

South Mayo River, North Fork Mayo River, South Fork Mayo River, Blackberry Creek, Marrowbone Creek, Leatherwood Creek, and Smith River Watershed Implementation Plan



Prepared By: Blue Ridge Environmental Solutions, Inc.

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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 six beneficial uses: drinking water, recreational (i.e., primary contact/swimming), fishing, shellfishing, aquatic life, and wildlife.

South Mayo River was initially placed on the Virginia Water Quality Assessment 305(b)/303(d) Integrated Report in 1998 for exceedances of the bacteria standard. Blackberry Creek, Marrowbone Creek, Leatherwood Creek, and Smith River were initially placed on the list in 2002 and in 2004 North Fork Mayo River and South Fork Mayo River were added. After these listings, a TMDL study was conducted to identify bacteria sources in the watersheds. After a TMDL study is complete and approved by the 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 TMDL implementation plan was developed to reduce bacteria levels to attain water quality standards allowing delisting of streams from the Virginia Water Quality Assessment 305(b)/303(d) Integrated Report. The TMDL 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.

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, source assessment, water quality modeling, and allocated reductions were reviewed to determine implications of TMDL and modeling procedures on implementation plan development. Conditions outlined in the TMDL development study to address the bacteria impairments in these watersheds include:

- Exclusion of most/all livestock including horses from streams is necessary;
- Substantial land-based nonpoint source pollution load reductions are called for on pasture and cropland;
- All straight pipes and failing septic systems need to be identified and corrected;

- Implicit in the requirement to correct straight pipes and failing septic systems is the requirement to maintain all properly functioning septic systems;
- Reductions to pet bacteria loads on residential land use are necessary;
- Installation of riparian buffers and retention ponds/basins were recommended in the South Mayo River TMDL to achieve land-based residential NPS load reductions; and
- Implicit in the requirement for no point source bacteria 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; Patrick County government; Henry County government; City of Martinsville government; Henry County Public Service Authority; Patrick Soil and Water Conservation District; Blue Ridge Soil and Water Conservation District; West Piedmont Planning District Commission; Piedmont Triad Regional Council; Patrick County Farm Bureau; Dan River Basin Association; Virginia Department of Conservation and Recreation; Virginia Department of Environmental Quality; Virginia Department of Health; Virginia Department of Forestry; Virginia Cooperative Extension; Natural Resources Conservation Service; United States Army Corps of Engineers; and Blue Ridge Environmental Solutions, Inc.

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, three working groups were formed: Agricultural, Residential/Urban, and Governmental. Third, a Steering Committee was formed with representation from the Agricultural, Residential/Urban, and Governmental Working Groups; Patrick and Henry Counties government; City of Martinsville government; Patrick Soil and Water Conservation District; Blue Ridge Soil and Water Conservation District; West Piedmont Planning District Commission; Virginia Department of Conservation and Recreation; Virginia Department of Environmental Quality; Virginia Department of Health; Virginia Department of Forestry; Natural Resources Conservation Service; and Blue Ridge Environmental Solutions, Inc. to guide the development of the implementation plan. Over 200 man-hours were devoted to attending these meetings by individuals representing agricultural, residential, urban, commercial, environmental, and government interests on a local, state, and federal level.

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 Virginia Department of Conservation and Recreation Agricultural BMP Database and TMDL document. Bacteria load reductions on 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 was used to verify the analyses.

Associated cost estimations for each implementation action were calculated by multiplying the average unit cost per the number of units. Focusing on Stage I (*i.e.*, removal of impaired stream segments from impaired waters list) costs, the total agricultural corrective action costs equal \$36.3 million. Estimated corrective action costs needed to replace straight pipes and fix failing septic systems during Stage I totals \$3.8 million. The cost to implement the pet waste reduction strategies totals an estimated \$0.1 million. Cost to install vegetated buffers, rain gardens, and infiltration trenches during Stage I equal \$2.0 million. The total costs to provide assistance in the agricultural and residential programs during Stage I implementation are expected to both equal to \$0.6 million. The total Stage I implementation cost including technical assistance is \$43.4 million with the agricultural cost being \$36.9 million and residential cost \$6.5 million. The total Stage II implementation cost including technical assistance is \$9.2 million with the agricultural cost being \$6.0 million and residential cost \$3.2 million.

The primary benefit of implementation is cleaner waters in Virginia, where bacteria levels in the South Mayo River, North Fork Mayo River, South Fork Mayo River, Blackberry Creek, Marrowbone Creek, Leatherwood Creek, and Smith River impairments will be reduced to meet water quality standards, benefiting human and livestock herd health, local economies, and aquatic ecosystems. An important objective of the implementation plan is to foster continued economic vitality and strength by increasing tourism and recreational opportunities.

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 Virginia Water Quality Assessment 305(b)/303(d) Integrated Report. Progress toward end goals will be assessed during implementation through tracking of control measure installations. The Virginia Department of Environmental Quality will continue to assess water quality through its monitoring program. Implementation will be assessed based on reducing exceedances of the bacteria water quality standard, thereby improving water quality. Implementation of control measures is scheduled for 15 years and will be assessed in two stages. Stage I is based on meeting source allocations that translate to an instantaneous standard exceedance rate of 10.5% or less resulting in de-listing of streams. The Stage II goal is based on implementing source allocations to meet the specified TMDL goal, 0% exceedance of water quality standards.

Implementation in years one through 12 for agricultural source reductions focuses on installing livestock stream exclusion systems, improving pasture management, and cropland conversion to permanent vegetative cover or forest. BMPs installed in years 13 through 15 are based on additional treatment of bacteria load not treated during Stage I from pasture and cropland using improved pasture management, cropland conversion, manure incorporation into soil, and retention ponds.

Implementation in years one through 12 for residential bacteria loads focuses on performing septic tank pump-outs, identification and removal of straight pipes, repairing or replacing failed septic systems, instituting pet waste control education program, installation of pet waste enzyme digesting composters, installation of confined canine unit waste treatment systems, and vegetated buffer installation. Rain garden and infiltration trench installations will be concentrated in years 13 through 15 if needed.

Stakeholder's Roles and Responsibilities

Stakeholders are individuals who live or have land management responsibilities in the watershed, including private individuals, businesses, government agencies, 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, citizens, businesses, and community watershed groups. 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.

The Blue Ridge and Patrick Soil and Water Conservation Districts will provide cost-share funds, lead education and technical assistance efforts, and track best management practice implementation for the agricultural and residential programs. The West Piedmont Planning District Commission will coordinate cost-share fund distribution with the districts, lead education and outreach efforts, and report best management practice implementation for the residential program. The Dan River Basin Association will assist in developing volunteer monitoring programs and lead education and outreach efforts. 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 Health; Virginia Department of Agriculture and Consumer Services; Virginia Department of Game and Inland Fisheries; Virginia Department of Forestry; Virginia Cooperative Extension; and Virginia Outdoors Foundation. 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 Watershed Implementation Plans, 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 planning efforts needs continuous evaluation to determine possible effects on implementation goals. Coordination of local programs can increase participation in implementation activities and prevent redundancy. Several planned initiatives coinciding with TMDL implementation in this watershed include:

- Updates to Patrick and Henry Counties Comprehensive Plans
- Update to City of Martinsville Comprehensive Plan
- Martinsville-Henry County Rivers and Trails Recreational Use Plan
- Henry County PSA Philpott Reservoir Source Water Protection Plan
- Dan River Basin Association Eden Watershed Assessment – an IP-like study on a small watershed in the North Carolina portion of the Smith River watershed
- VADCR Mayo River State Park Endangered Species Study
- Trout Unlimited Strategic Plan

The implementation actions proposed in this plan will enhance these community improvement initiatives by improving water quality and making the rivers more attractive to visitors for tourism and recreational activities. Combined, these efforts can contribute to improvements in the area economy and residents' quality of life.

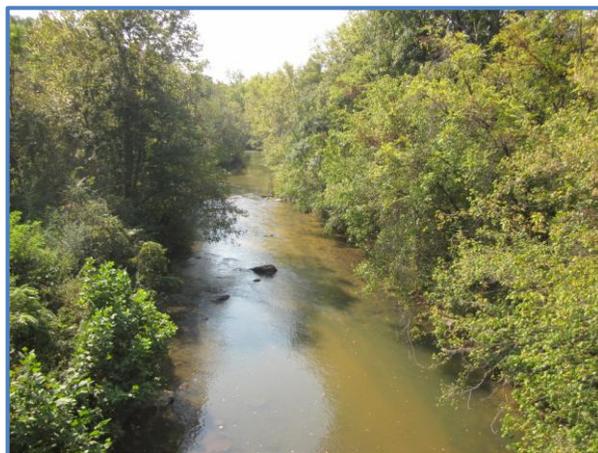
Potential Funding Sources

Potential funding sources available during implementation were identified in the course of plan development. An approved Watershed Implementation Plan makes these watersheds eligible for competitively awarded TMDL Implementation grants currently awarded through Virginia Department of Conservation and Recreation. The Virginia Department of Conservation and Recreation has provided Patrick Soil and Water Conservation District with Livestock Exclusion Initiative funds to promote livestock exclusion practices in the implementation plan area between July 2012 and June 2014. Detailed description of each funding source (*i.e.*, eligibility requirements, specifications, incentive payments) can be obtained from the Blue Ridge Soil and Water Conservation District; Patrick Soil and Water Conservation District; Virginia Department of Conservation and Recreation; Virginia Department of Health; Virginia Department of Environmental Quality; Virginia Department of Game and Inland Fisheries; Virginia Department of Forestry; Virginia Cooperative Extension; Virginia Outdoors Foundation; Natural Resources Conservation Service; and West Piedmont Planning District Commission.

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 six beneficial uses: drinking water, recreational (i.e., primary contact/swimming), fishing, shellfishing, aquatic life, and wildlife. 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.

South Mayo River was initially placed on the Virginia Water Quality Assessment 305(b)/303(d) Integrated Report in 1998 for exceedances of the bacteria standard. Blackberry Creek, Marrowbone Creek, Leatherwood Creek, and Smith River were initially placed on the list in 2002 and in 2004 North Fork Mayo River and South Fork Mayo River were added.



South Mayo River

After these listings, a TMDL study was conducted for South Mayo River in 2004 and remaining impairments in 2008 to identify bacteria sources in the watersheds and set limits on the amount of bacteria these waterbodies can tolerate and still maintain support of the Recreational Use.

A TMDL Implementation Plan (IP) was developed to describe and quantify implementation efforts that would reduce bacteria levels to attain water quality standards allowing delisting of the impaired waters from the Section 303(d) List. 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. Opportunities for Patrick and Henry Counties, City of Martinsville, local agencies, and watershed residents to obtain funding will improve with an approved IP.

STATE AND FEDERAL REQUIREMENTS FOR IMPLEMENTATION PLANS

In developing this implementation plan, both state and federal requirements and recommendations were followed. Virginia's 1997 Water Quality Monitoring, Information, and Restoration Act (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.



Blackberry Creek

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, Virginia Department of Environmental Quality (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

Bacteria TMDL for the South Mayo River watershed was completed in January 2004 with subsequent approval by USEPA in February 2004. Bacteria TMDLs for the North Fork Mayo River, South Fork Mayo River, Blackberry Creek, Marrowbone Creek, Leatherwood Creek, and Smith River watersheds were completed in September 2008 with subsequent approval by USEPA in December 2008 as part of the Dan River Watershed TMDL. The TMDL development documents can be obtained at the VADEQ office in Roanoke, VA or via the Internet at:

<http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/TMDL/TMDLDevelopment/ApprovedTMDLReports.aspx>.

Impairment description, water quality monitoring, watershed description, source assessment, water quality modeling, and allocated reductions were reviewed to determine implications of TMDL and modeling procedures on IP development.



