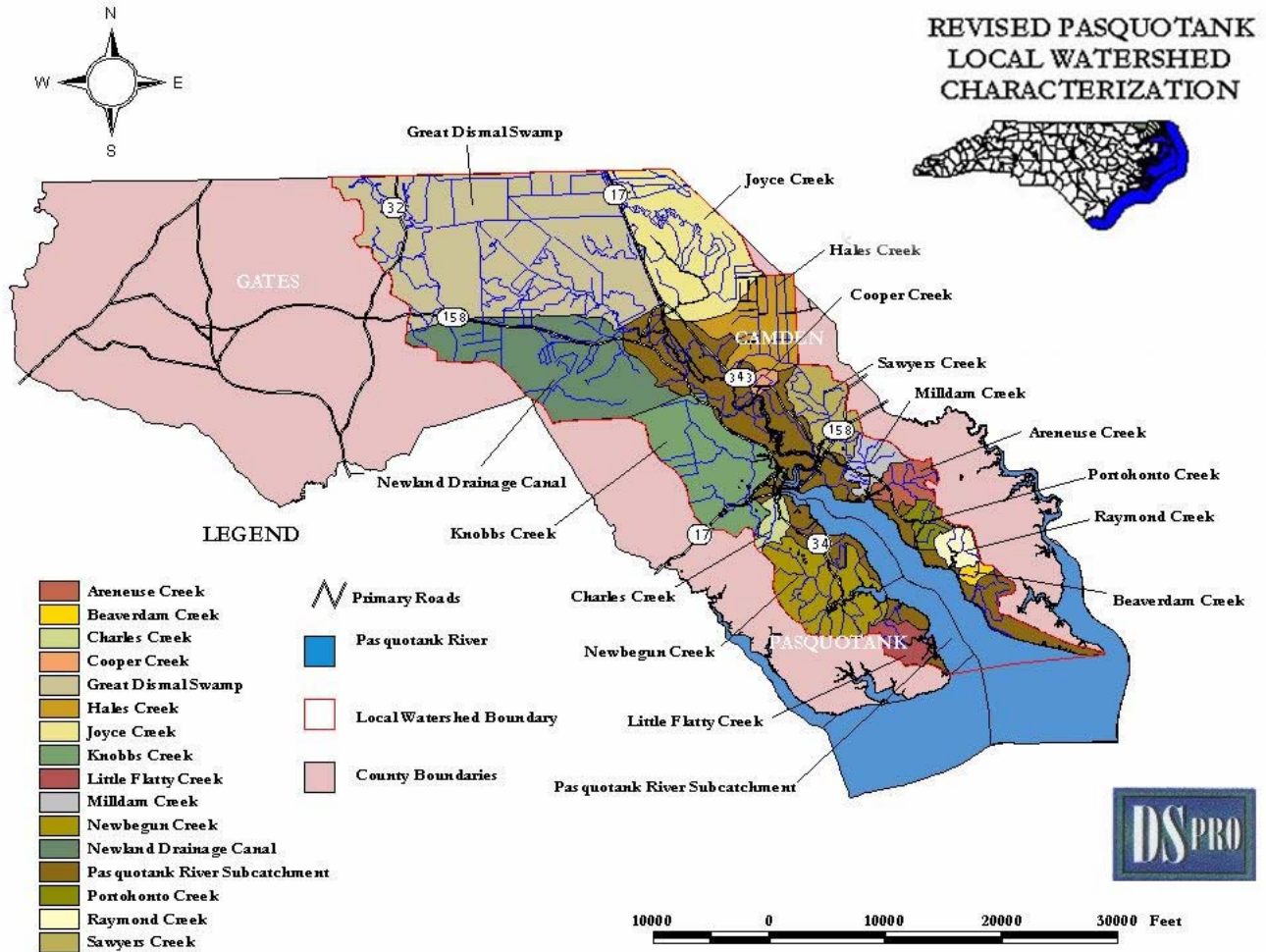


Figure 1: Pasquotank Local Watershed Planning Area



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

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/pasquiriv.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



Joyce Creek 1

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.



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:

- 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.



Sediment Input

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.

