Lewis Creek
Sediment Total Maximum Daily Load Implementation Plan

Presented By: Stakeholders of Lewis Creek Watershed

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EXECUTIVE SUMMARY

Introduction

The Virginia Total Maximum Daily Load (TMDL) program is a process to improve water quality and restore impaired waters in Virginia. Specifically, TMDL is the maximum amount of pollutant that a waterbody can assimilate without surpassing the state water quality standards for protection of the five beneficial uses: drinking water, recreational (i.e., primary contact/swimming), fishing, shellfishing, and aquatic life. If the water body surpasses the water quality standard during an assessment period, Section 303(d) of the Clean Water Act and the United States Environmental Protection Agency's Water Quality Management and Planning Regulation (40 CFR Part 130) both require states to develop a total maximum daily load for each pollutant.

Lewis Creek was initially placed on the Commonwealth of Virginia's Section 303(d) List of Impaired Waters in 1998 for exceedance of the General Standard (Benthic). The listing resulted from partial support of the Aquatic Life Use due to results of biological monitoring efforts conducted by the Virginia Department of Environmental Quality (VADEQ). After this listing, a TMDL study was conducted that identified excessive sediment as the pollutant causing the aquatic life impairment. The TMDL set limits on the amount of sediment Lewis Creek can tolerate and still maintain support of the Aquatic Life Use.

After a TMDL study is complete and approved by USEPA, Virginia's 1997 Water Quality Monitoring, Information and Restoration Act (WQMIRA) states in section 62.1-44.19:7 that the "Board shall develop and implement a plan to achieve fully supporting status for impaired waters". To comply with this state requirement, a TMDL implementation plan (IP) was developed to reduce sediment levels to attain water quality standards allowing delisting of Lewis Creek from the Section 303(d) List of Impaired Waters. The TMDL IP describes control measures, which can include the use of better treatment technology and the installation of best management practices (BMPs), to be implemented in a staged process. Local support and successful completion of the implementation plan will enable restoration of the impaired water while enhancing the value of this important resource for the Commonwealth. Opportunities for Russell County, Town of Honaker, local agencies, and watershed residents to obtain funding will improve with an approved IP.

Key components of the implementation plan are discussed in the following sections:

- **Review of TMDL Development Study**
- **Public Participation**
- **Implementation Actions**
- **Measurable Goals and Milestones for Attaining Water Quality Standards**
- **Stakeholder's Roles and Responsibilities**
- **Integration with Other Watershed Plans**
- **Potential Funding Sources**

Review of TMDL Study

Impairment description, water quality monitoring, watershed description, stressor identification, source assessment, water quality modeling, and allocated reductions were reviewed to determine implications of TMDL and modeling procedures on implementation plan development. Excessive sedimentation was determined by the TMDL study as the primary stressor to the benthic community in the Lewis Creek watershed. Sediment is delivered to Lewis Creek through the processes of surface runoff, channel and streambank erosion, and point sources, as well as background geologic processes. Natural sediment generation is accelerated through human-related land-disturbing activities related to mining, agricultural, urban, and forest land uses. During surface runoff events, exposed sediment particles can be dislodged from the soil and carried in runoff from both pervious and impervious surfaces in the watershed to the stream. Increased runoff rates due to man-induced influence in a watershed and streambank instability from decreased riparian cover or livestock trampling results in streambank erosion. Conditions outlined in the TMDL development study to address the sediment impairment in the Lewis Creek watershed include:

- Sediment load reduced by 80% on transitional landuse (i.e., abandoned mine land);
- Sediment load reduced by 33% on pasture/hay, cropland, and urban lands;
- Streambank erosion was represented in the land-based sediment loadings; and
- Implicit in the requirement for no point source sediment load adjustment is the requirement for point sources to maintain permit compliance.

Public Participation

The actions and commitments compiled in this document are formulated through input from citizens of the watershed; Russell County and Town of Honaker governments; Clinch Valley Soil and Water Conservation District; Virginia Department of Conservation and Recreation; Virginia Department of Mines, Minerals, and Energy; Virginia Department of Environmental Quality; Virginia Department of Game and Inland Fisheries; Virginia Department of Health; Natural Resources Conservation Service; Black Diamond Resource Conservation and Development Council; Canaan Valley Institute; The Nature Conservancy; and Blue Ridge Environmental Solutions, Inc. Every citizen and interested party in the watershed is encouraged to put the IP into action and contribute what he or she is able to help restore the health of Lewis Creek.

Public participation took place during IP development on three levels. First, public meetings were held to provide an opportunity for informing the public as to the end goals and status of the project, as well as, a forum for soliciting participation in the smaller, more-targeted meetings (*i.e.*, working groups and Steering Committee). Second, three working groups were formed: Agricultural, Urban/Residential, and Governmental. A representative from VADCR or BRES coordinated each working group in order to facilitate the process and integrate information. Third, a Steering Committee was formed with representation from the Agricultural, Urban/Residential, and Governmental Working Groups; Russell County; Town of Honaker; Clinch Valley Soil and Water Conservation District; Virginia Department of Conservation and Recreation; Virginia Department of Mines, Minerals, and Energy; Virginia Department of Environmental Quality; Virginia Department of Game and Inland Fisheries; Canaan Valley Institute; The Nature Conservancy; and Blue Ridge Environmental Solutions, Inc. to guide the development of the

IP. Over 160 man-hours were devoted to attending these meetings by individuals representing agricultural, mining, residential, commercial, environmental, and government interests on a local, state, and federal level. Throughout the public participation process, major emphasis was placed on discussing best management practices (BMPs), locations of control measures, education, technical assistance, monitoring, and funding.

Implementation Actions

The quantity of control measures, or BMPs, required during implementation was determined through spatial analyses of land use, stream-network, and the Commonwealth of Virginia aerial maps along with regionally appropriate data archived in the VADCR Agricultural BMP Database, VADMME Mining Permit Database, and TMDL document. The map layers and archived data were combined to establish average estimates of control measures required. Sediment load reductions on urban and transitional land uses were determined through modeling alternative implementation scenarios, defining percentage of land use area or unit amount treated by control measure, then applying related reduction efficiency to the associated load. Additionally, input from local agency representatives, citizens, and contractors were used to verify the analyses. Estimates of control practices needed for full implementation in the Lewis Creek watershed are listed in Table 2.

Associated cost estimations for each implementation action were calculated by multiplying the average unit cost per the number of units. The total average installation cost for livestock exclusion systems, Lime Assistance Program, and Horse Owner Education Program treating pasture sediment loads is $0.75 million. The total installation cost for converting cropland to permanent vegetative cover and forest is estimated at $0.04 million. Estimated corrective action costs needed to reduce sediment loads on urban and transitional (i.e., AML) land uses is $0.60 million and $0.86million, respectively. The total cost to provide assistance in the agricultural, urban, and mining programs during implementation is expected to be $0.30, $0.30, and $0.30 million, respectively. The total implementation cost including technical assistance is $3.15 million with the agricultural cost being $1.09 million, urban cost $0.90 million, and transitional landuse cost $1.16 million.

The primary benefit of implementation is cleaner waters in Virginia, where sediment levels in Lewis Creek will be reduced to meet water quality standards, benefiting livestock herd health, stakeholder economy, and effort to reduce bacteria loads to Lewis Creek. An important objective of the IP will be to foster continued economic vitality and strength. Healthy waters can improve economic opportunities for Virginians, and a healthy economic base can provide the resources and funding necessary to pursue restoration and enhancement activities. The control measures recommended in this document will provide economic benefits to the landowner, along with the expected environmental benefits on-site and downstream. Improved aesthetics in public areas and surrounding businesses provided by control measures (*e.g.*, bioretention) has the potential to draw local citizens and visitors to these areas and a healthy waterway has the potential to attract local citizens and visitors for recreation. Additionally, money spent on materials and technical assistance resources by landowners, government agencies, and non-profit organizations in the process of implementing the implementation plan will stimulate the local economy.

Measurable Goals and Milestones for Attaining Water Quality Standards

The end goals of implementation are restored water quality in the impaired waters and subsequent de-listing of streams from the Commonwealth of Virginia's Section 303(d) List of Impaired Waters. Progress toward end goals will be assessed during implementation through tracking of control measure installations by Clinch Valley Soil and Water Conservation District; Natural Resources Conservation Service; Virginia Department of Conservation and Recreation; Virginia Department of Mines, Minerals, and Energy; Russell County; and Town of Honaker. The Virginia Department of Environmental Quality will continue to assess water quality through its monitoring program. Other monitoring project activities in the watershed will be coordinated to augment the Virginia Department of Environmental Quality monitoring program. Implementation will be assessed based on reducing sediment to improve the benthic community. Implementation of control measures is scheduled for 10 years beginning in October 2010 lasting to September 2020. After implementation inception, five milestones will be met in two-year increments until Lewis Creek is removed from Commonwealth of Virginia's Section 303(d) List of Impaired Waters.

Implementation in years one through six for agricultural source reductions focuses on developing and implementing the Horse Owner Education and Lime Assistance Programs and installing livestock stream exclusion systems. Cropland conversion BMPs will be focal point for years seven through ten. For urban sediment load reductions, limited progress for streambank restoration and street sweeping is expected for the first two years. After which, streambank stabilization and vegetated buffers progress is expected to occur throughout years three and four. Street sweeping is slated to begin in year three providing time to purchase a sweeper and train town personnel. The street sweeping amount is expected to remain even over year three through ten. Bioretention installation is expected to occur evenly over the first five years. Urban land use treated by increased erosion and sediment control is expected to occur uniformly over the ten years. Infiltration trench installations are expected to occur equally in the years seven and eight. A manufactured stormwater BMP is expected to be installed every two years. Streambank stabilization on the transitional landuse is estimated to occur equally over the ten years. Abandoned mine land reclamation is expected to commence in year two and occur evenly during years two through ten.

Water quality improvement is expected to increase each year. An 8% overall sediment load reduction is expected in the second year, 23% in the fourth year, 37% in the sixth year, 51% in the eighth year, and 64% in the tenth year. Based on water quality modeling projections for the tenth year, implementation milestone equaling 100% installation of agricultural, urban, and mining control measures, Lewis Creek would be in a probable position to be de-listed from the Commonwealth of Virginia's Section 303(d) List of Impaired Waters. Considering the dynamics of a stream ecosystem and the inherent difficulties that may arise preventing implementation, the final milestone of TMDL allocation attainment was set at 10 years following implementation commencement.