*Straight Pipe
&
Failing Septic System*



Figure 1 depicts watershed boundaries (i.e., all colored areas) draining to impaired segments addressed in the project area of the IP. Marrowbone Creek and Leatherwood Creek impairment watersheds are located in Henry County. South Mayo River, North Fork Mayo River, and South Fork Mayo River impairment watersheds are located in Patrick and Henry Counties. Blackberry Creek, Smith River #1, and Smith River #2 impairment watersheds are predominantly located in Henry County; City of Martinsville; and Patrick County with small portions of the Smith River #1 watershed extending into Floyd County and Franklin County. Table 1 and Figure 2 illustrate landuse distribution within impairment watersheds based on 2001 U.S. Geological Survey National Land Coverage Database (NLCD) data used to develop TMDLs. South Mayo River drains into South Fork Mayo River and joins North Fork Mayo River to form the Mayo River before confluence with Dan River in North Carolina. Blackberry Creek flows southeast and drains into Smith River #1 to backwaters of Martinsville Dam. Smith River #1 forms at Martinsville Dam flowing south with Marrowbone Creek entering from west and Leatherwood Creek entering from east until emptying into Dan River.

Table 1. Watershed area and land use distribution.

Control Measure	South Mayo River	North Fork Mayo River	South Fork Mayo River	Blackberry Creek	Marrowbone Creek	Leatherwood Creek	Smith River #1	Smith River #2
Watershed Area (ac)	55,623	70,096	37,984	9,870	19,225	46,762	232,311	16,654
<u>Portion of Watershed Area (%)</u>								
Cropland	2	1	2	<1	<1	<1	<1	1
Pasture	22	17	17	12	15	18	11	19
Residential / Urban	11	4	11	8	8	6	8	17
Water / Wetland	1	<1	<1	<1	1	1	2	1
Forest	74	78	70	80	76	75	79	62

Potential sources of bacteria include both point source and nonpoint source (NPS) contributions. Nonpoint sources include: wildlife, grazing livestock, land application of manure and biosolids, urban/residential runoff, failed and malfunctioning septic systems, and uncontrolled discharges (straight pipes). General strategy to address bacteria impairments in the South Mayo River, North Fork Mayo River, South Fork Mayo River, Blackberry Creek, Marrowbone Creek, Leatherwood Creek, and Smith River watersheds includes:

- ★ Exclusion of most/all livestock including horses from streams is necessary;
- ★ Substantial land-based NPS load reductions are called for on pasture and cropland;
- ★ All straight pipes and failing septic systems need to be identified and corrected;
- ★ Implicit in the requirement to correct straight pipes and failing septic systems is the requirement to maintain all properly functioning septic systems;
- ★ Reductions to pet bacteria loads on residential land use are necessary;
- ★ Installation of riparian buffers and retention ponds/basins were recommended in the South Mayo River TMDL to achieve land-based residential NPS load reductions; and
- ★ Implicit in the requirement for no point source bacteria load adjustment is the requirement for point sources to maintain permit compliance.

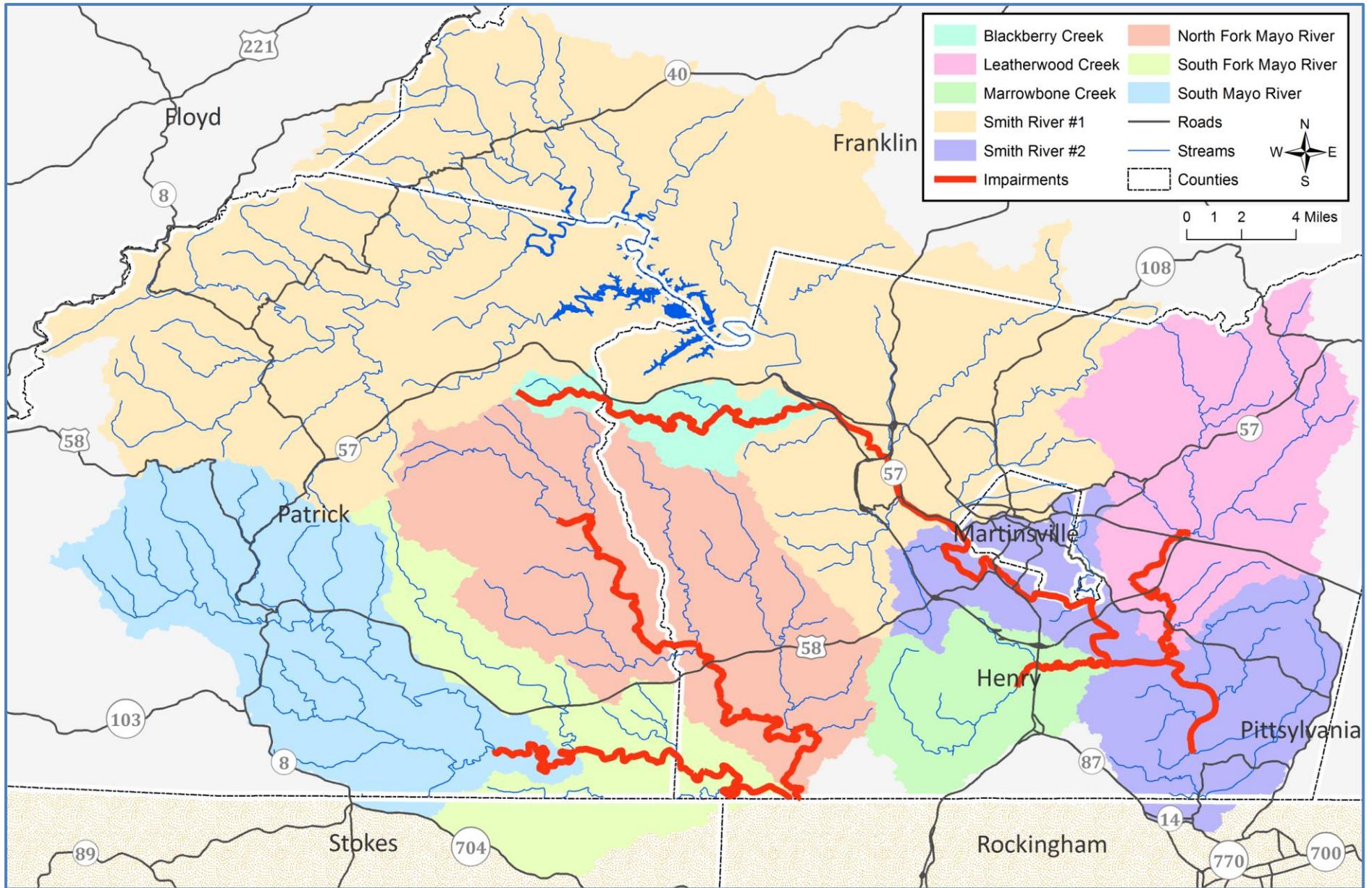


Figure 1. Watersheds location.

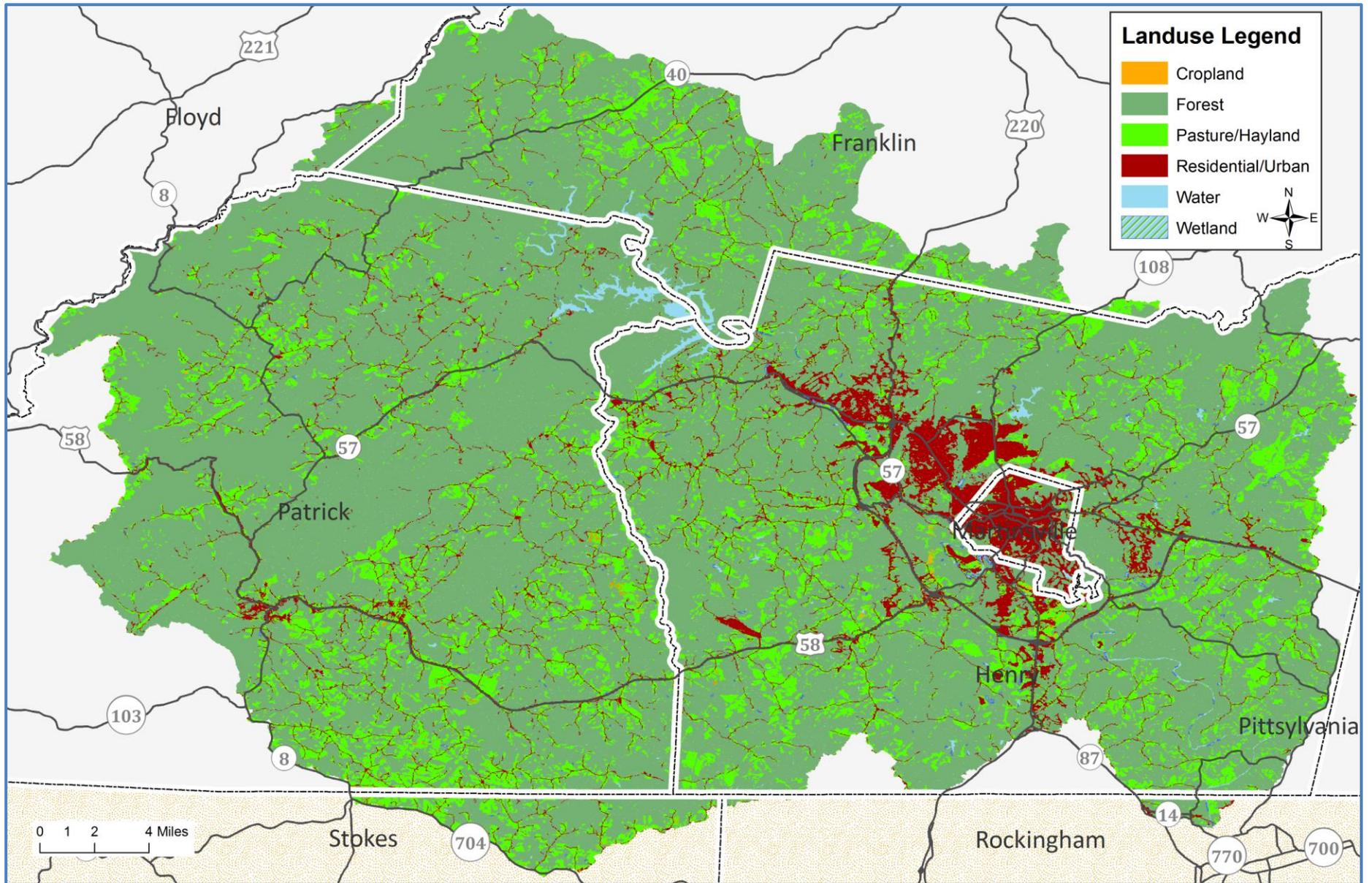


Figure 2. Land uses in the watersheds.

PUBLIC PARTICIPATION

Process

The actions and commitments compiled in this document are formulated through input from citizens of the watershed; Patrick County government; Henry County government; City of Martinsville government; Henry County Public Service Authority; Patrick Soil and Water Conservation District (PSWCD); Blue Ridge Soil and Water Conservation District (BRSWCD); West Piedmont Planning District Commission (WPPDC); Piedmont Triad Regional Council; Patrick County Farm Bureau; Dan River Basin Association (DRBA); Virginia Department of Conservation and Recreation (VADCR); Virginia Department of Environmental Quality (VADEQ); Virginia Department of Health (VDH); Virginia Department of Forestry (VADOF); Virginia Cooperative Extension (VCE); Natural Resources Conservation Service (NRCS); United States Army Corps of Engineers; 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 these waterbodies.

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, three working groups were formed: Agricultural, Residential/Urban, and Governmental. Third, a Steering Committee was formed with representation from the Agricultural, Residential/Urban, and Governmental Working Groups; Patrick and Henry Counties government; City of Martinsville government; PSWCD; BRSWCD; WPPDC; VADCR; VADEQ; VDH; VADOF; NRCS; and BRES to guide the development of the implementation plan. Over 200 man-hours were devoted to attending these meetings by individuals representing agricultural, residential, urban, commercial, environmental, and government interests on a local, state, and federal level (Table 2).



Livestock Stream Access



Pastured Livestock



Land Application

Table 2. Meetings held during the TMDL IP development process.

