

# Upper Clinch River Sediment Total Maximum Daily Load Implementation Plan



## Submitted to:

Stakeholders of Upper Clinch River Watershed; Tazewell County; and Town of Tazewell

## On Behalf of:

The Commonwealth of Virginia  
Department of Conservation and Recreation and  
Department of Environmental Quality

## Prepared by:

Engineering Concepts, Inc.

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## 1. EXECUTIVE SUMMARY

The Total Maximum Daily Load program is a process to 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, 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 that states develop a TMDL for each pollutant. The Upper Clinch River 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 at biomonitoring station 6BCLN346.80 in May 1995 and June 1997. The biologist involved in the 1997 efforts noted that habitat was impacted due to heavy siltation. The impaired segment is 5.5 miles in length and extends from the Upper Clinch River confluence with Lincolnshire Branch downstream to its confluence with Plum Creek. After this listing, a Total Maximum Daily Load study was conducted that identified sediment as the pollutant causing the aquatic life impairment. The Total Maximum Daily Load set limits on the amount of sediment the Upper Clinch River can tolerate and still maintain support of the Aquatic Life Use. After the Total Maximum Daily Load study is complete and approved by United States Environmental Protection Agency, Virginia's 1997 Water Quality Monitoring, Information and Restoration Act 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 Total Maximum Daily Load implementation plan was formulated to reduce sediment levels to attain water quality standards enabling delisting of stream from the Section 303(d) List of Impaired Waters. The Total Maximum Daily Load implementation plan describes control measures, which can include the use of better treatment technology and the installation of best management practices, to be implemented in a staged process. Successful completion and local support of the implementation plan will enable restoration of the impaired waters while enhancing the value of this important resource for the Commonwealth. Opportunities for Tazewell County, Town of Tazewell, local agencies, and watershed residents to obtain funding will improve with an approved implementation plan.

### ***Review of TMDL Study***

Watershed description, stressor identification, source assessment, water quality modeling, and allocated reductions were reviewed to determine implications of Total Maximum Daily Load and modeling procedures on implementation plan development. Excessive sedimentation was determined by the Total Maximum Daily Load study as the primary stressor to the benthic community in the Upper Clinch River watershed. Sediment is delivered to the Clinch River 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 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 Total Maximum Daily Load development study to address the benthic impairment on the Upper Clinch River include:

- Sediment load reduced by 56% on pasture land;
- Sediment load reduced by 55% on cropland, urban, and transitional land;
- Streambank erosion was represented in the land-based sediment loadings; and
- Implicit in the requisite 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, the Tazewell County and Town of Tazewell governments, Virginia Department of Conservation and Recreation, Virginia Department of Environmental Quality, Virginia Department of Game and Inland Fisheries, Virginia Department of Forestry, Tazewell Soil and Water Conservation District, Natural Resources Conservation Service, Tennessee Valley Authority, and Engineering Concepts, Inc. Every citizen and interested party in the watershed is encouraged to put the implementation plan into action and contribute what they are able to help restore the health of the streams.

Public participation took place during implementation plan 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, working groups were assembled from communities of people with common concerns regarding the implementation process and were the primary arena for seeking public input. Two working groups were formed: Agricultural and Urban/Governmental. A representative from Virginia Department of Conservation and Recreation 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 and Urban/Governmental Working Groups; Virginia Department of Conservation and Recreation; Virginia Department of Environmental Quality; Virginia Department of Game and Inland Fisheries; Tazewell County; Town of Tazewell; Tazewell Soil and Water Conservation District; Natural Resources Conservation Service; Tennessee Valley Authority; and Engineering Concepts, Inc. to guide the development of the IP. Over 200 man-hours were devoted to attending these meetings by individuals representing agricultural, 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, locations of control measures, education, technical assistance, monitoring, and funding.

### ***Implementation Actions***

The quantity of control measures, or best management practices, recommended during implementation was determined through spatial analyses and modeling alternative implementation scenarios. Spatial analyses of land use, stream-network, farm tracts, and the Commonwealth of Virginia aerial maps along with regionally appropriate data archived in the Virginia Department of Conservation and Recreation Agricultural Best Management Practice Database were utilized to establish average estimates of control measures to reduce sediment

loads on pasture and cropland land uses. Sediment load reductions on urban and transitional land uses was determined through modeling alternative implementation scenarios, defining length of streambank stabilization and percentage of land use area treated by stormwater best management practices, and applying the related reduction efficiencies to their associated loads. Additionally, input from local agency representatives, citizens, and contractors were used to verify the analyses.

Estimates of actions needed for full implementation in the watershed are as follows:

- 59 Grazing Land Protection Systems for farm tracts > 100 acres
- 59 Grazing Land Protection Systems for farm tracts < 100 acres
- 12 Stream Protection Systems
- 288 Acres of Cropland Converted to Permanent Vegetative Cover
- 387 Acres of Cropland Converted to Forests
- 5,000 Feet of Streambank Restoration on Urban Land Use
- 5,000 Feet of Vegetated Buffers on Urban Land Use
- 155 Acres of Urban Land Use Treated by Bioretention
- 67 Acres of Urban Land Use Treated by Infiltration Trenches
- 11 Acres of Porous Pavement Installed
- 34 Lane Miles of Street Sweeping
- 200 Acres of Urban Land Use Treated by Increased Erosion and Sediment Control
- 47 Acres of Urban Land Use Treated by Retention Ponds
- 10 Agricultural Technical Assistance Full Time Equivalents
- 10 Residential Technical Assistance Full Time Equivalents

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 treating pasture loads is \$3.89 million. The total installation cost for control measures to obtain the cropland sediment load reductions is estimated at \$0.23 million. Estimated corrective action costs needed to reduce sediment loads on urban and transitional land uses is \$5.95 million and \$0.04 million, respectively. The total cost to provide assistance in the agricultural and residential programs during best management practice implementation (i.e., years 1-5) is expected to be \$0.30 million and \$0.30 million, respectively. Technical assistance cost during years 6-10 was estimated for the agricultural (\$0.30 million) and urban (\$0.30 million) programs. The total implementation cost including technical assistance is \$11.31 million with the agricultural cost being \$4.72 million and the residential cost \$6.59 million.

The primary benefit of implementation is cleaner waters in Virginia, where sediment levels in Upper Clinch River will be reduced to meet water quality standards. 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, exclusion of cattle from streams leading to the development of alternative (clean) water sources, improved

pasture management, and improved aesthetics around businesses provide economic benefits. Additionally, money spent by landowners, government agencies, and non-profit organizations in the process of implementing the IP 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 Tazewell Soil and Water Conservation District, Virginia Department of Conservation and Recreation, Tazewell County, Town of Tazewell, and Office of Surface Mining / AmeriCorps\*Volunteers in Service to America volunteer. 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.*, Office of Surface Mining / AmeriCorps\*Volunteers in Service to America and Tennessee Valley Authority) will be coordinated to augment the Virginia Department of Environmental Quality monitoring program. Implementation will be assessed based on reducing sediment to improve benthic community resulting in removal of Upper Clinch River from the Commonwealth of Virginia's Section 303(d) List of Impaired Waters.

Implementation of control measures is scheduled for five years beginning in January 2008 lasting to December 2013. The agricultural implementation actually began in 2007 with the Tazewell Soil and Water Conservation District receiving state cost-share funds through the Water Quality Improvement Act. The Tazewell Soil and Water Conservation District also received funding for a conservation specialist to work with landowners in the watershed. After implementation inception, five milestones will be met at the end of each of the first five years and a final milestone in year ten, the removal of the Clinch River from impaired waters list. Implementation in years one through three for agricultural source reductions focuses on livestock exclusion for farm tracts < 100 acres and conversion of cropland to pasture and forest land uses. The majority of livestock exclusion systems on farm tracts > 100 acres installations are anticipated in years four and five. Stream protection system installations are predicted to occur evenly over the five years. For urban and transitional sediment load reductions, limited progress for streambank restoration and street sweeping is expected for the first year. After which, streambank restoration progress is expected to occur evenly in years two through five. Street sweeping amount is expected to build almost evenly to allow town maintenance workers to become more accustomed to the task. Urban and transitional land use acres treated by bioretention and increased erosion and sediment control is expected to occur uniformly over the five years. Infiltration trench, retention pond, and porous pavement installations are expected to increase each implementation year culminating in years four and five.