The process of a staged implementation implies targeting of control measures, ensuring optimum utilization of resources. In quantifying agricultural BMPs through the use of aerial photography, land use, and stream network GIS layers, maps were formulated showing potential livestock stream access, pastures, and crop fields. These maps identify farm tracts that Clinch Valley Soil and Water Conservation District should concentrate their efforts in. The district will coordinate with landowners and track BMP

installation progress. The Downtown Revitalization Plan, which Town of Honaker is partnering with Cumberland Plateau Planning District Commission to develop, will outline plans for the Train Caboose Visitor's Center and adjacent area. Targeting streambank stabilization, vegetated buffers, and bioretention projects in the adjacent area needs to be incorporated in the revitalization plan. VADMME personnel have evaluated the Lewis Creek watershed to estimate AML features such as portals, clogged streams, high walls, dangerous impoundment, equipment/ facilities, and vertical openings. Results from this initial evaluation will be used to develop an AML reclamation plan for the Lewis Creek watershed.

Stakeholder's Roles and Responsibilities

Stakeholders are individuals who live or have land management responsibilities in the watershed, including government agencies, businesses, private individuals, and special interest groups. Successful implementation depends on stakeholders taking responsibility for their role in the process, and the primary role falls on the local groups that are most affected; that is, businesses, community watershed groups, and citizens. However, local, state, and federal agencies also have a stake in seeing that Virginia's waters are clean and provide a healthy environment for its citizens. Stakeholder participation and support is essential for achieving the goals of this TMDL effort (*i.e.*, improving water quality and removing streams from the impaired waters list). It must first be acknowledged that there is a water quality problem, and changes must be made as needed in operations, programs, and legislation to address these pollutants. In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions.

Russell County will administer the erosion & sediment control and stormwater management programs and provide mapping assistance. The Clinch Valley Soil and Water Conservation District will provide state agricultural cost-share funds, lead education and technical assistance efforts, and track best management practice implementation for the agricultural and residential programs. The district has a well-developed education program successfully targeting school-aged children and adults. State agencies conducting regulatory, education, or funding procedures related to water quality in Virginia include: Virginia Department of Environmental Quality; Virginia Department of Conservation and Recreation; Virginia Department of Mines, Minerals, and Energy; Virginia Department of Agriculture and Consumer Services; Virginia Department of Game and Inland Fisheries; Virginia Department of Forestry; and Virginia Cooperative Extension. The Natural Resources Conservation Service will provide cost-share funds and technical assistance.

Integration with Other Watershed Plans

Each watershed within the state is under the jurisdiction of a multitude of individual yet related water quality programs and activities, many of which have specific geographical boundaries and goals. These include but are not limited to, TMDLs, Roundtables, Water Quality Management Plans, Erosion and Sediment Control regulations, Stormwater Management Program, Source Water Assessment Program, and local comprehensive plans. Financial and technical resources may be maximized for implementation by coordinating and expanding the planning and implementation activities of these on-going watershed projects or programs. Current initiatives within Russell County and Town of Honaker to be integrated with the Lewis Creek TMDL IP include:

- Russell County Comprehensive Plan
- Town of Honaker Comprehensive Plan and Downtown Revitalization Plan
- Black Diamond Resource Conservation and Development Council Strategic Plan
- Upper Tennessee River Roundtable Strategic Plan
- Nature Conservancy's Clinch Valley Program
- Clinch-Powell Clean Rivers Initiative
- Virginia Wildlife Action Plan

Potential Funding Sources

Potential funding sources available during implementation were identified in the course of plan development. Detailed description of each source (*i.e.*, eligibility requirements, specifications, incentive payments) can be obtained from the Clinch Valley Soil and Water Conservation District; Virginia Department of Conservation and Recreation; Virginia Department of Mines, Minerals, and Energy; Virginia Department of Environmental Quality; Virginia Department of Game and Inland Fisheries; Virginia Cooperative Extension; and Natural Resources Conservation Service. Potential funding sources include:

- U.S. Department of Agriculture Conservation Reserve Enhancement Program, Conservation Reserve Program, Environmental Quality Incentives Program, Forest Incentive Program. Wetland Reserve Program, and Wildlife Habitat Incentive Program
- U.S. Fish and Wildlife Service Conservation Grants and Private Stewardship Programs
- U.S. Department of Interior – Office of Surface Mining Abandoned Mine Land Reclamation Program
- Virginia Agricultural Best Management Practices Cost-Share and Tax Credit Programs
- Virginia Water Quality Improvement Fund
- Virginia Forest Stewardship Program
- Virginia Small Business Environmental Compliance Assistance Fund
- Virginia Landowner Incentive Program
- Virginia Revolving Loan Programs
- Community Development Block Grant Program
- National Fish and Wildlife Foundation
- Southeast Rural Community Assistance Project

INTRODUCTION

The Virginia Total Maximum Daily Load (TMDL) program is a process to improve water quality and restore impaired waters in Virginia. Specifically, TMDL is the maximum amount of pollutant that a water body can assimilate without surpassing the state water quality standards for protection of the five beneficial uses: drinking water, recreational (i.e., primary contact/swimming), fishing, shellfishing, and aquatic life. If the water body surpasses the water quality criteria during an assessment period, Section 303(d) of the Clean Water Act (CWA) and the United States Environmental Protection Agency's (USEPA) Water Quality Management and Planning Regulation (40 CFR Part 130) both require states to develop a TMDL for each pollutant.

Lewis Creek was initially placed on the Commonwealth of Virginia's Section 303(d) List of Impaired Waters in 1998 for exceedances of the General Standard (Benthic). The listing resulted from partial support of the Aquatic Life Use due to results of biological monitoring efforts conducted by the Virginia Department of Environmental Quality (VADEQ) at biomonitoring station 6BLW000.90. The impaired segment is 4.84 miles in length and extends from the Lewis Creek confluence with Stone Branch downstream to its confluence with Clinch River. After this listing, a TMDL study was conducted that identified excessive sediment as the pollutant causing the aquatic life impairment. The TMDL set limits on the amount of sediment the Lewis Creek can tolerate and still maintain support of the Aquatic Life Use. After the TMDL study is complete and approved by USEPA, Virginia's 1997 Water Quality Monitoring, Information and Restoration Act (WQMIRA) states in section 62.1-44.19:7 that the "Board shall develop and implement a plan to achieve fully supporting status for impaired waters".

Lewis Creek & Clinch River Confluence

To comply with this state requirement, a TMDL implementation plan (IP) was developed to reduce sediment levels to attain water quality standards allowing delisting of stream from the Section 303(d) List of Impaired Waters. The TMDL IP describes control measures, which can include the use of better treatment technology and the installation of best management practices (BMPs), to be implemented in a staged process. Local support and successful completion of the implementation plan will enable restoration of the impaired water while enhancing the value of this important resource for the Commonwealth. Opportunities for Russell County, Town of Honaker, local agencies, and watershed residents to obtain funding will improve with an approved IP.

This public document is an abbreviated version of the technical document, which can be obtained by contacting the Virginia Department of Conservation and Recreation (VADCR) office.

STATE AND FEDERAL REQUIREMENTS FOR IMPLEMENTATION PLANS

In developing this implementation plan, both state and federal requirements and recommendations were followed. Virginia's 1997 WQMIRA directs the State Water Control Board (SWCB) to "develop and implement a plan to achieve fully supporting status for impaired waters" (§62.1-44.19:4 through 19:8 of the Code of Virginia). WQMIRA establishes that the implementation plan shall include the date of expected achievement of water quality objectives, measurable goals, corrective actions necessary and the associated costs, benefits, and environmental impacts of addressing the impairments.

Section 303(d) of the CWA and current USEPA regulations do not require the development of implementation strategies. USEPA does, however, outline the minimum elements of an approvable IP in its 1999 "Guidance for Water Quality-Based Decisions: The TMDL Process". The listed elements include description of the implementation actions and management measures, timeline for implementing these measures, legal or regulatory controls, time required to attain water quality standards, monitoring plan, and milestones for attaining water quality standards.

Tributary to Lewis Creek Behind Caboose Welcome Center

USEPA develops guidelines that describe the process and criteria to be used to award CWA Section 319 nonpoint source grants to States. The "Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories in FY 2003" identifies the nine elements that must be included in the IP to meet the Section 319 requirements.

Once developed, VADEQ will present the IP to the SWCB for approval as the plan for implementing pollutant allocations and reductions contained in the TMDL. In addition, VADEQ will request the plan be included in the appropriate Water Quality Management Plan (WQMP), in accordance with the CWA's Section 303(e) and Virginia's Public Participation Guidelines for Water Quality Management Planning.

REVIEW OF TMDL DEVELOPMENT STUDY

George Mason University and TetraTech, Inc. were contracted by VADEQ to develop a benthic TMDL for Lewis Creek. The final TMDL was completed in March 2004 with subsequent approval by USEPA in April 2004. The TMDL development document can be obtained at the VADEQ office in Abingdon, VA or via the Internet. Impairment description, water quality monitoring, watershed description, stressor identification, source assessment, water quality modeling, and allocated reductions were reviewed to determine implications of TMDL and modeling procedures on IP development.

The Lewis Creek watershed, comprising National Watershed Boundary Dataset (NWBD) TC10, is located in Russell County, Virginia in the Tennessee/Big Sandy River basin (USGS Hydrologic Unit Code, 06010205) (Figure 1). The Lewis Creek watershed area is approximately 13,960 acres, with forest as the primary land use (82%) followed by agricultural (13%), barren/transitional/quarries (3%), and urban (2%) land uses (Figure 2). The "barren/transitional/quarries" landuse category primarily represented previously mined land and abandoned mine land (AML) in the TMDL study. A reference watershed approach was used to develop the sediment TMDL for Lewis Creek. The Generalized Watershed Loading Functions (GWLF) model was used to simulate runoff and sediment loads within the watershed.

Sedimentation in Stormwater Runoff

Excessive sedimentation was determined by the TMDL study as the primary stressor to the benthic community in the Lewis Creek watershed. Sediment is delivered to Lewis Creek through the processes of surface runoff, channel and streambank erosion, and point sources, as well as background geologic processes. Natural sediment generation is accelerated through human-related land-disturbing activities related to mining, agricultural, urban, and forest land uses. During surface runoff events, exposed sediment particles can be dislodged from the soil and carried in runoff from both pervious and impervious surfaces in the watershed to the stream. Increased runoff rates due to man-induced influence in a watershed and streambank instability from decreased riparian cover or livestock trampling results in streambank erosion. Conditions outlined in the TMDL development study to address the sediment impairment in the Lewis Creek watershed include:

- ★ Sediment load reduced by 80% on transitional landuse (i.e., abandoned mine land);
- ★ Sediment load reduced by 33% on pasture/hay, cropland, and urban lands;
- ★ Streambank erosion was represented in the land-based sediment loadings; and
- ★ Implicit in the requirement for no point source sediment load adjustment is the requirement for point sources to maintain permit compliance.

