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North Carolina Ecosystem Enhancement Program: Implementation and Lessons Learned from North Carolina's Watershed-Based Approach to Mitigation

Nancy Daly^{a*} and Marc Recktenwald^b

Abstract

North Carolina's Ecosystem Enhancement Program (EEP), formerly known as the Wetland Restoration program, has had a strong commitment to watershed planning throughout its 14-year history. That long-term dedication to watershed planning, the volume of watershed plans developed, and the variety of projects implemented in the context of those plans provides EEP with a unique perspective on the evolution of watershed planning and how it is accomplished.

Introduction: Ecosystem Enhancement Program Background and History

The Clean Water Act's Sections 404 and 401 (33 USC 1344) require "compensatory mitigation" for unavoidable impacts to streams, wetlands, and other waters of the United States. This means that the restoration, creation, or enhancement of streams and wetlands is necessary to compensate for the loss of these resources, where loss is measured in terms of both acres and functions lost. This article describes the Ecosystem Enhancement Program's (EEP's) watershed planning-based approach to compensatory mitigation and provides lessons learned from the development and implementation of watershed plans.

A 1998 memorandum of understanding between the US Army Corps of Engineers (USACE) Wilmington District and the North Carolina Department of Environment and Natural Resources established the Wetland Restoration Program as North Carolina's in-lieu fee (ILF) mitigation program. Through this voluntary ILF program, applicants (e.g., private sector, state agencies, municipalities, schools, and military bases) may make payments to satisfy the Clean Water Act's compensatory mitigation requirement. The mitigation requirement is then transferred to the ILF program, which implements stream and wetland mitigation projects to satisfy the requirements. Like other such programs across the country, North Carolina's ILF program combines multiple mitigation payments to generate larger-scale watershed projects. Enabling legislation also required the Wetland Restoration Program to develop watershed planning documents for all

of the state's 17 river basins and directed the initiative to update them at least every five years, concurrent with the North Carolina Division of Water Quality's basin-wide planning cycle. This program became the state's response to the need for a high-quality compensatory mitigation option for private and public entities with Section 404 permits under the Clean Water Act.

In 2000, as the North Carolina Department of Transportation (NCDOT) began to increase its reliance on the Wetland Restoration Program to meet its off-site compensatory mitigation needs, it contracted with the program for the development of watershed plans to identify specific mitigation projects. The increased demand and funding enabled the Wetland Restoration Program to develop local watershed plans (LWPs), a more detailed level of watershed planning that involves a comprehensive assessment of watershed conditions. This approach results in a list of specific projects—prioritized based on their ability to address identified watershed stressors (e.g., sediment loading)—that could be implemented to meet mitigation needs. In addition, LWPs include management recommendations (e.g., best management practices [BMPs] and institutional measures) that could be implemented by watershed stakeholders. This watershed planning approach to mitigation sets the program apart from many other mitigation providers in the state and across the country.

In response to delays of NCDOT transportation projects due to mitigation challenges, NCDOT, the North Carolina Department of Natural Resources, USACE, and other federal and state agencies developed a new program that combined the mitigation requirements of the Wetland Restoration Program's traditional ILF program with all of NCDOT's off-site mitigation needs. In 2003, the North Carolina Department of Environment and Natural Resources entered into a memorandum of agreement with NCDOT and USACE, and EEP was formally established, replacing the Wetland Restoration Program. As outlined in the memorandum of agreement, EEP's purpose is to provide a comprehensive natural resource enhancement program

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that identifies ecosystem needs at the local watershed level and preserves, enhances, and restores ecological functions within the target watersheds while addressing anticipated impacts from NCDOT transportation projects. The identification of mitigation projects in advance of NCDOT's environmental impacts became an innovative element of this new program, highlighting NCDOT's commitment to the environment while advancing transportation projects. In addition to its commitment to provide mitigation for NCDOT impacts, EEP maintained the role, formerly played by the Wetland Restoration Program, of providing ILF compensatory mitigation for private and governmental entities. EEP formally began operations in July 2003.

In July 2010, EEP secured approval of its current operating instrument in compliance with the 2008 federal mitigation rule, Compensatory Mitigation for Losses of Aquatic Resources, 33 CFR Parts 325 and 332; 40 CFR Part 230. While the new instrument replaced the 2003 memorandum of agreement, EEP's mission for ILF customers and NCDOT remains intact, including the program's adherence to the watershed planning approach and to providing NCDOT mitigation in advance of permitted impacts.

