

Crane's Creek Local Watershed Planning Team
Middle Cape Fear River Basin
June 2005



Crane's Creek Local Watershed Plan Summary

Watershed Education for Communities and Local Officials
NC Cooperative Extension
www.ces.ncsu.edu/WECO

Ecosystem Enhancement Program
NC Department of Environment and Natural Resources
www.nceep.net

Executive Summary

The Crane's Creek Local Watershed Planning Team presents this Local Watershed Plan for Crane's Creek in association with the NC Ecosystem Enhancement Program (EEP). In Spring 2002 Local Watershed Planning was undertaken in the Crane's Creek watershed, of the Middle Cape Fear River basin, containing portions of Moore, Lee, and Harnett Counties. The impetus for the planning process was to identify wetland and stream restoration sites for mitigation due to future road improvements in this area by the NC Department of Transportation. The end result of the process is much greater. Local involvement and support has produced a comprehensive watershed plan to restore and protect the area now and in the future.

The intent of this plan is to outline recommendations which would help this watershed meet the needs of future development while preserving the quality of life already present. More specifically, this plan formulates strategies through the application of appropriate stream/wetland restoration, land preservation, best management practices (BMPs) and land use planning recommendations.

The watershed was initially targeted by EEP because Crane's Creek and its tributaries were listed as 303(d) listed impaired waters. The impairment was thought to be mostly from water quality degradation and impaired biological communities due to non-point source pollution. In addition, a public meeting demonstrated strong local support in the watershed, including local natural resource agencies. Interestingly, the Crane's Creek Local Watershed plan determined that Crane's Creek and most of its tributaries was not significantly degraded and initiated the process for delisting this stream from the 303(d) list. Nevertheless, multiple degraded areas, threatened areas, restoration areas, and preservation areas were identified during the planning process.

Collaborative watershed planning involves anyone who is impacted by or impacts water resource decisions. This process aids the implementation of local watershed plans by incorporating local influences to champion the recommendations to local citizens, industry, agencies and governments. Involving stakeholders from the beginning speeds the overall planning and implementation process by incorporating diverse stakeholders - the more diverse, the more overall acceptance of the final results.

The stakeholder interests in this plan range from government agencies: federal, state, county and local; county and municipal representatives; local residents, advocacy groups, agriculture, and non-government support organizations. The Crane's Creek Local Watershed Planning Team was sponsored by the NC Ecosystem Enhancement Program. The technical watershed assessment was conducted by BLUE: Land, Water, Infrastructure (BLUE: LWI) and the overall Team was facilitated by Watershed Education for Communities and Local Officials (WECO). WECO is a program of NC Cooperative Extension, housed in the Department of Agricultural and Resource Economics at NCSU.

The Crane's Creek Local Watershed Planning Team offers the following fifteen (15) recommendations. The full text of these recommendations and supporting information can be found in the last section of this report, entitled Stakeholder Recommendations.

Recommendations Regarding Stream and Wetland Restoration Opportunities

- 1) **NCEEP should fund and implement identified wetland and stream restoration projects where there is landowner willingness to participate.**

Watershed Wide Recommendations

- 2) **Establish a local sedimentation and erosion control program.**
- 3) **Establish voluntary incentives for agricultural operations to adhere to sedimentation and erosion control programs.**
- 4) **Increase awareness of littering and penalties associated, with road signs.**
- 5) **Encourage the use of agricultural best management practices (BMPs) to reduce nutrient runoff from fields on which chicken litter has been spread.**
- 6) **Encourage local participation in NC Streamwatch groups.**

NC Streamwatch is a voluntary local education program offered through the NC Division of Water Resources. (www.ncwater.org) Streamwatch staff can work with volunteers interested in local streams and waterbodies. Volunteers often include neighborhood groups and schools.

Woodlake Recommendations

- 7) Wood Lake Management should take steps to aggressively reduce erosion at Wood Lake.**
- 8) Wood Lake Management should uphold the covenants stating septic systems shall not be located within 100 feet of the lake.**
- 9) A water quality testing program should be initiated for Wood Lake. Wood Lake Management should take the lead for such an initiative.**
- 10) Boat repairs at Wood Lake should be done out of the water.**
- 11) Grass clippings and other organic waste should not be dumped into Wood Lake or drainage ditches of Wood Lake.**
- 12) The Wood Lake golf courses should maintain a buffer along the lake where possible.**
- 13) Excessive Canada geese populations are a problem at Wood Lake. Steps should be taken to control the Canada Geese population.**
- 14) Excessive aquatic weeds are currently a problem at Wood Lake. Wood Lake Management should take the lead for controlling excessive aquatic weeds (controlling nutrient inputs should be a significant component of an aquatic weed control program).**
- 15) A homeowner education program should be established at Wood Lake.**

Additional recommendations from technical advisors

- 16) Remove Crane's Creek and its tributaries from the 303 (d) list and classify them as supporting streams.**
- 17) Monitor Little Crane's Creek and Cypress Creek for water quality.**
- 18) Establish a copper testing program in the watershed.**
- 19) Preserve the existing two large Significant Natural Heritage Communities in the watershed.**

This Local Watershed Plan is intended to act as living document that the watershed community should revisit and update as changes in the watershed occur.