Figure 1. Lewis Creek watershed location.

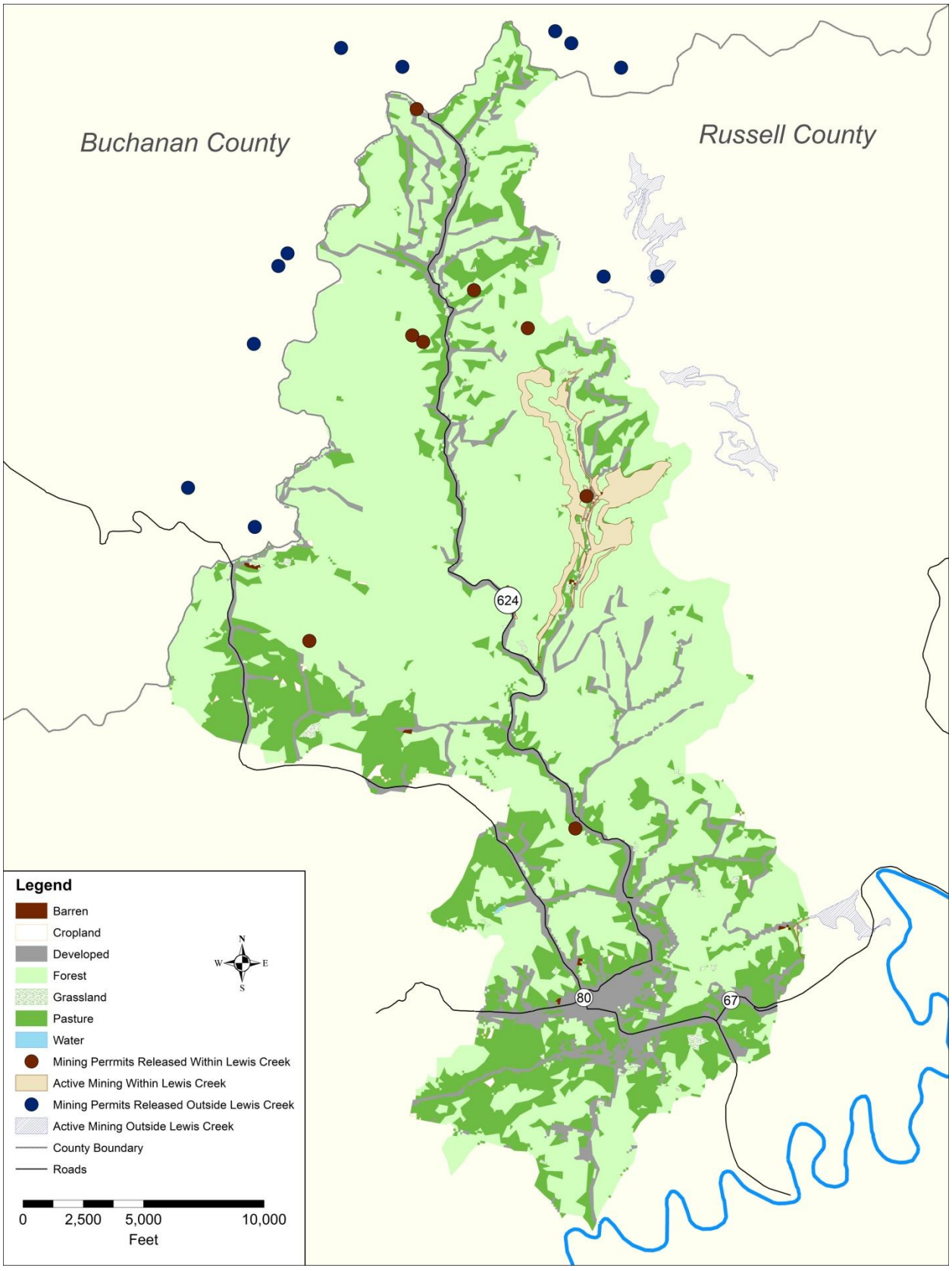

Figure 2. Land uses along with mining areas in the Lewis Creek watershed.

PUBLIC PARTICIPATION

Process

The actions and commitments compiled in this document are formulated through input from citizens of the watershed; Russell County and Town of Honaker governments; Clinch Valley Soil and Water Conservation District (CVSWCD); Virginia Department of Conservation and Recreation (VADCR); Virginia Department of Mines, Minerals, and Energy (VADMME); Virginia Department of Environmental Quality (VADEQ); Virginia Department of Game and Inland Fisheries (VDGIF), Virginia Department of Health (VDH); Natural Resources Conservation Service (NRCS), Black Diamond Resource Conservation and Development Council (BDRCD); Canaan Valley Institute (CVI); The Nature Conservancy (TNC); and Blue Ridge Environmental Solutions, Inc. (BRES). Every citizen and interested party in the watershed is encouraged to put the IP into action and contribute what he or she is able to help restore the health of Lewis Creek.

Bioretention (Rain Garden)

Public participation took place during IP development on three levels. First, public meetings were held to provide an opportunity for informing the public as to the end goals and status of the project, as well as, a forum for soliciting participation in the smaller, more-targeted meetings (*i.e.*, working groups and Steering Committee). Second, three working groups were formed: Agricultural, Urban/Residential, and Governmental. A representative from VADCR, or BRES coordinated each working group in order to facilitate the process and integrate information collected from the various communities. Third, a steering committee was formed with representation from the Agricultural, Urban/Residential, and Governmental Working Groups; Russell County and Town of Honaker governments; CVSWCD; VADCR; VADMME; VADEQ; VDGIF; NRCS; BDRCD; CVI; TNC; and BRES to guide the development of the IP. Over 160 man-hours were devoted to attending these meetings by individuals representing agricultural, mining, residential, commercial, environmental, and government interests on a local, state, and federal level (Table 1).

Throughout the public participation process, major emphasis was placed on discussing best management practices (BMPs), locations of control measures, education, technical assistance, monitoring, and funding.

Table 1. Meetings held during the Lewis Creek TMDL IP development process.

Date	Meeting Type	Location	Attendance	Time (hr)
01/26/10	Agricultural Working Group	Lebanon USDA Service Center	8	2
02/08/10	Public Meeting	Honaker High School	11	1
02/08/10	Agricultural Working Group	Honaker High School	11	1
04/01/10	Residential Working Group	Town of Honaker Office	3	1
04/01/10	Governmental Working Group	Lebanon USDA Service Center	10	2
05/25/10	Agricultural Working Group	Town of Honaker Office	3	1
07/01/10	Steering Committee	Lebanon USDA Service Center	5	2
07/22/10	Public Meeting	Town of Honaker Office	5	1

Agricultural Working Group Summary

The Agricultural Working Group (AWG) consisted predominantly of beef producers and horse owners throughout the watershed. Representatives from organizations that serve this community and will have a role in implementation were also included (*e.g.*, CVSWCD, NRCS, and VADCR). The AWG is confident that current BMPs eligible for cost-share in TMDL areas and proposed recommendations will provide the necessary incentive for producers and horse owners to implement required BMPs to meet specified reductions to pasture and cropland sediment loads. Challenges, recommendations, and keys for success discussed in the meetings included:

- ★ Condition of pasture in many places throughout watershed is poor and improved pasture management would greatly reduce sediment loadings. Livestock exclusion fencing coupled with rotational grazing would be a great start to addressing sediment loading. A Lime Assistance Program, modeled after program offered by Evergreen SWCD in Smyth County, would provide additional incentive to improve pasture condition and the group believes there would be a high participation level due to past inquiries at CVSWCD and NRCS. It is doubtful state or federal funds would be allocated to the program; therefore, other funding sources need to be pursued.
- ★ Attendees indicated sizeable groups of horses exist in the watershed and felt horse owners should be targeted for assistance. CVSWCD, Lonesome Pine SWCD, and Holston River SWCD are currently making plans to host a workshop for horse owners in the area. Assistance from the Prince William SWCD, a district with extensive experience in best management practices for horse owners, is being utilized to develop the workshop. CVSWCD will be targeting all of Russell County, but specific emphasis will be placed on the Town of Honaker area.

- Cropland acreage in the watershed has decreased as reflected in the 2001 NLCD landuse data. Cropland is still prominent in two areas totaling approximately 50 acres. Group consensus was most cropland has been converted to pasture rather than forest and livestock stream exclusion along with pasture load reductions should be a priority over cropland load reductions.
- Attendees agreed biggest constraints to implementation are initial cost and converting productive bottom land pasture to a 35-feet buffer. Offering alternatives to the 35-feet buffer requirement will entice farmers to participate. Stream exclusion with a 10-feet setback (LE-2T)is available now in Russell County to farmers through the VACS program.
- A survey was sent to agricultural producers in watershed to gather information regarding farmer's concerns, implementation constraints, and suitable outreach methods.
- Most residents in the watershed respond well to direct mailings and information in the Lebanon News and Bristol Herald Courier.

Residential Working Group Summary

The Residential Working Group (RWG), consisting of Mayor of Town of Honaker, VADCR, and BRES personnel, focused on means to educate and involve public with regard to implementing corrective actions to reduce the sediment load from residential/urban landuse. Challenges, recommendations, and keys for success discussed in the meeting included:

- Street sweeping in town is performed by town personnel with brooms and shovels along with a skid steer loader with various attachments (e.g., brush). The town previously considered purchasing a street sweeper, but cost was prohibitive at that time. The town is very interested in obtaining a street sweeper, but would require funding assistance.
- The town is currently working with Cumberland Plateau Planning District Commission on a Downtown Revitalization Project that would transform the Caboose into a Welcome Center and address some of the sidewalk and pedestrian issues within the town. Property at the New People's Bank (behind Caboose) is utilized for several community activities like the Redbud Festival. Significant exposure to a rain garden and/or streambank restoration project would be obtained if installed at the New People's Bank property. Honaker High School and Honaker Elementary School were also identified as potential project locations.
- Drop inlets available for manufactured stormwater BMPs exist along Coxtown Road. A manufactured BMP maintenance cost was identified as a potential constraint.
- Outreach opportunities exist with Lyons Club, Redbud Festival, area churches, Little League, senior citizens meeting in Finney, articles in The Lebanon News, and flyers at Town Office.
- Group agreed most funding for residential and urban actions would be through grant funds and possibly with assistance from businesses within the watershed.