Water quality improvement is expected to increase each year. A 14% overall sediment load reduction is expected in the first year, 16% in the second year, and 21% in the third year. The greatest water quality improvement is expected to occur in the fourth (25%) and fifth (24%) year. Based on water quality modeling projections for the fifth year implementation milestone equaling 100% installation of agricultural and urban best management practices, the Upper Clinch River 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 100% full best management implementation, the final milestone of de-listment 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 best management practices through the use of aerial, land use, farm tracts, and stream network geographic information system layers, maps were formulated showing potential livestock access, crop fields, and pastures per farm tract. These maps identify farm tracts that the district should concentrate efforts in. Owners will be contacted and progression through best management practice installation will be tracked. Site evaluation for stormwater management retrofits will begin with land along stretches of proposed Riverwalk. Priority focus would be on land owned by Town of Tazewell or Tazewell County followed by private land owners. Four bioretention sites have been selected and construction will commence by 2008 under a Water Quality Improvement Act grant awarded to the Town of Tazewell.

### ***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, 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 Total Maximum Daily Load 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.

The agencies regulating activities that impact water quality in Virginia include: Virginia Department of Environmental Quality, Virginia Department of Conservation and Recreation, Virginia Department of Agriculture and Consumer Services, Virginia Department of Game and Inland Fisheries, Virginia Department of Health, Virginia Department of Forestry, and Virginia Cooperative Extension. The Tazewell Soil and Water Conservation District is a local unit of government responsible for the soil and water conservation work within Tazewell County. The district's overall role is to increase voluntary conservation practices among farmers, ranchers, and other land users. Specific to the Total Maximum Daily Load implementation, the district will lead education and technical assistance efforts and track best management practice implementation for the agricultural program. Virginia Department of Conservation and Recreation, Tennessee Valley Authority, and Town of Tazewell have accepted responsibility of supporting an Office of Surface Mining / AmeriCorps\*Volunteer in Service to America volunteer to provide technical assistance, supply educational information, and coordinate programs/events for the urban sediment reduction program. Tazewell County will have responsible of complying with erosion & sediment control and stormwater management 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, Total Maximum Daily Loads, Roundtables, Water Quality Management Plans, Erosion and Sediment Control regulations, Stormwater Management Program, Source Water Assessment Program, and local comprehensive plans. In some cases, an implementation plan may even address multiple Total Maximum Daily Loads (e.g., bacteria and benthic) for the same impaired water body. 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 plans within Tazewell County and Town of Tazewell that should be integrated with the Upper Clinch River Total Maximum Daily Load Implementation Plan include:

- Tazewell County Comprehensive Plan
- Town of Tazewell Comprehensive Plan
- Upper Clinch River Stormwater Management Project - Town of Tazewell
- Upper Tennessee River Roundtable Strategic Plan
- Virginia Wildlife Action Plan

### ***Potential Funding Sources***

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

- Virginia Agricultural Best Management Practices Cost-Share Program
- Virginia Agricultural Best Management Practices Tax Credit Program
- Virginia Water Quality Improvement Fund
- Virginia Small Business Environmental Compliance Assistance Fund
- Virginia Landowner Incentive Program
- Southern Rivers Watershed Enhancement Program
- United States Department of Agriculture Conservation Reserve Enhancement Program
- United States Department of Agriculture Conservation Reserve Program
- United States Department of Agriculture Environmental Quality Incentives Program
- Wetland Reserve Program
- Wildlife Habitat Incentive Program
- United States Fish and Wildlife Service Conservation Grants
- United States Fish and Wildlife Service Private Stewardship Program
- Tennessee Valley Authority
- Southeast Rural Community Assistance Project
- National Fish and Wildlife Foundation

## 2. INTRODUCTION

The Total Maximum Daily Load (TMDL) program is a process to 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, 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 (CWA) and the United States Environmental Protection Agency's (USEPA) Water Quality Management and Planning Regulation (40 CFR Part 130) both require that states develop a TMDL for each pollutant. The Upper Clinch River 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 6BCLN346.80 in May 1995 and June 1997. The biologist involved in the 1997 efforts noted that habitat was impacted due to heavy siltation. The impaired segment is 5.5 miles in length and extends from the Upper Clinch River confluence with Lincolnshire Branch downstream to its confluence with Plum Creek. After this listing, a TMDL study was conducted that identified sediment as the pollutant causing the aquatic life impairment. The TMDL set limits on the amount of sediment the Upper Clinch River 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".



*Clinch River at River Jack, location of VADEQ station 6BCLN346.80*

To comply with this state requirement, a TMDL implementation plan (IP) was formulated to reduce sediment levels to attain water quality standards enabling 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. Successful completion and local support of the implementation plan will enable restoration of the impaired waters while enhancing the value of this important resource for the Commonwealth. Opportunities for Tazewell County, Town of Tazewell, 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.

### 3. 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.



*Witten Lake in Town of Tazewell*

USEPA develops guidelines that describe the process and criteria to be used to award CWA Section 319 nonpoint source grants to States. The guidance is subject to revision and the most recent version should be considered during implementation. 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.

The process of incorporating these state and federal guidelines into an IP consisted of three major components: 1) public participation, 2) implementation actions, and 3) measurable goals and milestones.

Once developed, VADEQ will present the IP to the SWCB for approval as the plan for implementing pollutant allocations and reductions contained in the TMDLs. 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. In response to a Memorandum of Understanding (MOU) between USEPA and VADEQ, VADEQ also submitted a draft Continuous Planning Process to USEPA in which VADEQ commits to regularly updating the WQMPs. Thus, the WQMPs will be, among other things, the repository for all TMDLs and TMDL IPs developed within a river basin.

#### 4. REVIEW OF TMDL DEVELOPMENT STUDY

George Mason University and TetraTech, Inc. were contracted by VADEQ to develop an approvable benthic TMDL for the Upper Clinch River. 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 at [www.deq.virginia.gov](http://www.deq.virginia.gov). 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 Upper Clinch River watershed is located in Tazewell County, Virginia in the Tennessee/Big Sandy River basin (USGS Hydrologic Unit Code, 06010205). VADEQ delineated the Upper Clinch River impairment from Lincolnshire Branch confluence to Plum Creek confluence. Plum Creek is impaired for exceedances of the bacteria standard; however, a TMDL has not been developed for it. The Upper Clinch River TMDL study watershed and Plum Creek watershed comprise National Watershed Boundary Dataset (NWBD) TC01 (Figure 1). To enable consistent implementation strategies, the implementation plan for the Upper Clinch River was written for the entire TC01 watershed.

The area of the Upper Clinch River watershed is approximately 31,600 acres, with forest as the primary land use (52%) followed by agricultural (44%) and urban (4%) land uses (Figure 2). A reference watershed approach was used to develop the sediment TMDL for the Upper Clinch River. The Generalized Watershed Loading Functions (GWLF) model was used to simulate runoff and sediment loads within the watershed.

Excessive sedimentation was determined by the TMDL study as the primary stressor to the benthic community in the Upper Clinch River watershed. Sediment is delivered to the Clinch River 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 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.



*Sedimentation in Stormwater Runoff*

Conditions outlined in the TMDL development study to address the benthic impairment on the Upper Clinch River include:

- Sediment load reduced by 56% on pasture land;
- Sediment load reduced by 55% on cropland, urban, and transitional land;
- Streambank erosion was represented in the land-based sediment loadings; and
- Implicit in the requisite for no point source sediment load adjustment is the requirement for point sources to maintain permit compliance.

