Upper Rapidan River
Total Maximum Daily Load (TMDL)
Implementation Plan

Technical Report

Submitted To: Rappahannock-Rapidan Regional Commission & Virginia Department of Environmental Quality

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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. If the water body surpasses the water quality standard during an assessment period, Section 303(d) of the Clean Water Act and the United States Environmental Protection Agency's Water Quality Management and Planning Regulation (40 CFR Part 130) both require states to develop a TMDL for each pollutant.

Blue Run and Rapidan River #1 were initially placed on the Virginia Water Quality Assessment 305(b)/303(d) Integrated Report in 2002 for exceedances of the bacteria standard. Marsh Run and Unnamed Tributary (UT) to Rapidan River #1 were initially placed on the list in 2004. After these listings, a TMDL study was conducted to identify bacteria sources in the watersheds. Rippin Run, Beautiful Run, and UT to Rapidan River #2 were listed as impairments in 2012 and Garth Run and Poplar Run were added in 2014. These watersheds are contained within the TMDL developed watershed. As a result, TMDL bacteria loadings and allocations were translated to these nested impairments. 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.

Local support and successful completion of the implementation plan will enable restoration of the impaired water while enhancing the value of this important resource for the Commonwealth. Opportunities for Orange, Madison, Greene, and Albemarle Counties; Town of Orange; Town of Stanardsville; local agencies; and watershed residents to obtain funding will improve with an approved implementation plan.

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; and
- Reductions to pet bacteria loads on residential land use are necessary; 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; Madison County government; Greene County government; Orange County Public Service Authority; Orange Farm Service Agency; Ecosystems Services, LLC; Center for Natural Capital; Piedmont Environmental Council; Friends of the Rappahannock; Old Rag Master Naturalists; Culpeper Soil and Water Conservation District; Thomas Jefferson Soil and Water Conservation District; Madison County Health Department; Greene County Health Department; Rappahannock-Rapidan Regional Commission; Virginia Department of Environmental Quality; Virginia Department of Health; Virginia Department of Forestry; Natural Resources Conservation Service; Shenandoah National Park; 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, and Governmental. Third, a Steering Committee was formed with representation from the Agricultural, Residential, and Governmental Working Groups; Culpeper Soil and Water Conservation District; Thomas Jefferson Soil and Water Conservation District; Rappahannock-Rapidan Regional Commission; Virginia Department of Environmental Quality; Virginia Department of Health; and Blue Ridge Environmental Solutions, Inc. to guide the development of the implementation plan. Over 200 hours were devoted to attending these meetings by individuals representing agricultural, residential, commercial, environmental, and government interests on a local, state, and federal level. Throughout the public participation process, major emphasis was placed on discussing best management practices (BMPs), locations of control measures, education, technical assistance, monitoring, and funding.

Implementation Actions

The actions and cost needed in both implementation stages were identified and quantified. The overall numbers presented represent the Stage II goal of TMDL source allocation attainment (*i.e.*, meeting water quality standard). An assessment was also conducted to quantify actions and cost to meet source allocations that translate to a single sample maximum standard violation rate of 10.5% or less resulting in removal of these streams from the Commonwealth of Virginia's Section 303(d) List of Impaired Waters. This is referred to as the Stage I implementation goal.

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. Estimates of control practices needed for full implementation in these watersheds are:

- 62 Livestock Exclusion Systems (CREP)
- 27 Livestock Exclusion Systems (EQIP)
- 159 Livestock Exclusion Systems (SL-6/6T, LE-1T)
- 6 Small Acreage Grazing Systems (SL-6AT)
- 50 Livestock Exclusion Systems (LE-2/2T)
- 10 Stream Protection Systems (WP-2/2T)
- 49,361 acres of Improved Pasture Management
- 11,464 acres of pasture treated by Sediment Retention, Erosion, or Water Quality Structure (WP-1)
- 43 acres of Permanent Vegetative Cover on Cropland (SL-1)
- 43 acres of Reforestation of Erodible Crop and Pastureland (FR-1)
- 3,266 acres of Cover Crops (SL-8)
- 892 acres of cropland with Manure/Litter/Biosolids Incorporation into Soil
- Two Poultry Litter Storage Facilities (WP-4)
- Two Dry Manure Storage Facilities (WP-4)
- Two Liquid Manure Storage Facilities (WP-4)
- 1,713 Septic Tank Pump-outs (RB-1)
- 30 Connections to Public Sewer (RB-2)
- 1,068 Septic System Repairs (RB-3)
- 501 New Conventional Septic Systems (RB-4)
- 68 New Conventional Septic Systems with Pump (RB-4P)
- 46 Alternative On-site Sewage Disposal Systems (RB-5)
- 10 Pet Waste Education Program
- 16 Pet Waste Disposal Stations (PW-1)
- 85 Pet Waste Enzyme Digesters (PW-2)
- Five Confined Canine Unit Waste Treatment Systems

- ★ 81 acres of residential landuse treated with Vegetated Buffers
- ★ 24 acres of residential landuse treated with Bioretention
- ★ 18 acres of residential landuse treated with Infiltration Trenches
- ★ Two Agricultural Technical Assistance Full Time Equivalent per year
- ★ Two Residential Technical Assistance Full Time Equivalent per year for Stage I
- ★ One Residential Technical Assistance Full Time Equivalent per year for Stage II

The associated cost estimations for each implementation action were calculated by multiplying the average unit cost per the number of units. The funding for implementation costs will be achieved through cost-share programs, grant programs, in-kind donation, and landowners. For the Stage I (*i.e.*, removal of impaired stream segments from impaired waters list) costs, the total agricultural corrective action costs equal $14.8 million. Estimated corrective action costs needed to replace straight pipes and fix failing septic systems during Stage I totals $9.3 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 $0.4 million. The total cost to provide assistance in the agricultural and residential programs during Stage I implementation are expected to be both equal to $1.4 million. The total Stage I implementation cost including technical assistance is $27.4 million with the agricultural cost being $16.2 million and residential cost $11.2 million. The total Stage II implementation cost including technical assistance is $12.4 million with the agricultural cost being $12.0 million and residential cost $0.4 million.

The primary benefit of implementation is cleaner waters in Virginia, where bacteria levels in the Garth Run, Rippin Run, Marsh Run, Blue Run, Beautiful Run, Poplar Run, UT to Rapidan River #1, UT to Rapidan River #2, Rapidan River #1, and Rapidan River #2 impairments will be reduced to meet water quality standards, benefiting human and livestock herd health, local economies, and aquatic ecosystems. 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. An important objective of the implementation plan is to foster continued economic vitality and strength by increasing tourism and recreational opportunities. Healthy waters can improve economic opportunities for Virginians, and a healthy economic base can provide the resources and funding necessary to pursue restoration and enhancement activities. The control measures recommended in this document will provide economic benefits to the landowner, along with the expected environmental benefits on-site and downstream. Improved aesthetics in public areas (*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. A healthy waterway is vital to the public's recreational enjoyment of the area. Additionally, money spent on materials and technical assistance resources by landowners, government agencies, and non-profit organizations in the process of implementing the implementation plan will stimulate the local economy.

Measurable Goals and Milestones for Attaining Water Quality Standards

The end goals of implementation are restored water quality in the impaired waters and subsequent de-listing of streams from the 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. The 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 a single maximum water quality standard exceedance rate of 10.5% or less resulting in de-listing of streams. The Stage II goal is meeting the specified TMDL load allocation based on single sample maximum and geometric mean water quality standard criteria. 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.

Implementation in years one through 12 for agricultural source reductions focuses on installing livestock stream exclusion systems, improving pasture management, cropland conversion, planting cover crops, manure incorporation, and constructing animal waste storage facilities. 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 sediment retention structures. Implementation in years one through 12 for residential bacteria loads focuses on performing septic tank pump-outs, identifying and removing straight pipes, repairing or replacing failed septic systems, connecting failed septic systems to the Town of Orange sanitary sewer, instituting pet waste control education program, and installing pet waste disposal stations, pet waste enzyme digesting composters, confined canine unit waste treatment systems, vegetated buffers, rain gardens, and infiltration trenches. Vegetated buffers, rain garden and infiltration trench installations will be concentrated in years 13 through 15 reduce bacteria loads in stormwater runoff from failing septic systems and pets. Based on water quality modeling projections, the impairments would be in a probable position to be de-listed from the List of Impaired Waters 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 a staged implementation implies targeting of control measures, ensuring optimum utilization of resources. In quantifying agricultural BMPs through the use of aerial photography, land use, and stream network GIS layers, maps were formulated showing potential livestock stream access, pastures, and crop fields. These maps identify farm tracts that Culpeper Soil and Water Conservation District and Thomas Jefferson Soil and Water Conservation District should concentrate their efforts in. The district will coordinate with landowners and track BMP installation progress. Known problem areas, clusters of older homes, or houses in close proximity to streams known by the Virginia Department of Health will be targeted for on-site sewage disposal system control measures. Steps outlined in pet waste management 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.

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. Stakeholder participation and support is essential for achieving the goals of this TMDL effort (*i.e.*, improving water quality and removing streams from the impaired waters list). It must first be acknowledged that there is a water quality problem, and changes must be made as needed in operations, programs, and legislation to address these pollutants. In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions.

The Culpeper and Thomas Jefferson 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 Rappahannock-Rapidan Regional Commission will lead education and outreach efforts, coordinate funding distribution to homeowners, and report best management practice implementation for the pet waste program. 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. Watershed groups such as Friends of Rappahannock or Old Rag Master Naturalists may assist with educational and citizen water quality monitoring efforts.

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 Orange, Madison, Greene, and Albemarle Counties Comprehensive Plans
- Madison County Asset Management Plan
- Chesapeake Bay Watershed Implementation Plan

- Piedmont Environmental Council Strategic Plan
- Trout Unlimited Strategic Plan
- Upper York TMDL Implementation Plan
- Upper Hazel TMDL Implementation Plan
- Robinson/Little Dark Run TMDL Implementation Plan
- Moores Creek TMDL Implementation Plan
- Upper Rapidan Brook Trout Restoration Initiative

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 Environmental Quality. Detailed descriptions of each funding source (*i.e.*, eligibility requirements, specifications, incentive payments) can be obtained from the Culpeper Soil and Water Conservation District; Thomas Jefferson 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 Rappahannock-Rapidan Regional Commission.

Potential funding sources include:

- 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 Agricultural Conservation Easement Program (ACEP)
- USDA Regional Conservation Partnership Program (RCPP)
- U.S. Fish and Wildlife Service Conservation Grants
- U.S. Fish and Wildlife Service Private Stewardship Program
- Virginia Agricultural Best Management Practices Cost-Share Program
- Virginia Agricultural Best Management Practices Tax Credit Program
- Virginia Conservation Assistance Program (VCAP)
- 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

- Virginia Trees for Clean Water
- Community Development Block Grant Program
- Southeast Rural Community Assistance Project (Southeast RCAP)
- National Fish and Wildlife Foundation
- Skyline Community Action Partnership
- Trout Unlimited
- Center for Natural Capital

INTRODUCTION

Background

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.

Blue Run, and Rapidan River #1 were initially placed on the Virginia Water Quality Assessment 305(b)/303(d) Integrated Report in 2002 for exceedances of the bacteria standard. Marsh Run and Unnamed Tributary (UT) to Rapidan River #1 were initially placed on the list in 2004.

After these listings, a TMDL study was conducted for the Rapidan River watershed in 2007 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. Rippin Run, Beautiful Run, UT to Rapidan River #2, and Rapidan River #2 were listed as impairments in 2012 and Garth Run and Poplar Run were added in 2014. These watersheds are contained within the TMDL developed watershed. As a result, TMDL bacteria loadings and allocations were translated to these nested impairments.

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 Orange, Madison, Greene, and Albemarle Counties, local agencies, and watershed residents to obtain funding will improve with an approved IP.

Project Methodology

The overall goal of this project was to begin the process of restoring water quality in the Garth Run, Rippin Run, Marsh Run, Blue Run, Beautiful Run, Poplar Run, UT to Rapidan River #1, UT to Rapidan River #2, Rapidan River #1, and Rapidan River #2 watersheds. Specific objectives in meeting this goal were:

1. Development of a staged IP for the watersheds;
2. Coordination of public participation; and
3. Implementation of control measures.

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**

Public participation was an integral part in developing the IP and is critical to promote reasonable assurance that the implementation actions will occur. Public participation took place during IP development on three levels. First, public meetings were held to inform the public of project end goals and status of the project, as well as, a forum for soliciting participation in the smaller, more-targeted meetings (*i.e.*, working groups and Steering Committee). Second, working groups were assembled from communities of people with common interests and concerns regarding implementation process and were the primary arena for seeking public input. Agricultural, Residential, and Governmental working groups were formed. A representative from Virginia Department of Environmental Quality (VADEQ), Rappahannock-Rapidan Regional Commission (RRRC), or Blue Ridge Environmental Solutions, Inc. (BRES) coordinated each working group in order to facilitate the process and integrate information collected from the various communities. Third, a Steering Committee was formed with representation from the Agricultural, Residential, and Governmental Working Groups; Culpeper Soil and Water Conservation District (CSWCD); Thomas Jefferson Soil and Water Conservation District (TJSWCD); RRRC; VADEQ; Virginia Department of Health (VDH); and BRES. Potential control measures, their associated costs and efficiencies, and potential funding sources were identified through review of the TMDL, input from working groups and Steering Committee, literature review, and discussion with CSWCD, TJSWCD, NRCS, and VDH. Implementation actions that can be promoted through existing programs were identified, as well as actions not currently supported by existing programs and their potential funding sources. Control measures were assessed based on cost, availability of existing funds, reasonable assurance of implementation, and water quality impacts.

The quantity of control measures, or BMPs, recommended during implementation was determined through spatial analyses and modeling alternative implementation scenarios. Spatial analyses of land use, stream-network, farm tracts, and the Commonwealth of Virginia aerial maps along with regionally appropriate data archived in the Virginia Department of Conservation and Recreation (VADCR) Agricultural BMP Database and TMDL document were combined to establish average estimates of control measures required. Bacteria load reductions on land uses was determined through modeling alternative implementation scenarios, defining percentage of land use area or unit amount treated by control measure, then applying related reduction efficiency to the associated load. Additionally, input from local agency representatives, citizens, and contractors were used to verify the analyses.

The assessment of water quality impacts consisted of the development and evaluation of implementation scenarios. Implemental strategies were presented to and evaluated by the Steering Committee. Based on the evaluated strategies, a staged implementation timeline was developed. Implicit in the process of a staged implementation is targeting of control measures. Targeting was proposed to ensure optimum utilization of resources. Modeling was used to evaluate measurable goals and milestones by linking water quality with specific levels of implementation. Through this process, a staged implementation plan was developed that will establish full implementation within 15 years.

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.

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:

1. Identify the causes and sources of groups of similar sources that will need to be controlled to achieve the load reductions estimated in the watershed-based plan;
2. Estimate the load reductions expected to achieve water quality standards;
3. Describe the NPS management measures that will need to be implemented to achieve the identified load reductions;
4. Estimate the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement the watershed-based plan;
5. Provide an information/education component that will be used to enhance public understanding of the project and encourage the public's participation in selecting, designing, and implementing NPS management measures;
6. Provide a schedule for implementing the NPS management measures identified in the watershed-based plan;
7. Describe interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented;
8. Identify a set of criteria for determining if loading reductions are being achieved and progress is being made towards attaining water quality standards, and if not, the criteria for determining if the watershed-based plan needs to be revised; and

9. Establish a monitoring component to evaluate the effectiveness of the implementation efforts.

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.

Designated Uses

The "Designation of Uses" of all waters in Virginia is defined in the Code of Virginia (9 VAC 25-260-10) as follows:

"A. All state waters are designated for the following uses: recreational uses (e.g., swimming and boating); the propagation and growth of a balanced indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources (e.g., fish and shellfish)." (SWCB, 2003)

The goal of the CWA is that all streams should be suitable for recreational uses, including swimming and fishing. **Fecal coliform and *E. coli* bacteria** are used to indicate the presence of pathogens in streams supporting the **swimmable use goal**. Bacteria in Garth Run, Rippin Run, Marsh Run, Blue Run, Beautiful Run, Poplar Run, UT to Rapidan River #1, UT to Rapidan River #2, Rapidan River #1, and Rapidan River #2 exceed the *E. coli* criterion.

REVIEW OF TMDL DEVELOPMENT STUDY

Bacteria TMDLs for the Marsh Run, Blue Run, Unnamed Tributary (UT) to Rapidan River, and Rapidan River watersheds were completed in April 2007 with subsequent approval by USEPA in December 2007 as part of the Bacteria TMDL Development for the Rapidan River Basin. Garth Run, Rippin Run, Beautiful Run, Poplar Run, UT to Rapidan River, and Rapidan River impairments are nested within the TMDL developed watershed; therefore, bacteria loadings and reductions from the TMDL can be translated to these impairments . The TMDL development document can be obtained at the VADEQ office in Woodbridge, 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.