Governmental Working Group Summary

The Governmental Working Group (GWG) consisting of representatives from CVSWCD, VADCR, VADMME, VADEQ, VGDIF, and BRES personnel, focused on corrective actions to reduce transitional sediment load, funding sources, technical assistance needs, regulatory controls, and lead agencies responsible for implementation. Key topics and recommendations included:

- ★ Changes in the transitional land use since TMDL development were investigated. Additional active mining permits currently exist in the watershed compared to permits comprising the TMDL waste load allocation. Landuse classified as AML in 2001 NLCD dataset was considerably less than landuse classified as AML in 1992 NLCD dataset.
- ★ A residential rain garden or rain barrel workshop sponsored by CVSWCD along with demonstration site at Honaker High School was suggested.
- ★ Review of local ordinances and comprehensive plans to identify opportunities to promote water quality improvement; such as, implementation and/or preservation of riparian buffers is needed. Local interest and activities to be integrated with implementation include: Virginia Wildlife Action Plan, Upper Tennessee Rive Roundtable's 5 Year Plan, The Nature Conservancy's Clinch Valley Program, and Clinch Powell Clean Rivers Initiative.
- ★ There are four monitoring stations in Lewis Creek watershed: two ambient, one biological, and one probabilistic. Currently, stations 6BLWS000.06 (ambient) and 6BLWS004.84 (ambient) are being monitored for bacteria through 2010. These stations will rotate out of the sampling rotation at the end of this year. Station 6BLWS000.90 (biological), the listing station, was last monitored in 2002. Station 6BLWS003.88 (probabilistic) was sampled in 2001 and 2008. SCI biological scores of 58 and 53 were recorded in 2001 and scores of 48 and 53 in 2008. These stations will continue to be monitored in accordance with VADEQ's ambient and biological monitoring program. Status of citizen monitoring activities in the watershed was unknown. CVSWCD has equipment available for Virginia Save-our-Streams monitoring, but it has not been used lately. Working with Honaker High School students to visit Lewis Creek for a monitoring event was suggested.
- ★ Proposed roles and responsibilities for agencies included:
  - **Russell County:** administer the counties erosion and sediment control program and provide mapping assistance
  - **CVSWCD:** provide state agricultural cost-share funds, administer and provide technical assistance for agricultural and residential programs, and continue well-developed education program to successfully target both school-aged children and adults
  - **VADMME:** DMLR will provide permit tracking through their TMDL offsets program as well as mining and re-mining permit inspection and oversight and Division of Gas and Oil will provide gas well permit inspection and oversight
  - **VADEQ:** provide ambient and biological monitoring and assist with citizen monitoring
  - **NRCS** and **VDGIF**: provide technical assistance and funding

Steering Committee Summary

The Steering Committee consisted of representatives from the AWG, URWG, GWG; Russell County; Town of Honaker; CVSWCD; VADCR; VADMME; VADEQ; VDGIF; CVI; TNC; and BRES. Steering Committee evaluated recommendations from working groups, reviewed BMP quantification and cost estimates, created implementation goals and milestones, reviewed monitoring plan, discussed potential funding resources available, revised implementation plan document, and evaluated materials for final public meeting. The steering committee will periodically revisit implementation progress and suggest plan revisions as needed.

IMPLEMENTATION ACTIONS

The actions and cost needed in the implementation stages were identified and quantified. The estimated units presented in Table 2 represent the implementation goal of TMDL source allocation attainment, which is required under WQMIRA and by USEPA for eligibility to receive Section 319 grant funds to apply during implementation. Allocation attainment will also result in removal of Lewis Creek from the Commonwealth of Virginia's Section 303(d) List of Impaired Waters. Potential control measures, their associated costs and efficiencies, and potential funding sources were identified through review of the TMDL, input from working groups, and literature review. Control measures were assessed based on cost, availability of existing funds, reasonable assurance of implementation, and water quality impacts. Measures that can be promoted through existing programs were identified, as well as those not currently supported by existing programs and their potential funding sources. The assurance of implementation of specific control measures was assessed through discussion with the working groups and Steering Committee.

The quantity of control measures, or BMPs, recommended during implementation was determined through spatial analyses and modeling alternative implementation scenarios. Spatial analyses of land use, stream-network, and the Commonwealth of Virginia aerial maps along with regionally appropriate data archived in the VADCR Agricultural BMP Database, VADMME Permit Database, and TMDL document were utilized to establish average estimates of control measures to reduce sediment loads in the watershed. Additionally, input from local agency representatives, citizens, and contractors were used to verify the analyses.

Agricultural Implementation Needs

Removing livestock from the stream corridor was identified as the primary control measure to reduce pasture sediment load. There are approximately 58 miles of perennial streams in the Lewis Creek watershed. Exclusion fencing necessary to prevent access to perennial streams and meet the stated TMDL reductions was estimated at approximately 11 miles of fence. Figure 3 displays analysis results for a portion of the watershed. This exclusion fencing is translated into a total of 32 exclusion systems to be installed to insure full exclusion of livestock from the streams. In order to provide implementation options to producers, several cost-share programs with varying goals and requirements were included. Based on historical cost-share program participation and working group feedback, total exclusion systems were divided between Conservation Reserve and Enhancement Program (CREP), Livestock Exclusion with Riparian Buffers (LE-1T), Livestock Exclusion with Reduced Setback (LE-2T), and Stream Protection (WP-2T) (Table 2). A

Stream Exclusion Fencing

typical LE-1T system includes streamside fencing for perennial and intermittent streams, cross-fencing for pasture management, hardened crossing, alternative watering system, watering trough, water distribution piping, and a 35-ft buffer from the stream. Sediment reduction is achieved through streambank stabilization, buffer treatment, and improved pasture management.

Re-forestation

During IP development, the AWG concluded there is a decreasing trend in cropland acres in the Lewis Creek watershed. During the TMDL study, land use was extracted from the 1992 National Land Cover Database (NLCD). Cropland acres were listed at 229 acres in the TMDL document. During IP development, 28 cropland acres were calculated using the 2001 NLCD. In addition, the AWG estimated 50 cropland acres currently exists in the watershed. The conversion of cropland to pasture or forest land uses results in a sediment load reduction. Therefore, it was decided that the primary control measure for cropland sediment load reduction will be permanent conversion of cropland to pasture and forest land uses. The conversion was divided between SL-1 Permanent Vegetative Cover and FR-1 Reforestation of Erodible Crop and Pastureland BMPs based on input from AWG and landuse difference. Leaving 113 acres cropland, converting 110 acres to pasture, and converting six acres to forest land use, satisfied the TMDL goal (Table 2).

CVSWCD is working with Prince William Soil and Water Conservation District as part of the Chesapeake Bay-Friendly Horse Farm Project to develop a Horse Owner Education Program that will address horse owners in the Lewis Creek watershed. A Lime Assistance Program, modeled after program offered by Evergreen SWCD in Smyth County, could provide additional incentive to improve pasture and hay land condition by providing assistance in purchasing and spreading lime. Cropland would not be eligible for the program.

Urban / Residential Implementation Needs

Sediment load reductions on urban land use was determined through modeling alternative implementation scenarios, defining percentage of land use area or unit amount treated by control measure, then applying related reduction efficiency to the associated load. BMP type and usage amount were based on RWG, GWG, and Steering Committee recommendations. Emphasis was placed on street sweeping, bioretention, streambank stabilization / vegetated buffers, and manufactured stormwater BMPs for the urban land use (Tables 2 and 3). It was estimated that approximately 60% of the calculated streets in Honaker would benefit from street sweeping. Based on the sediment reduction afforded by street sweeping, identifying supplemental funding for the Town of Honaker to purchase a street sweeper should be a priority.

The Town of Honaker is currently in the early stages of a downtown revitalization project which began in 2007. The Downtown Revitalization Project, which the town is partnering with Cumberland Plateau Planning District Commission to develop, will outline plans for the Train Caboose Visitor's Center and adjacent area. Targeting streambank stabilization, vegetated buffers, and bioretention projects in the adjacent area (i.e., Hometown Bank Property) needs to be incorporated in the revitalization plan. Additionally, drop inlets available for manufactured stormwater BMPs exist along Coxtown Road.

Street Sweeper

Transitional Implementation Needs

Analysis was performed to help determine current extent of transitional landuse in Lewis Creek. Items addressed included:

1. Permitted mining areas and mining permits released by VADMME;
2. Mining permits included in WLA when TMDL was developed;
3. Amount of land classified as transitional that lies within current permitted mining area;
4. Current landuse classification of land classified as transitional during TMDL study; and
5. Transitional landuse acres listed in TMDL needing AML reclamation versus other treatment like E & S control and vegetated buffers.

AML Revegetation

VADMME personnel provided current mining permit information for area inside and just outside the Lewis Creek watershed. Figure 2 shows locations for mining permits released by VADMME and active mining permitted areas. Approximately 273 acres are currently permitted for mining. The TMDL was developed utilizing landuse from the 1992 National Land Cover Dataset (NLCD). Based on "Barren/transitional/quarries" landuse from the 1992 NLCD and watershed boundary from the 6th order National Watershed Boundary Dataset (NWBD), there were 365 acres of "barren/transitional/quarries" landuse in the Lewis Creek watershed. About 43 acres of the 1992 "barren/transitional/quarries" landuse lie within the active permitted mining areas. After TMDL development, the 2001 NLCD dataset was released. Both datasets were clipped to the Lewis Creek watershed and the 1992 NLCD "barren/transitional/quarries" landuse was overlaid with 2001 NLCD landuse dataset to determine

landuse changes that have occurred in the Lewis Creek watershed. Of the 365 acres classified as "barren/transitional/quarries" in 1992, about three acres remained classified as "barren" in 2001. Due to these differences, VADMME personnel evaluated the Lewis Creek watershed to estimate AML features. Features were identified as portals, clogged streams, high walls, dangerous impoundment, equipment/ facilities, and vertical openings. The most prominent features were clogged streams and high walls, estimated at 480 and 324 acres, respectively. Based on evaluations completed, regrading and revegetating approximately 200 acres of AML and treating runoff from about 15 acres with infiltration channels, check dams, silt fences, and diversion ditches will reduce sediment load from transitional landuse to the level required in the TMDL (Table 2).

Other Potential Implementation Needs

Implicit in the TMDL is the need to avoid increased delivery of pollutants from sources that have not been identified as needing a reduction, and from sources that may develop over time, as implementation proceeds. Future mining and residential development were identified as potential sources to deliver sediment to streams through land disturbance. Care should be taken to monitor these activities and the impact on water quality. This needs to be carefully considered during permit issuance, site plans, and development. The local erosion and sediment control and stormwater management programs must be complied with.