The Ecosystem Enhancement Program's Watershed Planning Process

Since its inception, the Wetland Restoration Program emphasized the application of watershed planning principles in the delivery of compensatory mitigation. EEP has continued this practice, generally using two levels of watershed planning. At a macro scale, the program develops plans for the state's 17 river basins; this results in geographic targets that are presented in River Basin Restoration Priorities documents. And, at a smaller scale, the program develops LWPs in strategic areas of the state, resulting in more specific watershed management strategies. As watershed science, policy, tools, and funding levels change, EEP continues to explore ways in which to meet its watershed planning needs. This article describes the two primary levels of watershed planning used by EEP and illuminates lessons learned in the development and implementation of EEP's plans.

River Basin Restoration Priorities are macro-level watershed plans in which EEP identifies priority watersheds across the state that exhibit the best opportunities for functional improvement. EEP develops such a plan for each of the state's 17 river basins by conducting a detailed screening of problems,

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assets, and opportunities for individual eight-digit catalog units (1,300–5,000 km²) within a river basin (2,500–26,000 km²). Each River Basin Restoration Priorities document identifies priority 14-digit hydrologic unit code (HUC; 25–260 km²) watersheds that exhibit a need for restoration and protection of wetlands, streams, and riparian buffers. This planning process provides broad watershed improvement goals, but does not identify specific mitigation projects. The priority watersheds, referred to as targeted local watersheds, receive priority for EEP local watershed planning and restoration project funds. In addition, EEP encourages other agencies and organizations to focus funding in these watersheds.

EEP develops an LWP—a more comprehensive examination of the factors contributing to the degradation of a targeted local watershed—for an area in which the anticipated mitigation need is high (e.g., where multiple mitigation projects will need to be implemented). EEP selects at least one 14-digit HUC, totaling an area between 25 and 260 km², for an investigation conducted in collaboration with representatives of local governments, nonprofit organizations, and local communities as well as environmental resource professionals. The partnership focuses on opportunities for the protection and improvement of water quality, hydrology, and habitat. EEP carries out LWPs in four phases. Phase 1 provides a preliminary characterization of the watershed based on existing data; Phase 2 incorporates water quality monitoring, field assessments, and data analysis to fill in data gaps identified in Phase 1; Phase 3 identifies priorities for watershed management strategies, including a project atlas with specific project opportunities; and Phase 4 encompasses project implementation work by EEP and watershed stakeholders. As EEP has evolved, the Phase 3 project atlas has become more comprehensive and includes not only stream and wetland mitigation projects for EEP, but also agricultural and stormwater BMPs that may be implemented by diverse watershed stakeholders.

EEP's continued commitment to watershed planning is outlined in the compensation planning framework described in EEP (2010, appendix I).

Overall Results of the Ecosystem Enhancement Program's Watershed Planning Initiatives

The results of EEP's watershed planning-based mitigation approach must be considered in the context of a very dynamic program that has been responsible for the implementation of more than 500 mitigation projects in a compressed period

of time. EEP has always worked to maximize the benefits of mitigation investments by relying on watershed planning, but certain conditions have affected the program's ability to implement all projects within designated planning areas. First, the Wetland Restoration Program and EEP have always emphasized project implementation in watershed planning areas, but a requirement to do so was not in place until the establishment of EEP's current operating instrument, developed in compliance with the 2008 federal mitigation rule. Second, in its first few years of existence, EEP was required to provide a substantial amount of mitigation in a very short period of time to ensure that it could be completed prior to NCDOT impacts. Third, LWPs take years to develop and in some cases were not completed in time to be used for the substantial mitigation need for which they were initiated. Fourth, EEP inherited more than 140 NCDOT mitigation projects that were developed without regard to watershed planning. Finally, EEP implemented many projects in its High-Quality Preservation initiative at the program's inception as a bridge for advance mitigation requirements. These projects were developed on the basis of ecoregions (defined by county boundaries with similar geology and ecological characteristics) rather than on a watershed basis.