Watershed Description

Figure 1 depicts watershed boundaries (i.e., all colored areas) draining to impaired segments addressed in the project area of the IP. Garth Run, Beautiful Run, and UT to Rapidan River #2 impairment watersheds are located in Madison County. Rippin Run impairment watershed is located primarily in Greene County and partially in Madison County. Marsh Run impairment watershed is located primarily in Orange County and partially in Greene County. Blue Run impairment watershed is located predominantly in Orange County and partially in Albemarle County. Rapidan River #2 impairment watershed is located in Orange, Madison, and Greene Counties. Rapidan River # 1 impairment watershed is located in Orange and Madison Counties. Poplar Run and UT to Rapidan River #1 impairment watersheds are located entirely in Orange County. Table 1 and Figure 2 illustrate landuse distribution within impairment watersheds based on 2006 U.S. Geological Survey National Land Coverage Database (NLCD) data used to develop TMDLs. Garth Run, Rippin Run, UT to Rapidan River #2, and Marsh Run drain into Rapidan River #2 before joining Blue Run and draining into Rapidan River #1. Beautiful Run, Poplar Run, and UT to Rapidan River enter Rapidan River #1 before confluence with Robinson River.

Table 1. Watershed area and land use distribution.

Impairment	Watershed Area (ac)	Portion of Watershed Area (%)				
		Cropland	Pasture	Residential	Water / Wetland	Forest
Garth Run	4,849	0	8	2	0	90
Rippin Run	7,478	5	41	7	1	46
Marsh Run	10,709	1	22	4	1	72
Blue Run	20,955	2	39	5	2	52
Beautiful Run	14,702	5	45	3	1	46
Poplar Run	5,543	5	43	13	1	38
UT to Rapidan River #1	1,541	1	51	12	2	34
UT to Rapidan River #2	4,558	10	45	3	0	42
Rapidan River #1	8,702	7	57	7	1	28
Rapidan River #2	78,225	3	25	3	1	68
TOTAL	**157,262**	**3**	**32**	**4**	**1**	**60**

Water Quality Assessment

The impaired portion of Garth Run (VAN-E11R-GAR01A02), beginning at Route 665 crossing and continuing downstream approximately 1.61 miles to the confluence with Rapidan River, is listed as impaired due to water quality exceedances of the bacteria standard at station 3-GAR000.95.

Rippin Run (VAN-E12R-RIP01A04) is listed as impaired due to water quality exceedances of the bacteria standard at station 3-RIP000.22. The VADEQ has delineated the Rippin Run (VAN-E12R-RIP01A04) impairment on a stream length of 0.6 miles, beginning at White Run and continuing downstream to the confluence with Rapidan River.

The Blue Run (VAN-E13R-BLU01A00, VAN-E13R-BLU01B12, & VAN-E13R-BLU02A04) impaired segment begins at the headwaters and extends to the confluence with Rapidan River, at an approximate length of 12.72 miles. Blue Run (VAN-E13R-BLU01A00, VAN-E13R-BLU01B12, & VAN-E13R-BLU02A04) is listed as impaired due to water quality exceedances of the bacteria standard at stations 3-BLU000.80, 3-BLU002.60, and 3-BLU008.33.

The impaired portion of Marsh Run (VAN-E13R-MAS01A04), beginning at the headwaters and continuing downstream approximately 5.64 miles to the confluence with Rapidan River, is listed as impaired due to water quality exceedances of the bacteria standard at station 3-MAS001.55.

The impaired portion of Beautiful Run (VAN-E13R-BFL01A04 and VAN-E13R-BFL02A12), beginning at unnamed Tributary at river mile 3.4 and continuing downstream approximately 3.68 miles to Rapidan River confluence, is listed as impaired due to water quality exceedances of the bacteria standard at stations 3-BFL000.90 and 3-BFL002.90.

The impaired portion of Poplar Run (VAN-E13R-POL01A04), beginning at headwaters and continuing downstream approximately 4.10 miles to Rapidan River confluence, is listed as impaired due to water quality exceedances of the bacteria standard at station 3POL000.10.

UT to Rapidan River #1 (VAN-E13R-XBO01A04) is listed as impaired due to water quality exceedances of the bacteria standard at station 3-XBO000.26. The VADEQ has delineated the UT to Rapidan River #1 (VAN-E13R-XBO01A04) impairment on a stream length of 3.11 miles, beginning at the headwaters and continuing downstream to the Rapidan River confluence.

UT to Rapidan River #2 (VAN-E13R-XEZ01A04) impaired segment begins at the headwaters and extends to the Rapidan River confluence, at an approximate length of 2.67 miles. UT to Rapidan River #2 (VAN-E13R-XEZ01A04) is listed as impaired due to water quality exceedances of the bacteria standard at station 3-XEZ000.12.

The impaired portion of Rapidan River #1 (VAN-E13R-RAP02B12 and VAN-E13R-RAP02A06), beginning at Marsh Run confluence and continuing downstream approximately 4.33 miles to Blue Run confluence, is listed as impaired due to water quality exceedances of the bacteria standard at station 3-RAP055.84.

The impaired portion of Rapidan River #2 (VAN-E13R-RAP01A00), beginning at Poplar Run confluence and continuing downstream approximately 7.63 miles to Robinson River confluence, is listed as impaired due to water quality exceedances of the bacteria standard at station 3-RAP045.08.

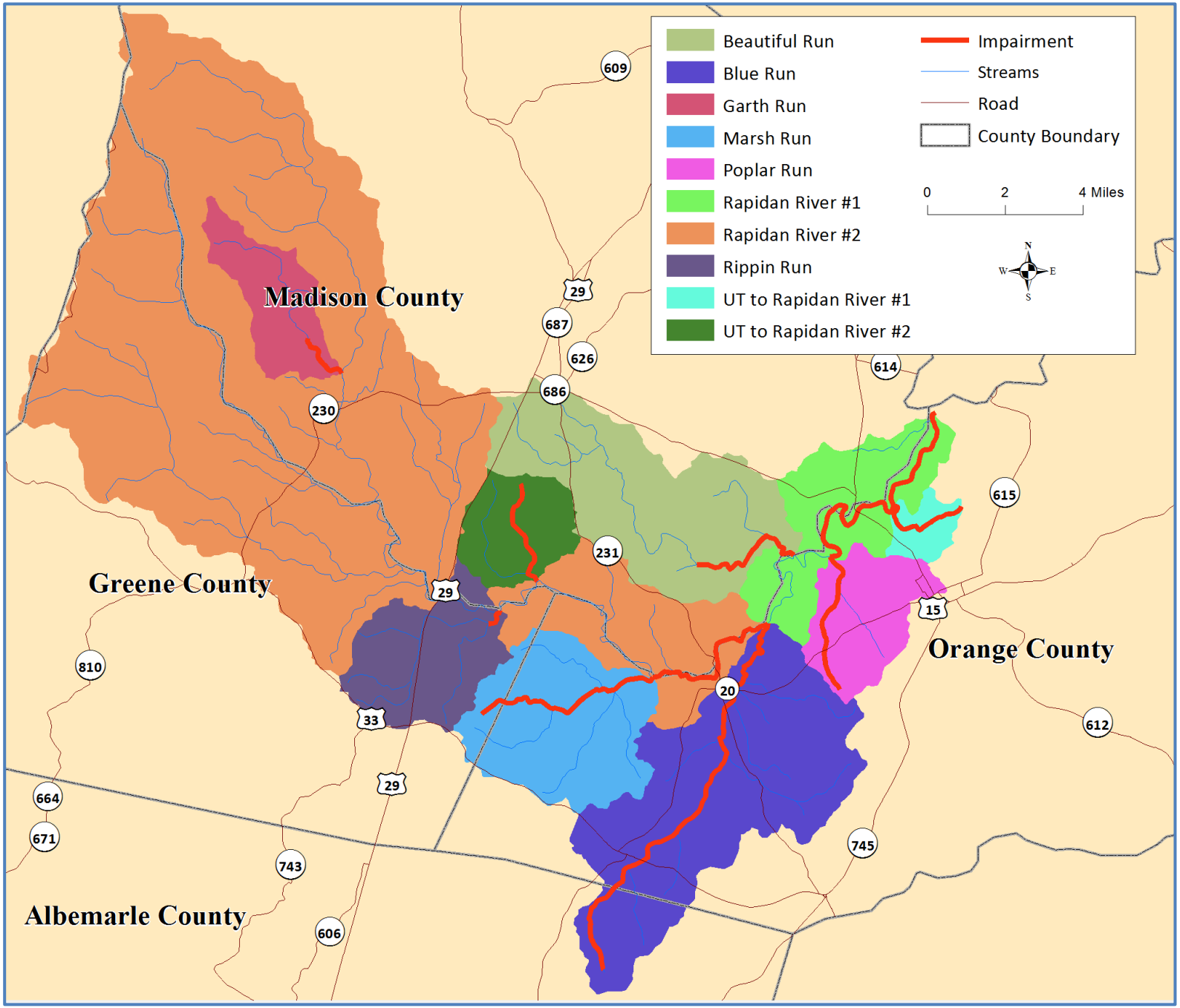

Figure 1. Watersheds location.

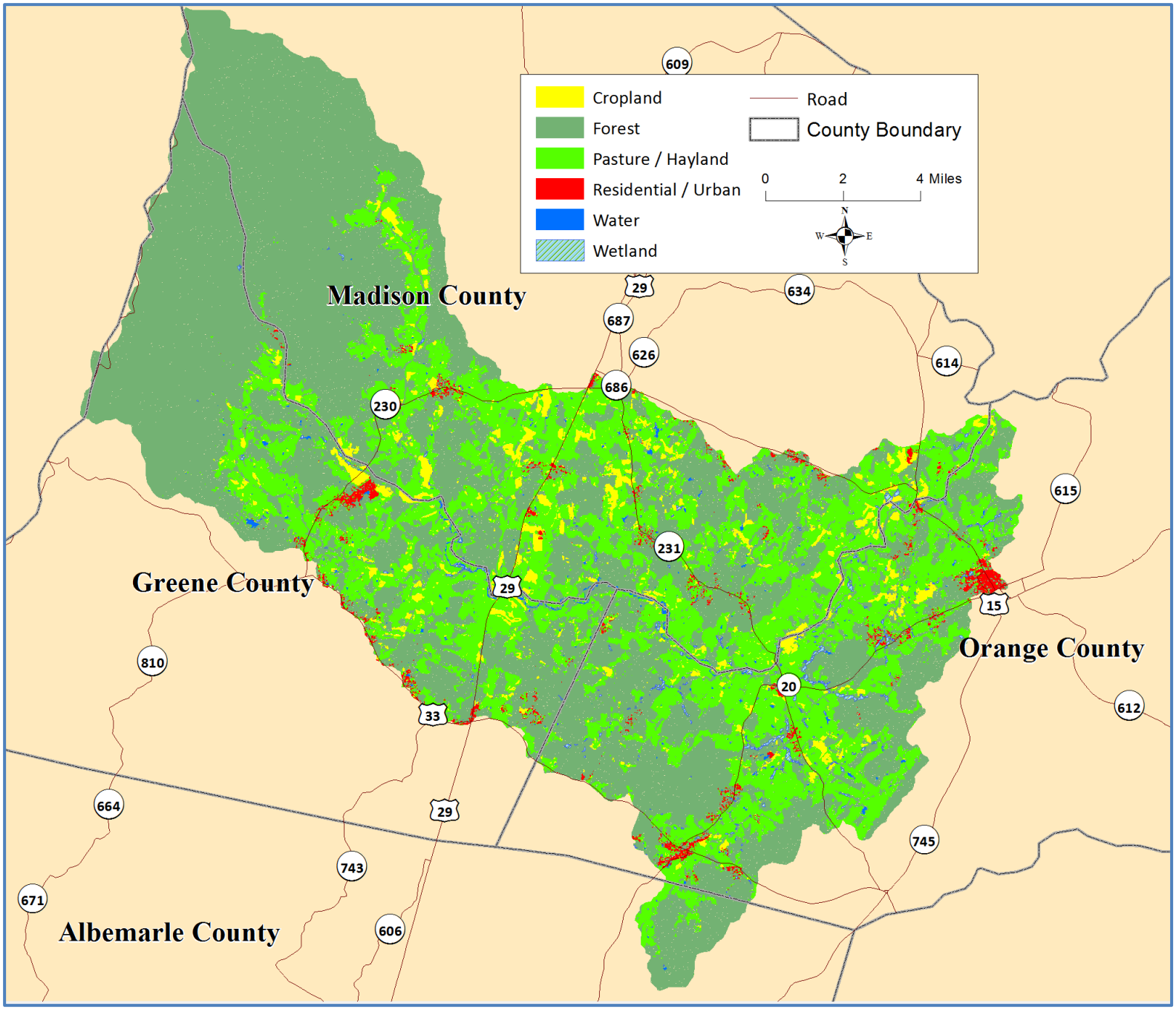

Figure 2. Land uses in the watersheds.

Bacteria Sources

Potential sources of bacteria considered in TMDL development included both point source and nonpoint source contributions. Individual permitted point sources listed in the TMDL development document were assigned a Waste Load Allocation (WLA) based on their Virginia Pollution Discharge Elimination System (VPDES) permit. Non-point bacteria sources from livestock, human, pets, and wildlife were considered in the watersheds. It is important to understand the types of sources modeled their delivery mechanisms, and temporal variations. Table 2 gives a summary of non-point source pollution loads. Loads were represented as either land-based load, where bacteria were deposited on land and available for wash-off during a rainfall event, or as direct loads, where bacteria were directly deposited to the stream. Loads that varied temporally were delivered at a constant rate throughout any given month, but varied on a monthly basis. All loads were spatially distributed based on land use types (e.g. land-based loads from beef cattle were applied to pasture). A portion of the non-point source load from cattle, straight pipes, and a portion of the wildlife load were modeled as a direct load to the stream.

Table 2. Sources of bacteria in the impaired watersheds.

Source Category	Source / Animal Type	Applied To	Variation
Human and Pets	Permitted Discharges	Stream	Temporal and Spatial
	Straight Pipes	Stream	Temporal and Spatial
	Failing Septic Systems	Land	Spatial
	Biosolids Applications	Land	Spatial
	Dogs / Cats	Land	Spatial
Agricultural	Beef	Land, Stream	Temporal and Spatial
	Dairy	Land, Stream	Temporal and Spatial
	Hogs	Land	Temporal and Spatial
	Horses	Land, Stream	Temporal and Spatial
	Poultry	Land	Temporal and Spatial
	Sheep	Land	Temporal and Spatial
Wildlife	Deer	Land, Stream	Spatial
	Turkeys	Land, Stream	Spatial
	Raccoon	Land, Stream	Spatial
	Muskrats	Land, Stream	Spatial
	Beavers	Land, Stream	Spatial
	Geese	Land, Stream	Spatial
	Ducks	Land, Stream	Spatial

Modeling Procedures

In order to understand the implications of the load allocations determined during TMDL development, it is important to understand the modeling methods used in the analysis. The United States Environmental Protection Agency (USEPA) and United States Geological Survey (USGS) Hydrologic Simulation Program - Fortran (HSPF) water quality model was selected as the modeling framework to simulate the bacteria fate and transport for existing conditions and perform TMDL allocations. Seasonal variations in hydrology, climatic conditions, and watershed activities can be explicitly accounted for in the HSPF model. To identify localized sources of bacteria, the watersheds were divided into subwatersheds. These subdivisions were based primarily on homogeneity of land use. The hydrologic model was calibrated using observed flow values from USGS station #01665500 on Rapidan River near Ruckersville, VA for the period October 1, 1989 to September 30, 1994. The calibration period covered a wide range of hydrologic conditions, including low- and high-flow conditions, as well as seasonal variations. The calibrated HSPF data set was validated using observed flow values from USGS station #01665500 on Rapidan River near Ruckersville, VA for the period October 1, 1994 to September 30, 1999. Calibration parameters were adjusted within the recommended ranges until the model performance was deemed acceptable. Water quality observations between 1993 to 2002 were utilized for the model water quality calibration.

TMDL Allocation and Staged Implementation Reductions

Several model runs were made investigating scenarios that would meet applicable water quality standards for the impairments. The recommended final scenario balances reductions from agricultural and residential land uses by maintaining existing watershed loading characteristics. Loadings from source categories were allocated according to their existing loads. Bacteria loads from point sources were not reduced because these facilities are currently meeting their pollutant discharge limits and other permit requirements. Current permit requirements are expected to result in attainment of the WLAs as required by the TMDL. The final TMDL load reductions required in the impairments are shown in Table 3. Bacteria load reductions required to meet the staged implementation goal (single sample maximum criterion exceedance rate below 10.5%) are listed in Table 4.