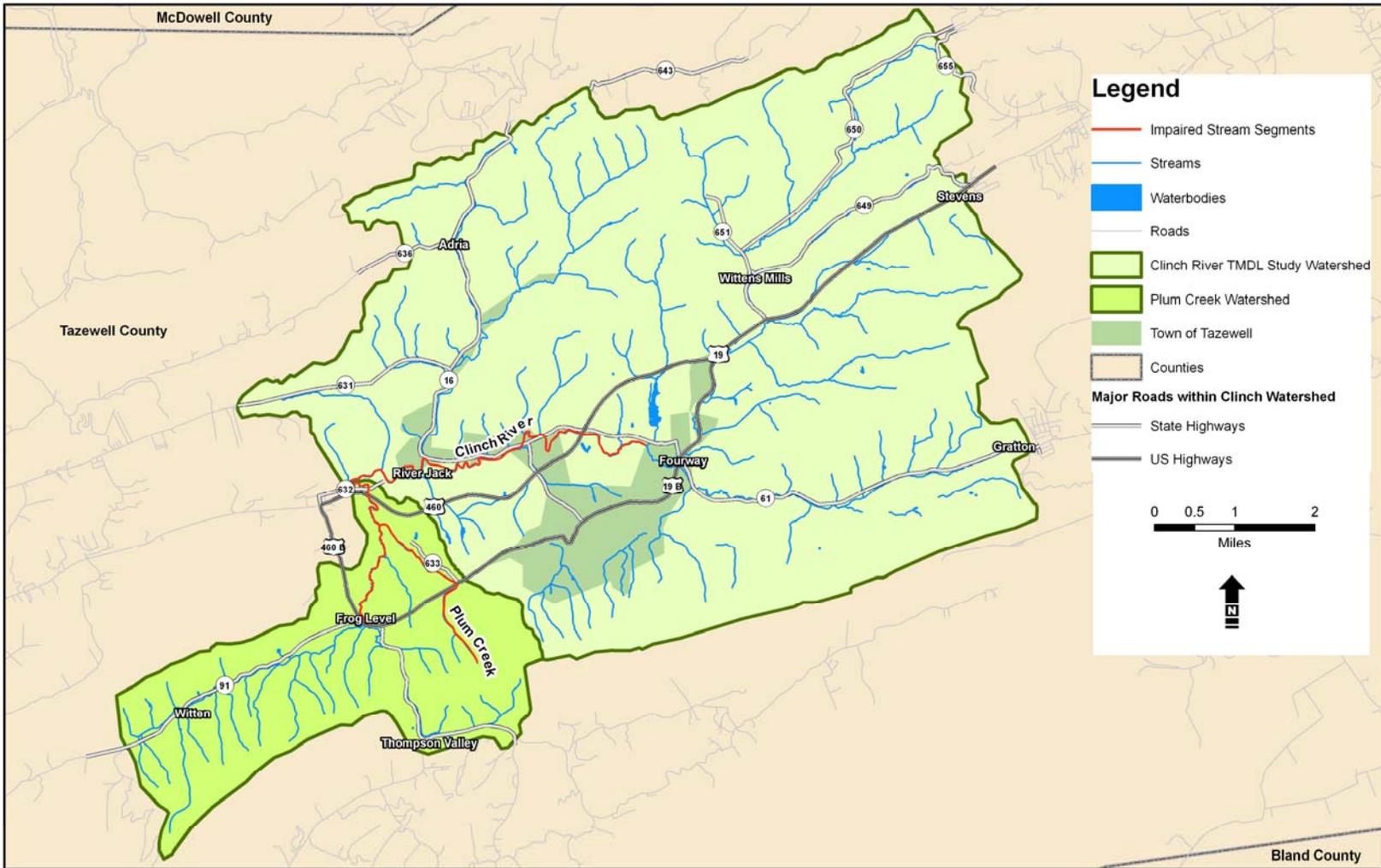


Figure 1. Upper Clinch River watershed location.

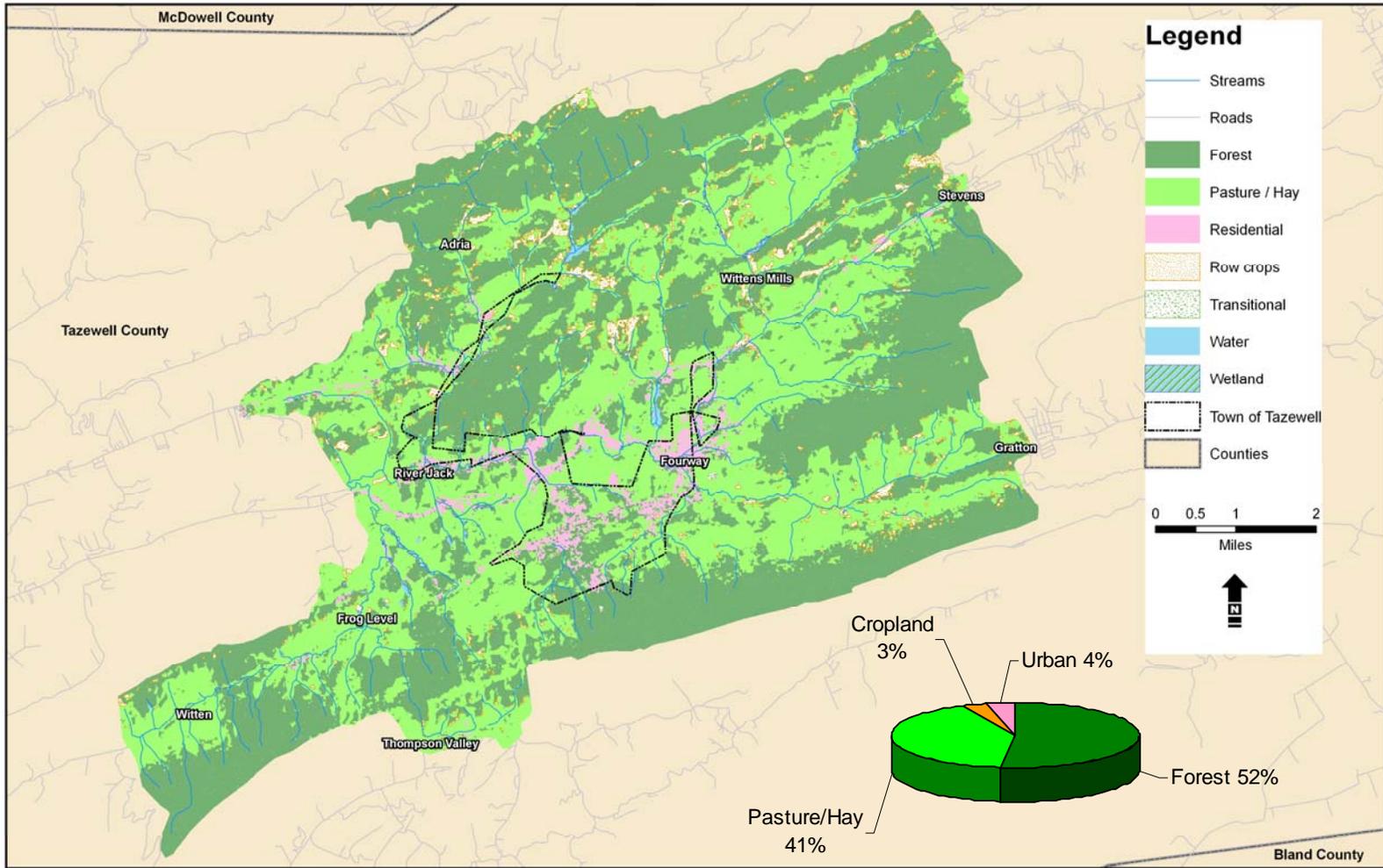


Figure 2. Land uses in the Upper Clinch River watershed.

## 5. PUBLIC PARTICIPATION

### 5.1 Process

The actions and commitments compiled in this document are formulated through input from citizens of the watershed, the Tazewell County and Town of Tazewell governments, VADCR, VADEQ, Virginia Department of Game and Inland Fisheries (VDGIF), Virginia Department of Forestry (VADOF), Tazewell Soil and Water Conservation District (TSWCD), Natural Resources Conservation Service (NRCS), Tennessee Valley Authority (TVA), and Engineering Concepts, Inc. (ECI). Every citizen and interested party in the watershed is encouraged to put the IP into action and contribute what they are able to help restore the health of the streams.