Crane's Creek Watershed Vicinity Map

Hamett, Lee, and Moore Counties
Towns of Cameron, Carthage,
and Vass, North Carolina
April 2002

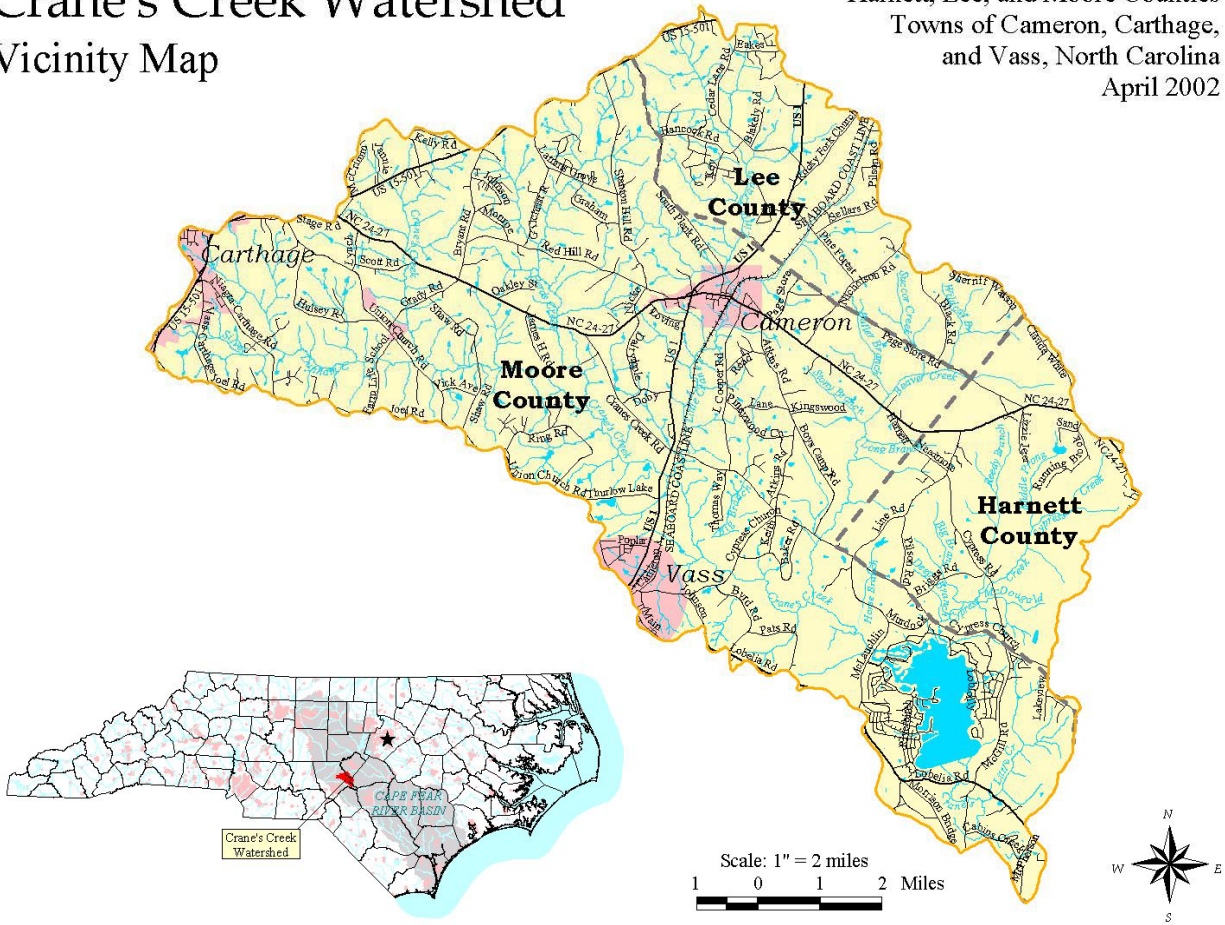


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Crane's Creek Local Watershed Plan 2004

I. The Local Watershed Plan

A. What is a Local Watershed Plan?

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

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

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

B. Why Crane's Creek?

In 2001, NCEEP chose the Crane's Creek watershed in the Middle Cape Fear River Basin as an appropriate watershed for a Local Watershed Planning effort. Planned transportation projects in the middle Cape Fear River Basin require wetland mitigation in this area to offset future potential watershed degradation. The decision to choose Crane's Creek was based on the combination of future mitigation needs and current restoration opportunities. In 2001, Crane's Creek and all of its tributaries were listed on the state's 303(d) list of impaired waters. This is a list of streams that are not meeting their intended uses as classified by the state. A public meeting held in the watershed in Fall 2001 determined that there was local interest in the project.

C. Goals of the Local Watershed Plan

The Local Watershed Planning Process is unique because local community members are asked to help direct state resources that will be spent in their watershed. The framework of the Local Watershed Planning process allows stakeholders to use the state as a technical and funding resource to work toward developing and implementing local recommendations. Without local understanding of the issues and solutions, good resource planning and water quality improvement are difficult to achieve. The insight and experience brought to the Local Watershed Planning process by local citizens and groups who live in the area is irreplaceable and in some cases more valuable than the data, especially when implementation is considered. The Local Watershed Planning process is better able to serve citizens through empowering them with the expertise and resources to make a difference in quality of the water in their own communities and backyards. Stakeholders have a vested interest in working toward water quality

improvement within their watersheds for their own health, safety, enjoyment, and future. Local involvement generates more support for the plan which is developed.

The goals of the Local Watershed Planning Process include:

- To protect and improve water quality by restoring wetland, stream and riparian area functions and values lost through historic, current and future impacts
- to achieve a net increase in riparian zone acreage, functions and values in all NC rivers basins
- to promote a comprehensive approach for the protection of natural resources.
- to educating and empower citizens, with a view toward public involvement and participation

The primary purpose of the Crane's Creek Local Watershed Planning Team was to develop watershed improvement and protection recommendations for the Crane's Creek watershed. To help develop these recommendations, the group provides input at integral points during the planning process.