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*,

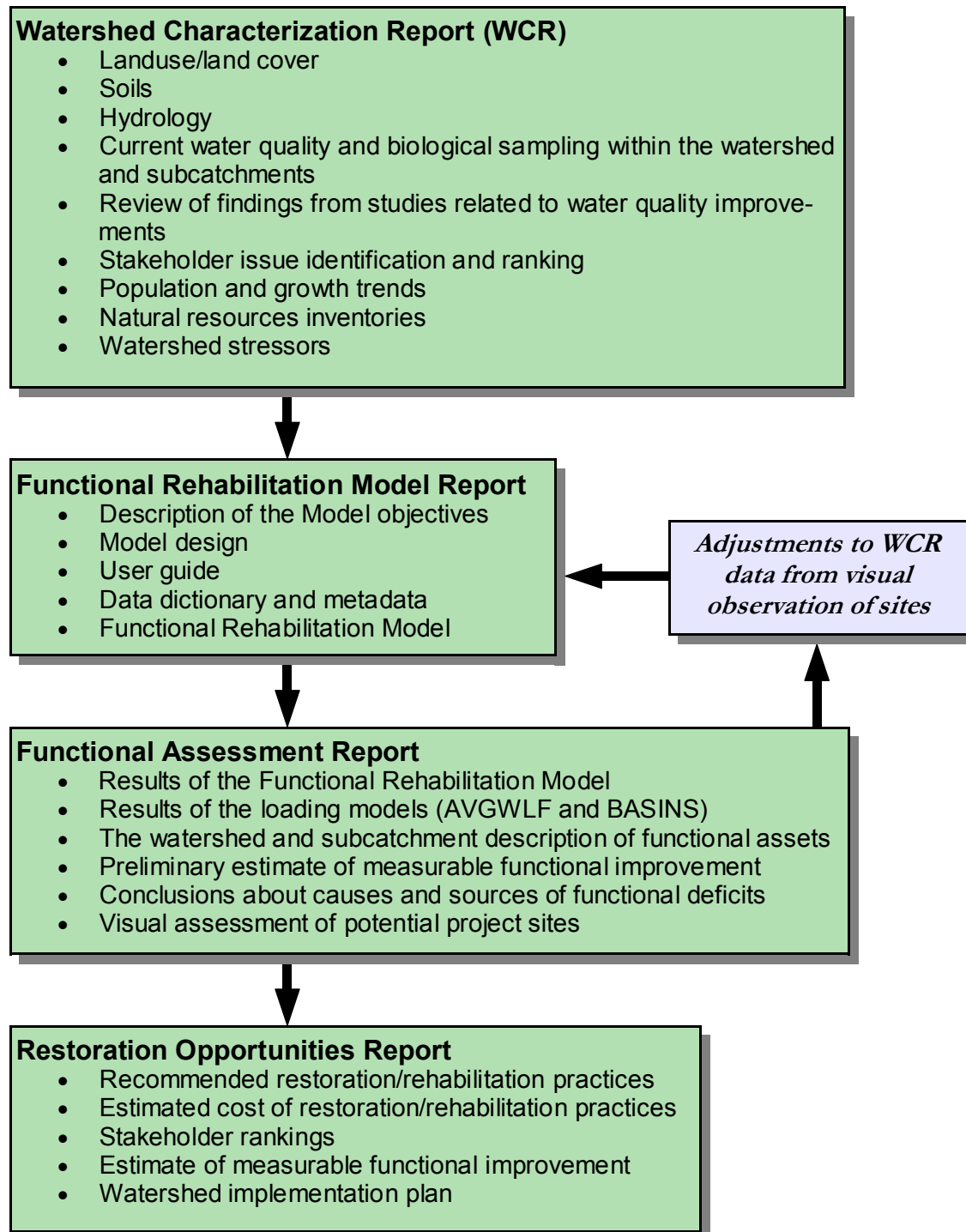


Sawyers Creek 1



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

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.



Elizabeth City

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).
- 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)



Algae Bloom

- 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

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).



Joyce Creek 6

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 files, 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.
- **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.



Newland Drainage Canal 5

- **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 NCDWM 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 NCDRCM 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 NCDWM 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 NCDWM 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)

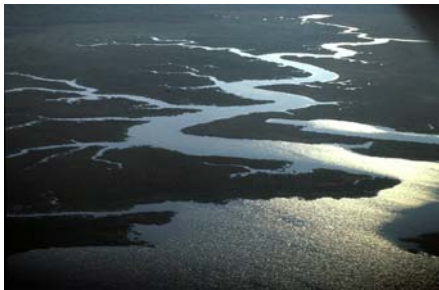
Based upon the results of the GIS data sets, areas that could potentially address the watershed functions impacted from the TIP project exist within the vicinity of the proposed TIP. Review of the entire watershed planning area indicates that opportunities exist that could address the watershed functional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

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.

Charles Creek Project Site

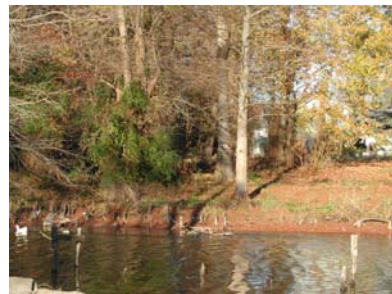


Table 1: Total Restoration/Enhancement Length Recommended for Improvement and Pollutant Removal Expected by Subcatchment

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	Bioretention 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	Bioretention 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/marquette>

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/pasquirivtxt.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://h2o.enr.state.nc.us/wrp/index.htm>

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>*