Table 3. TMDL load reductions specified during TMDL development.

Impairment	Required Load Reductions (%)						
	Straight Pipes	Residential	Livestock Direct Deposit	Pasture	Cropland	Wildlife Direct Deposit	Forest
Garth Run	100	98	98	98	98	0	0
Rippin Run	100	98	98	98	98	0	0
Marsh Run	100	98	98	98	98	0	0
Blue Run	100	99	99	99	99	30	0
Beautiful Run	100	98	98	98	98	0	0
Poplar Run	100	98	98	98	98	0	0
UT to Rapidan River #1	100	99	99	99	99	38	0
UT to Rapidan River #2	100	98	98	98	98	0	0
Rapidan River #1	100	98	98	98	98	0	0
Rapidan River #2	100	98	98	98	98	0	0

Table 4. Staged implementation load reductions specified during TMDL development.

Impairment	Required Load Reductions (%)						
	Straight Pipes	Residential	Livestock Direct Deposit	Pasture	Cropland	Wildlife Direct Deposit	Forest
Garth Run	100	78	95	78	78	0	0
Rippin Run	100	78	95	78	78	0	0
Marsh Run	100	75	75	75	75	0	0
Blue Run	100	78	90	78	78	0	0
Beautiful Run	100	78	95	78	78	0	0
Poplar Run	100	78	95	78	78	0	0
UT to Rapidan River #1	100	75	75	75	75	0	0
UT to Rapidan River #2	100	78	95	78	78	0	0
Rapidan River #1	100	78	95	78	78	0	0
Rapidan River #2	100	78	95	78	78	0	0

Implications of TMDL and Modeling Procedure on Implementation Plan Development

Conditions outlined in the TMDL development study to address the bacteria impairments in Garth Run, Rippin Run, Marsh Run, Blue Run, Beautiful Run, Poplar Run, UT to Rapidan River #1, UT to Rapidan River #2, Rapidan River #1, and Rapidan River #2 watersheds include:

- 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; and
- Implicit in the requirement for no point source bacteria load adjustment is the requirement for point sources to maintain permit compliance.

PUBLIC PARTICIPATION

Process

Public participation was an integral part of the IP development, and is also critical to promote reasonable assurance that the implementation actions will occur. The actions and commitments compiled in this document are formulated through input from citizens of the watershed; Madison County government; Greene County government; Orange County Public Service Authority; Orange Farm Service Agency (FSA); Ecosystems Service, LLC; Center for Natural Capital; Piedmont Environmental Council (PEC); Friends of the Rappahannock; Old Rag Master Naturalists; CSWCD; TJSWCD; Madison County Health Department; Greene County Health Department; Albemarle County Health Department; RRRC; VADEQ; VDH; Virginia Department of Forestry (VADOF); NRCS; Shenandoah National Park; and 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, and Governmental. The overall goal of the Agricultural, Residential, and Governmental Working Groups was to identify obstacles to implementation in their respective communities and recommend workable solutions that will overcome these obstacles. In addition, the working groups were expected to: identify funding/partnering opportunities that would help to overcome obstacles to implementation, review the IP from an environmental perspective, identify the regulatory authority in the specific areas related to implementation, identify existing programs and resources that might be relevant to the situation, and propose additional programs that would support implementation. A representative from VADEQ, RRRC, or BRES coordinated each working group in order to facilitate the process and integrate information collected from the various communities. Third, a Steering Committee was formed with representation from the Agricultural, Residential, and Governmental Working Groups; Ecosystems Service, LLC; Shenandoah National Park; Friends of Rappahannock; Old Rag Master Naturalists; CSWCD; TJSWCD; RRRC; VADEQ; VDH; and BRES to guide the development of the implementation plan. The Steering Committee had the expressed purpose of formulating the TMDL IP. In addition, this committee had responsibility for identifying control measures that are founded in practicality, establishing a timeline to insure expeditious implementation, and setting measurable goals and milestones for attaining water quality standards. All meetings conducted during the course of the IP development are listed in Table 5. Meeting summaries are located in Appendices A – D. 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 5. Meetings held during the TMDL IP development process.

Date	Meeting Type	Location	Attendance	Time (hr)
01/28/15	Public Meeting	Town of Orange Public Works	20	1
01/28/15	Agricultural & Residential Working Group	Town of Orange Public Works	20	1
01/29/15	Public Meeting	PVCC Eugene Giuseppe Center	20	1
01/29/15	Agricultural & Residential Working Group	PVCC Eugene Giuseppe Center	20	1
03/31/15	Governmental Working Group	Madison County Extension	14	2
04/16/15	Agricultural & Residential Working Group	PVCC Eugene Giuseppe Center	14	2
07/10/15	Steering Committee	Madison County Extension	12	2
08/13/15	Public Meeting	James Madison's Montpelier	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.*, CSWCD, TJSWCD, and NRCS). 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.

Many hay fields and timber tracts have been converted into crop land over the last five years. There has been an increase in poultry farms. Many are new, but some are existing operations that are expanding (i.e., three operations in Orange County). Much of the farmland in the region is leased, both farmland and cropland. It does not impact participation in the cost-share programs, because lessees are eligible provided they have 10-year lease at minimum. Absentee landowners are prevalent in the watershed, but usually the tenant cooperates with the district. A generational shift is occurring where children and grandchildren of farmers, who recognized the damage that poor farming practices create and who helped develop organizations such as Soil and Water Conservation Districts, are not aware of how their farming practices are affecting the soil, water and environment. Many farmers think because they do no-till farming, they do not need to implement other conservation practices.

There is evidence of intensive horse grazing in the watershed, many new horse rescue organizations where the average ratio of horse per acre is 10 to 1. While many horse farms do not allow horses to have direct access to streams, runoff is a significant issue that needs to be addressed. Little to no buffers exist, the soil is badly compacted exacerbating runoff, and often the manure pile is placed close to tributaries. It was recommended that VADEQ & VADCR partner with state equine organizations such as the Virginia Horse Council. However, it should be noted that many equine organizations are very fragmented; broken down by specific breeds and disciplines (dressage, reining, racing, etc.) and it may

be difficult to reach all of them. Both mass outreach from the state-level and local one-on-one grassroots outreach may be needed. Many horse owners may not be the highest priority when prioritizing BMP outreach strategies. However, farms with very high stocking rates and poor forage management should be targeted. Many horse owners do not seem to understand that they are a contributing source of bacteria and may be adding to the stream's bacteria impairment.

In the past, Virginia Cooperative Extension, Piedmont Environmental Council, Virginia Grasslands and Forage Council, and Soil and Water Conservation Districts have offered educational programs and hosted events targeting horse owners, but had very little attendance. Virginia Grasslands and Forage Council found that integrating the educational component into an event and including a well-known horse professional helped reach more horse owners. The Virginia Forage and Grassland Council will be offering a grazing mentoring program that will include the entire state. It will include information on soil retention, nutrient management, electric fencing, definition of flash grazing, etc. It was recommended this information be shared with Soil and Water Conservation Districts and VA Cooperative Extension.

Opportunities exist in the Upper Rapidan River watershed to improve stream buffers, but not all farmers are willing to participate in the cost share programs. Farmers with no stream buffers could be targeted for information distribution. Further up the watershed, it becomes harder to get participation with stream buffers, because the farmer loses a lot of land. To address this issue, attendees recommended that much smaller setbacks be required for those areas and that VADEQ / VADCR consider a no setback BMP for the farmers with many small tributaries needing fencing. Due to potential requirement non-compliance, flash grazing in buffers was not recommended.

Information is best shared one on one with farmers through recognized local government staff with the Soil and Water Conservation District, NRCS, and Virginia Cooperative Extension who have experience and knowledge in farming practices and have the existing relationships with producers and producer groups. Visibility is the key and trust is needed. Running programs on local television shows like Virginia Farming has been done in the past and would be helpful. As well, creative partnerships are an important part of every TMDL IP. Many partnerships currently exist between the various conservation agencies, Virginia Cooperative Extension and producer groups. The Virginia Cooperative Extension may be a good partner to assist with outreach to the equine industry. Other partnerships with established equine groups could also be considered. The Soil Conservation Districts have relationships with government agencies and producer groups, including but not limited to Virginia Farm Bureau and the Central Virginia Cattleman's Association. Other grazing groups were suggested for inclusion. The Culpeper SWCD sends an annual mailing to the Farm Bureau's mailing list, and expects to continue this. Attendees also recommended that education and outreach programs be targeted to the Virginia Cooperative Extension, large animal vets, horse owners, and farriers.

Residential Working Group Summary

The Residential Working Group (RWG) consisting of watershed residents, RRRC, CSWCD, TJSWCD, VADEQ, and NRCS personnel focused on ways 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.

Generally, homeowners in the watershed are aware they have a septic system, but while most know that maintenance should be done, they do nothing until they experience a problem. A lot of people do not know that maintenance can extend the life of septic systems. Many homeowners do not know

where their septic tank is, and it can be embarrassing to admit they have a problem. Incentives to help address the septic system problem can help mitigate that embarrassment, encouraging them to learn about proper septic system maintenance while participating in the cost-share programs. Rental properties can be a hot spot for septic issues, because of renters flushing undesirable "flushable" products that are not made for septic systems. Attendees expect to see an increase in failing septic systems in the future due to this issue since disposable products are marketed as being septic system friendly. Many homeowners are hesitant to seek help for fear of a VDH violation and possibly opening the door to higher costs if VDH requires substantial repairs. It was recommended that a septic tank pump-out program target areas near streams, but not limit cost-share to areas away from streams. Attendees felt there was more of an issue of grey water in the watershed than straight pipes. It was recommended 100% cost-share be considered for low-income homeowners needing septic systems, particularly those near streams. Partnerships with other agencies, such as Rural Development, could be developed to make this possible, if VADEQ cannot provide the full 100%. There are currently some alternative waste treatment systems attendees were aware of in Orange County, where there are many un-buildable lots with poor soils that don't perk. Attendees felt the systems were fairly new, so were not aware of any maintenance problems but thought it was possible in the future as the systems age.

Going door-to-door and speaking one-on-one was identified as the most promising homeowner outreach. Program information has been spread by word-of-mouth very effectively in residential subdivisions. CSWCD provides educational brochures to the homeowners and distributes the information through various venues. Churches and the Health Department have been especially helpful in getting the word out. Information has also been printed in local newspapers and signs are displayed at homeowners houses when a cost-share program is being implemented, helping to bring awareness to neighbors and the community. In other TML IP watersheds, CSWCD, NRCS and Virginia Cooperative Extension agricultural staff has been helpful in referring farmers to the residential cost-share programs.

Attendees recommended focusing on kennels and hunt clubs rather than pet waste station installations at towns and parks. There are many kennels and hunt clubs, including those used for fox hunting, in Orange and Madison counties. Greene and Madison Counties had once required residents with a certain number of dogs to get a kennel license, and may have that data available. The Town of Orange provided a list of their licensed kennel operations for the purpose of estimating numbers and will cooperate with providing educational information to those individuals. As well, contacts through hunt club associations will be useful when reaching out to the kennel and hunt clubs in the area with information on proper pet waste handling (e.g, digesters or scoop and trash). A portion of the Town of Orange, which is included in the Upper Rapidan watershed, may also have popular dog walking areas in need of pet waste bag stations. Other rural neighborhoods may wish to install them for residents, or they can be placed at area parks or schools where dog walking takes place. HOWS (Houses of Wood and Straw, a non-profit serving confined outdoor dogs with houses and straw in winter), was recommended to assist with outreach for pet waste programs, such as educational brochures and leash bag holders. Attendees recommended that pet waste stations be placed at parking lots and entrances to the Shenandoah National Park such as White Oak Canyon and Old Rag. Attendees recommended that rain gardens and infiltration trenches be a focus in Phase II of implementation.

Governmental Working Group Summary

The Governmental Working Group (GWG) consisting of representatives from Madison County government; Greene County government; Orange County Public Service Authority; CSWCD; TJSWCD; Madison County Health Department; Greene County Health Department; RRRC; VADEQ; VDH; VADOF; and BRES personnel, focused on control measure estimates, funding sources, technical assistance needs, regulatory controls, and lead agencies responsible for implementation.

Additional cost-share assistance such as SERCAP should be pursued to offset cost for fixing septic system failures. Low interest/no interest loans are available from additional programs. Price gouging by contractors in surrounding TMDL IP watersheds was identified and may be a potential hindrance to implementation. It was recommended that homeowners obtain three price estimates when requesting cost share and that SWCDs review invoices and agree to payment of reasonably priced estimates. Additionally, this concern could be addressed through the modified bid procedures coming out in the 2016 DEQ TMDL BMP Implementation Guidelines. For non–agricultural projects less than $5,000, bids are not required although greater than this amount will require bids. The towns of Orange and Stanardsville were suggested for potential public sewer hook-up options. In the past 5 years, Madison has not had that many new alternative systems, whereas in Greene County there have been about 15-20 alternative systems in that time period, mostly new construction. An area near the Rapidan River and Robinson River confluence was identified as having problem soils and may likely be a suspect area for failing septic systems where homeowners could use assistance. Older vacation style homes that are now full time residences may have septic systems unsuitable for year round usage in Garth Run. Based on this information, along with rocky and steep terrain, it was suggested to include a 50:50 split between new conventional systems (RB-4) and new conventional systems with pump (RB-4P) in the septic BMP estimates. Local average costs to fix or replace failing septic systems and straight pipes were provided. No counties have ordinances requiring mandatory pump-outs.

In rural areas, it is hard to get buy in from community for the pet waste digesters installations, but pet waste stations are popular. Madison County developed a septic database during the Robinson River TMDL IP that covered the entire county and is accessible by record look up. Orange County has some pet waste stations and requires a license for dog kennels.

State and federal agricultural cost-share funds received for Madison, Orange, Greene, and Albemarle Counties are allocated and disbursed by the CSWCD and TJSWCD. The length of fencing went dramatically up (feet) when 100% cost- share became available from the state. Since the 100% cost-share ended in June 2015, a bigger push for CREP will occur and the estimated distribution of cost -share funding should reflect this trend. Members questioned whether there was a regulatory buffer requirement for livestock. There is no regulatory requirement in general, but in order to receive cost-share funds one has to meet set-back requirements. However, it is a voluntary program. The probability that farmers will install exclusion fencing was explored by the AWG. CSWCD had $5 million in cost-share spent on BMPs for 35-foot setback at 100% cost share, 10-foot setback at 50% cost share, and no setback which allows for a 25% tax credit (Fencing installed at top of stream bank under SL - 6B is eligible for a 25% BMP tax credit up to $17, 500 per applicant per year). All of these optional cost-share programs are voluntary, although they require a 10-year maintenance agreement.

Potential funding sources were discussed and some consolidation of programs have occurred in the 2014 Farm Bill. RCPP is a new program this year, which brings together non-government partners with

district/state agencies. VADOF administers the Stewardship Program to assist landowners. VADOF has some money available through Virginia Trees for Clean Water for tree planting potentially available next year, but it is dependent on DCR and Chesapeake Bay funds. Funding sources similar to those developed through past TMDLs in Rappahannock County with Piedmont Environmental Council and the Krebser Fund, should be pursued. Incentive funds from Center for Natural Capital, Rapidan Better Housing, and USDA Rural Development should be explored. Although RRRC/Friends of the Rappahannock Rainscape Retrofit Program and CSWCD residential stormwater cost share programs (VCAP) are geared towards nutrient and sediment reductions, they will provide the added benefit of bacteria reductions in some situations. A 100% cost- share rate for straight-pipe conversion as a pilot program to see whether it would yield an improvement in sign-up, since straight pipes are difficult to find, was recommended .

Suggested outreach included a target mailing to older homes and/or dog owners. CSWCD goes door to door instead of using a mailing for their outreach programs. Some other areas include a mailing in the water or electric bill by partnering with utilities. The Center for Natural Capital student interns from Woodbury Forest, Master Naturalists, and Madison County 4H Wildlife Club could be possible groups interested in conducting citizen monitoring in the watershed.

Steering Committee Summary

The Steering Committee consisted of representatives from the AWG, RWG, and GWG; Ecosystems Service, LLC; Shenandoah National Park; Friends of Rappahannock; Old Rag Master Naturalists; CSWCD; TJSWCD; RRRC; VADEQ; VDH; and BRES. The Steering Committee evaluated recommendations from working groups, reviewed BMP quantification and cost estimates, revised the implementation plan document and discussed specific questions of some of the reviewers, and evaluated materials for the final public meeting. A representative from each of the working groups provided a summary of the discussions from the working group sessions. The Steering Committee will periodically revisit implementation progress and suggest plan revisions as needed.