D. Convening the Team

NCEEP contracted with Watershed Education for Communities and Local Officials (WECO), a Cooperative Extension program based at N.C. State University in the Department of Agricultural and Resource Economics. WECO was contracted to convene a local watershed stakeholder group and facilitate the watershed planning process. NCEEP also contracted with BLUE: LWI, a local consulting firm, to conduct a technical watershed assessment.

A public meeting in Fall 2001 introduced the local area to the watershed planning process and served as the initial contact gathering which was needed to begin the local stakeholder involvement process. WECO later interviewed watershed stakeholders and compiled an initial "Crane Creek Watershed Issue Assessment" to determine how to proceed (available at www.ces.ncsu.edu/WECO), and convened the Crane's Creek Local Watershed Planning Team in April 2002 with a public meeting in the watershed in Carthage, NC.

The following stakeholders participated in the watershed planning process and were party to the final agreements:

*Ken Averitte – NC Division of Water Quality, Fayetteville Office
Deborah Branson – resident / teacher – O'Neal School
Elizabeth Forbes – resident
Gene Frazelle – Wood Lake resident and Woodlake Committee member*

*Jerry Hall – Soil and Water Conservation District – Moore County
Laura Lee Matthews – resident
Hughie White – NC Division of Water Quality
Rosemary Maurath – Wood Lake resident and Woodlake Committee member*

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

*Bert Coffey – Cooperative Extension, Moore County
Russ Hardee – NC Division of Forest Resources
Kevin Williams - SWCD – Moore County
Angela D. Little - USDA , NRCS – Moore County
Harry Huberth – Moore Force
Vince Zucchini, SALT-Sandhills Area Land Trust
Carol Lucas – Town of Cameron
Doug Hawkins – Town of Cameron
Sue Phillips - Cameron Planning Board
Mark Womble - Mayor-Cameron
Jeff Jones - Moore County Planning Dept.
Gary Thomas – business owner*

*Robert Fowler - Woodlake Country Club
Harold Brady, Consulting Forester
Gray Boyette - Landstar Properties
David Cummings - Farmer
Billy Campbell - Farmer
James Ray Pilson - Farmer
Joseph Matthews - landowner
C.H. "Pat" Blue - landowner
Doris L. Blue - landowner
Marsh Smith, landowner
Cy Wilcox - landowner
David Cooley – resident / teacher – Union Pines High School
Jessica Baker - student-Union Pines HS
Matthew Bean - student-Union Pines HS
Hunter Boyette - student-Union Pines HS
Kelly Callahan - student-Union Pines HS
Jessie Ferrel - student-Union Pines HS
Jamie Gumm - student-Union Pines HS
Shanna Gwyn - student-Union Pines HS
Lauren Israel - student-Union Pines HS
Cori Johnson - student-Union Pines HS
Amanda Kellis - student-Union Pines HS
Martin Locklear - student-Union Pines HS
Garrett Lynn - student-Union Pines HS
Darlene Newton - student-Union Pines HS
Scott Schwartz - student-Union Pines HS
George Simoni - student-Union Pines HS
Joe Wood, - student-Union Pines HS
Jeff Boyles - student, O'Neal School
Jade Frank - student, O'Neal School*

The following technical support team was involved at different times throughout the planning process:

*Mary Lou Addor – Natural Resources Leadership Institute
Patrick Beggs – Watershed Education for Communities and Local Officials
Rob Breeding – NC Division of Water Quality
Leon Danielson – Watershed Education for Communities and Local Officials
Jason Jolley – Watershed Education for Communities and Local Officials
Suzanne Klimek – NC Ecosystem Enhancement Program
Bonnie Duncan - NC Ecosystem Enhancement Program
Christy Perrin – Watershed Education for Communities and Local Officials
Scott Pohlman – NC Natural Heritage Program
Jim Stanfill – NC Ecosystem Enhancement Program
Phillip Todd – NC Division of Transportation
Tom Blue – Blue Land Water Infrastructure
Brian Smith – Blue Land Water Infrastructure
Amber Coleman - Blue Land Water Infrastructure
Deborah Amaral - guest – Cape Fear River Assembly*

II. The Technical Watershed Assessment

To be able to assess all aspects relating to natural resources in the watershed, BLUE: LWI, a local consulting firm, was contracted by NCEEP to conduct a technical watershed assessment.

The primary goals of the technical watershed assessment were to:

- 1) Identify the sources of water quality problems associated with Crane's Creek and its tributaries
- 2) Locate high quality restoration sites for mitigation needs that alleviate or eliminate the major problems identified during the plan.
- 3) Improve the overall water quality in the watershed
- 4) Protect the watershed against possible future water quality degradation

Objectives included:

- evaluating the current condition of the watershed and identify threats to watershed functions
- gathering information to assist with future planning to maintain or improve the watershed's current environmental state.
- giving guidance into how future watershed degradation may be avoided
- providing a baseline of existing water quality information
- determining if the problems identified merited restoration, enhancement, preservation, best management practices (BMPs) or policy recommendations,
- developing effective strategies for solutions.