Since 2000, EEP has completed 30 LWPs, with an additional 5 LWPs in progress and 4 LWPs partially completed and placed on hold because of a decrease in mitigation needs (i.e., a decline in mitigation requests from NCDOT and other ILF applicants). As of June 2011, EEP implemented a total of 583 mitigation projects. Of these projects, 394 (67%) are within targeted local watersheds and 105 (18%) are within LWP areas. In addition, EEP has leveraged \$26.8 million in grant funding for project implementation by other entities in LWP areas. The funding sources include federal, state, and local governments as well as private sources. Projects implemented with alternative funding sources complement the effects of restoration conducted for the purposes of compensatory mitigation and move North Carolina toward comprehensive watershed restoration.

Specific Examples of Local Watershed Plan Success

Success is defined differently by different stakeholders and may include quantitative and qualitative measures. For example, indicators of success may include the number of projects implemented, improvement in water quality parameters, the long-term establishment of watershed stakeholder groups, or increased public education and awareness of watershed issues. The two LWPs described below

demonstrate both quantitative (number of projects) and qualitative (active stakeholder support) successes.

Muddy Creek Local Watershed Plan

For the Muddy Creek LWP, EEP built on an existing watershed restoration effort. The LWP area is 285 km² and encompasses three HUCs (03050101040010, 03050101040020, and part of 03050101030060) in the Catawba River basin (Figure 1). An earlier effort, the Muddy Creek Restoration Partnership (not related to EEP), began in 1998 to address severe sedimentation issues. This partnership included representatives from federal, state, and local government agencies; the private sector; nonprofit environmental organizations; and local citizens. In 2003, the partnership developed a watershed plan that identified priority project areas for the implementation of stream restoration and protection and agricultural BMPs (Equinox Environmental 2003). In 2008, EEP began building on this plan by developing an atlas of potential mitigation projects that would address watershed needs (Equinox Environmental 2008a).

From 2004 to the present, project partners have implemented priority conservation projects with an organized outreach initiative. From 2004 to 2008, a part-time, grant-funded landowner outreach coordinator implemented an education and outreach program to build community support and recruit key landowners. Since then, landowner recruitment efforts have continued through EEP staff and private mitigation bankers.

The partnership developed a monitoring program to collect baseline data and evaluate site-specific and cumulative impacts of on-the-ground restoration. This project effectiveness study (Equinox 2008b), conducted from 2005 to 2007, evaluated the following parameters: bed substrate, bank erosion (through bank erosion hazard index evaluations), habitat quality, fecal coliform bacteria, and benthic community characteristics. Project implementation during this period represented approximately one-half of the implementation that has occurred to date (i.e., 11 km of stream restoration had been completed at the time of the study). Results of the study indicate an improvement in aquatic habitat scores (based on the rating of habitat suitable for benthic macroinvertebrates and fish by the North Carolina Division of Water Quality [2003]) and in the bank erosion hazard index at the reach-specific scale; however, bed substrate and benthic community parameters did not show improvement. The study identified the age of projects (zero to three years) and contributions from the larger watershed as limiting factors to additional reach-scale and watershed-scale improvements (Equinox Environmental 2003, 2008b, 2011).