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, working groups were assembled from communities of people with common concerns regarding the implementation process and were the primary arena for seeking public input. Two working groups were formed: Agricultural and Urban/Governmental. A representative from VADCR 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 and Urban/Governmental Working Groups; VADCR; VADEQ; VDGIF; Tazewell County; Town of Tazewell; TSWCD; NRCS; TVA; and ECI to guide the development of the IP. Over 200 man-hours were devoted to attending these meetings by individuals representing agricultural, residential, commercial, environmental, and government interests on a local, state, and federal level (Table 1).



*Bioretention (LID Practice)*

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 Upper Clinch River TMDL IP development process.**

<b>Date</b>	<b>Meeting Type</b>	<b>Location</b>	<b>Attendance</b>	<b>Time (hr)</b>
02/20/07	Public Meeting	Tazewell, VA	17	3.0
03/26/07	Agricultural Working Group	Tazewell, VA	9	2.0
03/29/07	Residential/Government Working Group	Tazewell, VA	8	2.0
05/22/07	Agricultural Working Group	Tazewell, VA	11	2.0
05/24/07	Residential/Government Working Group	Tazewell, VA	6	2.0
06/19/07	Steering Committee	Tazewell, VA	13	2.5
08/15/07	Steering Committee	Tazewell, VA	10	2.5
08/28/07	Public Meeting	Tazewell, VA	18	2.5

## **5.2 Working Groups 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.*, TSWCD, 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 pasture and cropland sediment load reductions. Challenges, recommendations, and keys for success discussed in the two meetings included:

- Agricultural Sinkhole Protection BMP (WQ-11) listed in the Virginia Agricultural BMP Handbook should be added to list of BMPs eligible for cost-share assistance in the watershed.
- Must overcome the financial constraint to landowners installing streamside fencing and alternative watering systems due to terrain of watershed. Availability of electricity could be restrictive due to installation cost of \$2,500 per electric pole.
- Reluctance of farmers in watershed to work on any “government” project will need to be addressed during implementation.
- Estimating BMP quantification and cost using farm tracts provided more realistic estimates. Farm tract categorization enables the TSWCD to incorporate whole farm approach and tract BMP installation.
- Individual contact with farmer to define TMDL, explain what it means to the farmer, and outline options for funding sources will be needed. Additional outreach includes farm tours, a “herd health” report, and talks at association meetings.
- Targeting larger farm tract owners initially could provide highest reduction of sediment loads and greatest exposure of process to other landowners.

Due to membership overlap, the Urban and Governmental Working Groups were combined to form an Urban/Governmental Working Group (UGWG). The UGWG consisted of citizens and representatives from Upper Tennessee Roundtable, Tazewell County Public Service Authority,

TSWCD, TVA, and VADCR. The group focused on means to educate and involve public with regard to implementing corrective actions and applicable stormwater management BMPs for urban areas, regulatory controls currently in place, and potential parties to be responsible for implementation. The following key topics and recommendations resulted from the two UGWG meetings:

- Past and future enforcement, effect, and impact of existing regulatory controls (*i.e.*, Virginia Agricultural Stewardship Act, Local Ordinances, Erosion and Sediment Control Program, and Stormwater Management Regulations) related to water quality were discussed.
- Recommendations on proposed ordinance updates (*e.g.*, stricter E&S control for minimum disturbance of 5,000 square feet within Town limits) and BMPs in *Tazewell County, VA - Growth Readiness Report January 2007* facilitated by TVA and Town of Tazewell should be incorporated into the IP.
- Low impact development (LID) (*i.e.*, bioretention, infiltration trenches, and porous pavement) are preferred methods to treat stormwater runoff.
- The UGWG suggested urban technical assistance be provided through Office of Surface Mining / AmeriCorps\*VISTA (Volunteer in Service to America) volunteer.
- An organized education and outreach program, with genuine incentives for participation, will be essential for the implementation effort to succeed. Public awareness of water quality issues in the watershed, how residents affect it, and how they can improve it needs to be the overall focus. Outreach examples included: newspaper articles, small community meetings, workshops, video displayed in public buildings, demonstration at county fair, and mailings.

Reports from each working group to the Steering Committee are included as appendices of the *Upper Clinch River Sediment TMDL Implementation Plan Technical Report*.

### **5.3 Steering Committee Summary**

The Steering Committee consisted of representatives from the AWG, UGWG, watershed residents, county and town personnel, government agencies, and ECI. The 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.



*Livestock Hardened Stream Crossing*

## **6. IMPLEMENTATION ACTIONS**

### **6.1 Assessment of Implementation Action Needs**

The actions and cost needed in the implementation stages were identified and quantified. The numbers 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 Upper Clinch River 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.

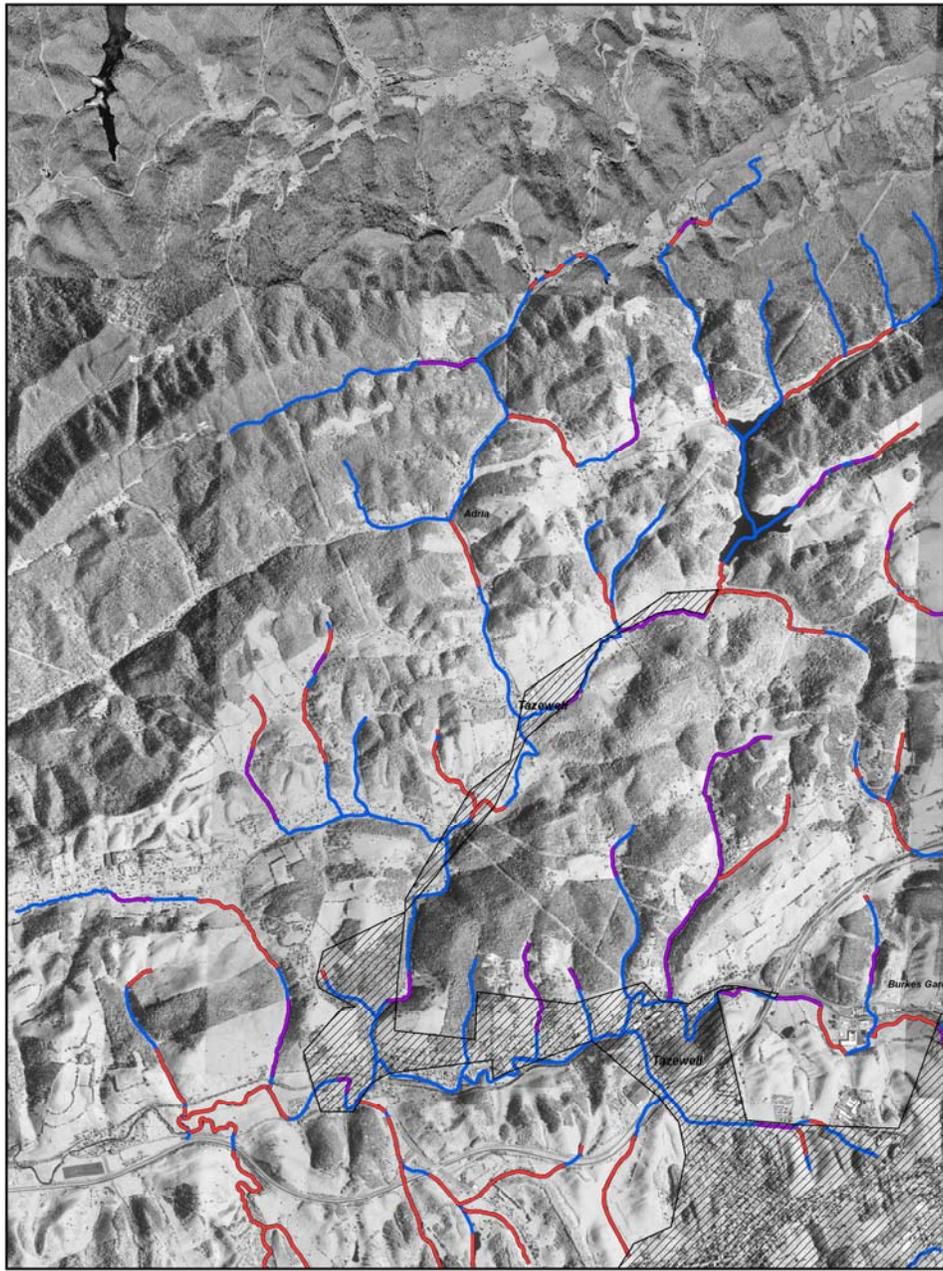
The quantity of control measures, or BMPs, recommended during implementation was determined through spatial analyses and modeling alternative implementation scenarios. Spatial analyses of land use, stream-network, farm tracts, and the Commonwealth of Virginia aerial maps along with regionally appropriate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