Date	Meeting Type	Location	Attendance	Time (hr)
10/16/12	Public Meeting	Horsepasture District Volunteer Fire Department	33	1
10/16/12	Agricultural Working Group	Horsepasture District Volunteer Fire Department	12	1
10/16/12	Residential/Urban Working Group	Horsepasture District Volunteer Fire Department	21	1
12/12/12	Governmental Working Group	Spencer Penn Centre	18	2
01/29/13	Agricultural & Residential/Urban Working Group	Patrick Henry Community College	14	2
01/30/13	Agricultural & Residential/Urban Working Group	Henry County Administration Building	12	2
03/14/13	Steering Committee	Spencer Penn Centre	14	2
03/28/13	Public Meeting	Spencer Penn Centre	21	2

Agricultural Working Group Summary

The Agricultural Working Group (AWG) consisted of representatives from organizations that serve this community and will have a role in implementation (*e.g.*, PSWCD, BRSWCD, 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 landowners to implement necessary BMPs to meet specified reductions to direct stream, pasture, and cropland bacteria loads. Challenges, recommendations, and keys for success were discussed in the meetings.

Primarily part-time beef and horse operations exist in these watersheds. Full time farming is estimated at less than 30% of farms. Agricultural production is changing based on land use conversion such as cropland to pasture, cropland and/or pasture to forests, etc. Very little tobacco being raised anymore, goat production has increased in the past five years. Two sizeable feedlots exist in Patrick County with a number of stockers; however, these feedlots are not large enough to be considered confined animal feeding operations. No poultry operations in these watersheds. Poultry litter is imported into Henry County from North Carolina and Shenandoah Valley. Poultry litter is imported into Patrick County from North Carolina; however, very little poultry litter imported into Patrick County. It is estimated 50 to 70% of local producers have implemented stream fencing within the two counties. Voluntary BMPs, particularly those that meet specifications, are virtually non-existent in Patrick County. Fence is the most common voluntary BMP because there no restrictions when implemented as a voluntary BMP.

Several AWG participants felt that runoff contributed most to the loading in streams rather than direct deposition. One AWG participant mentioned that cattle prefer clean water over that of streams when given an option and questioned whether exclusion fence was even needed. Cattle may also utilize shade

and water in the stream corridor to cool off. Portable shade structures could provide an option for producers, but are not common in these counties. Participants felt that the major barriers to fencing included buffer requirements gives up too much productive pasture; flood-prone areas require excessive fence maintenance; cost, especially paying upfront ; reluctance to participate in government programs; and many absentee landowners in Patrick and Henry Counties lease property and lessees do not want to commit to BMP lifespans requirements.

The Department of Forestry commented that the cost of reforestation for the FR-1 seemed high. BRESI suggested this may be the average cost of planting pine and hardwood. DOF said that people in this area rarely use hardwoods, and the cost of pine is only about \$175. Stakeholders agreed that a cost of \$175/acre would be more accurate for the area. Patrick SWCD commented that districts now use a cost of \$300/acre for total vegetative cover.

In Patrick County, less than 10% of Environmental Quality Incentives Program (EQIP) applications are funded because this program awards money competitively across the state. Conservation Reserve Enhancement Program (CREP) and state cost share are popular in the North and South Fork Mayo River watersheds. Currently, Patrick County also has some targeted TMDL implementation funds for livestock exclusion practices in this watershed. All of the money received in July 2012 has been allocated for projects. Henry County is not currently CREP eligible but may be once this Implementation Plan is complete. According to NRCS, about two-thirds of EQIP applications from Henry County are funded. The state does offer \$1 per linear foot to maintain cost-share fence after the life span of 10 years has expired with the requirement that the fence be maintained an additional five years. Also, the \$1 per linear foot incentive is available for voluntary installed fence that does not meet fencing standards with a requirement that the fence be maintained for five years. The WP-2T practice has an incentive payment of \$0.50 per linear foot of fence installed to offset fence maintenance costs. The Virginia Outdoors Foundation (VOF) has shown interest in Patrick County. The PSWCD has agreed to be co-holder of easements in the area. In Virginia, landowners who place perpetual easements on their land may be eligible for Federal tax deductions and state tax credits. Working group participants suggested that the DRBA and Trout Unlimited may be able to help fund agricultural practices in the watershed.



Alternative Water Source

Residential/Urban Working Group Summary

The Residential/Urban Working Group (RUWG) consisting of watershed residents and; Patrick and Henry Counties; City of Martinsville; WPPDC; DRBA; PSWCD; BRSWCD; VADCR; VADEQ; and VDH personnel; focused on means to educate and involve public with regard to implementing corrective actions to replace straight pipes, correct failing septic systems, and manage pet waste. Challenges, recommendations, and keys for success were discussed in the meetings.

The RUWG participants suggested that most residents don't practice regular maintenance of their systems and aren't concerned with problems unless they have back-ups into their homes. Septic tank pump-outs would be an effective way to identify failing septic systems and those in need of repair. There is no septic tank pump-out ordinance in Patrick County, Henry County, or the City of Martinsville. Residents in both counties may be intimidated by perceived financial costs and potential repercussions associated with approaching the Health Department to address on-site sewage disposal system issues. RUWG participants felt strongly that cost share for pump-outs, repairs, and replacements would be very effective in encouraging people to come forward with problems. Septic haulers may leave flyers as a form of outreach to notify residents of funding.



Septic Tank Pump-out

It was suggested the Foley Mountain area off of Polebridge Road in the North Mayo watershed may have increased risk of failing septic systems and/or straight pipes, but residents in that area may not be receptive to education/repair programs. Several sewage lagoons exist in the watershed, including a lagoon servicing several trailers off of Wells Hollow Road, but several participants thought those homes may have recently been connected to public sewer. There are no sewer extensions currently planned in Henry County; however, five potential areas have been identified. In Patrick County, the Patrick Springs sewer line extension is complete, but there are still homes in the area not hooked up to the line. Another sewer line is slated for the West End of Stuart (at the intersection of Routes 8 and 58) to service about six businesses there.

Pet waste education and disposal programs should be limited to highly-concentrated residential areas in the watershed, as well as parks, trails, and confined canine units (i.e., kennels, veterinary clinics, animal shelters, etc.). Patrick County stakeholders mentioned two veterinarian offices in the Mayo River watershed that may benefit from a Confined Canine Unit (CCU) Waste Treatment System. Henry County stakeholders said animal shelters and veterinarians within county were either on public sewer or had a VDH-designed onsite sewage disposal system. No hunt clubs or kennels were identified by stakeholders in either meeting.



Alternative On-site Sewage Disposal System

RUWG participants were not aware of any stormwater BMPs in Henry County. The Patriot Centre Industrial Park in Martinsville has retention ponds to control runoff. In Patrick County, sedimentation ponds collect flow from public sewers in Stuart.

RUWG participants felt that outreach and education could both be best achieved through announcements and articles in local newspapers (The Enterprise in Patrick County and Martinsville Bulletin) and distribution of flyers via companies offering septic tank pump-outs. Representatives from a

local TV station (WGSR47) and radio station (WZBB) were present for the meeting and suggested they could assist with advertising, as well.

West Piedmont Planning District Commission (WPPDC) has gathered partners to develop a proposal for the 2012 TMDL Implementation grant. They are seeking funding for residential (septic) BMPs, citizen monitoring, and vegetated riparian buffer installation in the Patrick County portion of the North and South Mayo River watersheds. Blue Ridge Soil and Water Conservation District (BRSWCD) has applied for the 2012 TMDL Implementation grant requesting funds for residential (septic) and agricultural BMPs in portions of the Smith River, as well as the Leatherwood Creek, and Marrowbone Creek watersheds. Local agencies that may be able to assist with Residential/Urban education and funding include Support to Eliminate Poverty (STEP), Southeast Rural Community Assistance Project (SERCAP), Dan River Basin Association (DRBA), and the Harvest Foundation.

Governmental Working Group Summary

The Governmental Working Group (GWG) consisting of representatives from Patrick County; Henry County; City of Martinsville; PSWCD; BRSWCD; WPPDC; VADCR; VADEQ; VDH; NRCS; and BRES personnel, focused on funding sources, technical assistance needs, regulatory controls, and lead agencies responsible for implementation.

State and federal agricultural cost-share funds received for Patrick and Henry Counties are allocated and disbursed by the PSWCD and BRSWCD. Farm Service Agency (FSA) is currently taking applications for Conservation Reserve Enhancement Program (CREP), but no money is allocated to the program. CREP applications are ranked for funding from a statewide pool; money is not allocated by County or District. Unlike state cost-share, participants may receive partial reimbursement as they complete each conservation practice. Environmental Quality Incentives Program (EQIP), especially in the Mayo River watershed is used primarily to help fund cattle exclusion and watering systems. EQIP is sometimes partnered with state cost-share to maximize the benefit to the farmer. Typically, the Virginia Agricultural Cost-share Program reimburses the producer a percentage of the cost of approved practices, though the state recently announced that it will offer 100% cost-share for select livestock exclusion practices during the current fiscal year. Patrick SWCD recently received money to fund the Livestock Exclusion Initiative project aimed at excluding livestock from streams in TMDL watersheds. Stakeholders anticipate this will reduce the number of applications for federal funding of similar practices. Both NRCS representatives felt participation in federal programs could be improved by more outreach; but they don't have the time to do that. Henry County NRCS could use more assistance in making available options known to farmers; several County representatives offered suggestions and assistance for advertising in the future. Agricultural stakeholders present agreed that the most positive marketing result comes from word of mouth shared among producers.

Stakeholders felt strongly that pump-outs help to identify systems in need of repair; it was recommended that grant funding for pump-outs be sought as part of the implementation process. The housing boom in Henry County peaked 30-40 years ago, indicating many systems may be at risk for failure. Shrinking lot sizes make it difficult to fit adequate drain fields on properties; this problem may also arise during repairs on small lots (especially row houses). Some areas may require alternative

waste disposal systems. VDH personnel suggested that fears of high permitting fees deterred residents from approaching them about septic repairs. The permit for installing an OSDS costs \$425, but this is waived for repairs. Often, people can't afford repair costs. It was suggested that SERCAP might be able to further subsidize such projects. Neither Patrick County nor Henry County requires residents to hook up to sewer lines. If Henry County were able to further extend lines, such a policy may be reinstated. The Henry County Capital Improvement Plan includes sewer extensions; however, there is currently no funding for such projects. Henry County has three lagoon systems that they would like to take off line and connect houses directly to sewerage. This would cost several million dollars in funds the county does not currently have. There are still OSDS within Martinsville City Limits. Residents with OSDS pay a monthly fee to the city and must connect to sewer if their OSDS fails. The implementation plan should include "connections to sewer" as a means of remediating failing septic systems. Stakeholders would like to seek funding to help identify areas where sewer connection would be the most beneficial. Blue Ridge SWCD has experience with residential cost-share from the Pigg and Blackwater Rivers Implementation Plans and would be willing to pursue future funding in the Smith River and tributaries. Dan River Basin Association (DRBA) is well respected in the area. Local stakeholders would consider them an asset in managing implementation grant funds in the area. West Piedmont PDC may not be able to support staffing needs for such a project.

It was suggested that Jack Dalton and the Smith River Sports Complex, both areas in Henry County where people may walk dogs, already have signage about picking up after pets. Stakeholders suggested "Activate Martinsville-Henry County" would be a good place to find additional parks and trails where signage and pet waste stations could be implemented. Patrick County also has one park and two trails. Martinsville-Henry County SPCA could assist with a pet waste education program. The Patrick County Animal Pound has a septic system with a fur filter operating for about 10 years without any known problems.

Areas of need in Patrick County, Henry County, and Martinsville are eligible to receive Appalachian Regional Commission (ARC) construction funds. Tobacco commission funds are available in the area, but are generally aimed at promoting economic development. They may not be a good fit for implementation projects. Community Development Block Grants have been pursued for Henry County sewer extensions in the past. Housing and community development may be able to assist with residential projects; such funding usually requires in-kind match ("sweat equity"). Although the Harvest Foundation does fund health initiatives, their focus is mainly on physical activity. Also, they do not offer services that replace government functions and are unlikely partners for residential implementation.