IMPLEMENTATION ACTIONS

Identification of Control Measures

An important element of the implementation plan is to encourage voluntary implementation of control measures for bacteria reductions on the part of local, state, and federal government agencies, agricultural producers, business owners, and private citizens. In order to encourage voluntary implementation, the best information available on types of control measures and program options that achieve the bacteria reduction goals practically and cost-effectively was obtained. Potential control measures, their associated costs and efficiencies, and potential funding sources were identified through Steering Committee and working group input; literature review; review of the TMDL; and discussion with the CSWCD; TJSWCD; Orange, Madison, Greene, and Albemarle Counties; Towns of Orange and Stanardsville; NRCS; VADEQ; and VDH government personnel. Control measures were assessed based on cost, availability of existing funds, reasonable assurance of implementation, and water quality impacts (Table 6).

The cost of installing potential control measures was determined based on published values and discussion with working groups; Steering Committee; CSWCD; TJSWCD; Orange, Madison, Greene, and Albemarle Counties; VADEQ; VDH; and local contractors. Control measures that can be promoted through existing programs were identified, as well as control measures that are not currently supported by existing programs and their potential funding sources. Availability of existing programs was determined through discussion with CSWCD, TJSWCD, VADEQ, VDH, NRCS, and officials from Orange, Madison, Greene, and Albemarle Counties participating in the working groups and Steering Committee. The assurance of implementation of specific control measures was assessed through discussion with the AWG, RWG, and GWG.

The allocations determined during the TMDL development dictate, largely, the control measures that must be employed during implementation. In order to meet the stated reductions in direct deposition from livestock, some form of stream exclusion is necessary. Fencing is the most obvious choice; however, the type of fencing, distance from the stream bank, and most appropriate management strategy for the fenced pasture are less obvious. Accounting for this variability at each farm, a full livestock exclusion system was used to estimate the control measure needed to reduce livestock direct deposition.

Due to the treatment capacity of a 35-feet buffer along the streambank, it is preferred that all fence, even that which is installed solely at the landowners expense, be placed at least 35 feet from the stream. The LE-2 livestock exclusion system with 10-feet set-back was included to address farmers wanting to minimize fencing costs and the amount of pasture lost. An alternative water source will typically be required with the livestock exclusion system. SWCD and NRCS staffs have assisted with the installation of various types of alternative water systems, including; wells, spring developments, pumped stream water, and public water. The main criterion is that the system be dependable. From an environmental perspective, the best management scenario would be to exclude livestock from the stream bank 100% of the time and establish permanent vegetation in the buffer area. This prevents livestock from eroding the stream bank, provides a buffer for capturing pollutants in runoff from the pasture, and establishes (with the growth of streamside vegetation) one of the foundations for healthy aquatic life. From a livestock production perspective, the best management scenario is one that

provides the greatest profit to the farmer. Obviously, taking land (even a small amount) out of production is contrary to that goal. However, a clean water source has been shown to improve weight gain. Clean water will also improve the health of animals (e.g., cattle and horses) by decreasing the incidence of waterborne illnesses and exposure to swampy areas near streams. Additionally, intensive pasture management, which becomes possible with an alternative water source, has been shown to improve overall farm profitability and environmental impact. From a part-time farmer's perspective, the best management scenario is one that requires minimal input of time. This would seem to preclude intensive pasture management; however, those farmers who have adopted an intensive pasture management system typically report that the additional management of the established system amounts to "opening a gate and getting out of the way" every couple of days. Additionally, the efficient use of the pasture often means that fewer supplemental feedings are necessary. Among both part-time and full-time farmers there are individuals who are hesitant to allow streamside vegetation to grow unrestricted because of aesthetic preferences or because they have spent a lifetime preventing this growth.

Improved Pasture Management BMPs will be utilized to reduce bacteria loads from pasture land-use. If needed, sediment retention structures will be installed during Stage II of implementation for additional treatment of the stormwater runoff from pasture land.

Conversion of cropland field borders to vegetated buffers or forest and manure incorporation into the soil will be utilized to reduce bacteria loads from cropland. Average parameters of the SL-1 Permanent Vegetative Cover and FR-1 Reforestation of Erodible Crop and Pastureland BMPs previously installed in the CSWCD and TJRSWCD areas as reported in the VADCR BMP Database were utilized. Manure incorporation or injection is a practice in which farmers inject liquid manure below the soil surface or spread manure, then disk the land. The disking mixes manure with soil and has shown to keep manure and nutrients on the land longer. This practice can be done on cropland or pasture/hay land use where manure or biosolids are applied. Cover crops reduce winter runoff from cropland, thus, reducing bacteria levels delivered to stream from fall manure applied to cropland.

Septic system repair, connection to public sewer, conventional septic system installation, and alternative on-site sewage disposal system installation will be needed to fix failed septic systems and replace straight pipes. Pet contributions to bacteria runoff from residential land use will be reduced through implementation of pet waste control program in the watersheds, installation of pet waste disposal stations, installation of pet waste enzyme digesting composters, installation of confined canine unit waste treatment systems, and installation of vegetated buffers, rain gardens and infiltration trenches.

Table 6. Control measures with average unit cost and reduction efficiency identified to meet implementation goals for bacteria reductions.

Control Measure	Unit	Unit Cost[1] ($)	Reduction Efficiency (%)
Pasture and Livestock Exclusion			
Livestock Exclusion System (CREP)	System[4]	18,000	50 (100)[2]
Livestock Exclusion System (EQIP)	System[4]	15,000	50 (100)[2]
Livestock Exclusion with Riparian Buffers (SL-6/6T, LE-1T)	System[4]	35,500	50 (100)[2]
Small Acreage Grazing System (SL-6AT)	System[4]	9,000	50 (100)[2]
Livestock Exclusion with Reduced Setback (LE-2/2T)	System[4]	12,000	50 (100)[2]
Stream Protection (WP-2/2T)	System[4]	2,500	50 (100)[2]
Stream Exclusion (CCI-SE-1)	Feet	1	50 (100)[2]
Forested Riparian Buffer (CCI-FRB-1)	Acres-Installed	100	50
Improved Pasture Management[3]	Acres-Installed	165	50
Sediment Retention, Erosion, or Water Control Structure (WP-1)	Acres-Treated	870	75
Cropland			
Permanent Vegetative Cover on Cropland (SL-1)	Acres - Installed	350	75
Reforestation of Erodible Crop and Pastureland (FR-1)	Acres - Installed	450	75
Cover Crops (SL-8)	Acres - Installed	50	20
Manure/Litter Incorporation into Soil	Acres - Installed	25	100
Poultry Litter Storage Facility (WP-4)	System	38,000	99
Dry Manure Storage Facility (WP-4)	System	50,000	80
Liquid Manure Storage Facility (WP-4)	System	75,000	80
Onsite-Sewage Disposal Systems			
Septic Tank Pump-out	System	300	N/A
Septic System Repair	System	3,500	100
Connection of OSDS to Public Sewer	System	12,500	100
New Conventional Septic System	System	6,000	100
New Conventional Septic System with Pump	System	8,000	100
Alternative Onsite Sewage Disposal System	System	25,000	100
Pet Waste Management			
Pet waste education program	Program[5]	2,500	50
Pet waste disposal station (PW-1)	System	500	50
Pet waste digesters (PW-2)	System	50	50
Confined canine unit (CCU) Waste Treatment System	System	12,300	100
Stormwater Runoff Best Management Practices			
Vegetated Buffers	Acres-Installed	400	50
Bioretention	Acres-Treated	15,000	90
Infiltration Trench	Acres-Treated	11,300	90
Technical Assistance			
Agricultural	Full Time Equivalent	60,000 / yr	N/A
Residential	Full Time Equivalent	60,000 / yr	N/A

[1] Unit cost = installation or one-time incentive payment; [2] Direct load reduction efficiency in parentheses; [3]Improved pasture management comprised of: Pasture and Hayland Replanting (512), Prescribed Grazing (528), Grazing Land Management (SL-9), and Pasture Management (SL-10T) BMPs; [4] System typically includes stream exclusion and cross fencing, water trough, well, distribution piping, and riparian buffer, [5] Programs divided between Greene, Madison, Orange, and Albemarle Counties

Quantification of Control Measures

An assessment was conducted to quantify actions and costs for two implementation stages. Actions and costs that translate to a single sample maximum 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 9 through 12 depict the Stage I and II goals.

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

Agricultural Implementation Needs

To estimate the exclusionary fencing requirements, the National Hydrography Dataset (NHD) stream network was overlaid on aerial photography. Open areas were identified as having the potential to support livestock. Not every pasture area has livestock on it at any given point in time. However, it is assumed that all pasture areas have the potential for livestock access. Additionally, livestock will occasionally be given access to areas identified as cropland (e.g., following the last cutting of hay for the season) and forest. Perennial stream segments that flowed through or adjacent to pasture (open) areas were identified. If the stream segment flowed through the pasture area, it was assumed that fencing was required on both sides of the stream, while if a stream segment flowed adjacent to the pasture area; it was assumed that fencing was required on only one side of the stream. This initial classification was updated by examining land use criteria, size of resultant pasture, and existing BMPs. The CSWCD and TJSWCD were consulted to further update the potential fencing designations based on existing system installations and local knowledge of the watershed. Additionally, the AWG was asked to provide input at the second meeting. Analysis results for portion of Rapidan River watershed are displayed in Figure 3. Overall results for the watersheds are depicted in Figure 4. There are approximately 639 miles of perennial streams in these 10 watersheds. Currently in these watersheds, approximately 82 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 202 miles of fence (Table 7).

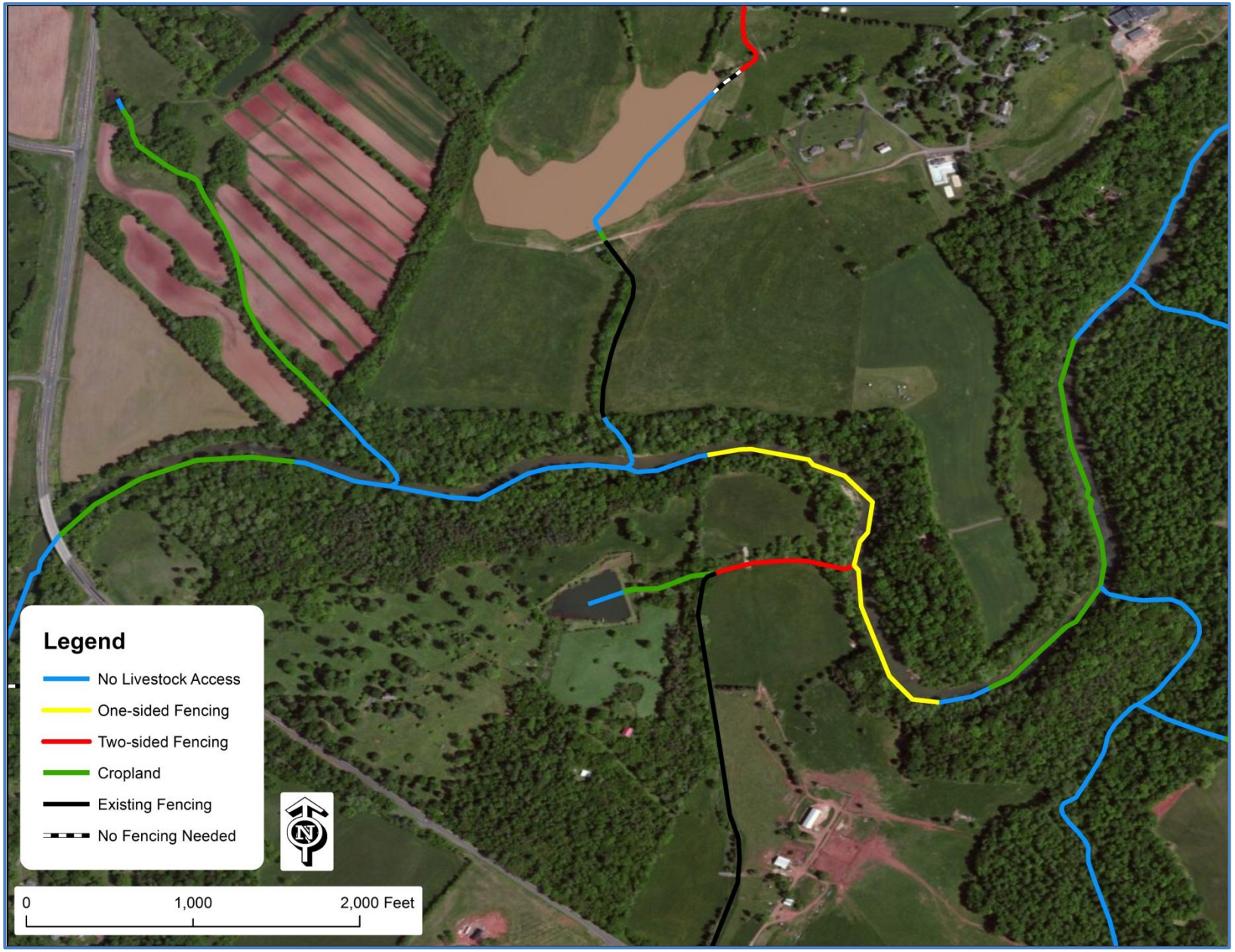

Figure 3. Potential livestock exclusion fencing analysis results for portion of Rapidan River.

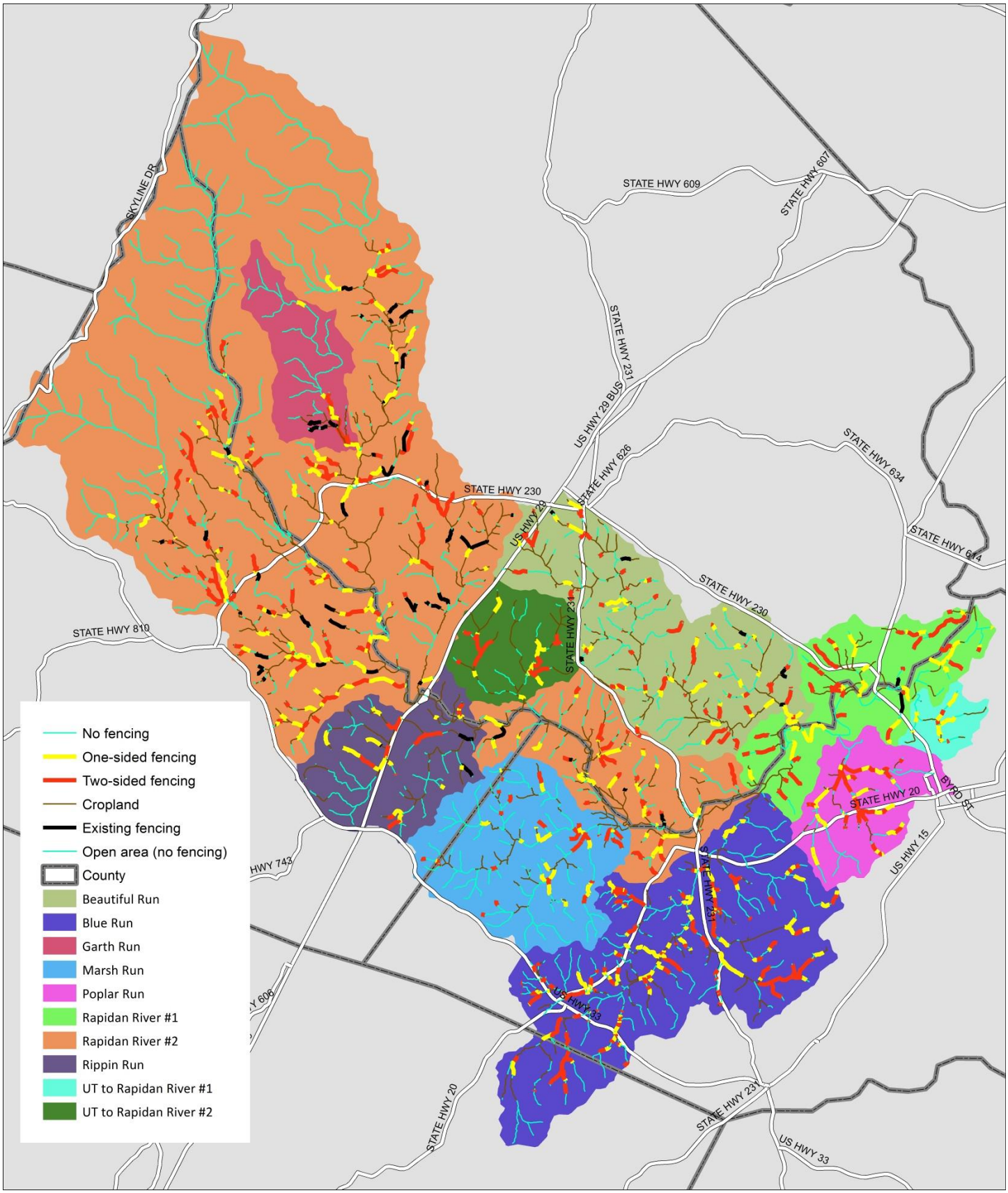

Figure 4. Potential livestock exclusion fencing analysis results for the Smith River watersheds.