Retention Pond

Table 2. Estimation of control measures with unit cost (average) needed to meet implementation goals during 10-year timeline for sediment reductions in Lewis Creek.

Control Measure	Unit	Estimated Units Needed[1] (#)	Unit Cost[2] ($)
Pasture			
Livestock Exclusion System with 35 feet buffer (SL-6 & SL-6AT)	System	3	23,800
Livestock Exclusion System with 35 feet buffer (LE-1T)	System	20	23,800
Livestock Exclusion System with 10 feet setback (LE-2)	System	5	18,800
Livestock Exclusion System with 35 feet buffer (WP-2T)	System	3	14,250
Horse Owner Education Program	Program	1	15,000
Lime Assistance Program	Program	1	50,000
Cropland			
Permanent Vegetative Cover on Cropland (SL-1)	Acres - Installed	110	300
Reforestation of Erodible Crop and Pastureland (FR-1)	Acres - Installed	6	400
Urban			
Streambank Stabilization	Feet	500	200
Vegetated Buffers	Acres - Installed	1	400
Bioretention	Acres - Treated	5	15,000
Infiltration Trench	Acres - Treated	1	11,300
Street Sweeping	Curb Miles	80	2,715
Increased Erosion and Sediment Control	Acres - Treated	10	7,200
Manufactured Stormwater BMPs	Acres - Treated	5	25,000
Transitional			
Streambank Stabilization	Feet	100	200
Vegetated Buffers	Acres - Installed	1	400
Revegetation	Acres - Installed	200	1,000
Regrading	Acres - Installed	200	2,500
Infiltration Channels	Acres - Treated	15	5,050
Check Dams	Acres - Treated	15	1,000
Silt Fence	Acres - Treated	15	1,450
Diversion Ditches	Acres - Treated	15	2,010
Technical Assistance			
Agricultural	Full Time Equivalent	0.5 /yr	60,000 /yr
Urban	Full Time Equivalent	0.5 /yr	60,000 /yr
Transitional	Full Time Equivalent	0.5 /yr	60,000 /yr

[1] Total for 10-year timeline; [2] Unit cost = installation or one-time incentive payment

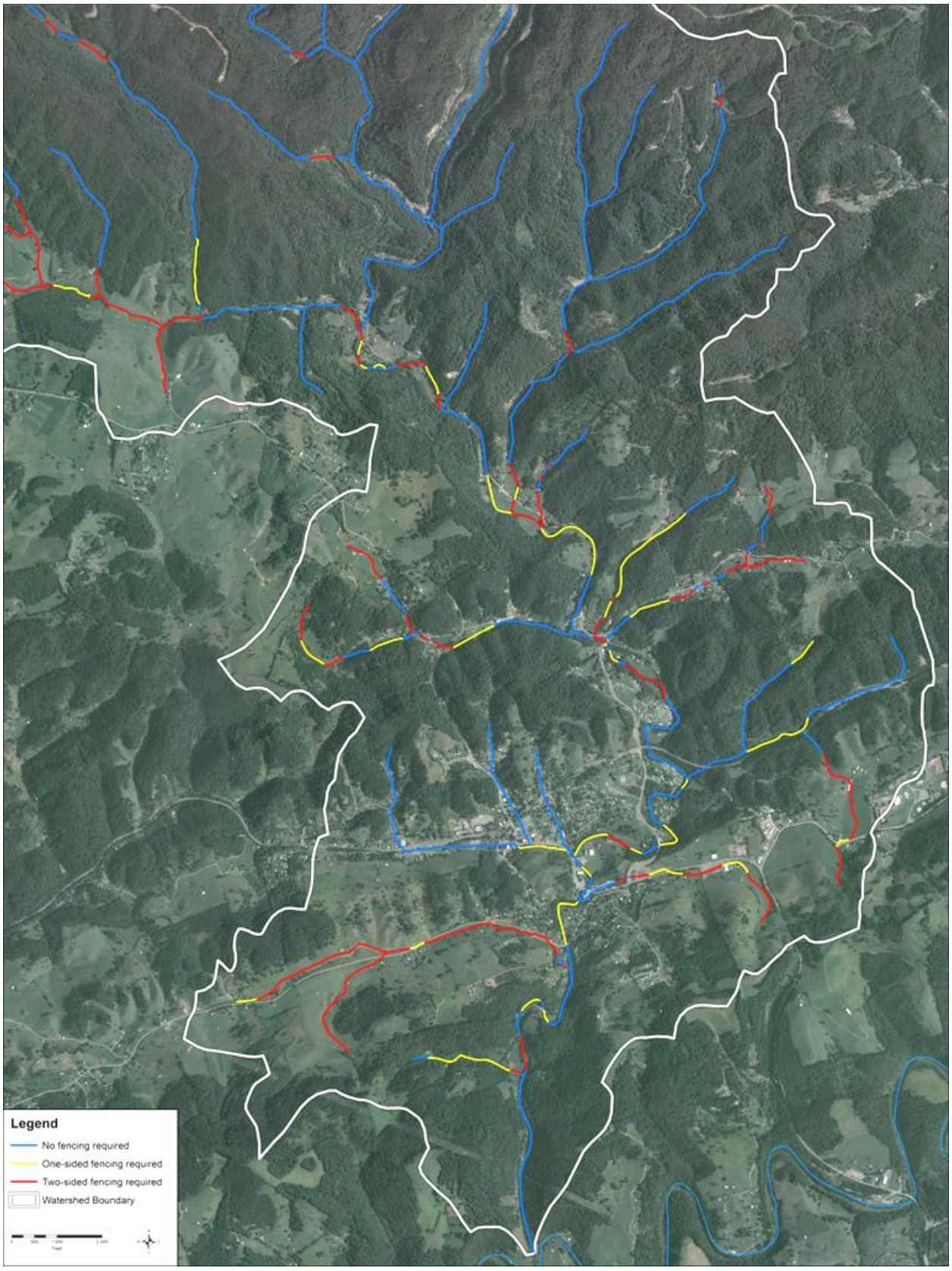

Figure 3. Potential livestock exclusion fencing analysis results for portion of Lewis Creek.

Assessment of Technical Assistance Needs

To determine the number of full time equivalents (FTE) considered necessary for agricultural technical assistance during implementation, the average cost-share amount of practices needed to be installed per year during implementation was divided by an average cost-share amount that one FTE can process in a year. It was assumed that all BMPs would need some level of technical assistance and the FTE would be responsible for educational outreach. Coupling the number of BMPs processed historically and estimates provided by CVSWCD and AWG, a half FTE per year is needed throughout implementation. Members of the GWG and Steering Committee estimated that a half FTE per year would be required throughout implementation to provide technical assistance and educational outreach tasks to reduce sediment loads on both urban and transitional land uses. The number of FTE needed to provide assistance during implementation in the watershed is listed in Table 2.

Rotational Grazing System

Cost Analysis

Associated cost estimations for each implementation action were calculated by multiplying the average unit cost per the number of units shown in Table 2. The total average installation cost for livestock exclusion systems, Lime Assistance Program, and Horse Owner Education Program treating pasture sediment loads is $0.75 million (Table 3). The total installation cost for converting cropland to permanent vegetative cover and forest is estimated at $0.04 million (Table 3). Estimated corrective action costs needed to reduce sediment loads on urban and transitional land uses is $0.60 million and $0.86 million, respectively (Table 3).

It was determined by the CVSWCD, VADCR, AWG, GWG, and Steering Committee members that it would require $60,000 to support the salary, benefits, travel, and training of one technical FTE. The total cost to provide assistance in the agricultural, urban, and mining programs during implementation is expected to be $0.30, $0.30, and $0.30 million, respectively (Table 3).

The total implementation cost including technical assistance is $3.15 million with the agricultural cost being $1.09million, urban cost $0.90 million, and transitional land cost $1.16 million (Table 3).

Table 3. Implementation cost associated with percentage of practices installed addressing agricultural, urban, and transitional practices along with technical assistance needed in Lewis Creek watershed.

Year	Agricultural				Urban / Residential			Transitional			Total Cost
	Pasture Sediment Load Reduction ($)	Cropland Sediment Load Reduction ($)	Technical Assistance ($)	Total ($)	Urban Sediment Load Reduction ($)	Technical Assistance ($)	Total ($)	Transitional Sediment Load Reduction ($)	Technical Assistance ($)	Total ($)	($)
1	73,900	0	30,000	103,900	22,200	30,000	52,200	2,000	30,000	32,000	188,100
2	146,500	0	30,000	176,500	47,200	30,000	77,200	95,900	30,000	125,900	379,600
3	177,100	0	30,000	207,100	99,600	30,000	129,600	95,900	30,000	125,900	462,600
4	152,100	0	30,000	182,100	124,600	30,000	154,600	95,900	30,000	125,900	462,600
5	152,100	0	30,000	182,100	49,400	30,000	79,400	95,900	30,000	125,900	387,400
6	47,600	0	30,000	77,600	59,400	30,000	89,400	95,900	30,000	125,900	292,900
7	0	8,900	30,000	38,900	40,100	30,000	70,100	95,900	30,000	125,900	234,900
8	0	8,900	30,000	38,900	65,100	30,000	95,100	94,900	30,000	124,900	258,900
9	0	8,900	30,000	38,900	34,400	30,000	64,400	94,900	30,000	124,900	228,200
10	0	8,900	30,000	38,900	59,400	30,000	89,400	95,600	30,000	125,600	253,900
Stage I Total (1-6)	**749,300**	**0**	**180,000**	**929,300**	**402,400**	**180,000**	**582,400**	**481,500**	**180,000**	**661,500**	**2,173,200**
Stage II Total (7-10)	**0**	**35,600**	**120,000**	**155,600**	**199,000**	**120,000**	**319,000**	**381,300**	**120,000**	**501,300**	**975,900**
Total (1-10)	**749,300**	**35,600**	**300,000**	**1,084,900**	**601,400**	**300,000**	**901,400**	**862,800**	**300,000**	**1,162,800**	**3,149,100**

Benefit Analysis

The primary benefit of implementation is cleaner waters in Virginia, where sediment levels in Lewis Creek will be reduced to meet water quality standards. Because of the many uncertainties involved in relating sediment reductions to biological health, the assumption used during implementation planning is similar to the one used during the TMDL study – namely that the degree of improvement in water quality due to implementation actions will be directly related to the degree of improvement in the biological health of the stream. Actions during implementation can improve livestock herd health, benefit stakeholder economy, and reduce bacteria loads to Lewis Creek.