Regulatory controls discussed: **Agricultural Stewardship Act (ASA)** – ASA is a complaint-driven bad-actor law administered by Virginia Department of Agriculture and Consumer Sciences (VDACS) which relies on either their own staff or SWCDs to investigate reported water quality problems concerning nutrients, sediment and toxins from agricultural activities. **Sewage Handling and Disposal Regulations** – VDH administers these regulations which results in enforcement actions to eliminate discharges from straight pipes and repair or replace failing septic systems. These regulations define gray water as sewage that needs to be treated. There are no pump-out ordinances in the watersheds, though it was pointed out that many mortgage lenders require a pump-out at the time of home sale. The WPPDC questioned if a

pump-out ordinance would be worthwhile, citing backlash in Franklin County where residents must provide paperwork to verify required pump-outs have occurred. A new sewer ordinance is being developed that would require new development in Henry County to have proper grease treatment technology. Existing problems are traced back to the source, and the PSA works with the property owner to rectify the problem.

Several VADEQ trend stations are located in the watershed, including 4ANMR002.60 (Rte. 629), 4ASRE007.90 (Rte. 622 Bridge) , 4ASRE033.19 (Rte. 701), 4ASRE043.54 (Rte. 674), 4ASMR075.69 (Rte. 708 bridge), and 4ASMR016.09 (Rte. 700 bridge). Trend stations are sampled every year, either monthly or bimonthly. Non-trend, or “rotating,” stations are monitored monthly or bimonthly for a cycle of two years on, four years off. Several stations in the watershed, including those in Leatherwood Creek and Smith River are in the 2013-14 monitoring plan to be monitored according to the “rotating” schedule. Other stations in the watershed won’t be monitored again until BMPs have been in place. VADEQ monitoring can be supplemented by citizen monitoring. TMDL Implementation grants through DCR often include funding for such monitoring programs.

Existing or planned activities, studies, and planning efforts in the watershed: Eden Watershed Assessment (DRBA) – an IP-like study on a small watershed in the North Carolina portion of the Smith River watershed; Martinsville-Henry County Rivers and Trails Recreational Use Plan; VADCR – Mayo River State Park study revealed rare mussels in the South Mayo River; and Henry County PSA conducted a source water protection plan study near Philpott Reservoir dam. A number of agricultural issues were identified through this process.

Steering Committee Summary

The Steering Committee consisted of representatives from the AWG, RUWG, and GWG; Patrick County; Henry County; City of Martinsville; PSWCD; BRSWCD; WPPDC; DRBA; VADCR; VADEQ; VDH; NRCS; and BRES. Steering Committee evaluated recommendations from working groups, reviewed BMP quantification and cost estimates, 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

An assessment was conducted to quantify actions and costs for two implementation stages. Actions and costs that translate to an instantaneous standard exceedance rate of 10.5% or less, resulting in removal of these streams from the Virginia Water Quality Assessment 305(b)/303(d) Integrated Report, were quantified. This is referred to as the Stage I implementation goal. The Stage II implementation goal is full attainment with the TMDL source load reductions. Estimated units presented in Tables 3 through 6 depict the Stage I and II goals. 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.

Agricultural Implementation Needs

Removing livestock from the stream corridor was identified as the primary control measure to reduce the livestock direct deposition bacteria load. There are approximately 2,241 miles of perennial streams in these eight watersheds. Currently in these watersheds, approximately 61 miles of exclusion fencing have been installed. Exclusion fencing, necessary to prevent access to perennial streams and meet the stated TMDL reductions, was estimated at approximately 539 miles of fence. Figure 3 displays analysis results for a portion of South Fork Mayo River watershed. The exclusion fencing is translated into a total of 1,335 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)**, **Environmental Quality Incentives Program (EQIP)**, **Livestock Exclusion with Riparian Buffers (LE-1T)**, **Livestock Exclusion with Reduced Setback (LE-2T)**, **Small Acreage Grazing System (SL-6AT)**, **Stream Protection (WP-2T)**, and **Support for Extension of CREP Watering Systems (SL-7T)** (Table 3).



Stream Exclusion Fencing



Improved pasture management BMPs are needed to reduce bacteria load contributed from grazing animals and transported to stream during precipitation events after accounting for bacteria removal from riparian buffers installed from livestock stream fencing. Total of 71,637 acres in the watershed would require **Improved Pasture Management** with portions of this acreage improved by the **Pasture and Hayland Planting (NRCS Code 512)** and **Prescribed Grazing (NRCS Code 528)** BMPs. Given reductions were not sufficient to meet TMDL reduction goals, installation of retention ponds may be necessary to treat runoff from this acreage during Stage II of implementation.

The AWG decided the primary control measure for cropland bacteria 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 Erodeable Crop and Pastureland BMPs** based on input from AWG and landuse difference. Additionally, **manure incorporation** into soil was needed in the watersheds. Currently in these watersheds, approximately 450 cropland acres have been converted utilizing the SL-1 (127 ac) and FR-1 (323 ac) practices. Converting 28 acres to pasture and 56 acres to forest land uses during Stages I & II and incorporating manure into soil on approximately 1,625 cropland acres during Stage II satisfied the TMDL goal (Tables 3 and 4). There may be two opportunities in the South Fork Mayo River watershed to utilize a dry manure storage facility.



Permanent Vegetative Cover on Cropland



Re-forestation

Table 3. Estimation of control measures with unit cost (average) needed to meet pasture and cropland bacteria load reduction Stage I (years 1-12) implementation goals.

Control Measure	Unit	Average Unit Cost ⁴ (\$)	Estimated Units Needed (#)								Total
			South Mayo River	North Fork Mayo River	South Fork Mayo River	Blackberry Creek	Marrowbone Creek	Leatherwood Creek	Smith River #1	Smith River #2	
<u>Pasture and Livestock Exclusion</u>											
Livestock Exclusion System (CREP)	System	27,000	16	18	6	2	3	10	52	6	113
Livestock Exclusion System (EQIP)	System	25,000	45	50	16	7	5	25	144	16	308
Livestock Exclusion System (LE-1T)	System	25,000	92	103	33	14	10	52	295	33	632
Livestock Exclusion System (SL-6AT)	System	9,000	2	3	1	0	0	1	8	1	16
Livestock Exclusion System (LE-2T)	System	17,000	35	40	13	5	4	20	114	13	244
Livestock Exclusion System (WP-2T)	System	5,000	3	3	2	1	0	2	10	1	22
CREP Watering System Extension (SL-7T)	System	10,000	8	9	3	1	1	5	26	3	56
Improved Pasture Management ¹	Acres ²	75	9,436	9,360	5,092	880	2,196	6,539	20,488	3,315	57,306
<u>Cropland</u>											
Permanent Vegetative Cover on Cropland (SL-1)	Acres ²	300	8.0	1.6	4.0	0.8	0.8	2.4	3.2	1.6	22.4
Reforestation of Erodible Crop and Pastureland (FR-1)	Acres ²	175	8.0	4.0	4.0	0.8	0.8	1.6	19.2	6.4	44.8
Dry Manure Storage Facility	System	75,000	1	1	0	0	0	0	0	0	2
<u>Technical Assistance</u>											
Agricultural – Pasture and Cropland	FTE ⁵	50,000									1/yr

¹ Improved pasture management comprised of: Pasture and Hayland Replanting (512), Pasture Management, and Prescribed Grazing (528) BMPs;

² Acres installed; ³ Acres treated; ⁴ Unit cost = installation or one-time incentive payment; ⁵ Full time equivalent

Table 4. Estimation of control measures with unit cost (average) needed to meet pasture and cropland bacteria load reduction Stage II (years 13-15) implementation goals.

Control Measure	Unit	Average Unit Cost ⁴ (\$)	Estimated Units Needed (#)								Total	
			South Mayo River	North Fork Mayo River	South Fork Mayo River	Blackberry Creek	Marrowbone Creek	Leatherwood Creek	Smith River #1	Smith River #2		
<u>Pasture and Livestock Exclusion</u>												
Livestock Exclusion System (CREP)	System	27,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Livestock Exclusion System (EQIP)	System	25,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Livestock Exclusion System (LE-1T)	System	25,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Livestock Exclusion System (SL-6AT)	System	9,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Livestock Exclusion System (LE-2T)	System	17,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Livestock Exclusion System (WP-2T)	System	5,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CREP Watering System Extension (SL-7T)	System	10,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Improved Pasture Management ¹	Acres ²	75	2,360	2,340	1,275	222	551	1,636	5,121	825		14,330
Retention Ponds	Acre ³	150	5,638	3,920	3,316	376	1,461	4,218	10,982	1,594		31,505
<u>Cropland</u>												
Permanent Vegetative Cover on Cropland (SL-1)	Acres ²	300	2.0	0.4	1.0	0.2	0.2	0.6	0.8	0.4		5.6
Reforestation of Erodible Crop and Pastureland (FR-1)	Acres ²	175	2.0	1.0	1.0	0.2	0.2	0.4	4.8	1.6		11.2
Manure Incorporation Into Soil	Acres ²	75,000	1,000	95	225	16	0	33	209	47		1,625
Dry Manure Storage Facility	System		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<u>Technical Assistance</u>												
		50,000										
Agricultural – Pasture and Cropland	FTE ⁵	300										1/yr

¹ Improved pasture management comprised of: Pasture and Hayland Replanting (512), Pasture Management, and Prescribed Grazing (528) BMPs;

² Acres installed; ³ Acres treated; ⁴ Unit cost = installation or one-time incentive payment; ⁵ Full time equivalent

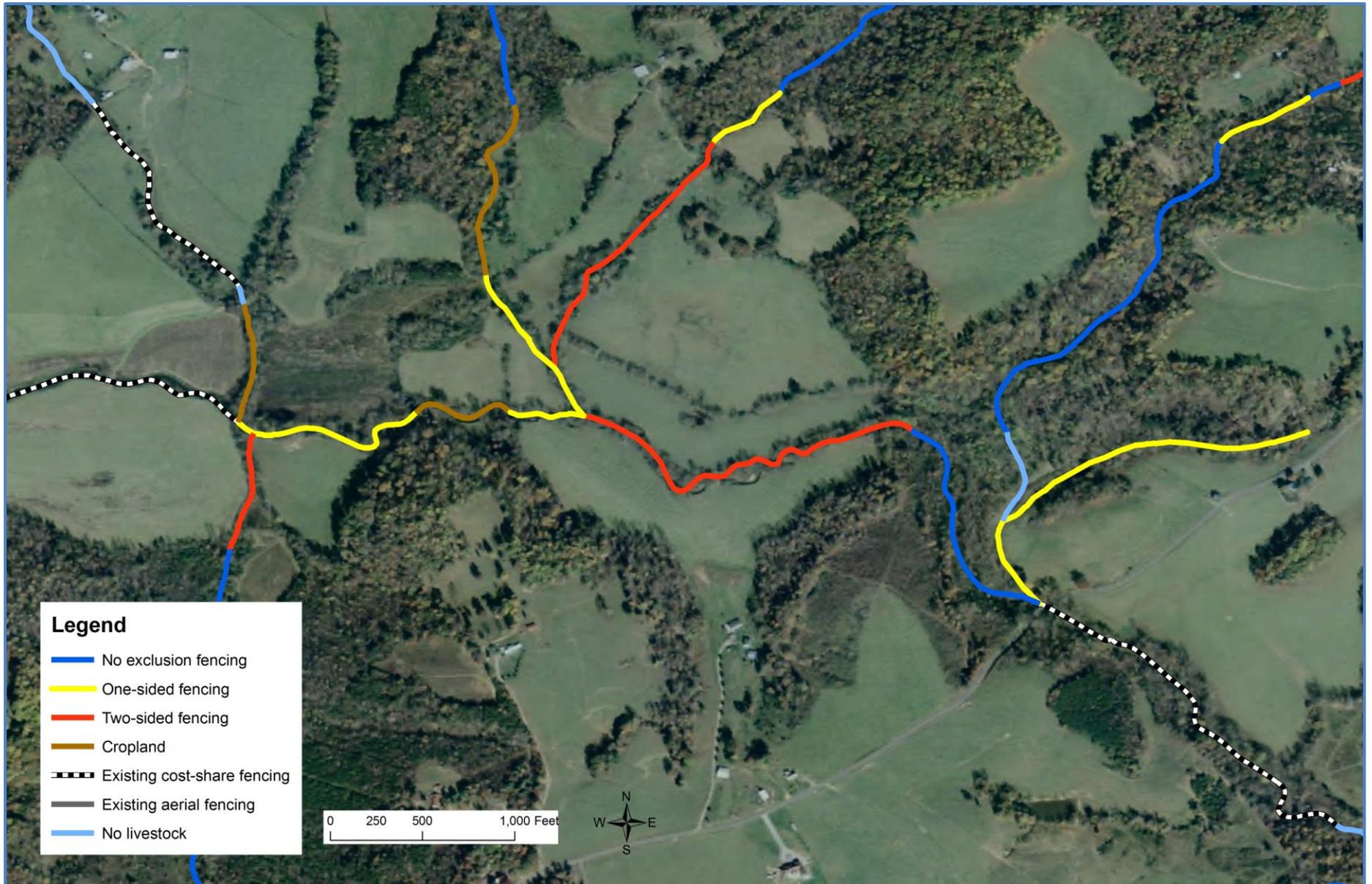


Figure 3. Potential livestock exclusion fencing analysis results for portion of South Fork Mayo River.