Removing livestock from the stream corridor was identified as the primary control measure to reduce pasture sediment load. Exclusion fencing necessary to prevent access to perennial streams and meet the stated TMDL reductions was estimated at approximately 106 miles of fence. Figure 3 displays analysis results for a portion of the watershed. This exclusion fencing is translated into a total of 118 Grazing Land Protection Systems (SL-6) to be installed to insure full exclusion of livestock from the streams (Table 2). A typical SL-6 system includes streamside fencing for perennial and intermittent streams, cross-fencing for pasture management, hardened crossings, alternative watering systems, and a 35-ft buffer from the stream. Sediment reduction is achieved through streambank restoration, buffer treatment, and improved pasture management.

During the TMDL study, land use was extracted from the 1992 National Land Cover Database (NLCD). Cropland acres were listed at 993 acres in the TMDL document. During IP development, 126 cropland acres were calculated using the 2001 NLCD. The United States Department of Agriculture – Farm Service Agency (USDA-FSA) crop records, TSWCD reports, and AWG input also confirmed this decreasing trend in cropland acres. 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. Average parameters of the SL-1 Permanent Vegetative Cover and FR-1 Reforestation of Erodible Crop and Pastureland BMPs previously installed in the Clinch River watershed, input from AWG, and sediment loads reported in TMDL were used to divide the cropland conversion between pasture and forest land uses. Leaving 318 acres cropland, converting 288 acres to pasture, and converting 387 acres to forest land use, satisfied the TMDL goal (Table 2).

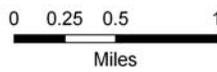


*Permanent Vegetative Cover on Cropland*



**Legend**

-  Town of Tazewell
-  No Stream Access
-  One-Sided Stream Access
-  Two-Sided Stream Access



**Figure 3. Example of potential livestock exclusion fencing analysis results for portion of Upper Clinch River watershed.**

**Table 2. Estimation of control measures with unit cost (average) needed to meet implementation goals for agricultural and urban lands in Upper Clinch River watershed.**

Control Measure	Unit	Estimated Units Needed (#)	Unit Cost <sup>1</sup> (\$)
<b><u>Agricultural</u></b>			
Grazing Land Protection System (SL-6) for farm tracts > 100 acres	System	59	53,400
Grazing Land Protection System (SL-6) for farm tracts < 100 acres	System	59	11,900
Stream Protection System (WP-2T)	System	12	3,400
Permanent Vegetative Cover on Cropland (SL-1)	Acres - Installed	288	280
Reforestation of Erodible Crop and Pastureland (FR-1)	Acres - Installed	387	383
Technical Assistance	Full Time Equivalent	5.0	60,000
<b><u>Urban</u></b>			
Streambank Restoration	Feet	5,000	194
Vegetated Buffers	Feet	5,000	194
Bioretention	Acres - Treated	155	15,000
Infiltration Trench	Acres - Treated	67	11,300
Porous Pavement	Acres - Installed	11	62,500
Street Sweeping	Lane Miles	34	2,715
Increased Erosion and Sediment Control	Acres - Treated	200	7,200
Retention Pond	Acres - Treated	47	2,500
Technical Assistance	Full Time Equivalent	5.0	60,000

<sup>1</sup> Unit cost = installation or one-time incentive payment

Sediment load reductions on urban and transitional land uses was determined through modeling alternative implementation scenarios, defining length of streambank stabilization and percentage of land use area treated by stormwater BMPs, and applying the related reduction efficiencies to their associated loads. BMP type and usage amount were based on the *Tazewell County, VA - Growth Readiness Report January 2007* as well as UGWG and Steering Committee recommendations. Emphasis was placed on LID stormwater BMPs for the urban land use and increased erosion and sediment control for the transitional land use (Tables 2 and 3).

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. One potential for additional sources of the pollutants identified is future residential and urban development. Care should be taken to monitor development and its impact on water quality. Where residential development occurs, there is potential for additional pollutant loads from sediment delivered to streams by land disturbance. This needs to be carefully considered in site plans and during development. The local erosion and sediment control and stormwater management programs must be complied with.

**Table 3. Potential implementation scenarios defining length of streambank stabilization and/or acres of urban and transitional land use area treated by BMPs that satisfy the needed urban sediment load reduction.**

Landuse	Streambank Stabilization	Vegetated Buffers	Bioretention	Infiltration Trench	Porous Pavement	Street Sweeping	Increased E & S Control	Retention Pond
	(ft)	(ft)	(ac)	(ac)	(ac)	(mile)	(ac)	(ac)
Urban	5,000	5,000	155	67	11	34	166	44
Transitional	0	0	0	0	0	0	32	3

### **6.2 Assessment of Technical Assistance Needs**

To determine the number of full time equivalents (FTE) considered necessary for agricultural technical assistance during implementation, the total number of practices needed to be installed per year during implementation was divided by the number of BMPs 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 TSWCD, one FTE providing technical assistance for the agricultural program is needed throughout implementation. Members of the UGWG and Steering Committee estimated that one technical FTE would be required throughout implementation to provide technical assistance and educational outreach tasks to reduce sediment loads on urban and transitional land uses. The number of FTE needed to provide assistance during implementation in the watershed is listed in Table 2.

### **6.3 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 treating pasture loads is \$3.89 million (Table 4). The total installation cost for control measures to obtain the cropland sediment load reductions is estimated at \$0.23 million (Table 4). Estimated corrective action costs needed to reduce sediment loads on urban and transitional land uses is \$5.95 million and \$0.04 million, respectively (Table 4).

It was determined by the TSWCD, Tazewell County, Town of Tazewell, VADCR, UGWG, 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 and residential programs during BMP implementation (i.e., years 1-5) is expected to be \$0.30 million and \$0.30 million, respectively (Table 4). Table 4 lists the estimated technical assistance cost during years 6-10 for the agricultural (\$0.30 million) and urban (\$0.30 million) programs.

The total implementation cost including technical assistance is \$11.31 million with the agricultural cost being \$4.72 million and the residential cost \$6.59 million (Table 4).

**Table 4. Implementation cost associated with percentage of practices installed addressing agricultural and residential practices along with technical assistance needed in Upper Clinch River watershed.**

Year	Agricultural				Residential				Total Cost
	Pasture Load Reduction	Cropland Load Reduction	Technical Assistance	Total	Urban Load Reduction	Transitional Load Reduction	Technical Assistance	Total	
	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)	
1	470,000	68,500	60,000	598,500	558,900	8,700	60,000	627,600	1,226,100
2	541,400	68,500	60,000	669,900	1,067,000	8,700	60,000	1,135,700	1,805,600
3	861,800	45,700	60,000	967,500	1,360,000	8,700	60,000	1,428,700	2,396,200
4	1,042,800	23,100	60,000	1,125,900	1,481,100	8,700	60,000	1,549,800	2,675,700
5	977,500	23,100	60,000	1,060,600	1,481,100	8,700	60,000	1,549,800	2,610,400
6	0	0	60,000	60,000	0	0	60,000	60,000	120,000
7	0	0	60,000	60,000	0	0	60,000	60,000	120,000
8	0	0	60,000	60,000	0	0	60,000	60,000	120,000
9	0	0	60,000	60,000	0	0	60,000	60,000	120,000
10	0	0	60,000	60,000	0	0	60,000	60,000	120,000
<b>Total (1-5)</b>	<b>3,893,500</b>	<b>228,900</b>	<b>300,000</b>	<b>4,422,400</b>	<b>5,948,100</b>	<b>43,500</b>	<b>300,000</b>	<b>6,291,600</b>	<b>10,714,000</b>
<b>Total (1-10)</b>	<b>3,893,500</b>	<b>228,900</b>	<b>600,000</b>	<b>4,722,400</b>	<b>5,948,100</b>	<b>43,500</b>	<b>600,000</b>	<b>6,591,600</b>	<b>11,314,000</b>

## 6.4 Benefit Analysis

The primary benefit of implementation is cleaner waters in Virginia, where sediment levels in Upper Clinch River 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.