The technical assessment was conducted in conjunction with the Local Watershed Planning Process. With the recognition that local experience and expertise is necessary to compile a complete picture of the watershed, the Crane's Creek Local Watershed Planning Team (hereafter referred to as the Team), reviewed components of the technical assessment, weighing in and providing feedback on data collected throughout the planning process. Besides BLUE: LWI's own work, the technical watershed assessment includes work from the NC Watershed Assessment Restoration Program, the NC Division of Water Quality Bioassessment Unit, and the Moore County Soil and Water Conservation District Sedimentation Study.

This process began with data collection and baseline assessments of conditions in the watershed, resulting in the report titled: "Initial Assessment: General Watershed Characterization", available from NCEEP. Field survey work was conducted to characterize potential restoration sites which were identified. BLUE: LWI then produced the "Final Watershed Analysis." This is available from NCEEP and contains all the relevant data and conclusions from which recommendations were made. The watershed assessment reports are summarized below. The data in these reports were presented to the Team for review and considered by the Team when drafting the recommendations for this Local Watershed Plan. The Team's recommendations are found in the last section of this plan, Section III E. The initial scope of the state's contract with BLUE called for water quality modeling. The preliminary characterization of the watershed showed there were not many water quality problems present, and that water quality modeling would not be needed in this watershed.

A. Preliminary characterization and findings

While the group was learning about watershed issues, BLUE: LWI compiled a General Watershed Characterization. The report details the character of the watershed and its existing conditions, in addition to determining where future assessment efforts were needed.

The Crane's Creek watershed is located within the Cape Fear River (subbasin 03-23-16 as numbered in the NC DWQ Basinwide Planning Program.) The NCDWQ index number for Crane's Creek is 18-23-16. The Crane's Creek watershed consists of two USGS 14-digit Hydrologic Units. Based on soil type, it is

located in the Sandhills region of the coastal plain and comprises 101 square miles within Harnett, Lee and Moore Counties. Moore County towns, Cameron, Carthage and Vass, fall within the watershed, with Cameron being the only town completely in the watershed.

Crane's Creek Watershed consists of 250 miles of streams and 5524 acres of wetlands. Land Use/Land Cover data supports that the watershed is rural in character. 1.3 % of the watershed can be considered "developed" while approximately 78% is forested. Although 72% of the watershed is zoned agricultural, only 12% of the watershed is actually cultivated. Agriculture in the watershed includes 98 poultry houses and two swine operations.

Crane's Creek watershed, at a population density of 92 people per square mile, falls below that of all 3 of the counties forming it and the state of NC as a whole, with a population density of 165 people per square mile.

The NC Natural Heritage Program (NHP) tracks natural communities as well as individual species. Crane's Creek watershed is situated close to some important conservation areas, including Fort Bragg, Sandhills Gamelands, Weymouth Woods, and the Calloway Tract. Some NHP species and communities fall within watershed boundaries with many others in very close proximity. Several endangered and rare species exist within the watershed. Four animal species and 5 plant species are found in the watershed.

The watershed is dissected by several major roads. US Highway 1 runs north-south near the center of the watershed. NC Highway 24-27 runs east-west through the watershed. US Highway 15-501 runs along the northwest boundary and NC Highway 690 runs along the southern boundary. The watershed contains 282 miles of total roads. The Seaboard Coastline Railroad parallels US Highway 1 through the watershed. Most of these roads are scheduled for transportation improvements, thereby likely increasing traffic and development in the watershed.

Crane's Creek watershed lies within a larger watershed which is defined as a water supply watershed, listed as WS-III. Surface waters are classified according to their best intended uses and protection follows those uses. WS-III indicates the best use of the water is for potable water supply. WS-III includes protection of all class C uses also. Class C denotes waters protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, agriculture and other uses. Secondary recreation includes wading, boating, and other uses involving human body contact with water in an incidental manner. There are no restrictions on watershed development or types of discharges.

The Clean Water Act requires states to evaluate whether waters are able to support their intended uses, with ratings of fully supporting (FS), partially supporting (PS) or not supporting (NS). Waters that are rated PS or NS are required to be placed on a list of Impaired Waters, named for Section 303(d) of the Clean Water Act. Its impairment is the reason it is placed on the list.

During the initial watershed characterization, Crane's Creek, from its source to Wood Lake was listed on the state's 303(d) list of impaired waters since it was not supporting its State designated uses. According to Division of Water Quality documents, Crane's Creek was considered partially supporting (PS) because of an impaired biological community. The Division of Water Quality had identified Instream habitat degradation associated with agricultural nonpoint sources as a possible cause of impairment. DWQ generally encourages the implementation of agricultural best management practices to reduce potential impacts to surface waters.

B. Final Detailed Watershed Assessment

The "Final Watershed Analysis" by BLUE: LWI is available from NCEEP.

Several monitoring stations for water quality, sediment, benthos and fish were established through the watershed by Moore County Soil and Water Conservation District (SWCD), the NC Watershed Assessment Restoration Program (WARP), the NC Division of Water Quality Bioassessment Unit (DWQBU), and BLUE: LWI. Data collected provided input on rainfall, stream flow, nutrient and sediment loading, as well as biological communities. This data provides insight on existing conditions. All sampling was affected by the drought of 2002 which caused an extremely dry year with low flow streams and water levels. Low water conditions prevented the collection of data at many sites over the duration of the study.

period. More time and data is needed during average rainfall years to make conclusive decisions in regards to sedimentation issues existing in Crane's Creek watershed.