Table 7. Perennial stream length, existing fencing installed, and estimated exclusion fencing length needed in the impairments.

	Garth Run	Rippin Run	Marsh Run	Blue Run	Beautiful Run	Poplar Run	UT to Rapidan River #1	UT to Rapidan River #2	Rapidan River #1	Rapidan River #2	Total
Perennial stream length (mi)	18.8	32.4	51.0	94.4	63.6	20.1	6.0	16.8	28.3	307.7	**639.0**
Existing exclusion fencing (ft)	11,376	8,488	32,689	37,310	50,429	0	0	44,634	8,196	239,454	**432,577**
One-sided fencing needed (ft)	6,402	16,525	16,927	52,225	31,629	18,685	8,797	4,700	23,760	121,925	**301,575**
Two-sided fencing needed (ft)	9,044	32,348	46,559	186,445	74,866	54,786	3,878	7,947	61,422	288,846	**766,141**
Total Fencing Needed, ft (mi)	**15,446 (2.9)**	**48,873 (9.3)**	**63,486 (12.0)**	**238,670 (45.2)**	**106,495 (20.2)**	**73,471 (13.9)**	**12,676 (2.4)**	**12,647 (2.4)**	**85,182 (16.1)**	**410,770 (77.8)**	**1,067,716 (202.2)**
Fencing per stream length (%)	11	19	15	29	21	43	34	10	37	16	**20**

The VADCR Agricultural BMP Database was utilized to determine typical characteristics (e.g., streamside fencing length per practice) of full livestock exclusion systems leading to the quantification of the number of required systems. The database was queried for information on livestock exclusion systems installed in the CSWCD and TJSWCD districts. Average streamside fencing for incentive programs used to estimate livestock exclusion system quantity are listed in Table 8. An SL-6 system was categorized based on funding program, CRSL-6 (CREP) versus SL-6 (VA Agricultural BMP Cost-share Program). The query was limited to exclusion systems with "linear feet" as the "extent installed".

Table 8. Average streamside fencing and division of incentive programs used to estimate livestock exclusion system quantity and cost.

Program / Practice Code	Average Streamside Fencing per System (ft)	Program Division (%)
Livestock Exclusion System (CREP)	2,900	16
Livestock Exclusion System (EQIP)	2,600	7
Livestock Exclusion with Riparian Buffers (SL-6, LE-1T)	4,350	65
Small Acreage Grazing System (SL-6AT)	1,750	1
Livestock Exclusion with Reduced Setback (LE-2T)	2,100	10
Stream Protection (WP-2T)	1,200	1

Potential streamside fencing was divided by the average streamside length per system to estimate a total of 314 exclusion systems are needed 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), Stream Exclusion with Grazing Land Management (SL-6/6T, LE-1T), Livestock Exclusion with Reduced Setback (LE-2/2T), Small Acreage Grazing System (SL-6AT), and Stream Protection (WP-2/2T) (Tables 9 and 10). A typical LE-1T system includes streamside fencing, cross-fencing for pasture management, hardened crossing, alternative watering system, watering trough, water distribution piping, and a 35-ft buffer from the stream. Stream Exclusion (CCI-SE-1) and Forested Riparian Buffer (CCI-FRB-1) were listed to illustrate potential incentives to extend design life, continue maintenance of existing fencing, and to incentivize voluntary implementation of stream fencing by producers not participating in cost-share programs. Implementation costs were not included for these practices.

In order to address the pasture bacteria load reductions, the benefit of installing the livestock exclusion systems was calculated. A reduction efficiency of 100% was assumed for the buffered area (i.e. fenced out pasture) coupled with 50% efficiency for upland area twice that of the buffered area. Using these efficiencies, the area treated by the buffer was calculated for each watershed. The ratio of the buffered area bacteria load and the applied bacteria load from the TMDL was calculated for pasture livestock access. The bacteria load contributed from grazing animals and transported to stream during precipitation events from the remaining pasture land use would be managed using improved pasture

management BMPs. A total of 49,361 acres in the watershed would require Improved Pasture Management with portions of this acreage improved by the Pasture and Hayland Planting (NRCS Code 512), Prescribed Grazing (NRCS Code 528), Grazing Land Management (SL-9), and Pasture Management (SL-10T) BMPs. Given that reductions were not sufficient to meet TMDL reduction goals, the installation of Sediment Retention, Erosion, or Water Control Structures (WP-1) may be necessary to treat runoff from this acreage during Stage II of implementation.

The AWG decided the primary control measures for cropland bacteria load reduction will be cover crops (SL-8), permanent conversion of cropland to pasture and forest land uses, and manure incorporation. The conversion was divided between Permanent Vegetative Cover (SL-1) and Reforestation of Erodible Crop and Pastureland (FR-1) BMPs based on input from AWG and landuse difference. The VADCR Agricultural BMP Database was utilized to determine typical characteristics of SL-1 and FR-1 systems installed in the CSWCD and TJSWCD areas. Currently in these watersheds, approximately 136 cropland acres have been converted utilizing the SL-1 (128 ac) and FR-1 (8 ac) practices. Planting 3,266 acres of cover crops, converting 43 acres to pasture and 43 acres to forest land uses, and incorporating manure into soil on approximately 892 cropland acres during Stage I & II satisfied the TMDL goals (Tables 9 and 10). The CSWCD identified six opportunities within this watershed to utilize an Animal Waste Control Facility (WP-4).

Table 9. Estimation of control measures needed to meet pasture and cropland bacteria load reduction Stage I (years 1-12) implementation goals.

Control Measure	Unit	Estimated Units Needed (#)										Total
		Garth Run	Rippin Run	Marsh Run	Blue Run	Beautiful Run	Poplar Run	UT to Rapidan River #1	UT to Rapidan River #2	Rapidan River #1	Rapidan River #2	
Livestock Exclusion System (CREP)	System[6]	1	4	4	13	6	4	1	1	5	23	**62**
Livestock Exclusion System (EQIP)	System[6]	0	1	2	6	3	2	0	0	2	11	**27**
Livestock Exclusion System (SL-6/6T, LE-1T)	System[6]	2	7	9	36	16	11	2	2	13	61	**159**
Livestock Exclusion System (SL-6AT)	System[6]	1	0	0	2	0	1	0	0	0	2	**6**
Livestock Exclusion System (LE-2/2T)	System[6]	1	2	3	11	5	3	0	1	4	20	**50**
Livestock Exclusion System (WP-2/2T)	System[6]	0	0	1	2	1	1	0	0	1	4	**10**
Stream Exclusion (CCI-SE-1)[7]	*Feet*	*11,400*	*8,500*	*32,700*	*37,300*	*50,400*	*0*	*0*	*44,600*	*8,200*	*239,500*	***432,600***
Forested Riparian Buffer (CCI-FRB-1)[7]	*Acres*[2]	*9*	*7*	*26*	*30*	*41*	*0*	*0*	*36*	*7*	*192*	***348***
Improved Pasture Management[1]	Acres[2]	288	2,380	1,808	6,404	5,152	1,824	620	1,616	3,916	15,492	**39,500**
Permanent Vegetative Cover on Cropland (SL-1)	Acres[2]	0	2	8	4	2	2	0	2	8	8	**36**
Reforestation of Erodible Crop & Pastureland (FR-1)	Acres[2]	0	2	8	4	2	2	0	2	8	8	**36**
Cover Crops (SL-8)	Acres[2]	5	182	65	200	360	129	4	218	306	1,143	**2,612**
Manure / Litter Incorporation Into Soil	Acres[2]	8	40	82	217	40	40	8	40	80	160	**715**
Poultry Litter Storage Facility (WP-4)	System	0	0	0	0	1	0	0	0	0	1	**2**
Dry Manure Storage Facility (WP-4)	System	0	0	0	1	1	0	0	0	0	0	**2**
Liquid Manure Storage Facility (WP-4)	System	0	0	0	0	1	0	0	1	0	0	**2**
Agricultural – Pasture and Cropland	FTE[5]											**2/yr**

[1] Improved pasture management comprised of: Pasture and Hayland Replanting (512), Prescribed Grazing (528), Grazing Land Management (SL-9), and Pasture Management (SL-10T) BMPs; [2] Acres installed; [3] Acres treated; [4] Unit cost = installation or one-time incentive payment; [5] Full time equivalent; [6] System typically includes stream exclusion and cross fencing, water trough, well, distribution piping, and riparian buffer , [7] Illustrates existing fencing, but no implementation cost associated with these potential incentives

Table 10. Estimation of control measures needed to meet pasture and cropland bacteria load reduction Stage II (years 13-15) implementation goals.

Control Measure	Unit	Estimated Units Needed (#)										Total
		Garth Run	Rippin Run	Marsh Run	Blue Run	Beautiful Run	Poplar Run	UT to Rapidan River #1	UT to Rapidan River #2	Rapidan River #1	Rapidan River #2	
Livestock Exclusion System (CREP)	System[6]	n/a	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[6]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**
Livestock Exclusion System (SL-6/6T, LE-1T)	System[6]	n/a	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[6]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**
Livestock Exclusion System (LE-2/2T)	System[6]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**
Livestock Exclusion System (WP-2/2T)	System[6]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**
Stream Exclusion (CCI-SE-1)	Feet	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**
Forested Riparian Bufffer (CCI-FRB-1)	Acres[2]	n/a	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]	67	592	448	1,602	1,288	459	151	402	976	3,876	**9,861**
Sediment Retention, Erosion, or Water Control Structure (WP-1)	Acres[3]	62	758	474	1,761	1,610	445	208	565	1,223	4,358	**11,464**
Permanent Vegetative Cover on Cropland (SL-1)	Acres[2]	0	0	2	1	0	0	0	0	2	2	**7**
Reforestation of Erodible Crop & Pastureland (FR-1)	Acres[2]	0	0	2	1	0	0	0	0	2	2	**7**
Cover Crops (SL-8)	Acres[2]	1	46	16	50	90	32	2	55	76	286	**654**
Manure / Litter Incorporation Into Soil	Acres[2]	1	10	21	54	10	10	1	10	20	40	**177**
Poultry Litter Storage Facility (WP-4)	System	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**
Dry Manure Storage Facility (WP-4)	System	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**
Liquid Manure Storage Facility (WP-4)	System	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**
Agricultural – Pasture and Cropland	FTE[5]											**2/yr**

[1] Improved pasture management comprised of: Pasture and Hayland Replanting (512), Prescribed Grazing (528), Grazing Land Management (SL-9), and Pasture Management (SL-10T) BMPs; [2] Acres installed; [3] Acres treated; [4] Unit cost = installation or one-time incentive payment; [5] Full time equivalent; [6] System typically includes stream exclusion and cross fencing, water trough, well, distribution piping, and riparian buffer.

Residential Implementation Needs

Number of straight pipes and failing septi**c** systems to correct during implementation was established during TMDL development. Based on discussion with Virginia Department of Health and GWG, 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%). Garth Run was the exception; whereby, the GWG felt a greater number of conventional septic systems with pumps would be needed due to topography and soils. The RWG and GWG felt strongly that septic tank pump-outs, estimated at number of failing septic systems and straight pipes (about 25% 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 1,713 septic tank pump-outs; 30 connections to public sewer; 1,068 septic system repairs; 501 conventional septic systems; 68 conventional septic systems with pump; and 46 alternative OSDS are considered necessary to correct straight pipes and failing septic systems during implementation (Table 11).

A three-step program was proposed to address pet waste reductions. In the first step, pet waste control programs consisting of educational packets, signage, and disposal stations in public areas will be instituted in each watershed. The Madison, Greene, Orange, and Albemarle pet waste educational programs for the general public were mostly divided based on watershed area within county boundaries. In some areas it will be necessary to develop a specific outreach and educational program for the kennel and hunt club operations. Sixteen pet waste disposal stations (PW-1) were estimated based on at least one in each impairment watershed and three additional stations each in Poplar Run and UT to Rapidan River #1. The second step will be installing pet waste enzyme digesting composters (PW-2) at 85 residences. The GWG and Steering Committee estimated that 1% of all residences would utilize a composter for dog waste. The third step will be identification of confined canine units (CCU) and installing approximately five CCU waste treatment systems throughout the watersheds. CCUs may be in the form of a septic system specifically designed to break down dense dog waste, which could be more expensive, or a less expensive dry stacking/composting system. The installation of vegetated buffers, bioretention, and infiltration trenches during Stages I & II on residential land use to reduce bacteria loads from failing septic systems and pets then transported to streams during precipitation events are outlined in Tables 11 & 12.

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.

Table 11. Estimation of control measures needed to meet residential and onsite sewage disposal systems bacteria load reduction Stage I (years 1-12) implementation goals.

Control Measure	Unit	Estimated Units Needed (#)										Total
		Garth Run	Rippin Run	Marsh Run	Blue Run	Beautiful Run	Poplar Run	UT to Rapidan River #1	UT to Rapidan River #2	Rapidan River #1	Rapidan River #2	
Failing Septic Systems												
Septic Tank Pump-out	System	26	142	136	214	141	71	17	44	113	639	**1,543**
Connection of OSDS to Public Sewer	System	0	0	0	0	0	30	0	0	0	0	**30**
Septic System Repair	System	18	99	95	150	99	37	12	31	80	447	**1,068**
New Conventional Septic System	System	4	36	34	54	35	3	4	11	28	160	**369**
New Conventional Septic System with Pump	System	3	4	4	6	4	1	1	1	3	19	**46**
Alternative On-site Sewage Disposal System	System	1	3	3	4	3	0	0	1	2	13	**30**
Straight Pipes												
Septic Tank Pump-out	System	11	3	11	38	20	14	4	5	7	57	**170**
New Conventional Septic System	System	5	2	9	30	16	12	3	4	6	45	**132**
New Conventional Septic System with Pump	System	5	1	1	4	2	1	0	1	1	6	**22**
Alternative On-site Sewage Disposal System	System	1	0	1	4	2	1	1	0	0	6	**16**
Pet Waste and Residential BMPs												
Pet waste education program[5]	Program	1	1	1	1	1	1	1	1	1	1	**10**
Pet Waste Disposal Station	System	1	1	1	1	1	4	4	1	1	1	**16**
Pet waste digester	System	1	6	5	15	4	12	3	1	8	30	**85**
Confined Canine Unit Waste Treatment System	System	0	0	1	1	0	1	0	0	1	1	**5**
Vegetated Buffers	Acres[2]	2	4	4	10	3	10	1	1	4	21	**60**
Bioretention	Acres[3]	0	3	1	2	1	1	0	0	1	6	**15**
Infiltration Trench	Acres[3]	0	1	1	2	1	1	0	0	1	3	**10**
Technical Assistance												
On-site Sewage Disposal Systems	FTE[4]											**1.6/yr**
Pet Waste Management & Residential BMPs	FTE[4]											**0.4/yr**

[1] Unit cost = installation or one-time incentive payment; [2] Acres installed; [3] Acres treated; [4] Full time equivalent; [5] Programs divided between Greene, Madison, Orange, and Albemarle Counties

Table 12. Estimation of control measures needed to meet residential/urban and onsite sewage disposal systems bacteria load reduction Stage II (years 13-15) implementation goals.

Control Measure	Unit	Estimated Units Needed (#)										Total
		Garth Run	Rippin Run	Marsh Run	Blue Run	Beautiful Run	Poplar Run	UT to Rapidan River #1	UT to Rapidan River #2	Rapidan River #1	Rapidan River #2	
Failing Septic Systems												
Septic Tank Pump-out	System	n/a	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	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**
Septic System Repair	System	n/a	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	n/a	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	n/a	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	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**
Straight Pipes												
Septic Tank Pump-out	System	n/a	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	n/a	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	n/a	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	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**
Pet Waste and Residential BMPs												
Pet waste education program[5]	Program	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**
Pet Waste Disposal Station	System	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**
Pet waste digester	System	n/a	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	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**
Vegetated Buffers	Acres[2]	0	2	2	4	1	3	1	1	2	5	**21**
Bioretention	Acres[3]	1	0	1	1	0	1	1	0	0	4	**9**
Infiltration Trench	Acres[3]	1	1	1	1	0	1	1	0	0	2	**8**
Technical Assistance												
Pet Waste Management & Residential BMPs	FTE[4]											**1.0/yr**

[1] Unit cost = installation or one-time incentive payment; [2] Acres installed; [3] Acres treated; [4] Full time equivalent; [5] Programs divided between Greene, Madison, Orange, and Albemarle Counties

Assessment of Technical Assistance Needs

Members of the AWG, RWG, GWG, and Steering Committee agree that technical assistance and education are keys to getting people involved in implementation. There must be a proactive approach to contact farmers and residents to articulate exactly what the TMDL means to them and what will most practically get the job done. Several education/outreach techniques will be utilized during implementation. Articles describing the TMDL process, the reasons why high levels of fecal bacteria are a problem, the methods through which the problem can be corrected, the assistance that is currently available for landowners to deal with the problem, and the potential ramifications of not dealing with the problem should be made available to the public through as many channels as possible (*e.g.*, Farm Bureau, SWCD, NRCS, FSA, RRRC newsletters; and targeted mailings). Workshops and demonstrations should be organized to show landowners the extent of the problem, the effectiveness of control measures, and the process involved in obtaining technical and financial assistance.