### 6.4.1 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, exclusion of cattle from streams leading to the development of alternative (clean) water sources, improved pasture management, and improved aesthetics around businesses provide economic benefits. 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).



*Infiltration Trench (LID Practice)*

The economic benefits of the implementation of urban 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). Tazewell County and Town of Tazewell have inevitably been economically affected by the impairments on Upper

Clinch River and Plum Creek. 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.

#### 6.4.2 Livestock Herd Health

A clean water source coupled with exclusionary fencing has been shown to increase weight gains; 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.

### 7. 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 TSWCD, VADCR, Tazewell County, Town of Tazewell, and Office of Surface Mining / AmeriCorps\*VISTA volunteer. The VADEQ will continue to assess water quality through its monitoring program. Other monitoring project activities in the watersheds (*e.g.*, Office of Surface Mining / AmeriCorps\*VISTA volunteer and TVA) will be coordinated with VADEQ to augment the VADEQ monitoring program. Implementation will be assessed based on reducing sediment to improve benthic community resulting in removal of Upper Clinch River from the Commonwealth of Virginia's Section 303(d) List of Impaired Waters. Implementation of control measures is scheduled for five years beginning in January 2008 lasting to December 2013 (Tables 4 and 5). The agricultural implementation actually began in 2007 with the TSWCD receiving state cost-share funds through the Water Quality Improvement Act. The TSWCD also received funding for a conservation specialist to work with landowners in the watershed. After implementation inception, five milestones will be met at the end of each of the first five years and a final milestone in year ten, the removal of the Clinch River from impaired waters list.



*Alternative Water Source*

Implementation in years one through three for agricultural source reductions focuses on livestock exclusion for farm tracts < 100 acres and conversion of cropland to pasture and forest land uses. During this period, 80% of livestock exclusion systems on tracts <100 acres are to be installed and 80% of cropland converted. The remaining 20% is split between years four and five. The majority of livestock exclusion systems on farm tracts > 100 acres installations are anticipated in years four and five (60%). Installations in year one, two, and three are estimated at 10%, 10%,

and 20%; respectively. Stream protection system installations are predicted to occur evenly over the five years.

For urban and transitional sediment load reductions, limited progress for streambank restoration and street sweeping is expected for the first year. After which, streambank restoration progress is expected to occur evenly in years two through five. Street sweeping amount is expected to build almost evenly to allow town maintenance workers to become more accustomed to the task. Urban and transitional land use acres treated by bioretention and increased erosion and sediment control is expected to occur uniformly over the five years. Approximately 22% of the needed infiltration trench installations will occur equally in the first two years, 20% in the third year, and 58% split in years four and five. This installation pattern applies to retention ponds at 20%, 20%, and 60% for the categories. Porous pavement installations are expected to be 30% through year three, 35% for year four, and 35% for year five.



*Streambank Stabilization (North View)*



*Streambank Stabilization (South View)*

Table 5 lists the cumulative progress towards the sediment endpoint as implementation milestones are met. Water quality improvement is expected to increase each year. A 14% overall sediment load reduction is expected in the first year, 16% in the second year, and 21% in the third year. The greatest water quality improvement is expected to occur in the fourth (25%) and fifth (24%) year. Based on water quality modeling projections for the fifth year implementation milestone equaling 100% installation of agricultural and urban BMPs, the Upper Clinch River 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 100% full BMP implementation, the final milestone of de-listment 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, land use, farm tracts, and stream network GIS layers, maps were formulated showing potential livestock access, crop fields, and pastures per farm tract. Portion of map created of Upper Clinch River watershed is depicted in Figure 3. These maps identify farm tracts that TSWCD should concentrate efforts in. Owners will be contacted and progression through BMP installation will be tracked. Site evaluation for stormwater management retrofits will begin with land along stretches of proposed Riverwalk. Priority Focus would be on land owned by Town of Tazewell or Tazewell County followed by private land owners. Four bioretention sites have been selected and construction will commence by 2008 under a WQIA grant awarded to the Town of Tazewell.

**Table 5. Cumulative implementation and water quality milestones along with cost for Upper Clinch River watershed.**

Control Measure	Unit	Milestone 1 Completed by 2009	Milestone 2 Completed by 2010	Milestone 3 Completed by 2011	Milestone 4 Completed by 2012	Milestone 5 Completed by 2013
<b><u>Agricultural</u></b>						
Grazing Land Protection System (SL-6) for farm tracts > 100 acres	System	6	12	24	42	59
Grazing Land Protection System (SL-6) for farm tracts < 100 acres	System	12	30	48	54	59
Stream Protection System (WP-2T)	System	2	4	6	9	12
Permanent Vegetative Cover on Cropland (SL-1)	Acres - Installed	86	172	230	259	288
Reforestation of Erodible Crop and Pastureland (FR-1)	Acres - Installed	116	232	309	348	387
Technical Assistance	Full Time Equivalent	1.0	2.0	3.0	4.0	5.0
<b><u>Urban</u></b>						
Streambank Restoration	ft	0	1,250	2,500	3,750	5,000
Vegetated Buffers	ft	0	1,250	2,500	3,750	5,000
Bioretention	Acres - Treated	31	62	93	124	155
Infiltration Trench	Acres - Treated	7	14	27	47	67
Porous Pavement	Acres - Installed	0	0	3	7	11
Street Sweeping	Lane Miles	0	8	16	25	34
Increased Erosion and Sediment Control	Acres - Treated	40	80	120	160	200
Retention Pond	Acres - Treated	5	10	19	33	47
Technical Assistance	Full Time Equivalent	1.0	2.0	3.0	4.0	5.0
<b>Cumulative Cost (millions \$)</b>		<b>1.23</b>	<b>3.03</b>	<b>5.43</b>	<b>8.10</b>	<b>10.71</b>
<b>Cumulative Progress Toward Sediment Endpoint</b>		<b>14%</b>	<b>30%</b>	<b>51%</b>	<b>76%</b>	<b>100%</b>

## 7.1 Monitoring

Virginia's 1997 WQMIRA requires that TMDL IPs include measurable goals and milestones for attaining water quality standards. Implicit in those milestones is the requirement of a method to measure progress. Implementation progress will be evaluated through water quality monitoring conducted by VADEQ through the agency's monitoring program, TVA, and any additional monitoring support (*i.e.*, Office of Surface Mining / AmeriCorps\*VISTA volunteer and citizen) that may develop as implementation progresses.

VADEQ will monitor at six monitoring locations in the Upper Clinch River watershed (Table 6 and Figure 4). The Upper Clinch River impairment listing was based on biological monitoring results at station 6BCLN346.60. This station will be monitored in spring and fall of a monitoring year currently set for every two years. TVA performs biological monitoring at location of station 6BCLN346.60 on a five-year rotation. The remaining five ambient stations will be monitored on a bi-monthly basis from January 2007 through December 2008, after which monitoring continuation by VADEQ beyond this period will be evaluated. The following parameters will be collected at the ambient monitoring stations: *E. coli* bacteria, temperature, dissolved oxygen, pH, specific conductance, total nitrogen, total phosphorus, total solids, and total suspended solids. Additional monitoring to supplement the VADEQ and TVA effort was recommended by the Steering Committee. The Steering Committee suggests pairing a biological station with the ambient stations and locate new stations that help isolate areas to more closely evaluate implementation progress. Additional monitoring could be performed by the Office of Surface Mining / AmeriCorps\*VISTA volunteer, high school students, or other volunteers. Monitoring results are accessible on the VADEQ website (<http://www.deq.state.va.us/water/>).