Based on 2002 sampling data, WARP identified several areas of interest and concern within the watershed:

- Low pH, acidity, was found in Cypress Creek and Beaver Creek. Observations in the upper reaches of these streams suggest acidic swamp-like water quality may be natural for these areas.
- Poor water quality and high nutrients in Cypress Creek. Observations of the upper reaches suggest that agricultural spraying of animal waste is likely to be contributing to the high nutrient levels and poor water quality.
- Chlorine was found at two sample sites downstream of Wood Lake, which is downstream of a wastewater treatment plant (WWTP). Control tests in other areas of the watershed also tested positive for chlorine, suggesting the possibility that the first two sample sites may have yielded false-positive results. Further investigation into the test used determined that naturally found manganese may have caused the false positive chlorine results.
- Some Low Dissolved Oxygen, DO, readings were likely due to the drought and resulting low flows and the naturally occurring swamp like conditions that exist in various portions of the watershed.
- Suspended residue was found to be very low in the watershed.
- Insect sampling, part of the benthic macroinvertebrate sampling conducted by DWQBU resulted in low numbers in Little Crane's Creek. The diversity and composition of macroinvertebrates suggested that Little Crane's Creek's waters may be stressed as the species present are usually found in areas that have fair water quality. The Stakeholder and WARP Teams recommended that additional monitoring be conducted in the future. Specific reasons for the fair aquatic species could not be determined but there was a general concern that Little Crane's Creek was susceptible to becoming a nonsupporting and degraded stream.

Summary and important points from final assessment

Overall, the Crane's Creek identified Little Crane's Creek, Cypress Creek, and Woodlake as the areas of most concern. Both nutrient and sediment levels were higher at these sampling points. The results of the watershed analysis showed the watershed to be in surprisingly good shape. The water quality monitoring data show the need for increased protection from buffer loss and sediment loading. This can be accomplished with the use of restoration projects and best management practices (BMPs). Stormwater and agricultural BMPs can be implemented to reduce and filter runoff. This would reduce the higher concentrations of sediment and nutrient levels found after storms. Currently, the watershed is relatively undeveloped, but with population growth significantly expanding and transportation improvements being undertaken, measures need to be implemented to protect and preserve the watershed.

- Zoning regulations could promote the preservation of existing buffers and the containment of stormwater on site.
- It appears the inclusion of Crane's Creek on the 303(d) list of impaired waters was not warranted. It is the only stream in the watershed listed as impaired and further data have not supported its inclusion. The Crane's Creek Stakeholder team recommended that Crane's Creek and its tributaries be removed from the state's 303 (d) list and be considered supporting streams. In 2004, the Division of Water Quality did this and today, Cranes Creek and each of the tributaries are listed as supporting their water quality classifications.

- The Sandhills are a distinct ecological and hydrophysiographic region and must be assessed as such. Data collected from other coastal plain sites should not be used to judge the Sandhills area.
- Limited stream and restoration opportunities exist in watershed. It is important then to implement available projects and promote the preservation of the watershed's current water quality condition.
- Water quality protection regulations are relatively minor or absent in area.
- Significant opportunity for preservation, buffers, and best management practices exist in the watershed.
- The 2002 drought affected monitoring and sampling during the study period
- Significant development pressures and development potential exist in the watershed.

C. Potential Stream and Wetland Restoration, Enhancement, and Preservation Sites

The Crane's Creek LWP conducted three major investigative initiatives at identifying potential stream and wetland restoration, enhancement and preservation sites in the Crane's Creek Watershed

- A preliminary GIS based Assessment
- A comprehensive GIS Based Cataloging Unit Wetland Assessment Map
- GIS Based Site Specific Identification of Potential Stream and Wetlands Restoration and Enhancement Sites.

Preliminary GIS based Assessment:

Blue Land Water Infrastructure conducted a preliminary GIS based Potential Stream and Wetland Restoration and Enhancement map of the watershed area. The results identified 56 separate potential sites for restoration, enhancement, preservation, or BMP installation. The best of these are being field evaluated by the Ecosystem Enhancement Program for potential implementation. This assessment was done quickly in the beginning of the project. Unfortunately, most of the sites identified during this Phase 1 attempt were not viable projects because they were not sufficiently degraded to qualify as restoration or enhancement or because they were not feasible due to size or other constraints.

A comprehensive GIS Based Cataloging Unit Wetland Assessment Map:

Blue Land Water Infrastructure was tasked as part of their Technical effort on the Crane's Creek Local Watershed Plan to develop a Cataloging Unit sized digital GIS data of wetlands and streams and potential wetland and enhancement projects. This data and maps of the results are now available from the Ecosystem Enhancement Program. www.nceep.net

GIS Based Site Specific Identification of Potential Stream and Wetlands Restoration and Enhancement Sites.

The Ecosystem Enhancement Program and Blue Land Water Infrastructure collaborated to acquire and analyze GIS data to identify potential site specific stream and wetland restoration and enhancement projects. The results are summarized below:

Wetland Restoration	
Number of Sites	30
Average Size	5 acres
Mode	3.5 acres
Total Acreage	150.6 acres
Size of Potential Sites	Number of Sites
0-2 acres	8
2-4 acres	10
4-5 acres	4
> 5 acres	8

Stream Restoration	
Number of Sites	46
Average Size	1,118 ft
Mode	847 ft
Total Length	51,434 ft
Size of Potential Sites	Number of Sites
> 1000 ft	19
> 2000 ft	6
> 3000 ft	1

Of these sites, 13 wetland and 18 stream sites were prioritized for initial landowner contact and field site evaluation by Ecosystem Enhancement Program Staff. The Cranes Creek Local Watershed Team recommended that EEP implement each of the sites that were of good quality and where landowners were willing to participate.