Livestock Herd Health

A clean water source coupled with exclusionary fencing has been shown to improve weight gain; decrease stress; reduce herd health risks associated with increased exposure to water-transmitted diseases, bacteria, virus and cysts infections; reduce mastitis and foot rot; and decrease herd injuries associated with cattle climbing unstable streambanks or being stuck in mud.

Economics

An important objective of the IP is to foster continued economic vitality and strength. Healthy waters can improve economic opportunities for Virginians, and a healthy economic base can provide the resources and funding necessary to pursue restoration and enhancement activities. The agricultural and urban practices recommended in this document will provide economic benefits to the landowner, along with the expected environmental benefits on-site and downstream. For example, installing a livestock stream exclusion system leads to the development of alternative (clean) water sources and improves the pasture condition. Improved aesthetics throughout the watershed can have an economic benefit on the local economy. Additionally, money spent by landowners, government agencies, and non-profit organizations in the process of implementing the IP will stimulate the local economy.

The benefit of a Grazing Land Protection System BMP is improved profit through more efficient utilization and harvest of forage by grazing animals. Standing forage utilized directly by the grazing animal is always less costly and of higher quality than the same forage harvested with equipment and fed to the animal (VCE, 1996). Several factors contribute to greater profitability: stocking rate can usually be increased by 30% to 50%; high-quality, fresh, and unsoiled vegetative growth available throughout the grazing system increases weight gain per acre; vigor of the pasture sod is improved; and handling and checking grazing animals is easier. More accurate estimates of the amount of forage available, greater uniformity in grazing of pastures, flexibility of harvesting and storing forage not needed for grazing, and extending the length of the grazing season while providing a more uniform quality and quantity of forage throughout the season are important benefits afforded by this system (VCE, 1996).

The economic benefits of the implementation of urban and transitional BMPs may be less obvious to an individual landowner or business, but the cumulative impacts can benefit the entire community. It is

estimated that excessive erosion and sediment transport in waterways of the United States results in a $16 billion economic impact each year (Osterkamp et al., 1998). Russell County and Town of Honaker have inevitably been economically affected by the impairment on Lewis Creek. Town of Honaker commits substantial resources each year for removal of sediment on streets and sidewalks. Improved aesthetics surrounding businesses provided by control measures (*e.g.*, parking lot cleaning and bioretention) has the potential to draw local citizens and visitors to these commercial areas. In addition, a healthy waterway has the potential to attract local citizens and visitors for recreation.

Bacteria Reduction

Lewis Creek was listed on the 2010 Commonwealth of Virginia's Section 303(d) List of Impaired Waters for exceedance of the bacteria standard and a TMDL must be completed by 2022. Various control measures outlined in this plan to reduce sediment loads will reduce bacteria loads to Lewis Creek as well. Excluding livestock and horses from the stream will greatly reduce direct bacteria loadings to Lewis Creek. Vegetated buffers that are established will help reduce bacteria transport to the stream from upslope locations. The installation of improved pasture management systems should also reduce bacteria losses and increase infiltration of precipitation; thereby, decreasing peak flows downstream.

Permanent Vegetative Cover on Cropland

MEASUREABLE GOALS AND MILESTONES FOR ATTAINING WATER QUALITY STANDARDS

The end goals of implementation are:

1) Restored water quality in the impaired waters, and
2) Subsequent de-listing of streams from the Commonwealth of Virginia's Section 303(d) List of Impaired Waters.

Progress toward end goals will be assessed during implementation through tracking of control measure installations by Clinch Valley Soil and Water Conservation District; Natural Resources Conservation Service; Virginia Department of Conservation and Recreation; Virginia Department of Mines, Mineral, and Energy; Russell County; and Town of Honaker. The Virginia Department of Environmental Quality will continue to assess water quality through its monitoring program. Other monitoring project activities in the watershed (*e.g.*, TVA) will be coordinated to augment the Virginia Department of Environmental Quality monitoring program. Implementation will be assessed based on reducing sediment to improve the benthic community. Implementation of control measures is scheduled for 10 years beginning in October 2010 lasting to September 2020 (Table 4). After implementation inception, five milestones will be met in two-year increments until Lewis Creek is removed from Commonwealth of Virginia's Section 303(d) List of Impaired Waters.

Streambank Buffer Establishment

Implementation in years one through six for agricultural source reductions focuses on developing and implementing the Horse Owner Education and Lime Assistance Programs and installing livestock stream exclusion systems. Cropland conversion BMPs will be focal point for years seven through ten. For urban sediment load reductions, limited progress for streambank restoration and street sweeping is expected for the first two years. After which, streambank stabilization and vegetated buffers progress is expected to occur evenly in years three and four. Street sweeping is slated to begin in year three providing time to purchase a sweeper and train town personnel. The street sweeping amount is expected to remain even over years three through ten. Bioretention installation is expected to occur evenly over the first five years. Urban land use treated by increased erosion and sediment control is expected to occur uniformly over the ten years. Infiltration trench installations are expected to occur equally in years seven and eight. A manufactured stormwater BMP is expected to be installed every two years. Streambank stabilization on the transitional landuse is estimated to occur throughout the ten years. Abandoned mine land reclamation is expected to commence in year two and occur evenly during years two through ten.

Alternative Water Source

Table 4 lists the cumulative progress towards the TMDL endpoint as implementation milestones are met. Water quality improvement is expected to increase each year. An 8% overall sediment load reduction is expected in the second year, 23% in the fourth year, 37% in the sixth year, 51% in the eighth year, and 64% in the tenth year. Based on water quality modeling projections for the tenth year, implementation milestone equaling 100% installation of agricultural, urban, and mining control measures, Lewis Creek would be in a probable position to be de-listed from the List of Impaired Waters. Considering the dynamics of a stream ecosystem and the inherent difficulties that may arise preventing implementation, the final milestone of TMDL allocation attainment was set at 10 years following implementation commencement.

The process of a staged implementation implies targeting of control measures, ensuring optimum utilization of resources. In quantifying agricultural BMPs through the use of aerial photography, land use, and stream network GIS layers, maps were formulated showing potential livestock stream access, pastures, and crop fields. These maps identify farm tracts that CVSWCD should concentrate their efforts in. The district will coordinate with landowners and track BMP installation progress. Streambank stabilization, vegetated buffers, and bioretention projects needs to be incorporated in the Honaker Downtown Revitalization Plan. Significant exposure to a rain garden and/or streambank restoration project would be attained if installed at the New People's Bank property. Honaker High School and Honaker Elementary School were also identified as potential project locations. VADMME personnel have evaluated the Lewis Creek watershed to estimate AML features such as portals, clogged streams, high walls, dangerous impoundment, equipment/ facilities, and vertical openings. Results from this initial evaluation will be used to develop an AML reclamation plan for the Lewis Creek watershed.

Table 4. Cumulative implementation of control measures and water quality milestones for Lewis Creek watershed.

Control Measure	Unit	Milestone 1 Completed by Sept. 2012	Milestone 2 Completed by Sept. 2014	Milestone 3 Completed by Sept. 2016	Milestone 4 Completed by Sept. 2018	Milestone 5 Completed by Sept. 2020
Pasture						
Livestock Exclusion System (SL-6)	System	0	2	3	3	3
Livestock Exclusion System (LE-1T)	System	6	14	20	20	20
Livestock Exclusion System (LE-2T)	System	2	4	5	5	5
Livestock Exclusion System (WP-2T)	System	0	2	3	3	3
Horse Owner Education Program	Program	1	1	1	1	1
Lime Assistance Program	Program	0.5	1	1	1	1
Cropland						
Permanent Vegetative Cover on Cropland (SL-1)	Acres Installed	0	0	0	55	110
Reforestation of Erodible Crop and Pastureland (FR-1)	Acres Installed	0	0	0	3	6
Urban						
Streambank Stabilization	Feet	0	500	500	500	500
Vegetated Buffers	Feet	0	500	500	500	500
Bioretention	Acres Treated	2	4	5	5	5
Infiltration Trench	Acres Treated	0	0	0	1	1
Street Sweeping	Curb Miles	0	20	40	60	80
Increased Erosion & Sediment Control	Acres Treated	2	4	6	8	10
Manufactured Stormwater BMPs	Acres Treated	1	2	3	4	5
Transitional						
Streambank Stabilization	Feet	20	40	60	80	100
Vegetated Buffers	Feet	20	40	60	80	100
Regrading & Revegetation	Acres Installed	22	67	111	155	200
Infiltration Channels, Check Dams, Silt Fence, & Diversion Ditches	Acres Treated	2	5	9	12	15
Technical Assistance						
Agricultural	FTE			0.5 /yr		
Urban	FTE			0.5 /yr		
Transitional	FTE			0.5 /yr		
Cumulative Sediment Reduction (%)		**8**	**23**	**37**	**51**	**64**
Cumulative Cost (millions $)		**0.57**	**1.49**	**2.17**	**2.67**	**3.15**

Implementation progress will be evaluated through water quality monitoring conducted by VADEQ through the agency's monitoring program and any additional monitoring support (*i.e.*, citizen monitoring) that may develop as implementation progresses. CVSWCD has equipment available for Virginia Save-our-Streams monitoring, but it has not been used lately. TVA performs monitoring in the Clinch River watershed and could potentially supplement monitoring for Lewis Creek.

Four VADEQ monitoring stations exist in Lewis Creek watershed, two ambient, one biological, and one probabilistic. Currently, stations 6BLWS000.06 (ambient) and 6BLWS004.84 (ambient) are being monitored for bacteria through 2010. These stations will rotate out of the sampling rotation at the end of this year. Station 6BLWS000.90 (biological), the listing station, was last monitored in 2002. Station 6BLWS003.88 (probabilistic) was sampled in 2001 and 2008. SCI biological scores of 58 and 53 were recorded in 2001 and scores of 48 and 53 in 2008. These stations will continue to be monitored in accordance with VADEQ's ambient and biological monitoring program. The GWG and Steering Committee requests the following parameters be collected at the ambient monitoring stations: *E. coli* bacteria, temperature, dissolved oxygen, pH, specific conductance, total nitrogen, total phosphorus, and total suspended solids. Monitoring results are accessible on the VADEQ website

Table 5. Monitoring station identification, station location, station type, and monitoring schedule for VADEQ monitoring stations in the Lewis Creek watershed.

Station ID	Station Location	Station Type	Monitoring Schedule
6BLWS000.06	Route 653, near Clinch River confluence	Ambient	2010, 2013-2014
6BLWS000.90	Route 624, below Honaker STP	Biological	Program Dependent
6BLWS003.88	Route 637, near Town of Honaker	Probabilistic	Program Dependent
6BLWS004.84	Route 624, near Hickory Junction	Ambient	2010, 2013-2014

Figure 4. Location of VADEQ monitoring stations in the Lewis Creek watershed.