**Table 6. Monitoring station ID, station location, monitored by, station type, and monitoring schedule in Upper Clinch River watershed.**

Station ID	Station Location	Monitored By	Station Type	Monitoring Period
6BCLN339.53	Clinch River @ Route 637 Bridge Clinch River off Route 16 @	VADEQ	Ambient	01/07 – 12/08
6BCLN346.60	Walking Bridge off Broadway Street Clinch River off Route 16 @ Perry	VADEQ	Biological	2007; 2009; 2011
6BCLN348.00	Repair Service Bridge Plum Creek off Route 16/460E @	VADEQ	Ambient	01/07 – 12/08
6BPLU000.40	Bridge #6055 Johnson Branch near Adria off	VADEQ	Ambient	01/07 – 12/08
6BJNN001.35	Route 16 North Fork Clinch River off Route	VADEQ	Ambient	01/07 – 12/08
6BNCL000.30	16 Across from Ramey Ford Clinch River off Route 16 @	VADEQ	Ambient	01/07 – 12/08
2353-24	Walking Bridge off Broadway Street	TVA	Biological	2005; 2010; 2015

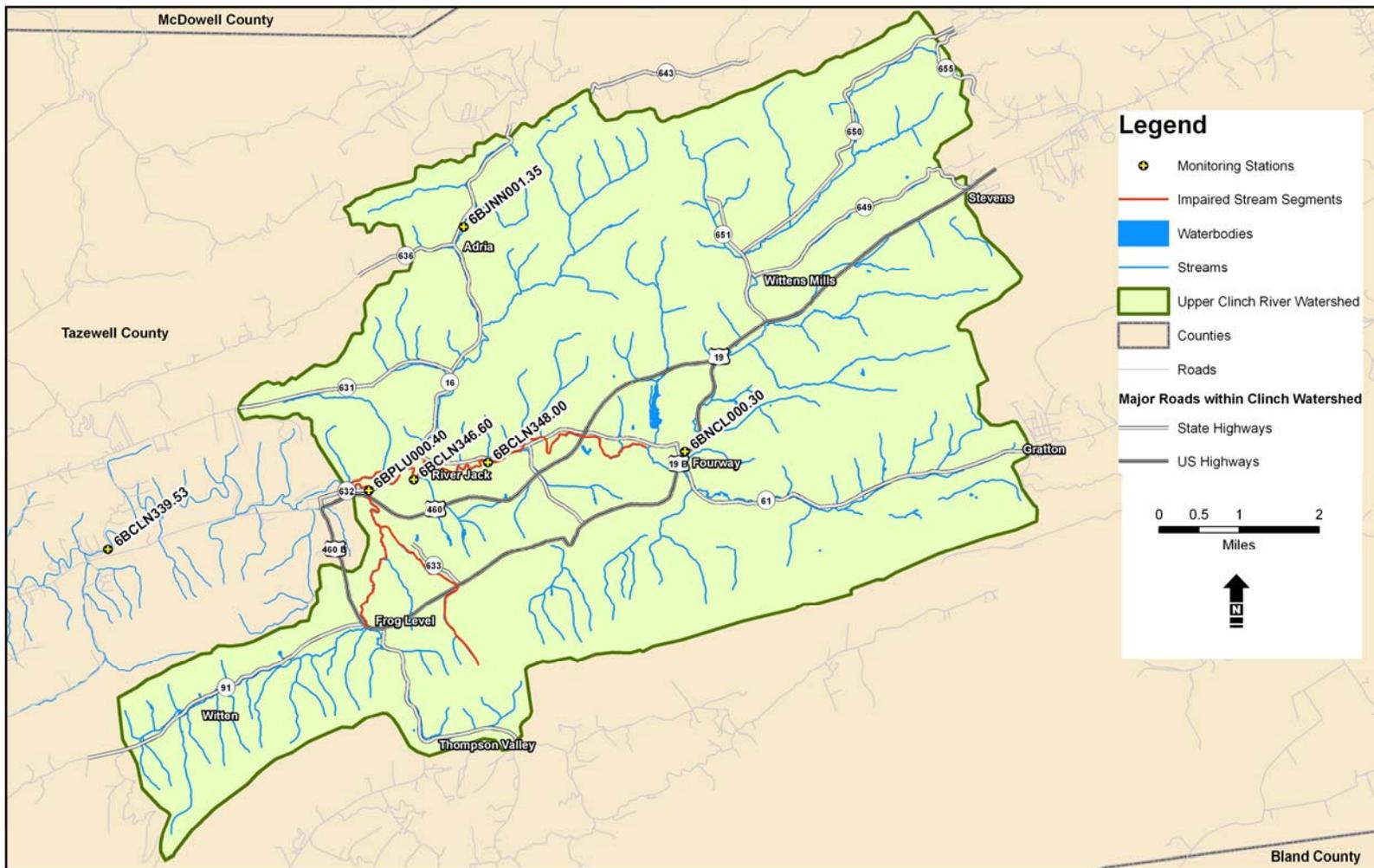


Figure 4. Location of VADEQ monitoring stations in the Upper Clinch River watershed.

## 8. 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. 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). Virginia's approach to correcting non-point source pollution problems continues to be encouragement of participation through education and financial incentives; that is, outside of the regulatory framework. If, however, voluntary approaches prove to be ineffective, it is likely that implementation will become less voluntary and more regulatory.

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

USEPA: The USEPA 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 NRCS 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 and policymakers also rely on the expertise of NRCS staff. NRCS is also a major funding stakeholder for impaired water bodies through the Conservation Reserve Enhancement Program (CREP) and the Environmental Quality Incentive Program (EQIP).

TVA: Through its Clean Water Initiative, which began in 1992, TVA builds partnerships with community residents, businesses, and government agencies to promote watershed protection. TVA's Holston-Cherokee Douglas Watershed Team is responsible for carrying out the program. They focus on improving water and shoreline conditions so that people and aquatic life can benefit from having clean water. Among other accomplishments, these community coalitions have: instituted agricultural and urban-management practices that reduce water pollution; treated eroded land and stabilized streambanks; planted vegetation and installed structures intended to improve aquatic habitat; and collected waste and litter from streambanks and shores. TVA provides funding for five targeted areas related to improving water quality: stream restoration; watershed assessment; partnership/capacity building; implementation/planning; and education/outreach.



*Street Sweeping*

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. Currently, there are seven state agencies responsible for regulating and/or overseeing statewide activities that impact water quality in Virginia. These agencies include: VADEQ, VADCR, Virginia Department of Agriculture and Consumer Services (VDACS), VDGIF, Virginia Department of Health (VDH), Virginia Department of Forestry (VADOF), and VCE.

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 swimming, 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, assessing water quality across the state, and conducting water quality standard related actions.

VADCR: The VADCR 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. USEPA is requiring that much of the §319 grant monies be used for the development of TMDLs. 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



*Silt Fence*

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.

**VDACS:** The VDACS 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.

**VDGIF:** The VDGIF 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.

**VDH:** The VDH is responsible for maintaining safe drinking water measured by standards set by the USEPA. Their duties also include septic system regulation and regulation of biosolids land application. Like VDACS, VDH is complaint driven. Complaints can range from a vent pipe odor that is not an actual sewage violation and takes very little time to investigate, to a large discharge violation that may take many weeks or longer to effect compliance. For TMDLs, VDH has the responsibility of enforcing actions to correct failed septic systems and/or eliminate straight pipes (Sewage Handling and Disposal Regulations, 12 VAC 5-610-10 *et seq.*).