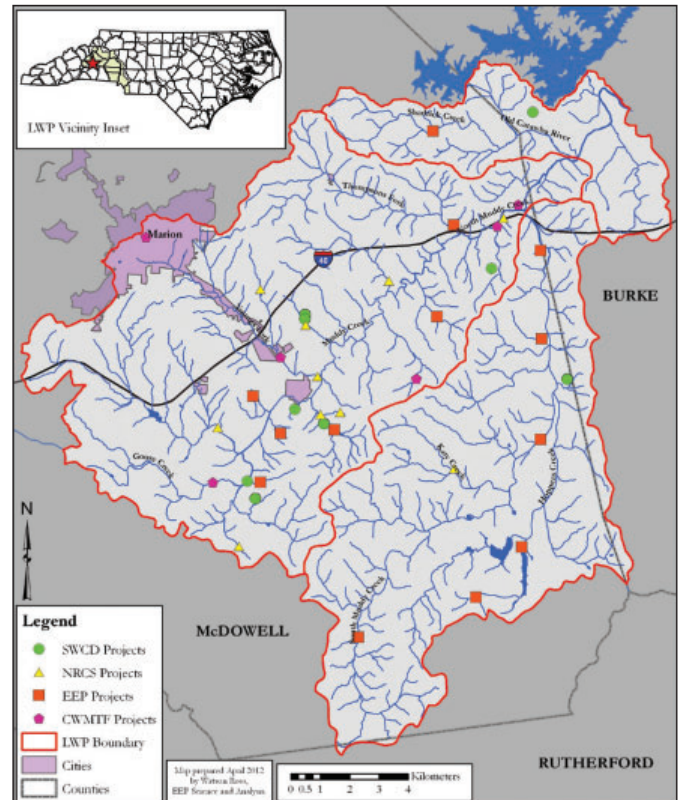


Figure 1. Projects located within the Muddy Creek local watershed plan. CWMTF, North Carolina Clean Water Management Trust Fund; EEP, North Carolina Ecosystem Enhancement Program; NRCS, US Department of Agriculture Natural Resources Conservation Service; SWCD, North Carolina Division of Soil and Water Conservation.

In 2007, the partnership initiated the Corpening–Jacktown watershed improvement initiative to address impacts to an impaired stream draining the City of Marion. The partnership completed a nine-element watershed plan in the Corpening–Jacktown watershed (Equinox Environmental 2011). Nine-element plans meet criteria outlined by the US Environmental Protection Agency (i.e., “a–i criteria”) to qualify for Clean Water Act Section 319 funds. These funds are designated to states to implement nonpoint source management programs and may be expended to develop a watershed plan that addresses nonpoint source water quality impairments for a particular watershed (US Environmental Protection Agency 2008, n.d.). The partnership is now seeking sustained funding for a watershed coordinator and project implementation.

To date, EEP has implemented 13 projects in the Muddy Creek LWP area, resulting in approximately 30 km of stream restoration, enhancement, and preservation; more than 8 ha of riparian buffer restoration; and more than 12 ha of wetland restoration, enhancement, and preservation.

Partners leveraged over \$2.3 million in grant funding since 1998, with \$500,000 of this funding occurring since 2008. Partnership projects include a 46-ha farmland preservation project; two stormwater BMPs (a rain garden and a stormwater wetland); additional planning efforts; and numerous stream restoration, preservation, and agricultural BMPs. Project funding sources include, but are not limited to, the US Department of Agriculture Natural Resources Conservation Service Environmental Quality Incentives Program, North Carolina Agriculture Cost Share Program, North Carolina Clean Water Management Trust Fund, North Carolina Division of Water Resources, US Environmental Protection Agency, and NCDOT. Documentation associated with the Muddy Creek LWP is available from EEP (n.d.[c]).

Little Alamance, Travis, and Tickle Creeks Local Watershed Plan

The Little Alamance, Travis, and Tickle Creeks LWP represents another collaborative effort with state and local partners. The LWP area is 132 km² and encompasses two HUCs (03030002040110 and 0303000203001) in the Cape Fear River basin (Figure 2). In 2000, the North Carolina Division of Water Quality listed Little Alamance Creek as impaired because of poor stream biological ratings, which were largely a result of impacts from urban stormwater runoff. Issues included poor water quality, impaired biology, loss of riparian vegetation, bank erosion, and urban runoff. Travis and Tickle Creeks also suffer from poor stream biological conditions. These conditions are primarily a result of poor riparian habitat, impacts from suburban development, and agricultural land use practices (EEP n.d.[a]; Piedmont Triad Council of Governments n.d.). EEP conducted a detailed study of these watersheds from 2006 to 2008 to understand the sources of identified problems and to lay the groundwork for the development of solutions to address the issues. The resulting *Little Alamance, Travis and Tickle Creeks Watersheds Report and Project Atlas* (Piedmont Triad Council of Governments 2008) highlights stressors affecting aquatic ecosystems in the local watershed planning area and provides management strategies to help improve water quality and protect area streams.

In October 2009, the North Carolina Division of Water Quality awarded the Piedmont Triad Council of Governments a federal 205(j) Water Quality Management Funding grant for the development of the Little Alamance Restoration Alliance. A partnership of citizens, local organizations, municipal staff, and resource professionals, this alliance focuses on improving the water quality of the Little Alamance Creek watershed through educational outreach and water quality awareness. The alliance solicited input on water quality monitoring from