III. Stakeholder Involvement Process

Watershed planning involves many different aspects of the physical and social environment we live in. Some factors that need to be considered include ownership of the land, planning for development, quality of the environment, quality of life, wildlife habitat and protection of resources. Stakeholder involvement is an important key to successful collaborative local watershed planning. Stakeholders can be a local source of information which would otherwise be unavailable.

One of the most important arguments for collaborative watershed planning is the inclusion of stakeholders who may champion future support for the watershed plan. Locally generated ownership of a watershed plan can help convince government and private decision makers of the importance of the recommendations.

Involving stakeholders in a collaborative planning process requires some training and education, but the time invested is usually gained back when implementing the plan.

D. Training in Collaborative Problem Solving Skills

The Natural Resources Leadership Institute (NRLI) of NCSU provided training about the principles of collaborative problem solving, principled negotiation, conflict resolution, and the basics of consensus decision making. Local watershed planning seeks to obtain the best possible outcomes, which is a function of involving diverse stakeholders. Integrating the interests and ideas of various participants with the technical and scientific data yields decisions that are often more innovative and, more importantly, better supported by stakeholders than decisions based solely on technical and scientific criteria. The training provided by NRLI prepared the team to make decisions that incorporate the various interests. The Team learned to separate their interests from their positions, with a goal toward the best possible solutions. Negotiations do not always result in agreement, nor is it always its purpose. The purpose of negotiation here is to explore whether participants' interests can be satisfied better through agreement, resulting in a successful plan, or by each participant pursuing their own goals individually.

E. Identification of Important Local Issues

WECO staff led the Team through exercises to help them identify issues of concern in the watershed. The Team was given disposable cameras and photo log sheets. They were asked to take pictures of things in and around the watershed that concern them. Both positive and negative issues were captured.

These pictures were shared with everyone on the Team, which then presented them along with their concerns. The entire list of concerns is found in Appendix A. The concerns were categorized into the following topics:

1. Water Supply / Irrigation
2. Runoff / Buffers
3. Agriculture
4. Development
5. Sediment
6. Trash / Dumping
7. Wood Lake-specific concerns
 - a. Sediment
 - b. Septic systems
 - c. Bulkheads
 - d. Erosion
 - e. Buffers
 - f. Dumping
 - g. Aquatic weeds
 - h. Avian Vacuolar Myelinopathy – a disease of birds found to exist at Wood Lake.
Information can be found at: <http://www.mvk.usace.army.mil/offices/od/odm/avm/>

F. Mutual Education of Team

After the Team identified their issues of concern, WECO and NCEEP helped find sources of information to educate the Team. Sharing a knowledge base about potential problem sources is an important step in collaborative problem solving. In order for the Team to choose effective watershed improvement solutions, they needed to have a mutual understanding of the problems and of their fellow Team member's concerns. In addition to sharing interests with one another, the Team participated in an educational process which included the topics listed below. A complete list of information presented to the Team is available on the WECO website: www.ces.ncsu.edu/WECO.

Partial List of Presentations given during the Local Watershed Planning Process:

- Local Watershed Planning: Objectives and Goals – NC EEP
- Collaborative Watershed Planning – NRLI
- General Watershed Characteristics – BLUE: LWI
- NC Transportation Improvement Program – NC DOT
- Technical Assessment: Preliminary Findings – BLUE: LWI
- Water Quality Updates – NC Watershed Assessment and Restoration Program
- Sediment Study Update – Moore County Soil and Water Conservation District
- Areas of Natural Significance in the Watershed – NC Natural Heritage Program
- Restoration Sites in the Watershed – NC EEP

Training of High School Students

In addition to the stakeholders involved in the planning process, two groups of students from 2 high schools participated when possible. Two stakeholders were science teachers, one each at Union Pines High School and O'Neal School. When available they brought students with them to the planning meetings. Students were able to learn about collaborative problem solving and local watershed planning

firsthand. The students learned how science, government, and civic duty can interact to solve problems locally.

G. Stakeholder Input

At key points during the planning process, the Team was asked for its input. This information was used by BLUE: LWI, EEP, and WECO to better design a planning process that works for this community. In addition, local input was very important when contacting landowners.

The bypass expansion of US Highway 1 through the watershed prompted some local newspaper articles. After investigations by the NC Division of Water Quality (DWQ), Notice of Violation (NOV) was presented to the NC Division of Transportation (DOT). This NOV outlined the possible water quality violations associated with the Route 1 bypass. The stakeholders expressed concern over this issue. They sought more information about it, and wanted to share their concern with the state agencies. NC EEP provided the public NOV to everyone and explained the process being used to resolve the issue to the stakeholders. The Fayetteville Regional Office of DWQ is the contact for this issue.

H. Stakeholder Recommendations

Recommendations Regarding Stream and Wetland Restoration Opportunities

- 1) NCEEP should fund and implement identified wetland and stream restoration projects where there is landowner willingness to participate.**

Wetland, stream, and riparian buffer restoration/enhancement projects can contribute to water quality protection and can improve water quality and aquatic habitat. The Cranes Creek Local Watershed Planning process has identified 13 wetland sites and 18 stream potential restoration sites where water quality, habitat, and other environmental functions could be improved.

Watershed Wide Recommendations

- 2) Establish a local sedimentation and erosion control program.**

These programs can be fee supported. They allow local governments to control their own fate better, using state standards, or stricter local standards. The NC Sediment Erosion Control Commission has money for start up costs. The Division of Land Quality and the Commission encourage local ordinances. In addition, they provide a lot of technical assistance to accomplish the goal.