**Virginia Department of Forestry (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 ([www.dof.state.va.us/wq/wq-bmp-guide.htm](http://www.dof.state.va.us/wq/wq-bmp-guide.htm)). 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.



*Riparian Forest Buffer*

**VCE:** VCE 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. For more information on these publications and to find the location of county extension offices, visit [www.ext.vt.edu](http://www.ext.vt.edu).

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. Some local government groups and their roles in the TMDL process are listed here:

TSWCD: The TSWCD is a local unit of government responsible for the soil and water conservation work within Tazewell 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 districts will lead education and technical assistance efforts and track BMP implementation for the agricultural program.

Tazewell County and Town of Tazewell Government Departments: Government staff work closely with local and state agencies to develop and implement the TMDL. The staff may also help to promote education and outreach to citizens, businesses, and developers to introduce the importance of the TMDL process. The Town of Tazewell has agreed to supply an office for the Office of Surface Mining / AmeriCorps\*VISTA volunteer working in implementation efforts.



*Porous Pavement*

Office of Surface Mining / AmeriCorps\*VISTA: Office of Surface Mining / AmeriCorps\*VISTA provides full-time members to nonprofit, faith-based and other community organizations, and public (*i.e.*, local, state, or federal) agencies to create and expand programs that ultimately bring low-income individuals and communities out of poverty. Office of Surface Mining / AmeriCorps\*VISTA members leverage human, financial, and material resources to increase the capacity of low-income communities across the country to solve their own problems. Members work to fight illiteracy, improve health services, create businesses, increase housing opportunities, bridge the digital divide, and strengthen the capacity of community organizations.

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.

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.

Clinch River Headwaters Association: A non-profit organization working to achieve clean water by involving citizens in planning, education, and coordination; thus, attracting funding and serving as advocates for water resources.

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 urban areas as well.

## 9. 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. In some cases, an IP may even address multiple TMDLs (*e.g.*, bacteria and benthic) for the same impaired water body. 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 ongoing watershed projects or programs. Current plans within Tazewell County and Town of Tazewell that should be integrated with the Upper Clinch River



*Retention Pond*

TMDL IP include:

- Tazewell County Comprehensive Plan
- Town of Tazewell Comprehensive Plan
- Upper Clinch River Stormwater Management Project - Town of Tazewell
- Upper Tennessee River Roundtable Strategic Plan
- Virginia Wildlife Action Plan

## 10. POTENTIAL FUNDING SOURCES

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

- Virginia Agricultural Best Management Practices Cost-Share Program
- Virginia Agricultural Best Management Practices Tax Credit Program
- Virginia Water Quality Improvement Fund
- Virginia Small Business Environmental Compliance Assistance Fund
- Virginia Landowner Incentive Program
- Southern Rivers Watershed Enhancement Program
- USDA Conservation Reserve Enhancement Program (CREP)
- USDA Conservation Reserve Program (CRP)
- USDA Environmental Quality Incentives Program (EQIP)
- Wetland Reserve Program (WRP)
- Wildlife Habitat Incentive Program (WHIP)
- U.S. Fish and Wildlife Service Conservation Grants
- U.S. Fish and Wildlife Service Private Stewardship Program
- Tennessee Valley Authority
- Southeast Rural Community Assistance Project (Southeast RCAP)
- National Fish and Wildlife Foundation

A possible funding scenario for BMP installation in the first year of implementation is presented in Table 6. This scenario represents 10% installation of livestock exclusion systems on farm tracts > 100 acres, 20% installation of livestock exclusion systems on farm tracts < 100 acres, 30% of cropland converted to pasture, 10% of cropland converted to forest, 20% of bioretention installed, 11% of infiltration trenches installed, 20% of E&S control implemented, and 10% of retention ponds installed. The scenario does not account for agricultural or residential technical assistance.

**Table 6. Possible installation funding scenario for first year of implementation.**

<i>TMDL Incentive Funds</i>	
Agricultural Practices	403,900
Residential Practices	200,000
Subtotal	603,900
<i>Landowner</i>	
Agricultural Practices	134,600
Residential Practices	367,600
Subtotal	502,200
<b>Total</b>	<b>1,106,100</b>

## LIST OF ACRONYMS

<b>AWG</b>	Agricultural Working Group
<b>BMP</b>	Best Management Practice
<b>CREP</b>	Conservation Reserve and Enhancement Program
<b>CRP</b>	Conservation Reserve Program
<b>CWA</b>	Clean Water Act
<b>ECI</b>	Engineering Concepts, Inc.
<b>EQIP</b>	Environmental Quality Incentive Program
<b>FR-1</b>	Reforestation of Erodible Crop and Pastureland
<b>FSA</b>	Farm Service Agency
<b>FTE</b>	Full Time Equivalent
<b>IP</b>	Implementation Plan
<b>LID</b>	Low Impact Development
<b>NPS</b>	Nonpoint Source
<b>NRCS</b>	Natural Resources Conservation Service
<b>NWBD</b>	National Watershed Boundary Dataset
<b>RCAP</b>	Rural Community Assistance Program
<b>RGWG</b>	Residential/Governmental Working Group
<b>SL-1</b>	Permanent Vegetative Cover on Cropland
<b>SL-6</b>	Grazing Land Protection System
<b>SWCD</b>	Soil and Water Conservation District
<b>TMDL</b>	Total Maximum Daily Load
<b>TSWCD</b>	Tazewell Soil and Water Conservation District
<b>TVA</b>	Tennessee Valley Authority
<b>USDA</b>	United States Department of Agriculture
<b>USEPA</b>	United States Environmental Protection Agency
<b>VADCR</b>	Virginia Department of Conservation and Recreation
<b>VADEQ</b>	Virginia Department of Environmental Quality
<b>VADOE</b>	Virginia Department of Forestry
<b>VCE</b>	Virginia Cooperative Extension
<b>VDACS</b>	Virginia Department of Agriculture and Consumer Services
<b>VDGIF</b>	Virginia Department of Game and Inland Fisheries
<b>VDH</b>	Virginia Department of Health
<b>WP-2T</b>	Stream Protection
<b>WQIF</b>	Water Quality Improvement Fund
<b>WQMIRA</b>	Water Quality Monitoring, Information and Restoration Act
<b>WHIP</b>	Wildlife Habitat Incentive Program
<b>WRP</b>	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)

**Benthic** – refers to material, especially sediment, at the bottom of a waterbody. It can be 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 project 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 no longer impaired.

**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 calculated by dividing the total number of paid hours by the number of hours in a time period.

**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.

**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.

**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.

**Stakeholder** - any person or organization with a vested interest in TMDL development and implementation in a specific watershed (e.g., farmer, landowner, resident, or business owner)

**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).

## **CONTACT INFORMATION**

### **Tazewell Soil and Water Conservation District**

117 Dial Rock Road  
North Tazewell, VA 24630  
(276) 988-9588

### **Natural Resources Conservation Service**

727R West Riverside Drive  
North Tazewell, VA 24630  
(276) 988-9588

### **Tazewell County**

106 E. Main Street  
Tazewell, VA 24651  
(276) 988-1202

### **Town of Tazewell**

201 Central Avenue, P.O. Box 608  
Tazewell, VA 24651  
(276) 988-2501

### **Virginia Department of Conservation and Recreation**

*Abingdon Regional Office*  
252 West Main Street  
Abingdon, VA 24210  
(276) 676-5418

### **Virginia Department of Environmental Quality**

355 Deadmore Street, P.O. Box 1688  
Abingdon, VA 24212  
(276) 676-4800

### **Virginia Department of Health (Cumberland Plateau Health District)**

Ben Bolt Avenue, P.O. Box 350  
Tazewell, VA 24651  
(276) 988-5585 or (276) 988-0414

### **Virginia Cooperative Extension Service**

552 East Riverside Drive  
North Tazewell, VA 24630  
(276) 988-0405

### **Engineering Concepts, Inc.**

20 South Roanoke Street, P.O. Box 619  
Fincastle, VA 24090  
(540) 473-1253