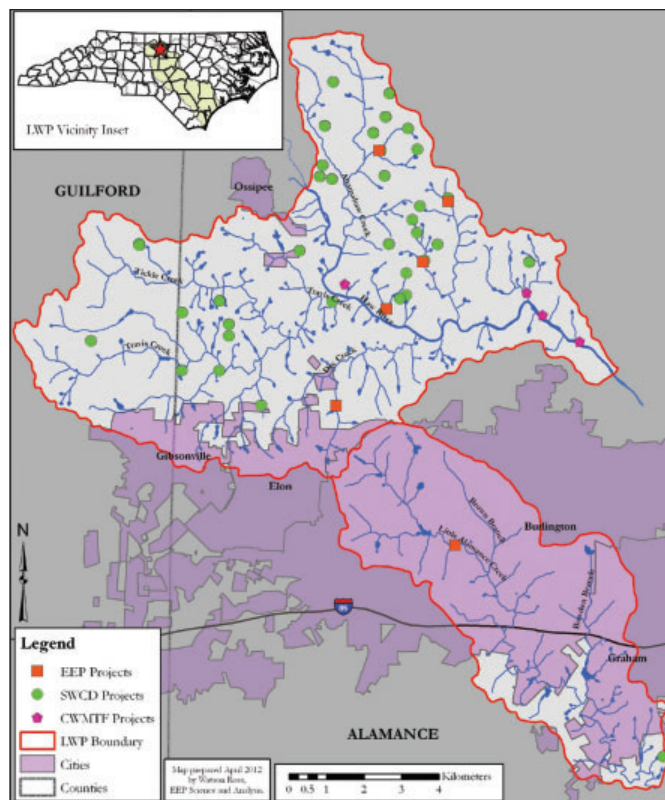


Figure 2. Projects located within the Little Alamance, Travis, and Tickle Creeks local watershed plan. CWMTF, North Carolina Clean Water Management Trust Fund; EEP, North Carolina Ecosystem Enhancement Program; SWCD, North Carolina Division of Soil and Water Conservation.

local citizens and organized the concerted efforts of focus groups. Educational topics included the promotion of stormwater treatment and the establishment of riparian buffers in this highly urbanized watershed (Little Alamance Restoration Alliance n.d.). In addition, the North Carolina Division of Water Quality is currently developing a total maximum daily load within the Little Alamance watershed with a goal of reducing the amount of *effective paved surface* by implementing strategic stormwater BMPs (Piedmont Triad Council of Governments n.d.).

To date, EEP has implemented six projects in these watersheds; these projects have resulted in more than 8 km of stream restoration, enhancement, and preservation and more than 2 ha of wetland enhancement and preservation. In addition, local government and a local land trust have leveraged more than \$1,000,000 in grant funds in this LWP area. Included in this amount is funding by the North Carolina Parks and Recreation Trust Fund for the preservation of 77 ha on the Haw River and its tributaries—a priority that was identified in the Little Alamance, Travis, and Tickle Creeks Project Atlas (Piedmont Triad Council

of Governments 2008). Documentation associated with the Little Alamance, Travis, and Tickle LWP is available from EEP (n.d.[b]).

Lessons Learned

Many factors, including federal and state regulations, economic fluctuations, and advances in restoration science, influence EEP's watershed planning process. Eleven years after the initiation of its first LWP, EEP can reflect on and share both its successes and its challenges. The key factors that influence LWP success and EEP's lessons learned are discussed below.

Stakeholder Composition

LWPs that have strong local support are more likely to achieve long-term commitments to the implementation of agreed upon recommendations. Federal and state resource agency personnel are part of EEP stakeholder processes and provide valuable support; but without local support, many management recommendations never progress beyond inclusion in the final report. Key local stakeholders in EEP watershed planning processes include the North Carolina Division of Soil and Water Conservation district staff, regional councils of government, and planning representatives from local government.

These representatives not only have relationships with landowners within the watershed, they are also familiar with officials in local government who can help foster support for LWP development and implementation. Key outcomes of this support may include endorsement of the watershed management plan, support for the implementation of watershed projects, and funding for a watershed coordinator position.

EEP considers the presence of local watershed champions a key factor in selecting locations for LWP development. This increases the likelihood of an active stakeholder process and helps ensure that local resource concerns are addressed in the watershed management plan. EEP routinely presents the results of watershed planning efforts to local government representatives and elected officials to gain support for watershed plan management recommendations.