For the agricultural community, field tours conducted by SWCDs, pasture walks, educational events conducted by Virginia Cooperative Extension, Farm Bureau and Cattleman's Association events, and information booth at County Fair were recommended. The emphasis was on having local farmers discuss their experiences with the cost-share programs, demonstrating the advantages of clean water source and pasture management, and presenting monitoring results to demonstrate the problem. It is generally accepted that farmers will be more persuaded by discussion with local technical personnel or fellow farmers who have implemented the suggested control measures than through presentations made by state-agency representatives. Notices using all media outlets (e.g., cable television, public access channel programming, newspapers, and links on county, agency, and organization websites) need to be posted regarding status of implementation. Posting of informative/recognition signage throughout watershed (e.g., conservation practices implemented on farm) may prompt neighbors to participate. In general, a proactive approach to education needs to take place, whereby, technicians need to contact each landowner instead of waiting for the landowner to make contact.

For residential issues, public outreach should focus 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. Several education/outreach techniques need to be utilized during implementation of corrective actions for straight pipes and failing septic systems. The focus must be on obstacles (*e.g.*, money, information, and understanding of issues) that property owners face in correcting problems and proper operation and maintenance of systems. Examples included: press releases identifying levels of cost-share available for fixing on-site sewage disposal systems problems; small community meetings; workshops; model septic system and video displayed in public buildings; demonstration at county fair; information packet provided through realtors on proper operation and maintenance of on-site sewage disposal systems; educational materials to encourage home owners' associations, veterinarians, kennels, hunt clubs and pet stores to practice and promote proper pet waste management; and mailings.

Technical assistance and educational outreach tasks were identified during plan development that would be needed during implementation. The following tasks associated with agricultural and residential programs were identified:

Agricultural Programs

1. Make contacts with landowners in the watershed to make them aware of implementation goals and cost-share assistance programs.
2. Provide technical assistance for agricultural programs (e.g. survey, design, layout, and approval of installation).
3. Develop educational materials & programs.
4. Organize educational programs (*e.g.*, pasture walks, presentations at field days or club events).
5. Distribute educational materials (*e.g.*, informational articles in FSA or Farm Bureau newsletters, local media).
6. Handle and track cost-share.
7. Assess and track progress toward BMP implementation goals.
8. Follow-up contact with landowners who have installed BMPs.
9. Coordinate use of existing agricultural programs and suggest modifications where necessary.

Residential Programs

1. Identify failing septic systems & straight-pipes (*e.g.*, stream walks, analysis of aerial photos, mailings, monitoring, and home visit).
2. Identify confined canine units (*e.g.*, mailings, County databases, site visit).
3. Track on-site sewage disposal system repairs/ replacements/ installations for human and confined canine units.
4. Handle and track cost-share.
5. Develop educational materials & programs.
6. Organize educational programs and demonstration projects.
7. Distribute educational materials (e.g., informational pamphlets on TMDL & on-site sewage disposal systems).
8. Assess progress toward implementation goals.
9. Follow-up contact with landowners who have participated in the program(s).

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 ($380,000 agricultural and $135,000 residential). Coupling the number of BMPs processed historically and estimates provided by the SWCDs and Steering Committee, two agricultural FTE per year and two residential FTE per year are needed during implementation. For Stage I, the residential FTE was divided between OSDS (80%) and pet waste management program and residential BMPs (20%) resulting in 1.6 FTE per year for OSDS and 0.4 FTE per year for pet waste management program and residential BMPs technical assistance, respectively (Tables 9 through 10). One residential FTE per year was estimated for pet waste management program and residential BMPs technical assistance during Stage II.

Cost Analysis

Associated cost estimations for each implementation action were calculated by multiplying the average unit cost (Table 6) per the number of units shown in Tables 9 to 12. Tables 13 and 14 list installation and technical assistance costs to implement agricultural and residential programs for implementation Stages I and II in all impairments combined. Focusing on Stage I, the total average installation cost for livestock exclusion systems and improved pasture management is $14.3 million. The total installation cost for planting cover crops, converting cropland to permanent vegetative cover and forest, incorporating manure, and installing animal waste control facilities is estimated at $0.5 million. Accordingly, total agricultural corrective action costs equal $14.8 million. Estimated corrective action costs needed to replace straight pipes and fix failing septic systems totals $9.3 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 $0.4 million.

It was determined by the CSWCD, TJSWCD, VADEQ, VDH, GWG, and Steering Committee members that it would require $60,000 to support one technical FTE per year. The total cost to provide assistance in the agricultural and residential programs during Stage I implementation are expected to be both equal to $1.4 million (Table 27). The total Stage I implementation cost including technical assistance is $27.4 million with the agricultural cost being $16.2 million and residential cost $11.2 million (Table 27). The total costs to provide assistance in the agricultural and residential programs during Stage II implementation are expected to be equal to $0.4 million and $0.2 million, respectively. The total Stage II implementation cost including technical assistance is $12.4 million with the agricultural cost being $12.0 million and residential cost $0.4 million (Table 27).

Table 13. Implementation cost for control measures installed addressing livestock access, pasture, and cropland bacteria load reductions in all impairments.

Control Measure	Livestock Exclusion, Pasture, and Cropland Cost ($)										Total Cost ($)
	Garth Run	Rippin Run	Marsh Run	Blue Run	Beautiful Run	Poplar Run	UT to Rapidan River #1	UT to Rapidan River #2	Rapidan River #1	Rapidan River #2	
Livestock Exclusion System (CREP)	18,000	72,000	72,000	234,000	108,000	72,000	18,000	18,000	90,000	414,000	**1,116,000**
Livestock Exclusion System (EQIP)	0	15,000	30,000	90,000	45,000	30,000	0	0	30,000	165,000	**405,000**
Stream Exclusion with Grazing Land Management (SL-6/6T, and LE-1T)	70,000	245,000	315,000	1,260,000	560,000	385,000	70,000	70,000	455,000	2,135,000	**5,565,000**
Small Acreage Grazing System (SL-6AT)	9,000	0	0	18,000	0	9,000	0	0	0	18,000	**54,000**
Livestock Exclusion with Reduced Setback (LE-2/2T)	12,000	24,000	36,000	132,000	60,000	36,000	0	12,000	48,000	240,000	**600,000**
Stream Protection (WP-2/2T)	0	0	2,500	5,000	2,500	2,500	0	0	2,500	10,000	**25,000**
Improved Pasture Management	58,600	490,400	372,200	1,321,000	1,062,600	376,700	127,200	333,000	807,200	3,195,700	**8,144,600**
Sediment Retention, Erosion, or Water Control Structure (WP-1)	53,900	659,500	412,400	1,532,100	1,400,700	387,200	181,000	491,600	1,064,000	3,791,500	**9,973,900**
Cover Crops (SL-8)	300	11,400	4,000	12,500	22,500	8,100	300	13,600	19,100	71,400	**163,200**
Permanent Vegetative Cover on Cropland (SL-1)	0	700	3,500	1,800	700	700	0	700	3,500	3,500	**15,100**
Aforestation of Crop, Hay and Pastureland (FR-1)	0	900	4,500	2,300	900	900	0	900	4,500	4,500	**19,400**
Manure / Litter Incorporation into Soil	200	1,300	2,600	6,800	1,300	1,300	200	1,300	2,500	5,000	**22,500**
Poultry Litter Shed	0	0	0	0	38,000	0	0	0	0	38,000	**76,000**
Dry manure storage facility	0	0	0	50,000	50,000	0	0	0	0	0	**100,000**
Liquid manure storage facility	0	0	0	0	75,000	0	0	75,000	0	0	**150,000**
Total Agricultural Installation Cost	**222,000**	**1,520,200**	**1,254,700**	**4,665,500**	**3,427,200**	**1,309,400**	**396,700**	**1,016,100**	**2,526,300**	**10,091,600**	**26,429,700**
Total Agricultural Technical Assistance Cost	**180,000**	**180,000**	**180,000**	**180,000**	**180,000**	**180,000**	**180,000**	**180,000**	**180,000**	**180,000**	**1,800,000**
TOTAL AGRICULTURAL COST	**402,000**	**1,700,200**	**1,434,700**	**4,845,500**	**3,607,200**	**1,489,400**	**576,700**	**1,196,100**	**2,706,300**	**10,271,600**	**28,229,700**

Table 14. Implementation cost for control measures installed addressing on-site sewage disposal systems, pets, and stormwater bacteria load reductions in all impairments.

Control Measure	On-site Sewage Disposal Systems, Pets, and Stormwater Runoff BMPs Cost ($)										Total Cost ($)
	Garth Run	Rippin Run	Marsh Run	Blue Run	Beautiful Run	Poplar Run	UT to Rapidan River #1	UT to Rapidan River #2	Rapidan River #1	Rapidan River #2	
Septic Tank Pump-out	11,100	43,500	44,100	75,600	48,300	25,500	6,300	14,700	36,000	208,800	513,900
Connection to Public Sewer	0	0	0	0	0	375,000	0	0	0	0	375,000
Septic System Repair	63,000	346,500	332,500	525,000	346,500	129,500	42,000	108,500	280,000	1,564,500	3,738,000
New Conventional Septic System	54,000	228,000	258,000	504,000	306,000	90,000	42,000	90,000	204,000	1,230,000	3,006,000
New Conventional Septic System with Pump	64,000	40,000	40,000	80,000	48,000	16,000	8,000	16,000	32,000	200,000	544,000
Alternative Sewage Disposal System	50,000	75,000	100,000	200,000	125,000	25,000	25,000	25,000	50,000	475,000	1,150,000
Pet waste education program and disposal stations	3,000	3,000	3,000	3,000	3,000	4,500	4,500	3,000	3,000	3,000	33,000
Pet waste digester	100	300	300	800	200	600	200	100	400	1,500	4,500
Confined Canine Unit Waste Treatment System	0	0	12,300	12,300	0	12,300	0	0	12,300	12,300	61,500
Vegetated Buffers	800	2,600	2,600	5,100	1,700	5,100	800	800	2,600	10,200	32,300
Bioretention	7,500	45,000	30,000	45,000	30,000	30,000	7,500	4,500	15,000	150,000	364,500
Infiltration Trench	5,700	22,600	22,600	33,900	11,300	22,600	5,700	3,400	11,300	56,500	195,600
Total Residential Installation Cost	**259,200**	**806,500**	**845,400**	**1,484,700**	**920,000**	**736,100**	**142,000**	**266,000**	**646,600**	**3,911,800**	**10,018,300**
Total Residential Technical Assistance Cost	**162,000**	**162,000**	**162,000**	**162,000**	**162,000**	**162,000**	**162,000**	**162,000**	**162,000**	**162,000**	**1,620,000**
TOTAL COST	**421,200**	**968,500**	**1,007,400**	**1,646,700**	**1,082,000**	**898,100**	**304,000**	**428,000**	**808,600**	**4,073,800**	**11,638,300**

Benefit Analysis

The primary benefit of implementation is cleaner waters in Virginia, where bacteria levels in the Garth Run, Rippin Run, Marsh Run, Blue Run, Beautiful Run, Poplar Run, UT to Rapidan River #1, UT to Rapidan River #2, Rapidan River #1, and Rapidan River #2 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.

In Orange County's Comprehensive Plan, the "thriving equestrian economy" is highlighted, as is the importance of protecting the quality and supply of surface waters and other valuable environmental resources. Madison County contains the headwaters of the Shenandoah National Park, an area visited by many people who add to the local economies. Greene County states in their Comprehensive Plan that they are committed to maintaining clean water not only for the drinking water purposes of citizens but also to preserve the fish habitat and the natural course of waterways both within the county and for communities downstream. Albemarle County, with their objective for "clean and abundant water resources" in their Comprehensive Plan, also recognizes the benefits of healthy stream buffers through their Watershed Protection Ordinance which protects 100-feet buffers along streams, ponds and wetlands to provide protection from erosion and stormwater runoff and offer shading and habitat for aquatic life. With the exception of Greene County, all of these counties have active TMDL implementation projects and are beginning to see the benefits at the individual and community level.

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. VCE 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 for livestock watering, 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.

The benefit of a Stream Exclusion with Grazing Land Management 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.

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 and stream buffer protection, 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.

Expected progress in implementation is established with two types of milestones: *implementation milestones* and *water quality milestones*. Implementation milestones establish the percentage of control measures installed within certain timeframes, while water quality milestones establish the corresponding improvements in water quality that can be expected as the implementation milestones are met.

Progress toward end goals will be assessed during implementation through tracking of control measure installations by CSWCD; TJSWCD; NRCS; VADCR; VADEQ; VDH; RRRC; along with Orange, Madison, Greene and Albemarle Counties. 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. Stage I is based on meeting source allocations that translate to a single sample maximum 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 meeting the specified TMDL load allocation based on single sample maximum and geometric mean water quality standard criteria. 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.

Implementation in years one through 12 for agricultural source reductions focuses on installing livestock stream exclusion systems, improving pasture management, cropland conversion, planting cover crops, manure incorporation, and constructing animal waste storage facilities (Table 15). 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 sediment retention structures (Table 15). Sediment retention structures are more costly and are logistically more difficult to design and locate on individual farms. Implementation in years one through 12 for residential bacteria loads focuses on performing septic tank pump-outs, identifying and removing straight pipes, repairing or replacing failed septic systems, instituting pet waste control education program, and installing pet waste disposal stations, pet waste enzyme digesting composters, confined canine unit waste treatment systems, vegetated buffers, rain gardens, and infiltration

trenches (Table 15). Vegetated buffer, rain garden, and infiltration trench installations are expected to rise over the last three years (Table 15).

Table 16 lists the cumulative progress towards the TMDL endpoint as implementation milestones are met. Based on water quality modeling projections, the impairments would be in a probable position to be de-listed from the Virginia Water Quality Assessment 305(b)/303(d) Integrated Report at the fourth milestone (Table 17). 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. Tables 18 through 27 list implementation cost associated with percentage of practices installed addressing agricultural and residential practices along with technical assistance for individual impairment watersheds. Table 28 lists total implementation cost associated with percentage of practices installed addressing agricultural and residential practices along with technical assistance for the entire Upper Rapidan River watershed.

Table 15. Targeted implementation stages for control measures installation.

Control Measure	Garth Run	Rippin Run	Marsh Run	Blue Run	Beautiful Run	Poplar Run	UT to Rapidan River #1	UT to Rapidan River #2	Rapidan River #1	Rapidan River #2
Livestock Exclusion and Pasture Management										
Livestock Exclusion System (CREP)	I	I	I	I	I	I	I	I	I	I
Livestock Exclusion System (EQIP)	I	I	I	I	I	I	I	I	I	I
Stream Exclusion with Grazing Land Management (SL-6/6T, and LE-1T)	I	I	I	I	I	I	I	I	I	I
Small Acreage Grazing System (SL-6AT)	I	I	I	I	I	I	I	I	I	I
Livestock Exclusion with Reduced Setback (LE-2/2T)	I	I	I	I	I	I	I	I	I	I
Stream Protection (WP-2/2T)	I	I	I	I	I	I	I	I	I	I
Stream Exclusion (CCI-SE-1)	I	I	I	I	I	I	I	I	I	I
Forested Riparian Buffer (CCI-FRB-1)	I	I	I	I	I	I	I	I	I	I
Improved Pasture Management	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II
Sediment Retention, Erosion, or Water Control Structure (WP-1)	II	II	II	II	II	II	II	II	II	II
Cropland										
Permanent Vegetative Cover on Cropland (SL-1)	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II
Aforestation of Crop, Hay and Pastureland (FR-1)	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II
Woodland Buffer Filter Area (FR-3)	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II
Cover Crops (SL-8)	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II
Manure / Litter Incorporation into Soil	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II
Animal Waste Control Facilities (WP-4)	I	I	I	I	I	I	I	I	I	I
Failing Septic Systems and Straight Pipes										
Septic Tank Pump-out (RB-1)	I	I	I	I	I	I	I	I	I	I
Connection to Public Sewer (RB-2)	N/A	N/A	N/A	N/A	N/A	I	N/A	N/A	N/A	N/A
Septic Tank System Repair (RB-3)	I	I	I	I	I	I	I	I	I	I
Septic Tank System Installation/Replacement (RB-4)	I	I	I	I	I	I	I	I	I	I
Septic Tank System Installation/Replacement w/ Pump (RB-4P)	I	I	I	I	I	I	I	I	I	I
Alternative On-site Waste Treatment System (RB-5)	I	I	I	I	I	I	I	I	I	I
Pet Waste Management										
Pet waste education program	I	I	I	I	I	I	I	I	I	I
Disposal Stations (PW-1)	I	I	I	I	I	I	I	I	I	I
Pet waste digesters (PW-2)	I	I	I	I	I	I	I	I	I	I
Confined Canine Unit Waste Treatment System	I	I	I	I	I	I	I	I	I	I
Stormwater Runoff Best Management Practices										
Vegetated Buffer	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II	I & II
Rain Garden	I & II	I & II	I & II	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	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 16. Cumulative implementation of control measures per milestone.