Residential/Urban Implementation Needs

Number of straight pipes and failing septic systems to correct during implementation was established during TMDL development. Based on discussion with Virginia Department of Health and RUWG, it was assumed that 80% of the straight pipes would be replaced with a conventional septic system, 10% replaced with conventional septic system with pump, and 10% replaced with an alternative on-site sewage disposal system (OSDS). Failing septic systems were assumed to be corrected by connecting to public sewer or repairing the existing septic system (70%), installing a new conventional septic system (25%), installing a new conventional septic system with pump (3%), or installing a new alternative OSDS (2%). The RUWG and GWG felt strongly that septic tank pump-outs, estimated at number of failing septic systems and straight pipes (about 4% of houses with OSDS), help to identify systems in need of repair and would be needed to identify and correct all failing septic systems and straight pipes. It is estimated that 754 **septic tank pump-outs**, 69 **connections to public sewer**, 351 **septic system repairs**, 269 **conventional septic systems**, 36 **conventional septic systems with pump**, and 29 **alternative OSDS** are considered necessary to correct straight pipes and failing septic systems during implementation (Table 5).



Septic System Repair



Pet Waste Kiosk

A three-step program was proposed to address pet waste reductions. In the first step, a **pet waste control program** consisting of educational packets, signage, and disposal stations in public areas will be instituted in each watershed. Activate Martinsville-Henry County” would be a good place to find additional parks and trails where signage and pet waste stations could be implemented. Patrick County also has one park and two trails. The second step will be installing **pet waste enzyme digesting composters** at 565



Pet Waste Composter

residences. An initial estimate of 10% of all residences would utilize a composter was determined to be high by RUWG and GWG members. The estimate was then varied based on housing density in the watersheds, resulting in a variation of <1% in South Mayo River to about 3% in Leatherwood Creek. The third step will be identification of confined canine units (CCU) and installing approximately five **CCU waste treatment systems** throughout the watersheds. The installation of **vegetated buffers**, **bioretention**, and **infiltration trenches** during Stages I & II on residential land use to reduce bacteria load contributed from pets and transported to streams during precipitation events are outlined in Tables 5 & 6.

Table 5. Estimation of control measures with unit cost (average) needed to meet residential/urban and onsite sewage disposal systems bacteria load reduction Stage I (years 1-12) implementation goals.

Control Measure	Unit	Unit Cost ¹ (\$)	Estimated Units Needed (#)								Total	
			South Mayo River	North Fork Mayo River	South Fork Mayo River	Blackberry Creek	Marrowbone Creek	Leatherwood Creek	Smith River #1	Smith River #2		
<u>Failing Septic Systems</u>												
Septic Tank Pump-out	System	250	39	87	33	16	37	86	222	82	602	
Septic System Repair	System	3,000	22	56	23	11	21	53	108	57	351	
Connection of OSDS to Public Sewer	System	2,000	5	5	0	0	5	7	47	0	69	
New Conventional Septic System	System	6,000	10	21	8	4	9	21	56	21	150	
New Conventional Septic System with Pump	System	8,000	1	3	1	1	1	3	7	2	19	
Alternative On-site Sewage Disposal System	System	15,000	1	2	1	0	1	2	4	2	13	
<u>Straight Pipes</u>												
Septic Tank Pump-out	System	250	5	18	5	4	9	22	49	40	152	
New Conventional Septic System	System	6,000	3	14	3	3	7	18	39	32	119	
New Conventional Septic System with Pump	System	8,000	1	2	1	1	1	2	5	4	17	
Alternative On-site Sewage Disposal System	System	15,000	1	2	1	0	1	2	5	4	16	
<u>Pet Waste Management</u>												
Pet waste education program	Program	5,000	1			1						2
Pet waste digesters	System	50	5	30	10	15	10	80	405	10	565	
Confined Canine Unit Waste Treatment System	System	20,000	2	0	0	0	1	0	2	0	5	
<u>Residential/Urban Best Management Practices</u>												
Vegetated Buffers	Acres ²	400	3.2	1.0	0.8	0.9	0.9	1.6	40.0	4.8	53.2	
Bioretention	Acres ³	15,000	4.0	0.7	0.4	0.6	0.6	0.6	120.0	2.8	129.7	
Infiltration Trench	Acres ³	11,300	0.6	0.7	0.4	0.6	0.6	0.6	4.0	0.8	8.3	
<u>Technical Assistance</u>												
On-site Sewage Disposal Systems	FTE ⁴	50,000									0.9 /yr	
Pet Waste Management & Residential BMPs	FTE ⁴	50,000									0.1 /yr	

¹ Unit cost = installation or one-time incentive payment; ² Acres installed; ³ Acres treated; ⁴ Full time equivalent

Table 6. Estimation of control measures with unit cost (average) needed to meet residential/urban and onsite sewage disposal systems bacteria load reduction Stage II (years 13-15) implementation goals.

Control Measure	Unit	Unit Cost ¹ (\$)	Estimated Units Needed (#)								Total	
			South Mayo River	North Fork Mayo River	South Fork Mayo River	Blackberry Creek	Marrowbone Creek	Leatherwood Creek	Smith River #1	Smith River #2		
<u>Failing Septic Systems</u>												
Septic Tank Pump-out	System	250	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Septic System Repair	System	3,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Connection of OSDS to Public Sewer	System	2,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
New Conventional Septic System	System	6,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
New Conventional Septic System with Pump	System	8,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Alternative On-site Sewage Disposal System	System	15,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<u>Straight Pipes</u>												
Septic Tank Pump-out	System	250	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
New Conventional Septic System	System	6,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
New Conventional Septic System with Pump	System	8,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Alternative On-site Sewage Disposal System	System	15,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<u>Pet Waste Management</u>												
Pet waste education program	Program	5,000	n/a			n/a					n/a	
Pet waste digesters	System	50	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Confined Canine Unit Waste Treatment System	System	20,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<u>Residential/Urban Best Management Practices</u>												
Vegetated Buffers	Acres ²	400	0.8	0.0	0.2	0.1	0.1	0.4	10.0	1.2	12.8	
Bioretention	Acres ³	15,000	6.0	0.3	0.6	0.4	0.4	0.4	180.0	4.2	192.3	
Infiltration Trench	Acres ³	11,300	0.4	0.3	0.6	0.4	0.4	0.4	6.0	1.2	9.7	
<u>Technical Assistance</u>												
On-site Sewage Disposal Systems	FTE ⁴	50,000									0.9 /yr	
Pet Waste Management & Residential BMPs	FTE ⁴	50,000									0.1 /yr	

¹ Unit cost = installation or one-time incentive payment; ² Acres installed; ³ Acres treated; ⁴ Full time equivalent

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. Future residential development was identified as a potential source to deliver bacteria to streams through additional septic systems and pets. 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.



Stormwater Runoff Control Structure

Assessment of Technical Assistance Needs

To determine the number of full time equivalents (FTE) considered necessary for agricultural and residential 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. Coupling the number of BMPs processed historically and estimates provided by the SWCDs and Steering Committee, one agricultural FTE per year and one residential FTE per year are needed during Stage I of implementation. The residential FTE was divided between OSDS (90%) and pet waste management program and residential BMPs (10%) resulting in 0.9 FTE per year for OSDS and 0.1 FTE per year for pet waste management program and residential BMPs technical assistance, respectively (Tables 3 through 6).



**Rotational
Grazing
System**



Cost Analysis

Associated unit cost estimations for each implementation action during Stages I and II are shown in Tables 3 through 6. Table 7 lists installation and technical assistance costs to implement agricultural and residential programs for implementation Stages I & II. Focusing on Stage I, the total average installation cost for livestock exclusion systems and improved pasture management is \$36.1 million. The total installation cost for converting cropland to permanent vegetative cover and forest is estimated at \$0.2 million. Accordingly, total agricultural corrective action costs equal \$36.3 million. Estimated corrective action costs needed to replace straight pipes and fix failing septic systems totals \$3.8 million. The cost to implement the pet waste reduction strategies totals an estimated \$0.1 million. Cost to install vegetated buffers, rain gardens, and infiltration trenches during Stage I equal \$2.0 million.

It was determined by the PSWCD, BRSWCD, VADCR, VDH, GWG, and Steering Committee members that it would require \$50,000 to support one technical FTE per year. The total costs to provide assistance in the agricultural and residential programs during Stage I implementation are expected to be both equal to \$0.6 million (Table 7). The total Stage I implementation cost including technical assistance is \$43.4 million with the agricultural cost being \$36.9 million and residential cost \$6.5 million (Table 7). The total costs to provide assistance in the agricultural and residential programs during Stage II implementation are expected to be both equal to \$0.15 million. The total Stage II implementation cost including technical assistance is \$9.2 million with the agricultural cost being \$6.0 million and residential cost \$3.2 million (Table 7).



Bioretention (Rain Garden)



Table 7. Implementation cost associated with percentage of practices to be installed along with technical assistance addressing agricultural and residential needs in the South Fork Mayo River and Smith River watersheds during Stages I & II of implementation.

Year	Agricultural				Residential					Total Cost
	Pasture & Livestock Access	Cropland	Technical Assistance	Total	On-site Sewage Disposal System	Pet Waste	Residential BMPs	Technical Assistance	Total	
	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)	
1	1,870,000	1,000	50,000	1,921,000	191,000	10,000	1,000	50,000	252,000	2,173,000
2	3,247,000	1,000	50,000	3,298,000	327,000	3,000	1,000	50,000	381,000	3,679,000
3	3,580,000	2,000	50,000	3,632,000	362,000	23,000	3,000	50,000	438,000	4,070,000
4	1,870,000	1,000	50,000	1,921,000	207,000	1,000	1,000	50,000	259,000	2,180,000
5	3,447,000	1,000	50,000	3,498,000	340,000	3,000	1,000	50,000	394,000	3,892,000
6	3,728,000	2,000	50,000	3,780,000	391,000	43,000	5,000	50,000	489,000	4,269,000
7	1,879,000	1,000	50,000	1,930,000	199,000	1,000	256,000	50,000	506,000	2,436,000
8	3,447,000	1,000	50,000	3,498,000	352,000	3,000	256,000	50,000	661,000	4,159,000
9	3,733,000	2,000	50,000	3,785,000	392,000	23,000	502,000	50,000	967,000	4,752,000
10	1,916,000	1,000	50,000	1,967,000	206,000	1,000	256,000	50,000	513,000	2,480,000
11	3,544,000	76,000	50,000	3,670,000	359,000	3,000	256,000	50,000	668,000	4,338,000
12	3,862,000	77,000	50,000	3,989,000	453,000	23,000	504,000	50,000	1,030,000	5,019,000
13	1,828,000	15,000	50,000	1,893,000	0	0	1,005,000	50,000	1,055,000	2,948,000
14	1,828,000	15,000	50,000	1,893,000	0	0	1,005,000	50,000	1,055,000	2,948,000
15	2,144,000	16,000	50,000	2,210,000	0	0	1,007,000	50,000	1,057,000	3,267,000
Stage I Total (1-12)	36,123,000	166,000	600,000	36,889,000	3,779,000	137,000	2,042,000	600,000	6,558,000	43,447,000
Stage II Total (13-15)	5,800,000	46,000	150,000	5,996,000	0	0	3,017,000	150,000	3,167,000	9,163,000
Total (1-15)	41,923,000	212,000	750,000	42,885,000	3,779,000	137,000	5,059,000	750,000	9,725,000	52,610,000

Benefit Analysis

The primary benefit of implementation is cleaner waters in Virginia, where bacteria levels in the South Mayo River, North Fork Mayo River, South Fork Mayo River, Blackberry Creek, Marrowbone Creek, Leatherwood Creek, and Smith River impairments will be reduced to meet water quality standards. Actions during implementation can improve human and livestock herd health, local economies, aquatic ecosystem health, and improved opportunities for recreation.

