land use and changes in land use generally.

Sara and Jeremiah ran a demonstration of the Community Viz model using various examples to show how different aspects of the tool could be used to analyze, assess and yield results. At the next meeting in June a draft version of the Community Viz model will incorporate Pasquotank River Watershed results up to this point (including the rankings recruited from the stakeholder team) in the planning process.

As Sara and Jeremiah were running the demonstration, one stakeholder asked about how last year's drought and this year's heavy rain would affect the model. Rob Breeding, of the Division of Water Quality also stated that these extreme weather fluctuations were also affecting water quality monitoring results. Bonnie and George explained that although these problems exist and are out of our control, we'll have to do the best we can and base some assumptions on the data we do have up to this point. One other stakeholder asked who would be the keeper of the Community Viz information. George Wood explained that the Community Viz information would be available to all stakeholders as well as local governments.

Pasquotank River Local Watershed Planning Team

Meeting Announcement & Summary

Next Meeting scheduled for

August 20, 2003

5:30-7:30 PM

Camden County Senior Center

Camden, NC

Agenda Items for our Next Meeting:

- **Presentation of Final Community Viz Product**
- **Discussion of potential restoration project types & sites identified**
- **Identification of projects by stakeholders (to be reviewed in Community Viz)**
- **Follow-up on watershed goals and measurable management objectives**

*******Based on all the information presented to you during the planning process, along with your own local insight and experience, please come to the August meeting prepared to discuss potential projects you feel exist in the watershed. Your input is invaluable to us and we'd like you to put some thought into potential opportunities prior to the meeting.***

Group Members/alternates present:

- Heather Allen for Liz Noble, ECSU
- Maurice Berry, Jr., Pasquotank Co. Farmer
- Bill Biddlecome, US Army Corps of Engineers
- Rodney Bunch, Pasq. Co. Planner & Asst. County Mgr.
- Lloyd Culp, USFWS
- J. Wayne Matthews, Pasquotank River Yacht Club
- Dave McHenry, Wildlife Resources Commission

Members Absent:

- Yates Barber, Pasquotank River Basin Council
- Bobby Brothers, Commercial Fisherman
- Travis Burke, Pasq. Cooperative Exten.
- Carl Classen, Camden Co. Manager
- James Fletcher, Weeksville Farmer
- Columbus Grant, Public Works, Elizabeth City
- Dwane Hinson, NRCS
- David Lane, NC Forest Service
- Kent Luton, JW Jones Lumber Company
- Tom Morgan, Gates Co. Representative
- J.C. Roundtree, Camden County Commissioner & South Mills Farmer
- Ted Sampson, DCM

GROUP MEMBERS ABSENT – WE MISSED YOU!

Support staff & guests present:

- George Wood, Helen Furr & Rob Sawyer, Decision Support Professionals (Kill Devil Hills)
- Michael Thomas, Jeremiah Asher & Sara Felker, Decision Support Professionals (Michigan)
- Bonnie Duncan & Suzanne Klimek, NC Wetlands Restoration Program
- Rob Breeding, NC Division of Water Quality

noted which issues pertained to specific subcatchments based

Meeting Minutes for June 3, 2003

APNEP Proposal

At the start of the meeting Bonnie explained that the NC Wetlands Restoration Program (NCWRP) worked with Camden County to submit a grant application to the Albemarle–Pamlico National Estuary Program to implement a rain garden / bioretention area on Camden High School's property (Sawyers Creek Subcatchment). Although the Local Watershed Plan for the Pasquotank River Drainage has not been completed, given that funding would be more limited next year, after consultation with Camden County, George Wood and NCWRP staff, we felt this application needed to be presented for funding. Unfortunately, the project was not selected to be funded by the Pasquotank River Basin Council in June. Since June, Bonnie has worked with the County and her NCWRP colleagues to secure funding for the project through the NCWRP. Although this project will be small in size, it will be located in a prominent location within Camden and will serve as a demonstration Best Management Practice project for others we hope to pursue through the Local Watershed Planning process. Project design for this project will be conducted by Environmental Professionals / DSPro (George Wood) and project design will occur this year.

Community Viz Presentation

Mike Thomas was introduced as part of the Decision Support Professionals Team, and is directing the Community Viz development activities in Michigan. Mike went over the Community Viz model objectives:

- Develop a functional assessment approach to achieve measurable strategies for watershed restoration.

- Evaluate and compare alternative restoration and rehabilitation strategies based on:

  -ecosystem functions and

  -local stakeholder involvement

- Introduce a Functional Rehabilitation Model using Community Viz – for subcatchments and the watershed.

Mike went on to discuss the "functional assessment" components related to the model mainly being centered around the NC Coastal Regional Evaluation of Wetland Significance (NC-CREWS) model. This level of assessment provides ratings for each wetland based on functions including water quality, hydrology and habitat and also describes level of risk to watershed integrity as wetlands are lost. The Community Viz model uses this functional assessment information in combination with stakeholder participation and data and information collected to identify and determine watershed indicators and assumptions.

Indicators are watershed qualities that can be measured and monitored. Assumptions are based on program objectives (Example: a BMP to reduce sedimentation will result in an increase in water quality). Finally constraints must also be considered as factors that must be taken into account when evaluating resources to be managed or management actions. Constraints considered could include physical, chemical, or biological, social, economic, regulatory, etc. limitations.

Mike also presented "next steps" which needed to be completed for the Community Viz model to be complete:

- integrate hydrological models

- incorporate recent water quality monitoring data to provide a new baseline for the watershed

- integrate restoration/rehabilitation opportunities with stakeholder issues across the watershed.

- Develop a training program for local units of government along with other interested parties (**Scheduled for August 21st at the Camden Senior Center from 9am – 12pm**).