Control Measure	Unit	Progress Since TMDL Study	Milestone 1 Completed by Year 3	Milestone 2 Completed by Year 6	Milestone 3 Completed by Year 9	Milestone 4 Completed by Year 12	Milestone 5 Completed by Year 15
Pasture							
Livestock Exclusion System (CREP)	System[1]	8	5	20	40	62	62
Livestock Exclusion System (EQIP)	System[1]	N/A	4	12	20	27	27
Livestock Exclusion System (Sl-6/6T, LE-1T)	System[1]	8	49	97	136	159	159
Livestock Exclusion System (SL-6AT)	System[1]	N/A	1	4	4	6	6
Livestock Exclusion System (LE-2/2T)	System[1]	N/A	11	26	40	50	50
Livestock Exclusion System (WP-2/2T)	System[1]	N/A	1	6	8	10	10
Stream Exclusion (CCI-SE-1)	Feet	N/A	108,150	216,300	324,450	432,600	432,600
Forested Riparian Buffer (CCI-FRB-1)	Acres - Installed	N/A	87	174	261	348	348
Improved Pasture Management	Acres - Installed	N/A	9,875	19,750	29,625	39,500	49,361
Sediment Retention, Erosion, or Water Control Structure (WP-1)	Acres - Treated	N/A	0	0	0	0	11,464
Cropland							
Permanent Vegetative Cover on Cropland (SL-1)	Acres - Installed	128	9	17	26	34	43
Reforestation of Erodible Crop & Pastureland (FR-1)	Acres - Installed	8	9	17	26	34	43
Cover Crops (SL-8)	Acres - Installed	N/A	653	1,305	1,958	2,611	3,266
Manure Incorporation into Soil	Acres - Treated	N/A	178	357	535	714	892
Animal Waste Storage Facility (WP-4)	System	N/A	2	5	6	6	6
On-site Sewage Disposal Systems							
Septic Tank Pump-out (RB-1)	System	N/A	414	846	1,286	1,713	1,713
Connection to Public Sewer (RB-2)	System	N/A	7	14	22	30	30
Septic System Repair (RB-3)	System	N/A	262	530	799	1,068	1,068
New Conventional Septic System (RB-4)	System	N/A	123	249	377	501	501
New Conventional Septic System with Pump (RB-4P)	System	N/A	14	32	52	68	68
Alternative Sewage Disposal System (RB-5)	System	N/A	8	21	36	46	46
Pet Waste Management							
Pet waste education program	System	N/A	2	4	7	10	10
Pet Waste Disposal Stations (PW-1)	System	N/A	4	10	13	16	16
Pet waste digesters (PW-2)	System	N/A	14	29	55	85	85
Confined Canine Unit Waste Treatment System	System	N/A	1	4	4	5	5
Residential/Urban Best Management Practices							
Vegetated Buffers	Acres - Installed	N/A	16	32	47	63	81
Bioretention	Acres - Treated	N/A	2	5	9	15	24
Infiltration Trench	Acres - Treated	N/A	1	3	6	10	18

[1] System typically includes stream exclusion and cross fencing, water trough, well, distribution piping, and riparian buffer

Table 17. Bacteria standard exceedance rate and average annual *E. coli* bacteria loads for Stage 4 and Stage 5 of implementation.

Impairment	Bacteria Standard Exceedance Rate (%)				Average *E.coli* Bacteria Loads (cfu/yr)		
	Existing Single Sample Maximum Standard	Stage 4 Single Sample Maximum Standard	Existing Geometric Mean Standard	Stage 4 Geometric Mean Standard	WLA	LA	TMDL
Garth Run	48	10	45	3	2.84E+11	2.81E+13	2.84E+13
Rippin Run	38	12	77	3	4.39E+11	4.35E+13	4.39E+13
Marsh Run	37	10	85	5	2.78E+11	2.75E+13	2.78E+13
Blue Run	62	9	100	7	8.48E+11	8.40E+13	8.48E+13
Beautiful Run	52	11	83	3	8.49E+11	8.41E+13	8.49E+13
Poplar Run	30	10	80	3	4.12E+11	4.08E+13	4.12E+13
UT to Rapidan River #1	50	10	95	10	4.40E+10	4.36E+12	4.40E+12
UT to Rapidan River #2	41	12	78	3	1.95E+11	1.93E+13	1.95E+13
Rapidan River #1	36	9	75	2	2.72E+13	6.92E+14	7.19E+14
Rapidan River #2	38	11	77	3	5.40E+12	5.51E+14	5.56E+14

Impairment	Bacteria Standard Exceedance Rate (%)				Average *E.coli* Bacteria Loads (cfu/yr)		
	Existing Single Sample Maximum Standard	Stage 5 Single Sample Maximum Standard	Existing Geometric Mean Standard	Stage 5 Geometric Mean Standard	WLA	LA	TMDL
Garth Run	48	1	45	3	9.63E+09	9.53E+11	9.63E+11
Rippin Run	38	0	77	0	7.99E+11	7.91E+13	7.99E+13
Marsh Run	37	0	85	0	7.78E+10	7.70E+12	7.78E+12
Blue Run	62	1	100	5	1.35E+11	1.34E+13	1.35E+13
Beautiful Run	52	1	83	0	1.49E+11	1.48E+13	1.49E+13
Poplar Run	30	0	80	0	7.04E+10	6.97E+12	7.04E+12
UT to Rapidan River #1	50	1	95	7	1.10E+10	1.09E+12	1.10E+12
UT to Rapidan River #2	41	1	78	0	3.78E+10	3.74E+12	3.78E+12
Rapidan River #1	36	0	75	0	2.72E+13	1.03E+14	1.30E+14
Rapidan River #2	38	0	77	0	5.40E+12	9.09E+13	9.63E+13

Table 18. Implementation cost associated with percentage of practices installed along with technical assistance addressing agricultural and residential needs in the Garth Run watershed 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	3,000	30	12,000	**15,030**	10,100	0	0	12,000	**22,100**	**37,130**
2	3,000	30	12,000	**15,030**	22,200	0	0	12,000	**34,200**	**49,230**
3	40,900	50	12,000	**52,950**	15,900	0	100	12,000	**28,000**	**80,950**
4	3,000	30	12,000	**15,030**	10,100	0	0	12,000	**22,100**	**37,130**
5	3,000	30	12,000	**15,030**	22,200	0	0	12,000	**34,200**	**49,230**
6	40,900	50	12,000	**52,950**	15,900	3,000	100	12,000	**31,000**	**83,950**
7	3,000	30	12,000	**15,030**	10,100	0	0	12,000	**22,100**	**37,130**
8	3,000	30	12,000	**15,030**	18,400	0	0	12,000	**30,400**	**45,430**
9	17,900	50	12,000	**29,950**	41,200	0	100	12,000	**53,300**	**83,250**
10	3,000	30	12,000	**15,030**	35,400	0	0	12,000	**47,400**	**62,430**
11	3,000	30	12,000	**15,030**	18,400	0	2,640	12,000	**33,040**	**48,070**
12	32,900	50	12,000	**44,950**	22,200	50	2,680	12,000	**36,930**	**81,880**
13	20,400	30	12,000	**32,430**	0	0	2,640	6,000	**8,640**	**41,070**
14	21,300	30	12,000	**33,330**	0	0	2,680	6,000	**8,680**	**42,010**
15	23,400	40	12,000	**35,440**	0	0	2,680	6,000	**8,680**	**44,120**
Stage I Total (1-12)	**156,600**	**440**	**144,000**	**301,040**	**242,100**	**3,050**	**5,620**	**144,000**	**394,770**	**695,810**
Stage II Total (13-15)	**65,100**	**100**	**36,000**	**101,200**	**0**	**0**	**8,000**	**18,000**	**26,000**	**127,200**
Total (1-15)	**221,700**	**540**	**180,000**	**402,240**	**242,100**	**3,050**	**13,620**	**162,000**	**420,770**	**823,010**

Table 19. Implementation cost associated with percentage of practices installed along with technical assistance addressing agricultural and residential needs in the Rippin Run watershed 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	59,600	700	12,000	**72,300**	31,600	0	3,100	12,000	**46,700**	**119,000**
2	59,600	700	12,000	**72,300**	63,200	0	3,100	12,000	**78,300**	**150,600**
3	96,000	1,400	12,000	**109,400**	71,500	0	4,300	12,000	**87,800**	**197,200**
4	77,600	700	12,000	**90,300**	56,900	0	4,200	12,000	**73,100**	**163,400**
5	59,600	700	12,000	**72,300**	63,200	0	4,200	12,000	**79,400**	**151,700**
6	111,000	1,400	12,000	**124,400**	71,500	0	4,300	12,000	**87,800**	**212,200**
7	77,600	700	12,000	**90,300**	39,900	3,050	4,200	12,000	**59,150**	**149,450**
8	24,600	700	12,000	**37,300**	82,200	50	4,200	12,000	**98,450**	**135,750**
9	49,000	1,400	12,000	**62,400**	71,500	50	4,300	12,000	**87,850**	**150,250**
10	42,600	700	12,000	**55,300**	31,600	50	4,200	12,000	**47,850**	**103,150**
11	24,600	700	12,000	**37,300**	56,900	50	5,420	12,000	**74,370**	**111,670**
12	67,000	1,400	12,000	**80,400**	93,000	50	5,540	12,000	**110,590**	**190,990**
13	242,100	700	12,000	**254,800**	0	0	5,420	6,000	**11,420**	**266,220**
14	242,100	700	12,000	**254,800**	0	0	5,420	6,000	**11,420**	**266,220**
15	273,000	1,400	12,000	**286,400**	0	0	7,900	6,000	**13,900**	**300,300**
Stage I Total (1-12)	**748,800**	**11,200**	**144,000**	**904,000**	**733,000**	**3,300**	**51,060**	**144,000**	**931,360**	**1,835,360**
Stage II Total (13-15)	**757,200**	**2,800**	**36,000**	**796,000**	**0**	**0**	**18,740**	**18,000**	**36,740**	**832,740**
Total (1-15)	**1,506,000**	**14,000**	**180,000**	**1,700,000**	**733,000**	**3,300**	**69,800**	**162,000**	**968,100**	**2,668,100**

Table 20. Implementation cost associated with percentage of practices installed along with technical assistance addressing agricultural and residential needs in the Marsh Run watershed 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	53,600	700	12,000	**66,300**	31,600	0	100	12,000	**43,700**	**110,000**
2	53,600	700	12,000	**66,300**	59,400	0	100	12,000	**71,500**	**137,800**
3	84,300	1,600	12,000	**97,900**	67,700	0	2,800	12,000	**82,500**	**180,400**
4	74,100	700	12,000	**86,800**	69,500	12,300	2,700	12,000	**96,500**	**183,300**
5	68,600	700	12,000	**81,300**	67,700	0	2,700	12,000	**82,400**	**163,700**
6	84,300	1,600	12,000	**97,900**	93,000	0	2,800	12,000	**107,800**	**205,700**
7	71,600	700	12,000	**84,300**	63,200	50	2,700	12,000	**77,950**	**162,250**
8	68,600	700	12,000	**81,300**	84,700	3,050	2,700	12,000	**102,450**	**183,750**
9	84,300	1,600	12,000	**97,900**	71,500	50	2,800	12,000	**86,350**	**184,250**
10	36,600	700	12,000	**49,300**	39,900	50	2,700	12,000	**54,650**	**103,950**
11	18,600	700	12,000	**31,300**	63,200	50	5,420	12,000	**80,670**	**111,970**
12	55,300	1,600	12,000	**68,900**	63,200	0	5,540	12,000	**80,740**	**149,640**
13	154,300	700	12,000	**167,000**	0	0	5,420	6,000	**11,420**	**178,420**
14	155,200	700	12,000	**167,900**	0	0	5,580	6,000	**11,580**	**179,480**
15	176,700	1,600	12,000	**190,300**	0	0	10,740	6,000	**16,740**	**207,040**
Stage I Total (1-12)	**753,500**	**12,000**	**144,000**	**909,500**	**774,600**	**15,550**	**33,060**	**144,000**	**967,210**	**1,876,710**
Stage II Total (13-15)	**486,200**	**3,000**	**36,000**	**525,200**	**0**	**0**	**21,740**	**18,000**	**39,740**	**564,940**
Total (1-15)	**1,239,700**	**15,000**	**180,000**	**1,434,700**	**774,600**	**15,550**	**54,800**	**162,000**	**1,006,950**	**2,441,650**

Table 21. Implementation cost associated with percentage of practices installed along with technical assistance addressing agricultural and residential needs in the Blue Run watershed 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	183,000	1,100	12,000	**196,100**	61,900	50	200	12,000	**74,150**	**270,250**
2	201,000	1,100	12,000	**214,100**	127,100	50	200	12,000	**139,350**	**353,450**
3	302,200	2,300	12,000	**316,500**	141,000	50	5,800	12,000	**158,850**	**475,350**
4	218,500	1,100	12,000	**231,600**	61,900	50	5,500	12,000	**79,450**	**311,050**
5	210,000	51,100	12,000	**273,100**	134,700	50	5,500	12,000	**152,250**	**425,350**
6	317,200	2,300	12,000	**331,500**	141,000	12,350	5,800	12,000	**171,150**	**502,650**
7	251,000	1,100	12,000	**264,100**	93,500	50	5,500	12,000	**111,050**	**375,150**
8	253,500	1,100	12,000	**266,600**	115,700	50	5,500	12,000	**133,250**	**399,850**
9	250,200	2,100	12,000	**264,300**	174,600	3,050	5,800	12,000	**195,450**	**459,750**
10	190,000	1,100	12,000	**203,100**	68,200	100	5,500	12,000	**85,800**	**288,900**
11	181,000	1,100	12,000	**194,100**	124,000	100	5,540	12,000	**141,640**	**335,740**
12	238,200	2,100	12,000	**252,300**	141,000	100	5,820	12,000	**158,920**	**411,220**
13	571,500	1,100	12,000	**584,600**	0	0	5,540	6,000	**11,540**	**596,140**
14	571,500	1,100	12,000	**584,600**	0	0	5,620	6,000	**11,620**	**596,220**
15	653,400	2,300	12,000	**667,700**	0	0	16,320	6,000	**22,320**	**690,020**
Stage I Total (1-12)	**2,795,800**	**67,600**	**144,000**	**3,007,400**	**1,384,600**	**16,050**	**56,660**	**144,000**	**1,601,310**	**4,608,710**
Stage II Total (13-15)	**1,796,400**	**4,500**	**36,000**	**1,836,900**	**0**	**0**	**27,480**	**18,000**	**45,480**	**1,882,380**
Total (1-15)	**4,592,200**	**72,100**	**180,000**	**4,844,300**	**1,384,600**	**16,050**	**84,140**	**162,000**	**1,646,790**	**6,491,090**