Human Health

It is hard to gauge the impact that reducing fecal contamination will have on public health, as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, the incidence of infection from fecal sources, through contact with surface waters, should be reduced considerably. The residential programs will play an important role in improving water quality, since human waste can carry with it human viruses in addition to the bacterial and protozoan pathogens potentially found in all fecal matter.

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. VADCR publication ***STREAMSIDE LIVESTOCK EXCLUSION: A tool for increasing farm income and improving water quality*** available at http://www.dcr.virginia.gov/stormwater_management/documents/streamsideexcl.pdf or at SWCDS further illustrates these benefits.

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 residential 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 with an alternative (clean) water source, improving pasture condition, performing sewage system maintenance, and improving 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.



Vegetated Buffer (No Mow Zone)

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. 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.

In terms of economic benefits to homeowners, an improved understanding of private OSDS, including knowledge of what steps can be taken to keep them functioning properly and the need for regular maintenance, will give homeowners the tools needed for extending the life of their systems and reducing the overall cost of ownership. In addition, investment in the home is protected with a properly functioning sewage disposal system. A home's value can be decreased up to 40% with a failed septic system. The average septic system will last 20-25 years if properly maintained. Proper maintenance includes: knowing the location of the system components and protecting them by not driving or parking on top of them, not planting trees where roots could damage the system, keeping hazardous chemicals out of the system, and pumping out the septic tank every three to five years. The cost of proper maintenance, as outlined here, is relatively inexpensive in comparison to repairing or replacing an entire system.



On-site Sewage Disposal System

Improved aesthetics in public areas (*e.g.*, parks) and surrounding businesses provided by control measures (*e.g.*, pet waste kiosks and bioretention) has the potential to draw local citizens and visitors to these areas. In addition, a healthy waterway is vital to the public's recreational enjoyment of the area.

Aquatic Community Improved

Stream bank protection provided through exclusion of livestock including horses from streams will improve the aquatic habitat in these streams. Vegetated buffers that are established will also help reduce sediment and nutrient transport to the stream from upslope locations. The installation of improved pasture management systems should also reduce soil and nutrient losses and increase infiltration of precipitation, thereby decreasing peak flows downstream. Local initiatives, such as riparian easements, will additionally be complemented by actions performed during TMDL implementation.

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 Virginia Water Quality Assessment 305(b)/303(d) Integrated Report.

Progress toward end goals will be assessed during implementation through tracking of control measure installations by BRSWCD; PSWCD; NRCS; VADCR; VDH; along with Patrick County, Henry County, and City of Martinsville. The VADEQ will continue to monitor and assess water quality for improvement and compliance with Virginia's Water Quality Standards through its Water Quality Monitoring and Assessment Program. Other monitoring project activities in the watershed (*e.g.* citizen monitoring) will be coordinated to augment the VADEQ monitoring program. Implementation will be assessed based on reducing exceedances of the bacteria water quality standard, thereby improving water quality.

Implementation of control measures is scheduled for 15 years and will be assessed in two stages beginning in July 2013 and lasting to June 2028. Stage I is based on meeting source allocations that translate to an instantaneous standard exceedance rate of 10.5% or less resulting in removal of streams from the Virginia Water Quality Assessment 305(b)/303(d) Integrated Report. The Stage II goal is based on implementing source allocations to meet the specified TMDL goal, 0% exceedance of water quality standards. After implementation inception, five milestones will be met in three-year increments until streams are removed from the Virginia Water Quality Assessment 305(b)/303(d) Integrated Report.



Streambank Buffer Establishment

Implementation in years one through 12 for agricultural source reductions focuses on installing livestock stream exclusion systems, improving pasture management, and cropland conversion (Table 8). BMPs installed in years 13 through 15 are based on additional treatment of bacteria load not treated during Stage I from pasture and cropland using improved pasture management, cropland conversion, manure incorporation into soil, dry manure storage facilities, and retention ponds (Table 8).



Livestock Exclusion Fencing

Retention ponds are more costly and are logistically more difficult to design and locate on individual farms. Implementation of residential control measure in years one through 12 focuses on identification and removal of straight pipes, repairing or replacing failed septic systems, instituting pet waste control program, installation of pet waste enzyme digesting composters, installation of confined canine unit (CCU) waste treatment systems, and installation of vegetated buffers (Table 8). Vegetated buffer, bioretention, and infiltration trench installations are expected to escalate over the last three years (Table 8).

Table 9 lists the cumulative progress towards the TMDL endpoint as implementation milestones are met. Water quality improvements expected to increase each year are outlined in the Technical Report. Based on water quality modeling projections, the impairments would be in a probable position to be delisted from the Virginia Water Quality Assessment 305(b)/303(d) Integrated Report at the fourth milestone. 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 15 years following implementation commencement.

The process of 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. Known problem areas, clusters of older homes, or houses in close proximity to streams known by the VDH will be targeted for on-site sewage disposal system control measures. Steps outlined in pet waste BMP stages results in targeting of source type and resources. Significant exposure to a rain garden and/or infiltration trench project would be attained if installed at schools, county administration buildings, or shopping centers in watershed. Spatial analysis targeting results are located in the Technical Report.



Riparian Buffer

Table 8. Targeted implementation stages for control measures installation.

Control Measure	South Mayo River	North Fork Mayo River	South Fork Mayo River	Blackberry Creek	Marrowbone Creek	Leatherwood Creek	Smith River 1 & 2
<u>Pasture and Livestock Exclusion</u>							
Livestock Exclusion System (CREP)	I	I	I	I	I	I	I
Livestock Exclusion System (EQIP)	I	I	I	I	I	I	I
Livestock Exclusion with Riparian Buffers (LE-1T)	I	I	I	I	I	I	I
Small Acreage Grazing System (SL-6AT)	I	I	I	I	I	I	I
Livestock Exclusion with Reduced Setback (LE-2T)	I	I	I	I	I	I	I
Stream Protection (WP-2T)	I	I	I	I	I	I	I
Support for Extension of CREP Watering System (SL-7T)	I	I	I	I	I	I	I
Improved Pasture Management	I & II	I & II	I & II	I & II	I & II	I & II	I & II
Retention Ponds	II	II	II	II	II	II	II
<u>Cropland</u>							
Permanent Vegetative Cover on Cropland (SL-1)	I & II	I & II	I & II	I & II	I & II	I & II	I & II
Reforestation of Erodible Crop and Pastureland (FR-1)	I & II	I & II	I & II	I & II	I & II	I & II	I & II
Manure Incorporation into Soil	II	II	II	II	II	II	II
Dry Manure Storage Facility	I	II	I	II	II	II	II
<u>Failing Septic Systems</u>							
Septic Tank Pump-out	I	I	I	I	I	I	I
Connection of OSDS to Public Sewer	I	I	I	I	I	I	I
Septic Tank System Repair	I	I	I	I	I	I	I
Septic Tank System Installation/Replacement	I	I	I	I	I	I	I
Septic Tank System Installation/Replacement w/ Pump	I	I	I	I	I	I	I
Alternative On-site Waste Treatment System	I	I	I	I	I	I	I
<u>Straight Pipes</u>							
Septic Tank System Installation/Replacement	I	I	I	I	I	I	I
Septic Tank System Installation/Replacement w/ Pump	I	I	I	I	I	I	I
Alternative On-site Waste Treatment System	I	I	I	I	I	I	I
<u>Pet Waste Management</u>							
Pet waste education program	I	I	I	I	I	I	I
Pet waste digesters	I	I	I	I	I	I	I
Confined Canine Unit Waste Treatment System	I	I	I	I	I	I	I
<u>Residential/Urban Best Management Practices</u>							
Vegetated Buffers	I & II	I & II	I & II	I & II	I & II	I & II	I & II
Bioretention	I & II	I & II	I & II	I & II	I & II	I & II	I & II
Infiltration Trench	I & II	I & II	I & II	I & II	I & II	I & II	I & II

Stage I = first 12 years of implementation for a 15-year timeline

Stage II = last three years of implementation for a 15-year timeline

Table 9. Cumulative implementation of control measures and water quality milestones.

Control Measure	Unit	Progress Since TMDL Study	Milestone 1 Completed by June 2016	Milestone 2 Completed by June 2019	Milestone 3 Completed by June 2022	Milestone 4 Completed by June 2025	Milestone 5 Completed by June 2028
<u>Pasture</u>							
Livestock Exclusion System (CREP)	System	26	25	55	85	118	118
Livestock Exclusion System (EQIP)	System	N/A	76	154	232	313	313
Livestock Exclusion System (LE-1T)	System	74	155	313	471	632	632
Livestock Exclusion System (SL-6AT)	System	N/A	4	8	13	16	16
Livestock Exclusion System (LE-2T)	System	N/A	58	120	182	244	244
Livestock Exclusion System (WP-2T)	System	1	4	8	13	22	22
Livestock Exclusion System (SL-7T)	System	N/A	13	28	43	56	56
Improved Pasture Management	Acres - Installed	N/A	14,326	28,652	42,979	57,306	71,637
Retention Pond	Acres - Treated	N/A	0	0	0	0	31,505
<u>Cropland</u>							
Permanent Vegetative Cover on Cropland (SL-1)	Acres - Installed	127	6	11	17	22	28
Reforestation of Erodible Crop and Pastureland (FR-1)	Acres - Installed	232	11	22	34	45	56
Manure Incorporation into Soil	Acres - Treated	N/A	0	0	0	0	1,625
Dry Manure Storage Facility	System	N/A	0	0	0	2	2
<u>On-site Sewage Disposal Systems</u>							
Septic Tank Pump-out	System	N/A	180	368	558	754	754
Septic System Repair	System	N/A	92	171	272	351	351
Connection to Public Sewer	System	N/A	10	37	42	69	69
New Conventional Septic System	System	N/A	65	131	199	269	269
New Conventional Septic System with Pump	System	N/A	8	17	27	36	36
Alternative Sewage Disposal System	System	N/A	5	12	18	29	29
<u>Pet Waste Management</u>							
Pet waste education program	System	N/A	2	2	2	2	2
Pet waste digesters	System	N/A	139	280	423	565	565
Confined Canine Unit Waste Treatment System	System	N/A	1	3	4	5	5
<u>Residential/Urban Best Management Practices</u>							
Vegetated Buffers	Acres - Installed	N/A	13	27	40	53	66
Bioretention	Acres - Treated	N/A	0	1	65	129	322
Infiltration Trench	Acres - Treated	N/A	0	1	4	8	18

Monitoring

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. Monitoring stations are subject to change based upon the development of the VADEQ Monitoring Strategy. Typically, post-IP monitoring begins 2-5 years after BMPs are established. The VADEQ uses the data to determine water quality improvement and gauge the success aimed at reducing the amount of pollutants in the stream of the South Mayo River, North Fork Mayo River, South Fork Mayo River, Blackberry Creek, Marrowbone Creek, Leatherwood Creek, and Smith River watersheds.