The following items should be present in a successful sedimentation and erosion control program:

- a) Hold Sedimentation and Erosion Control Workshops for contractors, engineers, and developers.
 - b) Hold Soil Watch Workshops for local volunteers. The purpose of Soil Watch workshops is to train volunteers to make sure sedimentation and erosion control practices are being properly employed. (This is similar to NC's Stream Watch Program.)
 - c) Establish a sedimentation and erosion control certification program for contractors, engineers, and developers. This could stem from the workshops mentioned in 1a.
 - d) Require a certified responsible party on-site. One of the most important keys to ensuring that best management practices are properly installed and maintained is having a certified, responsible party on-site. Local governments could require this on all construction sites with land disturbing activities above one acre or could use different criteria such as the size of the land disturbance, sensitivity of the area, proximity to streams, and existing water quality of the streams.
- 3) Establish voluntary incentives for agricultural operations to adhere to sedimentation and erosion control programs.**

The construction of chicken houses is exempt from sedimentation and erosion control ordinances, due to their agricultural status. Voluntary incentives, which include protecting the Crane's Creek Watershed, should be made available to agricultural construction operations. This includes horse farms that fall under agricultural exemptions for sedimentation and erosion control.

4) Increase awareness of littering and penalties associated, with road signs.

Dumping and littering is a problem in the watershed, especially around bridges. An educational component will help stem this problem. Signs should be in English and Spanish. Fines could be earmarked for a litter education program.

5) Encourage the use of agricultural best management practices (BMPs) to reduce nutrient runoff from fields on which chicken litter has been spread.

Copper has been found in streams in the watershed. Increased levels of copper could be toxic. Due to the proximity of chicken farms to the affected streams, the most likely source is chicken litter which is spread on the fields as fertilizer. Copper is found in chicken feed and subsequently in the litter removed from the chicken houses and spread on fields. Adding alum to the chicken litter has been found to reduce the runoff of nutrients from those fields. Phosphorous, copper, iron and zinc runoff was found to be decreased when alum was added to chicken litter. In addition, alum added to chicken litter increases production by reducing ammonia released from chicken manure into poultry house air. This improves breathing conditions for birds and poultry house workers. Also, improved feed conversion was found in chickens grown on alum-treated litter. (Moore and Sauer-1998, <http://www.ars.usda.gov/is/AR/archive/jun98/manu0698.pdf>) (US EPA Non-point Source News Notes, Issue 45, Notes on Agriculture, "Alum Improves Poultry Litter", June 1996)

6) Encourage local participation in NC Streamwatch groups.

NC Streamwatch is a voluntary local education program offered through the NC Division of Water Resources (www.ncwater.org). Streamwatch staff can work with volunteers interested in local streams and waterbodies. Volunteers often include neighborhood groups and schools.

Woodlake Recommendations

7) Wood Lake Management should take steps to aggressively reduce erosion at Wood Lake.

This includes, but is not limited to: shoreline erosion due to wave action and lack of buffers, and erosion and sedimentation due to construction. The following areas may be useful to Wood Lake Management. An initial source of information for all these is the NCSU Department of Biological and Agricultural Engineering. (<http://www.bae.ncsu.edu/programs/extension/proindex.html>)

- a) Stormwater management
- b) Shoreline best management practices (BMPs)
- c) Sedimentation and erosion BMPs

8) Wood Lake Management should uphold the covenants stating septic systems shall not be located within 100 feet of the lake.

There is increasing financial pressure among Wood Lake landowners and developers to lessen the 100 foot covenant. If this occurs, septic fields will be located too close to the lake.

9) A water quality testing program should be initiated for Wood Lake. Wood Lake Management should take the lead for such an initiative.

Wood Lake is the catch basin for the Crane's Creek Watershed. This includes agricultural runoff, septic fields, non-point source pollution from golf courses and residences. Wood Lake itself is the heart of the Wood Lake community, providing recreation in the form of fishing, swimming, viewing, and wildlife habitat, all of which could be damaged as a result of diminished water quality. In addition,

Wood Lake is a source of water for those downstream and should thereby be protected. Other factors which give credence to water quality testing include the presence of AVM and the shallow depth of the lake, which allows for greater heating of the water. The following should be tested: fecal coliform, turbidity, temperature, oxygen, conductivity, nutrients, Mercury, pH.

10) Boat repairs at Wood Lake should be done out of the water.

Repairing boats in the water does not allow for proper containment of chemicals, oil, and other pollutants.

11) Grass clippings and other organic waste should not be dumped into Wood Lake or drainage ditches of Wood Lake.

Organic matter such as grass clippings, raises the nutrient level of the lake, and lowers the oxygen level. A specific yard waste disposal site could be designated within the Wood Lake community for residential and management use.

12) The Wood Lake golf courses should maintain a buffer along the lake where possible.

This would require specification of a minimum height and width, dependant upon the available literature, to maximize water quality protection.

13) Excessive Canada geese populations are a problem at Wood Lake. Steps should be taken to control the Canada Geese population.

A population of Canada geese has become non-migratory at Wood Lake. Working with the Wildlife Resources Commission, Wood Lake management should investigate possible ways to minimize the nuisance. (One such way can tie into buffers in #'s 1 and 6 above. Tall grass can inhibit geese from exiting the water onto golf course lawns.)

14) Excessive aquatic weeds are currently a problem at Wood Lake. Wood Lake Management should take the lead for controlling excessive aquatic weeds (controlling nutrient inputs should be a significant component of an aquatic weed control program).