Stakeholder-Driven Plans

Given the importance of active stakeholders, EEP believes that building on existing watershed plans is an effective way to increase the long-term success (in both quantitative and qualitative measures) of watershed plans. Rather than

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asking multiple stakeholders to take part in an EEP planning effort, EEP becomes an active participant of an existing planning team. EEP watershed planners can then offer support in the form of facilitation and coordination, or through financial resources. These efforts are often centered around a specific resource issue, such as threatened or endangered species or nutrient runoff. If a specific resource concern exists, this translates into a greater likelihood of getting key partners to participate in the process, and a greater chance that grant funding opportunities exist and that projects will be implemented. By addressing the specific resource of concern as part of a larger watershed planning effort, greater awareness of watershed resources and a more comprehensive plan for improvement may be developed.

To foster collaboration with ongoing watershed initiatives, EEP developed a process by which entities can submit an existing watershed plan for review and acceptance. EEP's ILF instrument outlines minimum criteria required to meet federal requirements for a watershed approach. By reviewing existing watershed plans, EEP is able to learn about existing planning efforts and determine if they meet federal requirements. For those plans that do not meet all criteria, EEP may offer support for missing elements—such as water quality monitoring, field assessments, or project prioritization—that supplement and benefit local efforts.

By enabling EEP to build on existing local watershed initiatives, this process is more cost-effective than initiating a separate process because funding is focused on supplementing, rather than creating new watershed initiatives and datasets. Watershed partners benefit from this effort by receiving additional resources for watershed assessments and project implementation within the watershed. Once a plan has been adopted, EEP can focus mitigation funding within the planning area. In addition, the LVWP provides stakeholders with leveraging opportunities for grant-funded projects.

Feasible Projects

If implementation of watershed improvement projects is a goal, then projects must be technically and economically feasible. Some of EEP's earlier LVWPs included long lists of water quality improvement projects that proved to be technically infeasible because of design or construction constraints. In addition, EEP discovered that certain economies of scale exist and that, to be economically feasible, minimum size criteria for stream and wetland projects must be met.

Early on, EEP considered minimum size criteria for project implementation to be approximately 450 m for streams and 2 ha for wetlands. EEP learned that in areas of consistent

mitigation need, one large project is more economically efficient than many small projects in meeting the same amount of mitigation need because overall resources spent developing and managing contracts are reduced, the cost of mobilization for multiple sites decreases, and more competitive bids for design and construction are received. Larger sites may also provide more functional benefit (e.g., longer intact riparian corridors that provide habitat and water quality treatment, increased aquatic habitat connectivity, etc.). In areas that do not have consistent mitigation needs, however, the current economic climate makes investing in excess mitigation unlikely to be feasible because of the cost of developing and maintaining projects and uncertainty that future payments to the program will enable this cost to be recaptured in an economically suitable timeframe. In addition, highly urbanized watersheds often necessitate the implementation of smaller projects because of issues such as multiple landowners, utility constraints, and limited stream and wetland project opportunities.

EEP also learned that communication between EEP watershed planners and project implementation managers is a critical component in identifying feasible watershed improvement projects with the best opportunity for implementation. To improve communication and understanding, EEP organized its planners and project managers into regional teams; this greatly improved the watershed planning project atlases. Although EEP has since been reorganized into separate watershed planning and project development units, planners and project managers still serve on teams for plan and project development to continue product improvement.

Project Diversity

Watershed improvement often depends on the implementation of a diverse range of projects and management recommendations. EEP's projects must be implemented in compliance with federal and state requirements for stream and wetland compensatory mitigation. Some of EEP's early LVWPs identified projects to address specific mitigation needs, such as wetland requirements, and did not include stream, buffer, and BMP project opportunities. As regulatory mitigation requirements changed, so did the need for a more comprehensive project atlas. In addition, comprehensive watershed plans increase the usefulness of plans for watershed stakeholders. For example, in urban watersheds, while issues such as stormwater runoff may be a primary water quality stressor for the watershed, EEP is currently unable to implement stormwater BMP projects for the purposes of compensatory mitigation because current state and federal regulatory guidelines account for resource loss in acres and

feet rather than in functional measurements. In these situations, funding for stormwater BMP projects may be available through grant funding or local governments, and implementing such projects in concert with traditional stream and wetland restoration yields more comprehensive watershed restoration.

It is important to develop comprehensive LWPs that incorporate a diversity of projects and management recommendations, including, but not limited to, wetland and stream restoration and preservation projects, stormwater and agricultural BMPs, and local zoning and ordinance recommendations. In addition, LWPs should include action plans that identify funding resources and entities tasked with the implementation of project recommendations. This helps increase the likelihood that watershed stressors will be addressed through different implementation mechanisms and increases the utility of the plan for stakeholders with different interests in the watershed.