STAKEHOLDER'S ROLES & RESPONSIBILITIES

Stakeholders are individuals who live or have land management responsibilities in the watershed, including government agencies, businesses, private individuals, and special interest groups. Successful implementation depends on stakeholders taking responsibility for their role in the process. The primary role falls on the local groups that are most affected; that is, businesses, community watershed groups, and citizens. However, local, state, and federal agencies also have a stake in seeing that Virginia's waters are clean and provide a healthy environment for its citizens.

Regional and local government groups work closely with state and federal agencies throughout the TMDL process; these groups possess insights about their community that may help to ensure the success of TMDL implementation. These stakeholders have knowledge about a community's priorities, how decisions are made locally, and how the watershed's residents interact. Russell County and Clinch Valley Soil and Water Conservation District (CVSWCD) will have prominent roles during implementation. Russell County will administer the erosion & sediment control and stormwater management programs and provide mapping assistance. CVSWCD will provide state agricultural cost-share funds, lead education and technical assistance efforts, and track best management practice implementation for the agricultural and residential programs. The district has a well-developed education program successfully targeting school-aged children and adults.

In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. State government has the authority to establish state laws that control delivery of pollutants to local waters. Local governments in conjunction with the state can develop ordinances involving pollution prevention measures. In addition, citizens have the right to bring litigation against persons or groups of people who can be shown to be causing some harm to the claimant. Through hearing the claims of citizens in civil court, and the claims of government representatives in criminal court, the judicial branch of government also plays a significant role in the regulation of activities that impact water quality. State agencies conducting regulatory, education, or funding procedures related to water quality in Virginia include: Virginia Department of Environmental Quality (VADEQ); Virginia Department of Conservation and Recreation (VADCR); Virginia Department of Mines, Minerals, and Energy (VADMME); Virginia Department of Agriculture and Consumer Services (VADACS); Virginia Department of Game and Inland Fisheries (VDGIF); Virginia Department of Forestry (VADOF); and Virginia Cooperative Extension (VCE).

The roles and responsibilities of some of the major stakeholders on a local, state, and federal level are as follows:

Russell County and Town of Honaker Government Departments: Government staff work closely with local and state agencies to develop and implement the TMDL. Staff will administer the erosion & sediment control and stormwater programs, provide mapping assistance, and may also help to promote education and outreach to citizens, businesses, and developers to introduce the importance of the TMDL process.

CVSWCD: The Clinch Valley Soil and Water Conservation District is a local unit of government responsible for the soil and water conservation work within Russell County. The district's overall role is to increase voluntary conservation practices among farmers, ranchers, and other land users. District staff work closely with watershed residents and have valuable knowledge of local watershed practices. Specific to the TMDL implementation, the district will provide state agricultural cost-share funds, lead education and technical assistance efforts, and track best management practice implementation for the agricultural and residential programs.

Citizens & Businesses: The primary role of citizens and businesses is simply to get involved in the TMDL process. This may include participating in public meetings, assisting with public outreach, providing input about the local watershed history, and/or implementing BMPs to help restore water quality.

Community Civic Groups: Community civic groups take on a wide range of community service including environmental projects. Such groups include the Ruritan, Farm Clubs, Homeowner Associations and youth organizations such as 4-H and Future Farmers of America. These groups offer a resource to assist in the public participation process, educational outreach, and assisting with implementation activities in local watersheds.

Animal Clubs/Associations: Clubs and associations for various animal groups (*e.g.*, beef, equine, poultry, swine, and canine) provide a resource to assist and promote conservation practices among farmers and other landowners, not only in rural areas, but in residential areas as well.

Upper Tennessee River Roundtable: The Roundtable mission is to achieve clean water throughout the watershed with the involvement of citizens in planning, educating, attracting funding, and serving as advocates for our water resources. The Roundtable envisions the citizens within the watershed of the Clinch, Holston, and Powell Rivers practicing conservation and good stewardship thus insuring water quality and quantity so that the waters are fishable, swimmable, and sustain a healthy and diverse ecosystem.

The Nature Conservancy (TNC): A non-profit organization taking a scientific approach to conservation, selecting areas it seeks to preserve based on analysis of what is needed to ensure the preservation of the local plants, animals, and ecosystems. TNC works with all sectors of society including businesses, individuals, communities, partner organizations, and government agencies to achieve its

goals. TNC is known for working effectively and collaboratively with traditional land owners such as farmers, when such a partnership provides an opportunity to advance mutual goals.

VADEQ: The State Water Control Law authorizes the SWCB to control and plan for the reduction of pollutants impacting the chemical and biological quality of the State's waters resulting in the degradation of the recreation, fishing, shellfishing, aquatic life, and drinking water uses. For many years the focus of VADEQ's pollution reduction efforts was the treated effluent discharged into Virginia's waters via the VPDES permit process. The TMDL process has expanded the focus of VADEQ's pollution reduction efforts from the effluent of wastewater treatment plants to the pollutants causing impairments of the streams, lakes, and estuaries. The reduction tools are being expanded beyond the permit process to include a variety of voluntary strategies and BMPs. VADEQ is the lead agency in the TMDL process. The Code of Virginia directs VADEQ to develop a list of impaired waters, develop TMDLs for these waters, and develop IPs for the TMDLs. VADEQ administers the TMDL process, including the public participation component, and formally submits the TMDLs to USEPA and the SWCB for approval. VADEQ is also responsible for implementing point source WLAs, regulation of biosolids applications, assessing water quality across the state, and conducting water quality standard related actions.

Silt Fence

VADCR: The Virginia Department of Conservation and Recreation is authorized to administer Virginia's NPS pollution reduction programs in accordance with §10.1-104.1 of the Code of Virginia and §319 of the Clean Water Act. Because of the magnitude of the NPS component in the TMDL process, VADCR is a major participant in the TMDL process. VADCR has a lead role in the development of IPs to address correction of NPS pollution contributing to water quality impairments. VADCR also provides available funding and technical support for the implementation of NPS components of IPs. The staff resources in VADCR's TMDL program focus primarily on providing technical assistance and funding to stakeholders to develop and carry out IPs, and support to VADEQ in TMDL development related to NPS impacts. Under the Virginia Stormwater Management Program, VADCR is responsible for the issuance, denial, revocation, termination, and enforcement of National Pollutant Discharge Elimination System (NPDES) permits for the control of stormwater discharges from municipal separate storm sewer systems (MS4) and land disturbing activities. VADCR staff will be working with other state agencies, local governments, soil and water conservation districts, watershed groups, and citizens to gather support and to improve the implementation of TMDL plans through utilization of existing authorities and resources.

VADMME: The Virginia Department of Mines, Minerals, and Energy, Division of Mined Land Reclamation (DMLR) is responsible for ensuring the reclamation of land affected by surface and underground coal mining activity. Major functions include regulating surface effects of coal mining, reclaiming abandoned mine lands, issuing permits, performing inspections, assisting small operators,

and responding to citizen concerns. Through permitting, mine inspections, operator assistance, and training activities, the DMLR promotes an environmentally sound mining industry throughout Virginia's coalfield counties of Buchanan, Wise, Dickenson, Tazewell, Russell, Lee, and Scott.

VADACS: The Virginia Department of Agriculture and Consumer Services Commissioner of Agriculture has the authority to investigate claims that an agricultural producer is causing a water quality problem on a case-by-case basis (Pugh, 2001). If deemed a problem, the Commissioner can order the producer to submit an agricultural stewardship plan to the local soil and water conservation district. If a producer fails to implement the plan, corrective action can be taken, which may include civil penalties. The Commissioner of Agriculture can issue an emergency corrective action if runoff is likely to endanger public health, animals, fish and aquatic life, public water supply, *etc*. An emergency order can shut down all or part of an agricultural activity and require specific stewardship measures.

Riparian Forest Buffer

VDGIF: The Virginia Department of Game and Inland Fisheries manages Virginia's wildlife and inland fish to maintain optimum populations of all species to serve the needs of the Commonwealth; provides opportunity for all to enjoy wildlife, inland fish, boating and related outdoor recreation; and promotes safety for persons and property in connection with boating, hunting, and fishing. The VDGIF has responsibility for administering certain U.S. Fish and Wildlife Service funding programs. Personnel participate, review, and comment on projects processed through state and federal project and permitting review processes to insure the consideration for fish and wildlife populations and associated habitats.

VADOF: The VADOF has prepared a manual to inform and educate forest landowners and the professional forest community on proper BMPs and technical specifications for installation of these practices in forested areas. Forestry BMPs are intended to primarily control erosion. For example, streamside forest buffers provide nutrient uptake and soil stabilization, which can benefit water quality by reducing the amount of nutrients and sediments that enter local streams.

VCE: Virginia Cooperative Extension is an educational outreach program of Virginia's land grant universities (Virginia Tech and Virginia State University), and a part of the national Cooperative State Research, Education, and Extension Service, an agency of the United States Department of Agriculture (USDA). VCE is a product of cooperation among local, state, and federal governments in partnership with citizens. VCE offers educational programs and technical resources for topics such as crops, grains, livestock, poultry, dairy, natural resources, and environmental management. VCE has published several

publications that deal specifically with TMDLs.

USEPA: The United States Environmental Protection Agency has the responsibility of overseeing the various programs necessary for the success of the CWA. However, administration and enforcement of such programs falls largely to the states.

NRCS: The Natural Resources Conservation Service is the federal agency that works hand-in-hand with the American people to conserve natural resources on private lands. NRCS assists private landowners with conserving their soil, water, and other natural resources. Local, state and federal agencies along with policymakers also rely on the expertise of NRCS staff. NRCS is a major funding stakeholder for impaired water bodies through the CREP and EQIP programs.