Twelve VADEQ monitoring stations were utilized to assess water quality in the South Mayo River, North Fork Mayo River, South Fork Mayo River, Blackberry Creek, Marrowbone Creek, Leatherwood Creek, and Smith River watersheds (Figure 4). Stations are classified as a "trend station" or "watershed station" (Table 10). Trend stations are historically located, long-term water quality monitoring stations used to assess changes in water quality over long periods of time and are sampled every year, either monthly or bimonthly. Watershed stations are typically located near the mouth of a watershed, designed to provide a monitoring presence in smaller watersheds, and sampled 12 times over a consecutive two-year period (sampling occurs every other month) within a six-year rotational cycle. Several stations in the watershed, including those in Leatherwood Creek and Smith River are in the 2013-14 monitoring plan to be monitored according to the rotating schedule. Other stations in the watershed won't be monitored again until BMPs have been in place.

The citizen monitoring program can be utilized to supplement samples collected through VADEQ's monitoring program. The Coliscan Easygel method is a simple to use and relatively inexpensive method that measures total coliform and *E. coli*. The Coliscan Easygel method was compared to laboratory analysis and found to be an acceptable tool for screening purposes although the data cannot be used directly by VADEQ for water quality assessments. This method is important because it can assist in locating "hot spots" for fecal contamination, assess implementation progress, and target areas for more extensive monitoring.

The AWG, RUWG, GWG, and Steering Committee request that monitoring continue at the trend stations and TMDL impairment listing stations for the following parameters: *E. coli* bacteria, temperature, dissolved oxygen, pH, specific conductivity, total nitrogen, total phosphorus, and total suspended solids. Listing stations for South Mayo River, North Fork Mayo River, South Fork Mayo River, Blackberry Creek, Marrowbone Creek, Leatherwood Creek, Smith River #1, and Smith River #2 were 4ASMR016.09, 4ANMR002.6, 4ASMR004.14, 4ABRY000.05, 4AMRR000.02, 4ALWD002.54, 4ASRE033.19, and 4ASRE015.43, respectively (Table 10 and Figure 4).

Table 10. Monitoring station identification, station location, and station type for VADEQ monitoring stations in the watershed.

Station ID	Station Location	Station Type
4ASMR016.09	South Mayo River near Nettle Ridge at Route 700	Trend
4ANMR002.60	North Fork Mayo River near Spencer at Route 629	Trend
4ASMR004.14	South Fork Mayo River at Route 695	Watershed
4ABRY000.05	Blackberry Creek at American Legion Bridge	Watershed
4ASRE075.69	Smith River at Route 708	Trend
4ASRE043.54	Smith River at Route 674 above Town Creek	Trend
4ASRE033.19	Smith River at Route 701 below Fieldcrest Mill	Trend
4AMRR000.02	Marrowbone Creek at Route 642	Watershed
4ALWD002.54	Leatherwood Creek at Route 650	Watershed
4ASRE021.58	Smith River at Route 58 Bypass	Watershed
4ASRE015.43	Smith River at Route 636	Watershed
4ASRE007.90	Smith River at Route 622 (Morgan Ford Bridge)	Trend

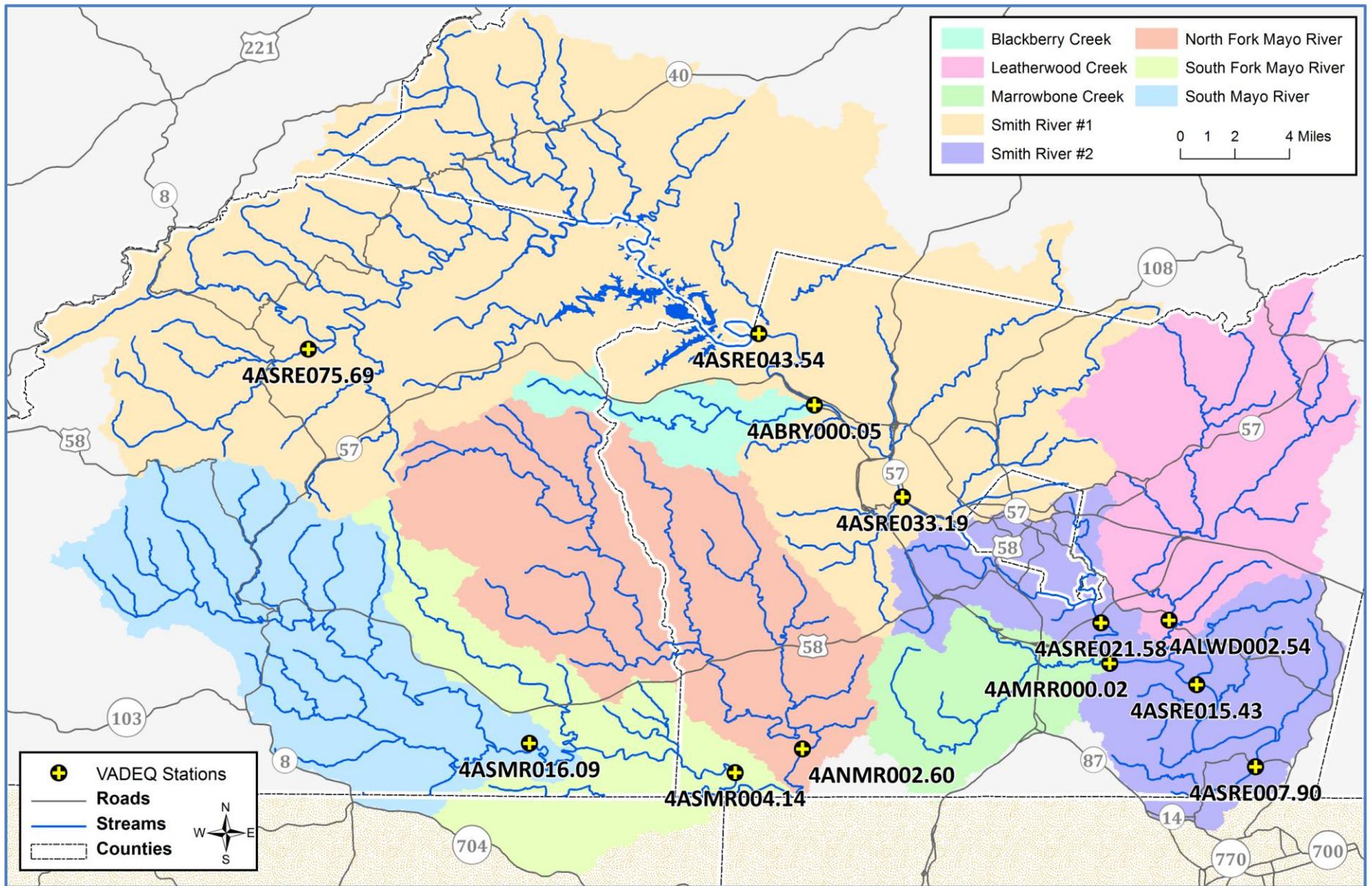


Figure 4. Location of VADEQ monitoring stations in the watersheds.

STAKEHOLDER'S ROLES & RESPONSIBILITIES

Stakeholders are individuals who live or have land management responsibilities in the watershed, including private individuals, businesses, government agencies, 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, citizens, businesses, and community watershed groups. 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.



Smith River



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. [BRSWCD](#) and [PSWCD](#) will have prominent roles during implementation. [BRSWCD](#) and [PSWCD](#) will provide cost-share funds, lead education and technical assistance efforts, and track best management practice implementation for the agricultural and residential programs. The West Piedmont Planning District Commission will coordinate cost-share fund distribution with the districts, lead education and outreach efforts, and report best management practice implementation for the residential program. The Dan River Basin Association will assist in developing volunteer monitoring programs and lead education and outreach efforts. 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. State agencies conducting regulatory, education, or funding procedures related to water quality in Virginia include: [VADEQ](#), [VADCR](#), [VDH](#), [VADACS](#), [VDGIF](#), [VADOF](#), [VCE](#), and [VOF](#). Governmental, agricultural, residential action items during implementation are included in Tables 11 through 13, respectively. List of acronym used in tables can be found on page 47.

Table 11. Governmental implementation action items.

Source Issues	Actions & Support	Potential Funding Source	Who will assist?
Continual baseline water quality monitoring	Water quality monitoring: ambient/benthic	VADEQ	VADEQ
Supplemental ambient/benthic monitoring	Water quality monitoring: ambient/benthic; coliscan (bacteria monitoring)	VADEQ, VA Naturally, grant, DRBA	SWCD, Citizen Volunteers, DRBA
Local government incentives	Ordinance/code options to improve water quality	Local Government, Grants	Local Government, Planning District Commission (PDC), as appropriate
Inadequate tracking of on-site sewage disposal systems	Develop tracking system; ensure alternative OSDS maintenance agreement in place	VDH, Local Government	VDH

Table 12. Agricultural implementation action items.

Source Issues	Corrective Actions	Potential Funding Source	Who will assist?
Livestock in stream	Livestock exclusion best management practices, Water development upslope	Ag BMP Cost-Share, WQIF, Section 319 Funds, NRCS	SWCD, NRCS
Cropland runoff	Cropland best management practices	Ag BMP Cost-Share, NRCS	SWCD, NRCS
Pasture runoff	Pasture management best management practices	Ag BMP Cost-Share, NRCS	SWCD, NRCS
Streamside runoff	Improved buffers (grass, shrubs, trees)	CREP, EQIP, VDGIF, VADOF, Ag. BMP Cost-Share	VDGIF, VADOF, SWCD, NRCS
Lack of BMP knowledge	Ag BMP education, outreach events	WQIF, VCE, NRCS	SWCD, VCE, NRCS
Livestock access to water	Alternate water source	Ag BMP, VADEQ (low interest loan), NRCS	SWCD, VADEQ, NRCS
Targeting locations for fencing	Ground truthing, stream walks	WQIF, grants	SWCD, community interest groups

Table 13. Residential/urban implementation action items.

Source Issues	Corrective Actions	Potential Funding Source	Who will assist?
Lack of septic system maintenance	Regular maintenance	WQIF, NFWF grant, Homeowners, Section 319 Funds	VDH, SWCD, PDC
Septic system failure and/or straight pipes	Septic system repairs, replacement, hook-ups, & maintenance	WQIF, NFWF grant, Homeowners, Block Grants	VDH, Local Government, SWCD, PDC, SERCAP
No septic system pump out tracking	Computerized tracking system	VDH	VDH, Local Government
Need information on system location at time of home sale	State requirement – initiated by Board of Realtors	Homeowners	VDH
Education needed on septic system function	Septic system education program	WQIF, NFWF grant	Realtors, Teachers, VDH, School Groups, Community Interest Groups, PDC
No pet waste management	Education, bag stations, composters, structural practices in concentrated canine areas (kennels)	VCE, SWCD, WQIF, NFWF grant, Roundtables	Interest Groups, Local Governments, Hunt Clubs, Veterinarians, SPCA
Stormwater runoff BMPs	Targeting locations for runoff reduction BMPs	DRBA, grants	DRBA, citizens, volunteers, landowners
Waterfowl impact to ponds	Buffer ponds to discourage waterfowl, especially geese	HOAs, NFWF grant, VDGIF	VADOF, Landowners
Runoff from streamside properties - non-agricultural	Low impact development techniques, install grass/shrub/tree buffers along streams, education on proper land management including erosion control and fertilizer	Homeowners, Developers, NFWF grant, VADOF, Private Foundations	Local Government, VCE, Interest Groups
Best management practices education for horse owners	Pasture management education; alternative watering sources, livestock exclusion	Ag BMPs, VCE, WQIF	SWCD, VCE, Interest Groups

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

BRSWCD and PSWCD: The Blue Ridge and Patrick Soil and Water Conservation Districts are local units of government responsible for the soil and water conservation work within Patrick and Henry Counties. 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 IP, the district will provide agricultural cost-share funds, lead education and technical assistance efforts, and track best management practice implementation for the agricultural and residential programs.