Future of Watershed Planning by the Ecosystem Enhancement Program

EEP's watershed planning process continues to evolve. As demonstrated in the above lessons learned, EEP continues to adapt and tailor its planning process to meet both EEP and stakeholder goals. One key question that remains is, *what watershed scale and concentration of projects is most effective at bringing about measurable water quality improvements?*

EEP is actively trying to address this question. The scale needs to be large enough to support multiple stakeholder interests so

that a diversity of projects (e.g., restoration, preservation, BMPs, point source issues, and wildlife habitat) can be implemented, yet not so large that projects are widely distributed and fail to provide a synergistic influence on watershed improvement. EEP is beginning a regional watershed planning initiative that has a much larger geographic range (~1,480 km²) than traditional LWPs, but with a focus on small priority watersheds and specific functions that can be improved with tailored projects.

After more than a decade of watershed planning and project implementation efforts, EEP is beginning to examine watersheds in which many projects have been implemented and evaluate how these projects have influenced watershed and receiving water quality and living resource conditions. This effort involves studying not only EEP projects, but also projects implemented by other federal, state, and local entities. The results of these inquiries will undoubtedly provide more lessons learned.

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REFERENCES

- Ecosystem Enhancement Program. 2010. *North Carolina Department of Natural Resources Ecosystem Enhancement Program in-lieu fee instrument*. Raleigh, NC: North Carolina Ecosystem Enhancement Program.
- . No date [a]. *Little Alamance, Travis and Tickle Creeks local watershed plan*. Fact sheet. Raleigh, NC: North Carolina Ecosystem Enhancement Program.
- . No date [b]. *Watershed planning documents. River basin restoration priority plans (Cape Fear River basin)*. <http://portal.ncdenr.org/web/eep/rbrps/cape-fear>.
- . No date [c]. *Watershed planning documents. River basin restoration priority plans (Catawba River basin)*. <http://portal.ncdenr.org/web/eep/rbrps/catawba>.
- Equinox Environmental. 2003. *Muddy Creek Watershed Restoration Initiative: Feasibility report and restoration plan for the Muddy Creek watershed. Burke and McDowell counties, North Carolina Catawba River basin*. Prepared for the Muddy Creek Restoration Partners. Asheville, NC: Equinox Environmental Consultation & Design, Inc.
- . 2008a. *Technical memorandum: Evaluation and update of mitigation opportunities. 2008 Muddy Creek mitigation search*. Prepared for the North Carolina Ecosystem Enhancement Program. Asheville, NC: Equinox Environmental Consultation & Design, Inc.
- . 2008b. *Muddy Creek Restoration Partnership: Final project report Section 319 project number EW06043*. Prepared for the Muddy Creek Partnership. Asheville, NC: Equinox Environmental Consultation & Design, Inc.
- . 2011. *Corpening Creek watershed plan*. Prepared for the Muddy Creek Partnership on behalf of the Carolina Land and Lakes Resource Conservation & Development Council. Asheville, NC: Equinox Environmental Consultation & Design, Inc.
- Little Alamance Restoration Alliance. No date. *Little Alamance Restoration Alliance home page*. <http://www.stormwatersmart.org/lara.html>.
- North Carolina Division of Water Quality. 2003. *Standard operating procedures for macroinvertebrates*. Raleigh, NC: North Carolina Division of Water Quality, Environmental Sciences Branch, Biological Assessment Unit.
- Piedmont Triad Council of Governments. 2008. *Little Alamance, Travis, & Tickle Creek watersheds report & project atlas. An Ecosystem Enhancement Program-funded local watershed plan phase III*. Greensboro, NC: Piedmont Triad Council of Governments.
- . No date. *Little Alamance and Travis/Tickle Creek*. http://www.ptcog.org/planning_services/environmental_planning/water_resources/water_quality/eep.php.
- US Environmental Protection Agency. 2008. *Handbook for developing watershed plans to restore and protect our waters*. EPA 841-B-08-002. Washington, DC: US Environmental Protection Agency.
- . No date. *Process for applying for 319(h) funds*. <http://water.epa.gov/polwaste/nps/319hfunds.cfm>.