INTEGRATION WITH OTHER WATERSHED PLANS

Each watershed within the state is under the jurisdiction of a multitude of individual yet related water quality programs and activities, many of which have specific geographical boundaries and goals. These include but are not limited to, TMDLs, Roundtables, Water Quality Management Plans, Erosion and Sediment Control regulations, Stormwater Management Program, Source Water Assessment Program, and local comprehensive plans. The progress of these projects or programs needs continuous evaluation to determine possible effects on implementation goals. For example, financial and technical resources may be maximized for implementation by coordinating and expanding the planning and implementation activities of these on-going watershed projects or programs. Current initiatives within Russell County and Town of Honaker to be integrated with the Lewis Creek TMDL IP include:

- Russell County Comprehensive Plan
- Town of Honaker Comprehensive Plan and Downtown Revitalization Plan
- Black Diamond Resource Conservation and Development Council Strategic Plan
- Upper Tennessee River Roundtable Strategic Plan
- The Nature Conservancy's Clinch Valley Program
- Clinch-Powell Clean Rivers Initiative
- Virginia Wildlife Action Plan

Honaker Caboose Welcome Center

POTENTIAL FUNDING SOURCES

Potential funding sources available during implementation were identified in the course of plan development. Detailed description of each source (*i.e.*, eligibility requirements, specifications, incentive payments) can be obtained from the CVSWCD, VADCR, VADEQ, VADGIF, VCE, and NRCS. Sources include:

- U.S. Department of Agriculture (USDA) Conservation Reserve Enhancement Program (CREP)
- USDA Conservation Reserve Program (CRP)
- USDA Environmental Quality Incentives Program (EQIP)
- USDA Forest Incentive Program (FIP)
- USDA Wetland Reserve Program (WRP)
- USDA Wildlife Habitat Incentive Program (WHIP)
- U.S. Fish and Wildlife Service Conservation Grants
- U.S. Fish and Wildlife Service Private Stewardship Program
- U.S. Department of Interior – Office of Surface Mining Abandoned Mine Land Reclamation Program
- Virginia Agricultural Best Management Practices Cost-Share Program
- Virginia Agricultural Best Management Practices Tax Credit Program
- Virginia Water Quality Improvement Fund
- Virginia Forest Stewardship Program
- Virginia Small Business Environmental Compliance Assistance Fund
- Virginia Landowner Incentive Program
- Virginia Clean Water Revolving Loan Fund (VCWRLF)
- Community Development Block Grant Program
- National Fish and Wildlife Foundation
- Southeast Rural Community Assistance Project

LIST OF ACRONYMS

AWG	Agricultural Working Group
BMP	Best Management Practice
CREP	Conservation Reserve and Enhancement Program
CRP	Conservation Reserve Program
CVSWCD	Clinch Valley Soil and Water Conservation District
CWA	Clean Water Act
EQIP	Environmental Quality Incentive Program
FR-1	Reforestation of Erodible Crop and Pastureland
FSA	Farm Service Agency
FTE	Full Time Equivalent
GWG	Government Working Group
IP	Implementation Plan
LE-1T	Livestock Exclusion with Riparian Buffers
LE-2T	Livestock Exclusion with Reduced Setback
LID	Low Impact Development
NLCD	National Land Cover Dataset
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
NWBD	National Watershed Boundary Dataset
RCAP	Rural Community Assistance Program
SL-1	Permanent Vegetative Cover on Cropland
SL-6	Grazing Land Protection System
SWCB	State Water Control Board
TMDL	Total Maximum Daily Load
TVA	Tennessee Valley Authority
URWG	Urban/Residential Working Group
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
VADACS	Virginia Department of Agriculture and Consumer Services
VADCR	Virginia Department of Conservation and Recreation
VADEQ	Virginia Department of Environmental Quality
VADMME	Virginia Department of Mines, Minerals, and Energy
VADOF	Virginia Department of Forestry
VCE	Virginia Cooperative Extension
VDGIF	Virginia Department of Game and Inland Fisheries
WP-2T	Stream Protection
WQIF	Water Quality Improvement Fund
WQMIRA	Water Quality Monitoring, Information and Restoration Act
WHIP	Wildlife Habitat Incentive Program
WRP	Wetland Reserve Program

GLOSSARY

Anthropogenic - involving the impact of humans on nature; specifically items or actions induced, caused, or altered by the presence and activities of humans.

Assimilative Capacity - a measure of the ability of a natural body of water to effectively degrade and/or disperse chemical substances. Assimilative capacity is used to define the ability of a waterbody to naturally assimilate a substance without impairing water quality or degrading the aquatic ecosystem. Numerically, it is the amount of pollutant that can be discharged to a specific waterbody without exceeding water quality standards. (see Loading Capacity)

Barren Land - Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.

Benthic – refers to material, especially sediment, at the bottom of a waterbody. It can used to describe the organisms that live on, or in, the bottom of a waterbody.

Best Management Practices (BMPs) - reasonable and cost-effective means to reduce the likelihood of pollutants entering a water body. BMPs include riparian buffer strips, filter strips, nutrient management plans, conservation tillage, etc.

Cost-share Program - a program that allocates funds to pay a percentage of the cost of constructing or implementing a BMP. The remaining costs are paid by the producer(s).

Delisting - the process by which an impaired waterbody is removed from the Section 303(d) Impaired Waters List. To remove a waterbody from the Section 303(d) list, the state must demonstrate to USEPA, using monitoring or other data, that the waterbody is attaining the water quality standard.

Discharge - flow of surface water in a stream or canal or the outflow of groundwater from a flowing artesian well, ditch or spring; can also apply to discharge of liquid effluent from a facility or to chemical emissions into the air through designated venting systems.

Erosion - detachment and transport of soil particles by water and wind. Sediment resulting from soil erosion represents the single largest source of nonpoint source pollution in the United States.

Full Time Equivalent (FTE) - Is a way to estimate staff needed for a project. A FTE of 1.0 means that the position is equivalent to a full-time worker, while a FTE of 0.5 indicates a part-time worker. **Geographic Information System (GIS)** - a system of hardware, software, data, people, organizations and institutional arrangements for collecting, storing, analyzing and disseminating information about areas of the earth. An example of a GIS is the use of spatial data for Emergency Services response (E-911). Dispatchers use GIS to locate the caller's house, identify the closest responder, and even determine the shortest route. All these activities are automated using the electronic spatial data in the GIS.

GWLF (Generalized Watershed Loading Functions) - A computer-based model that calculates runoff, sediment, and dissolved and attached nitrogen and phosphorus loads delivered to streams. The model was developed at Cornell University (Haith and Shoemaker, 1987; Haith, et al., 1992) for use in un-gaged watersheds.

Impaired waters - those waters with chronic or recurring monitored violations of the applicable numeric and/or narrative water quality standards.

Load allocation (LA) - portion of the loading capacity attributed to 1) the existing or future nonpoint sources of pollution, and 2) natural background sources. Wherever possible, nonpoint source loads and natural loads should be distinguished.

Loading capacity (LC) - greatest amount of pollutant loading a waterbody can receive without violating water quality standards. (see assimilative capacity)

Margin of safety (MOS) - a required component of the TMDL that accounts for the uncertainty in calculations of pollutant loading from point, nonpoint, and background sources.

Modeling - a system of mathematical expressions that describe both hydrologic and water quality processes. When used for the development of TMDLs, models can estimate the load of a specific pollutant to a waterbody and make predictions about how the load would change as remediation steps are implemented.

Monitoring - periodic or continuous sampling and measurement to determine the physical, chemical, and biological status of a particular media like air, soil, or water.

Nonpoint source pollution - pollution originating from multiple sources on and above the land. Examples include runoff from fields, stormwater runoff from urban landscapes, roadbed erosion in forestry, and atmospheric deposition.

Nutrient - any substance assimilated by living things that promotes growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

Pathogen - Disease-causing agent, especially microorganisms such as certain bacteria, protozoa, and viruses.

Point source pollution - pollutant loads discharged at a specific location from pipes, outfalls, and conveyance channels from either municipal wastewater treatment plants or industrial treatment facilities or any conveyance such as a ditch, tunnel, conduit or pipe from which pollutants are discharged. Point sources have a single point of entry with a direct path to a water body. Point sources can also include pollutant loads contributed by tributaries to the main receiving stream or river.

Rapid Bioassessment Protocol (RBP) - a suite of measurements based upon a quantitative assessment of benthic macroinvertebrates and a qualitative assessment of their habitat. RBP scores are compared to reference conditions to determine to what degree a waterbody may be biologically impaired.

Reference conditions - the chemical, physical, or biological quality or condition exhibited at either a single site or an aggregation of sites that are representative of non-impaired conditions for a watershed of a certain size, land use distribution, and other related characteristics. Reference conditions are used to describe reference sites.

Reference site - a benchmark against which the water quality in a specific watershed is compared; for example, a biological evaluation in the watershed would be compared with that from a reference site (unimpaired) to determine the level of impairment.

Riparian - pertaining to the banks of a river, stream, pond, lake, etc., as well as to the plant and animal communities along such bodies of water

Runoff - that part of precipitation, snowmelt, or irrigation water that does not infiltrate but flows over the land surface, eventually making its way to a stream, river, lake or an ocean. It can carry pollutants from the land and air into receiving waters.

Sediment - in the context of water quality, soil particles, sand, and minerals dislodged from the land and deposited into aquatic systems as a result of erosion.

Simulation - The use of mathematical models to approximate the observed behavior of a natural water system in response to a specific known set of input and forcing conditions. Models that have been validated, or verified, are then used to predict the response of a natural water system to changes in the input or forcing conditions.

Stakeholder - any person or organization with a vested interest in development and implementation of a local watershed water quality implementation plan (e.g., farmer, landowner, resident, business owner, or government official)

Stressor - any substance or condition that adversely impacts the aquatic ecosystem (e.g., elevated levels of nutrients or sediment).

Total Maximum Daily Load (TMDL) - a pollution "budget" that is used to determine the maximum amount of pollution a waterbody can assimilate without violating water quality standards. The TMDL includes waste load allocations (WLAs) for permitted point sources, load allocations (LAs) for nonpoint and natural background sources, plus a Margin of Safety (MOS). A TMDL is developed for a specific pollutant and can be expressed in terms of mass per time, toxicity, or other appropriate measures that relate to a state's water quality standard.

Transitional land use - areas of sparse vegetative cover (less than 25 percent of cover) that are dynamically changing from one land cover to another, often because of land use activities. Examples include forest clearcuts, a transition phase between forest and agricultural land, the temporary clearing of vegetation, and changes due to natural causes (e.g. fire, flood, etc.).

Wasteload allocation (WLA) - the portion of a receiving water's loading capacity that is allocated to one of its existing or future permitted point sources of pollution. WLAs constitute a type of water quality-based effluent limitation.

Water quality - the biological, chemical, and physical conditions of a waterbody. It is a measure of a waterbody's ability to support beneficial uses.

Water quality standards - a group of statements that constitute a regulation describing specific water quality requirements. Virginia's water quality standards have the following three components: designated uses, water quality criteria to protect designated uses, and an anti-degradation policy.

Watershed - area that drains to, or contributes water to, a particular point, stream, river, lake or ocean. Larger watersheds are also referred to as basins. Watersheds range in size from a few acres for a small stream, to large areas of the country like the Chesapeake Bay Basin that includes parts of six states (see, drainage basin).

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