Patrick and Henry Counties & City of Martinsville 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.

Citizens & Businesses: The primary role of citizens and businesses is simply to get involved in implementation. This may include participating in public outreach, implementing BMPs to help restore water quality, and partnering with other stakeholders to improve 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.

Dan River Basin Association: DRBA works to: preserve the river corridor with a series of municipal, county, and state parks and trails; increase public access to rivers; build constituency for the rivers and outdoor recreation through monthly outings; protect water quality by instituting stream monitoring across the Basin; promote regional nature and heritage tourism; and bridge boundaries to create a bi-state borderland community.

West Piedmont Planning District Commission: Environmental planning is a long-standing area of emphasis of the WPPDC, which is complementary to the TMDL process. WPPDC continues to promote efficient development of the environment by assisting and encouraging local governmental agencies to plan for the future. WPPDC will support residential implementation with assistance from localities and SWCDs. Additionally, WPPDC will continue to work with VADCR and the Steering Committee to periodically revisit implementation progress and suggest plan revisions as needed.

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, wildlife, 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 actions related to Virginia's Water Quality Standards.

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.

VDH: The Virginia Department of Health is responsible for maintaining safe drinking water measured by standards set by the USEPA. Their duties also include septic system regulation, driven by complaints. 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.*).

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. If deemed a problem, the Commissioner can order the producer to submit an agricultural stewardship plan to the local SWCD. If a producer fails to implement the plan, corrective action can be taken, which may include civil penalties. An emergency corrective action can be issued 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: 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 to insure consideration for fish and wildlife populations and associated habitats.

VADOF: Virginia Department of Forestry 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). 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 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.

VOF: The Virginia Outdoors Foundation was established in 1966 "to promote the preservation of open-space lands and to encourage private gifts of money, securities, land or other property to preserve the natural, scenic, historic, scientific, open-space and recreational areas of the Commonwealth." The primary mechanism for accomplishing VOF's mission is through open-space easements. Open-space easements allow land to continue to be privately owned but restricted to serve and protect land for the public good.

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. USEPA provides funding to implement TMDLs through Section 319 Incremental Funds.

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 Watershed Implementation Plans, 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 planning efforts needs continuous evaluation to determine possible effects on implementation goals. Coordination of local programs can increase participation in implementation activities and prevent redundancy. Several planned initiatives coinciding with TMDL implementation in this watershed include:

- Updates to Patrick and Henry Counties Comprehensive Plans
- Update to City of Martinsville Comprehensive Plan
- Dan River Basin Association Eden Watershed Assessment – an IP-like study on a small watershed in the North Carolina portion of the Smith River watershed
- Martinsville-Henry County Rivers and Trails Recreational Use Plan
- Henry County PSA Philpott Reservoir Source Water Protection Plan
- VADCR Mayo River State Park Endangered Species Study
- Trout Unlimited Strategic Plan

The implementation actions proposed in this plan will enhance these community improvement initiatives by improving water quality and making the river more attractive to visitors for tourism and recreational activities. Combined, these efforts can contribute to improvements in the area economy and residents' quality of life.



Recreational Activities: Canoeing, Kayaking, and Fishing

POTENTIAL FUNDING SOURCES

Potential funding sources available during implementation were identified in the course of plan development. An approved Watershed Implementation Plan makes these watersheds eligible for competitively awarded TMDL Implementation grants currently awarded through VADCR. The VADCR has provided Patrick Soil and Water Conservation District with Livestock Exclusion Initiative funds to promote livestock exclusion practices in the implementation plan area between July 2012 and June 2014. Detailed description of each funding source (*i.e.*, eligibility requirements, specifications, incentive payments) can be obtained from the BRSWCD, PSWCD, WPPDC, VADCR, VDH, VADEQ, VADGIF, VCE, VOF, and NRCS. Table 14 illustrates various financial opportunities that exist from selected cost-share programs for agricultural and residential implementation needs. Sources include:

Federal Sources

- Federal Clean Water Act Section 319 Incremental Funds
- U.S. Department of Agriculture (USDA) Conservation Reserve Enhancement Program (CREP)
- USDA Conservation Reserve Program (CRP)
- USDA Environmental Quality Incentives Program (EQIP)
- 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

Virginia Sources

- 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 Clean Water Revolving Loan Fund (VCWRLF)
- Virginia Outdoors Foundation

Regional and Private Sources

- Community Development Block Grant Program
- Southeast Rural Community Assistance Project (Southeast RCAP)
- National Fish and Wildlife Foundation
- STEP, Inc. (Support to Eliminate Poverty)
- Pittsylvania County Community Action Agency, Inc.
- Dan River Basin Association
- Trout Unlimited

Table 14. Control measures with estimated cost-share program and landowner costs.

Control Measure	Program Code	Unit	Cost-share	Average Cost/Unit to State or Federal Program (\$)	Average Cost/Unit to Landowner (\$)¹
Livestock exclusion with 35 ft or greater buffer	CREP	System	90% + varied incentive	24,300	2,700
	EQIP	System	75%	18,750	6,250
	LE-1T	System	85%	21,250	3,750
Small Acreage Grazing System with 35 ft setback	SL-6AT	System	50%	4,500	4,500
Livestock exclusion with 10 ft setback	LE-2T	System	50%	8,500	8,500
Stream Protection	WP-2T	System	75% + \$0.50/ft incentive	4,350	650
Pasture and Hayland Re-planting	512	Acres	\$165/ac	165	130
Prescribed grazing	528	Acres	\$30/ac	30	40
Permanent vegetative cover on cropland	SL-1	Acres	75% + \$35/ac incentive	260	40
Reforestation of erodible crop and pastureland	FR-1	Acres	up to \$300/ac	300	150
Manure / biosolids soil incorporation	N/A	Acres	N/A	0	25
Dry Manure Storage Facility	WP-4	System	75%	56,250	18,750
Septic Tank Pump-out	RB-1	System	50%	125	125
Connection of OSDS to Public Sewer	RB-2	System	50% - 75%	3,000 – 4,500	1,500 - 3,000
Septic Tank System Repair	RB-3	System	50% - 75%	1,500 – 2,250	750 - 1,500
Septic Tank System Installation / Replacement	RB-4	System	50% - 75%	3,000 – 4,500	1,500 - 3,000
Septic Tank System Installation / Replacement w/ Pump	RB-4P	System	50% - 75%	4,000 – 6,000	2,000 - 4,000
Alternative On-site Waste Treatment System	RB-5	System	50% - 75%	7,500 – 11,250	3,750 - 7,500
Pet waste education program	N/A	Program	N/A	0	5,000
Pet waste digesters	N/A	System	N/A	0	50
Confined Canine Unit Waste Treatment System	N/A	System	N/A	0	20,000
Vegetated Buffers	N/A	Acres²	N/A	0	400
Bioretention	N/A	Acres³	N/A	0	15,000
Infiltration Trench	N/A	Acres³	N/A	0	11,300

¹ Does not include tax credit or in-kind service; ² Acres treated; ³ Acres installed

LIST OF ACRONYMS

AWG	Agricultural Working Group
BMP	Best Management Practice
BRES	Blue Ridge Environmental Solutions, Inc.
BRSWCD	Blue Ridge Soil and Water Conservation District
CCU	Confined Canine Unit
CREP	Conservation Reserve and Enhancement Program
CRP	Conservation Reserve Program
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
HOA	Homeowners Association
IP	Implementation Plan
LE-1T	Livestock Exclusion with Riparian Buffers
LE-2T	Livestock Exclusion with Reduced Setback
LID	Low Impact Development
NFWF	National Fish and Wildlife Foundation
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
OSDS	On-Site Sewage Disposal System
PSWCD	Patrick Soil and Water Conservation District
RB-1	Septic System Pump-Out
RB-2	Connection of Malfunctioning OSDS or Straight Pipe to Public Sewer
RB-3	Septic Tank System Repair
RB-4	Septic Tank Installation / Replacement
RB-5	Alternative On-Site Waste Treatment System
RUWG	Residential / Urban Working Group
SL-1	Permanent Vegetative Cover on Cropland
SWCB	State Water Control Board
TMDL	Total Maximum Daily Load
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
VADOF	Virginia Department of Forestry
VCE	Virginia Cooperative Extension
VDGIF	Virginia Department of Game and Inland Fisheries
VDH	Virginia Department of Health
VOF	Virginia Outdoors Foundation
WP-2T	Stream Protection
WPPDC	West Piedmont Planning District Commission
WQIF	Water Quality Improvement Fund
WQMIRA	Water Quality Monitoring, Information and Restoration Act
WHIP	Wildlife Habitat Incentive Program
WRP	Wetland Reserve Program

GLOSSARY

303(d) List - is short for the list of impaired and threatened waters (stream/river segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years on even-numbered years.

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.

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.

E. coli - type of bacteria found in the feces of various warm-blooded animals that is used as indicator of the possible presence of pathogenic (disease causing) organisms.

Failing septic system - septic systems in which drain fields have failed such that effluent (wastewater) that is supposed to percolate into the soil, now rises to the surface and ponds on the surface where it can flow over the soil surface to streams or contribute pollutants to the surface where they can be lost during storm runoff events.

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.

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

Instantaneous criterion - the instantaneous criterion or instantaneous water quality standard is the value of the water quality standard that should not be exceeded at any time. For example, the Virginia instantaneous water quality standard for *E.coli* is 235 cfu/100 mL. If this value is exceeded at any time, the water body is in exceedance of the state water quality standard.

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 medium 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.

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.

Septic system - an on-site system designed to treat and dispose of domestic sewage. A typical septic system consists of a tank that receives liquid and solid wastes from a residence or business and a drainfield or subsurface absorption system consisting of a series of tile or percolation lines for disposal of the liquid effluent. Solids (sludge) that remain after decomposition by bacteria in the tank must be pumped out periodically.

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)

Straight pipe - delivers wastewater directly from a building, e.g., house or milking parlor, to a stream, pond, lake, or river.

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.

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.

CONTACT INFORMATION

Patrick Soil & Water Conservation District
135 Stonewall Court
Stuart, VA 24171
(276) 694-3121 ext. 3

Blue Ridge Soil & Water Conservation District
1297 State Street
Rocky Mount, VA 24151
(540) 483-5341 ext. 3

Natural Resources Conservation Service (Patrick)
135 Stonewall Court
Stuart, VA 24171
(276) 694-3121

Natural Resources Conservation Service (Henry)
1297 State Street
Rocky Mount, VA 24151
(540) 483-5341

VA Department of Health (Patrick)
106 Rucker Street
Stuart, VA 24171
(276) 693-2070

VA Department of Health (Henry/Martinsville)
295 Commonwealth Boulevard
Martinsville, VA 24114
(276) 638-2311

VA Department of Conservation and Recreation
8 Radford Street, Suite 102A
Christiansburg, VA 24073
(540) 332-8955

VA Department of Environmental Quality
3019 Peters Creek Road
Roanoke, VA 24019
(540) 562-6700

Patrick County
106 Rucker Street
Stuart, VA 24171
(276) 694-6094

Henry County
3300 Kings Mountain Road
Collinsville, VA 24078
(276) 634-4601

City of Martinsville
55 West Church Street
Martinsville, VA 24112
(276) 403-5000

VA Department of Forestry
106 Rucker Street
Stuart, VA 24171
(276) 694-2282

VA Department Game & Inland Fisheries
1132 Thomas Jefferson Road
Forest, VA 24551
(434) 525-7522

West Piedmont Planning District Commission
1100 Madison Street
Martinsville, VA 24115
(276) 638-3987

Dan River Basin Association
3300 Kings Mountain Road
Collinsville, VA 24078
(276) 634-2545

Blue Ridge Environmental Solutions, Inc.
734 White Oak Drive
Blue Ridge, VA 24064
(540) 588-5666