Finally, Jeremiah Asher went through a couple of examples to demonstrate how the current Community Viz framework would work. The first step is selecting a watershed area you are interested in (grid areas are ranked by high, moderate or low functional ability). Next, you must select a stakeholder issue (related to impacts), i.e. logging practices, residential development, etc. Then select the impact to treat (sedimentation, etc.). If there is a known or possible constraint, at this point the model will let you know – this step tells us what functions are lacking (based on NCCREWS) and what we can and can not do at a given location. This step provides a critical level of information to consider. At this point in the process you have a new project identified and the model can provide you with the size of the area, removal efficiencies and information related to all other functions. This phase of the process can also provide assumption definitions.

As the presentation / demonstration was occurring, stakeholders asked several questions:

- How does the stakeholder issue ranking feed into the model? The model does not prescribe issues based on ranking because issue rankings may change over time & we want to look at issues on a watershed scale, subcatchmenet scale or site specifically. The current model set up allows us to do exactly this.

- What is the size of the watershed grid squares you initially choose from in the process? 260 acres each, or 3,000 x 3,000 feet, on a subcatchment scale the grid size would be 5 acres or smaller.

- Is slope accounted for when considering sedimentation impact? Yes.

- What software is necessary to run the Community Viz model? ArcView 3.2

- Who can use the Community Viz tool once completed? Local governments could use the tool to place restrictions on new development based on existing and degraded watershed functions that are present, Department of Transportation could use the product, as well as state and federal agencies to identify project opportunities. Finally, this product could be used by regulatory agencies to assess watershed impacts.

- What year aerial photography was used for the model/tool? Aerials used were 1998s. George Wood said we can probably replace with newer aerials if we can get them in the right format for Community Viz. At minimum his staff will do the land use change analysis for Charles and Knobbs Creek since they are the most rapidly developing.

See you all August 20th!

Pasquotank River Local Watershed Planning Team

Meeting Announcement & Summary

Next Meeting scheduled for
December 2, 2003
5:30-7:30 PM
Camden County Senior Center
Camden, NC

Agenda Items for our Next Meeting:

- **Recap of Restoration and Rehabilitation Goals and Objectives**
- **Presentation & Discussion of Restoration and Rehabilitation Opportunities**
- **Plan wrap up schedule and follow up public meeting**

Holiday Refreshments will be served!

Group Members/alternates present:

-
- J.C. Roundtree, Camden County Commissioner & South Mills Farmer
- Ted Sampson, DCM
- Kathlene Fisher, for ECSU

Members Absent:

- Bill Biddlecome, US Army Corps of Engineers
- Rodney Bunch, Pasq. Co. Planner & Asst. County Mgr.
- Travis Burke, Pasq. Cooperative Exten.
- Carl Classen, Camden Co. Manager
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Support staff & guests present:

- George Wood, Helen Furr, Rob Sawyer & Jeremiah Asher Decision Support Professionals (Kill Devil Hills)
- Bonnie Duncan, NC Wetlands Restoration Program
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Meeting Minutes for August 20, 2003

At the August meeting, the final Pasquotank River Local Watershed Planning Functional Rehabilitation Model was presented. The model is set up in the Community Viz software package, a state of the art tool which allows several modeling, data and stakeholder input modules to run at the same time for any given location within the watershed. The model integrates functional assessment components and offers the opportunity to evaluate various restoration / rehabilitation opportunities to determine which application will yield the maximum functional benefits. Jeremiah Asher ran an example restoration site which was identified, delineated the stream corridor using the Model and evaluated it for existing watershed functions and features based on data, stakeholder comments and then various restoration / rehabilitation applications were tested. Each restoration / rehabilitation option provides potential removal efficiency which could be expected from a given application or practice. The example location selected and applied for this demonstration was in the Joyce Creek subcatchment. The issue at the location selected was channelized streams, natural drainage & habitat had been interuppted at this location. The stakeholders were then asked about other potential project locations they were interested in investigating using the Model.

Helen Furr, of DSPro then explained how the Model would be field verified to some extent since the Model would be used to determine locations of watershed functional degradation and also in potential project identification. Other factors considered during field assessment will include, knowledge of site location, acres that drain to a specific site, current land use, gradient / slope, determination about which restoration/rehabilitation practice may be most practicable given existing constraints, or watershed conditions.

Rob Sawyer went on to explain that the field assessment would tell us a great deal about how the model

Continued on Page 2

ties to the real world. The field verification allows us to check the model and fill in additional information where needed. The protocol for field assessment is working well thus far.

JC Roundtree asked if the Model would account for the sediment traps that exist along Joyce Creek. He also mentioned that the traps have been cleaned out twice and that the Corps of Engineers commended their efforts and approach to cleaning the traps. Jeremiah said the Model does not account for the traps along Joyce Creek – but that is a factor which must be considered in evaluating restoration/rehabilitation options within this subcatchment.

JC also mentioned that the drainage district works to remove approximately 8-10 trees in a normal year. This subcatchment has run-off / hydrology issues and stakeholders were concerned about any projects or impacts which would influence adjacent landowners (i.e. crop damage impacts are a large concern).

One stakeholder mentioned that on Styles Road, houses put along Joyce Creek within 100ft. are experiencing flooding issues.

Pat Mc Dowell

Following these exercises, Jeremiah Asher and Sara Felker were introduced as the designers of the Pasquotank Local Watershed Community Viz modeling effort as part of the Decision Support Professionals team. Sara Felker initiated the demonstration showing how the model would organize data geographically and use data and issue rankings / weightings. Sara explained that Community Viz is to be used as a tool to make decisions but the tool itself will not make decisions for us. Some of the benefits of using this tool include the ability to identify constraints and opportunities, to challenge decisions, and to continue to add new information into the model at any step of the process.

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