Aquatic weeds, such as hydrilla, have become a problem at Wood Lake, as well as throughout the Southeast. Wood Lake Management should consult with the NC Department of Agriculture and the NC Division of Water Resources to determine the best method for eradicating the weeds. An educational component at boat ramps will help stem the movement of the weeds to and from Wood Lake.

15) A homeowner education program should be established at Wood Lake.

Educating the community may be the most important step to enhancing the water quality of Wood Lake. Local resource agencies such as Cooperative Extension and the Soil and Water Conservation District, as well as state agencies can be called on to help with this. An educated Wood Lake community will help to educate contractors and developers working at Wood Lake. Some of the components of this program should include information about: shoreline erosion, septic systems, burning construction debris, yard waste, and non-point source pollution.

Additional recommendations from technical advisors

16) Remove Crane's Creek and its tributaries from the 303 (d) list and classify them as supporting streams.

Wood Lake and Cypress Creek should continue to be listed as nonsupporting.

The water quality data collected during the development of the Local Watershed Plan did not support classifying Cranes Creek and all of its tributaries as 303(d) list streams. (In 2004, the Division of Water Quality agreed and delisted Crane's Creek and its tributaries.)

17) Monitor Little Crane's Creek and Cypress Creek for water quality.

Little Crane's Creek exhibited fair water quality and contained aquatic species that generally persist in fair water quality conditions. Cypress Creek showed excessively high levels of nutrients. Cypress Creek is most likely being affected by upstream land application of animal wastes. Cypress and Little Sugar Creek appear to be the most threatened from a water quality perspective.

18) Establish a copper testing program in the watershed.

Copper was found at moderate levels in multiple portions of the watershed. The copper is thought to be originating from the land application of animal/ poultry wastes to agricultural fields. At this time, these levels are low enough that aquatic integrity is being maintained. At higher levels, serious aquatic degradation can occur. Also, high copper soil concentrations could affect the County's ability to continue to apply these wastes and use the fields for agricultural purposes. Given the importance of the poultry and livestock industries to the communities in the watershed, monitoring may allow the implementation of alternative copper reducing BMPs to be implemented prior to significant water quality or soil degradation and ensure the long term viability of those industries in the watershed.

19) Preserve the existing two large Significant Natural Heritage Communities in the watershed.

The Crane's Creek Local Watershed has nearly no large natural land in public ownership. The two identified NHP sites represent the best preservation sites known in the watershed planning area.

IV. Appendices

Appendix A: Stakeholder concerns

During the Crane's Creek Local Watershed Planning Process, the issues and concerns below were brought up by stakeholders.

WATER SUPPLY / IRRIGATION

What about the **quarry**? Do they have an intake on Crane's Creek? How much do they remove? Is there a limit to the volume of water they can withdraw?

What are the rules regarding **intakes on Crane's Creek**? Irrigation upstream of Wood Lake causes reduced flows (Wood Lake)

Private irrigation pump houses draw water from Wood Lake. (Wood Lake)

RUNOFF

stormwater runoff may contain pollutants

runoff from road

runoff from nursery

runoff from auto parts store

streamside trash may be leaching contaminants into stormwater runoff

tobacco farm – no buffers

BUFFERS

paths in streamside buffer behind Union Pines High School

lack of vegetation on logging road

everyone wants to be next to stream, so they clear vegetation away to have stream access, removing streamside buffers

un-vegetated shoulder on road where utilities were put in. It has not been planted yet, cause of lots of runoff

AGRICULTURE

animals near water, runoff of waste, nutrients

algae growth

poultry houses – much larger than previous operations, yet follow the same rules that the small farmer does, contributing to erosion

steep slopes contribute to erosion, both at poultry houses and new horse farm

Cows in creek and wetlands – degradation of stream banks due to erosion from cattle walking

Farmland preservation: potential loss of farmland to other land uses in the future

manure piles in creek

DEVELOPMENT

near Thurlow Lake, there is a lot of construction.

construction very close to water

new developments are crowded

In Lee County, at the intersection of Nicholson and Pine Forest Road, there has recently been a HUGE clearing of land. What is it for?

Planned equestrian community – the size of the farms seems small to allow keeping horses. How many horses are allowed to be kept on land?

SEDIMENT

sediment in stream behind Union Pines High School

sediment piles in stream, often very clayey

sediment in the creek

WOOD LAKE issues

Burning construction debris

lack of **sediment control**, construction silt fences lacking or not maintained

Septic tanks: The state calls for a distance of 50 ft. between a septic tank and the lake; Wood Lake calls for a distance of 100ft, but does not enforce the rule.

bulkheads: what are the rules? Does the US Army Corps of Engineers issue permits?

shoreline erosion due to wave action causes silting in. It is already a shallow lake.

Wood Lake Marina – oil and gas leaking into water

no lakeside buffer, grass is planted right to the edge of lake or bulkhead, allowing for fertilizer **runoff** from both golf course and private lawns

septic tanks/fields are at/below water level. Is this allowed – what are the rules?

lawn clippings dumped in lake

Dead birds. **Avian Vacuolar Myelinopathy (AVM)** is a disease of birds that has been found to exist at Wood Lake. The following website gives information concerning AVM:

http://www.mvk.usace.army.mil/offices/od/odm/avm/avm_main.htm

Hydrilla (an exotic water plant) is a problem at Wood Lake, including the movement of hydrilla from Wood Lake to other places via boats and trailers.

Wood Lake filters Crane's Creek for everyone downstream; it should be managed well and given that consideration.

fecal count is higher upstream of Wood Lake than down.