Table 22. Implementation cost associated with percentage of practices installed along with technical assistance addressing agricultural and residential needs in the Beautiful Run watershed 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	123,100	1,200	12,000	**136,300**	37,900	0	100	12,000	**50,000**	**186,300**
2	123,100	51,200	12,000	**186,300**	59,400	0	100	12,000	**71,500**	**257,800**
3	191,300	2,600	12,000	**205,900**	71,500	50	1,700	12,000	**85,250**	**291,150**
4	141,100	76,200	12,000	**229,300**	88,500	0	1,600	12,000	**102,100**	**331,400**
5	102,600	1,200	12,000	**115,800**	71,500	0	1,600	12,000	**85,100**	**200,900**
6	171,300	40,600	12,000	**223,900**	77,800	50	2,800	12,000	**92,650**	**316,550**
7	106,100	1,200	12,000	**119,300**	63,200	0	2,700	12,000	**77,900**	**197,200**
8	115,100	1,200	12,000	**128,300**	94,800	0	2,700	12,000	**109,500**	**237,800**
9	159,300	2,600	12,000	**173,900**	92,400	50	2,800	12,000	**107,250**	**281,150**
10	115,100	1,200	12,000	**128,300**	63,200	3,000	2,700	12,000	**80,900**	**209,200**
11	106,100	1,200	12,000	**119,300**	69,500	0	4,180	12,000	**85,680**	**204,980**
12	171,300	2,600	12,000	**185,900**	84,100	50	4,260	12,000	**100,410**	**286,310**
13	515,100	1,200	12,000	**528,300**	0	0	4,180	6,000	**10,180**	**538,480**
14	515,900	1,200	12,000	**529,100**	0	0	4,260	6,000	**10,260**	**539,360**
15	582,200	2,600	12,000	**596,800**	0	0	7,260	6,000	**13,260**	**610,060**
Stage I Total (1-12)	**1,625,500**	**183,000**	**144,000**	**1,952,500**	**873,800**	**3,200**	**27,240**	**144,000**	**1,048,240**	**3,000,740**
Stage II Total (13-15)	**1,613,200**	**5,000**	**36,000**	**1,654,200**	**0**	**0**	**15,700**	**18,000**	**33,700**	**1,687,900**
Total (1-15)	**3,238,700**	**188,000**	**180,000**	**3,606,700**	**873,800**	**3,200**	**42,940**	**162,000**	**1,081,940**	**4,688,640**

Table 23. Implementation cost associated with percentage of practices installed along with technical assistance addressing agricultural and residential needs in the Poplar Run watershed 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	53,800	500	12,000	**66,300**	39,500	50	200	12,000	**51,750**	**118,050**
2	53,800	500	12,000	**66,300**	57,900	16,850	200	12,000	**86,950**	**153,250**
3	102,600	1,100	12,000	**115,700**	81,400	50	3,100	12,000	**96,550**	**212,250**
4	62,800	500	12,000	**75,300**	47,800	50	2,800	12,000	**62,650**	**137,950**
5	56,300	500	12,000	**68,800**	49,600	50	2,800	12,000	**64,450**	**133,250**
6	102,600	1,100	12,000	**115,700**	59,900	50	3,100	12,000	**75,050**	**190,750**
7	68,800	500	12,000	**81,300**	39,500	50	2,800	12,000	**54,350**	**135,650**
8	53,800	500	12,000	**66,300**	66,200	50	2,800	12,000	**81,050**	**147,350**
9	102,600	1,100	12,000	**115,700**	59,900	50	3,100	12,000	**75,050**	**190,750**
10	68,800	500	12,000	**81,300**	39,500	50	2,800	12,000	**54,350**	**135,650**
11	53,800	500	12,000	**66,300**	59,900	50	5,540	12,000	**77,490**	**143,790**
12	55,600	1,100	12,000	**68,700**	59,900	50	5,820	12,000	**77,770**	**146,470**
13	146,700	500	12,000	**159,200**	0	0	5,540	6,000	**11,540**	**170,740**
14	147,200	500	12,000	**159,700**	0	0	5,620	6,000	**11,620**	**171,320**
15	169,000	1,100	12,000	**182,100**	0	0	11,020	6,000	**17,020**	**199,120**
Stage I Total (1-12)	**835,300**	**8,400**	**144,000**	**987,700**	**661,000**	**17,400**	**35,060**	**144,000**	**857,460**	**1,845,160**
Stage II Total (13-15)	**462,900**	**2,100**	**36,000**	**501,000**	**0**	**0**	**22,180**	**18,000**	**40,180**	**541,180**
Total (1-15)	**1,298,200**	**10,500**	**180,000**	**1,488,700**	**661,000**	**17,400**	**57,240**	**162,000**	**897,640**	**2,386,340**

Table 24. Implementation cost associated with percentage of practices installed along with technical assistance addressing agricultural and residential needs in the UT to Rapidan River #1 watershed 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	6,400	0	12,000	**18,400**	10,100	0	0	12,000	**22,100**	**40,500**
2	6,400	0	12,000	**18,400**	10,100	50	0	12,000	**22,150**	**40,550**
3	47,700	0	12,000	**59,700**	43,700	0	100	12,000	**55,800**	**115,500**
4	6,400	0	12,000	**18,400**	3,800	0	0	12,000	**15,800**	**34,200**
5	6,400	0	12,000	**18,400**	16,400	0	0	12,000	**28,400**	**46,800**
6	47,700	0	12,000	**59,700**	3,800	0	100	12,000	**15,900**	**75,600**
7	6,400	0	12,000	**18,400**	16,400	0	0	12,000	**28,400**	**46,800**
8	24,400	0	12,000	**36,400**	3,800	50	0	12,000	**15,850**	**52,250**
9	12,700	0	12,000	**24,700**	3,800	0	100	12,000	**15,900**	**40,600**
10	6,400	0	12,000	**18,400**	3,800	0	0	12,000	**15,800**	**34,200**
11	6,400	0	12,000	**18,400**	3,800	4,550	2,640	12,000	**22,990**	**41,390**
12	12,700	0	12,000	**24,700**	3,800	0	2,680	12,000	**18,480**	**43,180**
13	66,400	0	12,000	**78,400**	0	0	2,640	6,000	**8,640**	**87,040**
14	66,400	0	12,000	**78,400**	0	0	2,680	6,000	**8,680**	**87,080**
15	72,900	0	12,000	**84,900**	0	0	2,680	6,000	**8,680**	**93,580**
Stage I Total (1-12)	**190,000**	**0**	**144,000**	**334,000**	**123,300**	**4,650**	**5,620**	**144,000**	**277,570**	**611,570**
Stage II Total (13-15)	**205,700**	**0**	**36,000**	**241,700**	**0**	**0**	**8,000**	**18,000**	**26,000**	**267,700**
Total (1-15)	**395,700**	**0**	**180,000**	**575,700**	**123,300**	**4,650**	**13,620**	**162,000**	**303,570**	**879,270**

Table 25. Implementation cost associated with percentage of practices installed along with technical assistance addressing agricultural and residential needs in the UT to Rapidan River #2 watershed 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	16,700	800	12,000	**29,500**	20,200	0	0	12,000	**32,200**	**61,700**
2	51,700	800	12,000	**64,500**	13,900	0	0	12,000	**25,900**	**90,400**
3	45,300	1,700	12,000	**59,000**	24,000	3,000	100	12,000	**39,100**	**98,100**
4	16,700	800	12,000	**29,500**	20,200	0	0	12,000	**32,200**	**61,700**
5	51,700	800	12,000	**64,500**	17,700	0	0	12,000	**29,700**	**94,200**
6	33,300	1,700	12,000	**47,000**	49,300	0	100	12,000	**61,400**	**108,400**
7	16,700	800	12,000	**29,500**	13,900	0	0	12,000	**25,900**	**55,400**
8	16,700	75,800	12,000	**104,500**	26,000	0	0	12,000	**38,000**	**142,500**
9	51,300	1,700	12,000	**65,000**	26,000	0	100	12,000	**38,100**	**103,100**
10	16,700	800	12,000	**29,500**	13,900	50	0	12,000	**25,950**	**55,450**
11	16,700	800	12,000	**29,500**	17,700	0	40	12,000	**29,740**	**59,240**
12	33,300	1,700	12,000	**47,000**	11,400	0	80	12,000	**23,480**	**70,480**
13	178,500	800	12,000	**191,300**	0	0	2,640	6,000	**8,640**	**199,940**
14	179,400	800	12,000	**192,200**	0	0	2,680	6,000	**8,680**	**200,880**
15	200,000	1,700	12,000	**213,700**	0	0	2,680	6,000	**8,680**	**222,380**
Stage I Total (1-12)	**366,800**	**88,200**	**144,000**	**599,000**	**254,200**	**3,050**	**420**	**144,000**	**401,670**	**1,000,670**
Stage II Total (13-15)	**557,900**	**3,300**	**36,000**	**597,200**	**0**	**0**	**8,000**	**18,000**	**26,000**	**623,200**
Total (1-15)	**924,700**	**91,500**	**180,000**	**1,196,200**	**254,200**	**3,050**	**8,420**	**162,000**	**427,670**	**1,623,870**

Table 26. Implementation cost associated with percentage of practices installed along with technical assistance addressing agricultural and residential needs in the Rapidan River #1 watershed 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	75,400	1,500	12,000	**88,900**	21,500	0	100	12,000	**33,600**	**122,500**
2	87,400	1,500	12,000	**100,900**	55,600	0	100	12,000	**67,700**	**168,600**
3	130,700	3,100	12,000	**145,800**	49,300	0	200	12,000	**61,500**	**207,300**
4	122,400	1,500	12,000	**135,900**	21,500	3,000	100	12,000	**36,600**	**172,500**
5	75,400	1,500	12,000	**88,900**	55,600	12,350	100	12,000	**80,050**	**168,950**
6	160,700	3,100	12,000	**175,800**	91,200	50	200	12,000	**103,450**	**279,250**
7	75,400	1,500	12,000	**88,900**	21,500	50	2,700	12,000	**36,250**	**125,150**
8	105,400	1,500	12,000	**118,900**	55,600	50	2,700	12,000	**70,350**	**189,250**
9	133,700	3,100	12,000	**148,800**	89,200	50	2,800	12,000	**104,050**	**252,850**
10	77,900	1,500	12,000	**91,400**	21,500	50	2,700	12,000	**36,250**	**127,650**
11	93,400	1,500	12,000	**106,900**	55,600	50	2,720	12,000	**70,370**	**177,270**
12	133,700	3,100	12,000	**148,800**	63,900	50	2,840	12,000	**78,790**	**227,590**
13	391,900	1,500	12,000	**405,400**	0	0	2,800	6,000	**8,800**	**414,200**
14	391,900	1,500	12,000	**405,400**	0	0	2,800	6,000	**8,800**	**414,200**
15	441,300	3,100	12,000	**456,400**	0	0	5,540	6,000	**11,540**	**467,940**
Stage I Total (1-12)	**1,271,500**	**24,400**	**144,000**	**1,439,900**	**602,000**	**15,700**	**17,260**	**144,000**	**778,960**	**2,218,860**
Stage II Total (13-15)	**1,225,100**	**6,100**	**36,000**	**1,267,200**	**0**	**0**	**11,140**	**18,000**	**29,140**	**1,296,340**
Total (1-15)	**2,496,600**	**30,500**	**180,000**	**2,707,100**	**602,000**	**15,700**	**28,400**	**162,000**	**808,100**	**3,515,200**

Table 27. Implementation cost associated with percentage of practices installed along with technical assistance addressing agricultural and residential needs in the Rapidan River #2 watershed 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	381,700	4,300	12,000	**398,000**	180,200	100	500	12,000	**192,800**	**590,800**
2	417,200	4,300	12,000	**433,500**	320,500	100	500	12,000	**333,100**	**766,600**
3	583,600	46,500	12,000	**642,100**	378,800	100	11,900	12,000	**402,800**	**1,044,900**
4	432,700	4,300	12,000	**449,000**	180,200	100	11,400	12,000	**203,700**	**652,700**
5	447,200	4,300	12,000	**463,500**	338,900	100	11,400	12,000	**362,400**	**825,900**
6	613,600	8,500	12,000	**634,100**	378,800	100	11,900	12,000	**402,800**	**1,036,900**
7	444,700	4,300	12,000	**461,000**	180,200	150	11,400	12,000	**203,750**	**664,750**
8	447,200	4,300	12,000	**463,500**	378,800	150	11,400	12,000	**402,350**	**865,850**
9	552,600	8,500	12,000	**573,100**	378,800	150	11,900	12,000	**402,850**	**975,950**
10	339,700	4,300	12,000	**356,000**	180,200	12,450	11,400	12,000	**216,050**	**572,050**
11	360,200	4,300	12,000	**376,500**	378,800	150	18,920	12,000	**409,870**	**786,370**
12	517,600	8,500	12,000	**538,100**	404,100	3,150	19,240	12,000	**438,490**	**976,590**
13	1,410,800	4,300	12,000	**1,427,100**	0	0	21,220	6,000	**27,220**	**1,454,320**
14	1,411,300	4,300	12,000	**1,427,600**	0	0	21,220	6,000	**27,220**	**1,454,820**
15	1,608,900	8,500	12,000	**1,629,400**	0	0	42,340	6,000	**48,340**	**1,677,740**
Stage I Total (1-12)	**5,538,000**	**106,400**	**144,000**	**5,788,400**	**3,678,300**	**16,800**	**131,860**	**144,000**	**3,970,960**	**9,759,360**
Stage II Total (13-15)	**4,431,000**	**17,100**	**36,000**	**4,484,100**	**0**	**0**	**84,780**	**18,000**	**102,780**	**4,586,880**
Total (1-15)	**9,969,000**	**123,500**	**180,000**	**10,272,500**	**3,678,300**	**16,800**	**216,640**	**162,000**	**4,073,740**	**14,346,240**

Table 28. Implementation cost associated with percentage of practices installed along with technical assistance addressing agricultural and residential needs in the entire Upper Rapidan River watershed 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	956,300	10,830	120,000	**1,087,130**	444,600	200	4,300	120,000	**569,100**	**1,656,230**
2	1,056,800	60,830	120,000	**1,237,630**	789,300	17,050	4,300	120,000	**930,650**	**2,168,280**
3	1,624,600	60,350	120,000	**1,804,950**	944,800	3,250	30,100	120,000	**1,098,150**	**2,903,100**
4	1,155,300	85,830	120,000	**1,361,130**	560,400	15,500	28,300	120,000	**724,200**	**2,085,330**
5	1,080,800	60,830	120,000	**1,261,630**	837,500	12,550	28,300	120,000	**998,350**	**2,259,980**
6	1,682,600	60,350	120,000	**1,862,950**	982,200	15,600	31,200	120,000	**1,149,000**	**3,011,950**
7	1,121,300	10,830	120,000	**1,252,130**	541,400	3,400	32,000	120,000	**696,800**	**1,948,930**
8	1,112,300	85,830	120,000	**1,318,130**	926,200	3,450	32,000	120,000	**1,081,650**	**2,399,780**
9	1,413,600	22,150	120,000	**1,555,750**	1,008,900	3,450	33,800	120,000	**1,166,150**	**2,721,900**
10	896,800	10,830	120,000	**1,027,630**	497,200	15,800	32,000	120,000	**665,000**	**1,692,630**
11	863,800	10,830	120,000	**994,630**	847,800	5,000	53,060	120,000	**1,025,860**	**2,020,490**
12	1,317,600	22,150	120,000	**1,459,750**	946,600	3,500	54,500	120,000	**1,124,600**	**2,584,350**
13	3,697,700	10,830	120,000	**3,828,530**	0	0	58,040	60,000	**118,040**	**3,946,570**
14	3,702,200	10,830	120,000	**3,833,030**	0	0	58,560	60,000	**118,560**	**3,951,590**
15	4,200,800	22,340	120,000	**4,343,140**	0	0	109,160	60,000	**169,160**	**4,512,300**
Stage I Total (1-12)	**14,281,800**	**501,640**	**1,440,000**	**16,223,440**	**9,326,900**	**98,750**	**363,860**	**1,440,000**	**11,229,510**	**27,452,950**
Stage II Total (13-15)	**11,600,700**	**44,000**	**360,000**	**12,004,700**	**0**	**0**	**225,760**	**180,000**	**405,760**	**12,410,460**
Total (1-15)	**25,882,500**	**545,640**	**1,800,000**	**28,228,140**	**9,326,900**	**98,750**	**589,620**	**1,620,000**	**11,635,270**	**39,863,410**

Targeting

The process of staged implementation implies targeting of control measures, ensuring optimum utilization of resources. The impaired watersheds were divided into subwatersheds during TMDL development to aid modeling procedures (Figure 5). These subdivisions were based primarily on homogeneity of land use. Subdivision can be used during implementation to identify localized sources of bacteria and target control measure installation.

In quantifying agricultural BMPs through the use of aerial photography, land use, and stream network Geographic Information System (GIS) layers, maps were formulated showing potential livestock stream access, pastures, and crop fields. Subwatershed priority ranking was established for potential livestock exclusion fencing based on ratio of animal population and estimated length of fencing per subwatershed (Table 29). The maps and prioritization ranking will help identify farm tracts that CSWCD and TJSWCD should concentrate their efforts in. The appropriate district will coordinate with landowners and track BMP installation progress.

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. To assist VDH and district personnel in targeting financial and technical resources, subwatershed priority ranking was established based on total bacteria load from estimated failing septic systems and straight pipes in each watershed (Figures 6 and 7, Table 30). The steps outlined in pet waste BMP stages results in targeting of source type and resources. Significant exposure to rain garden and/or infiltration trench projects would be attained if installed at schools, county administration buildings, or shopping centers in the watershed.

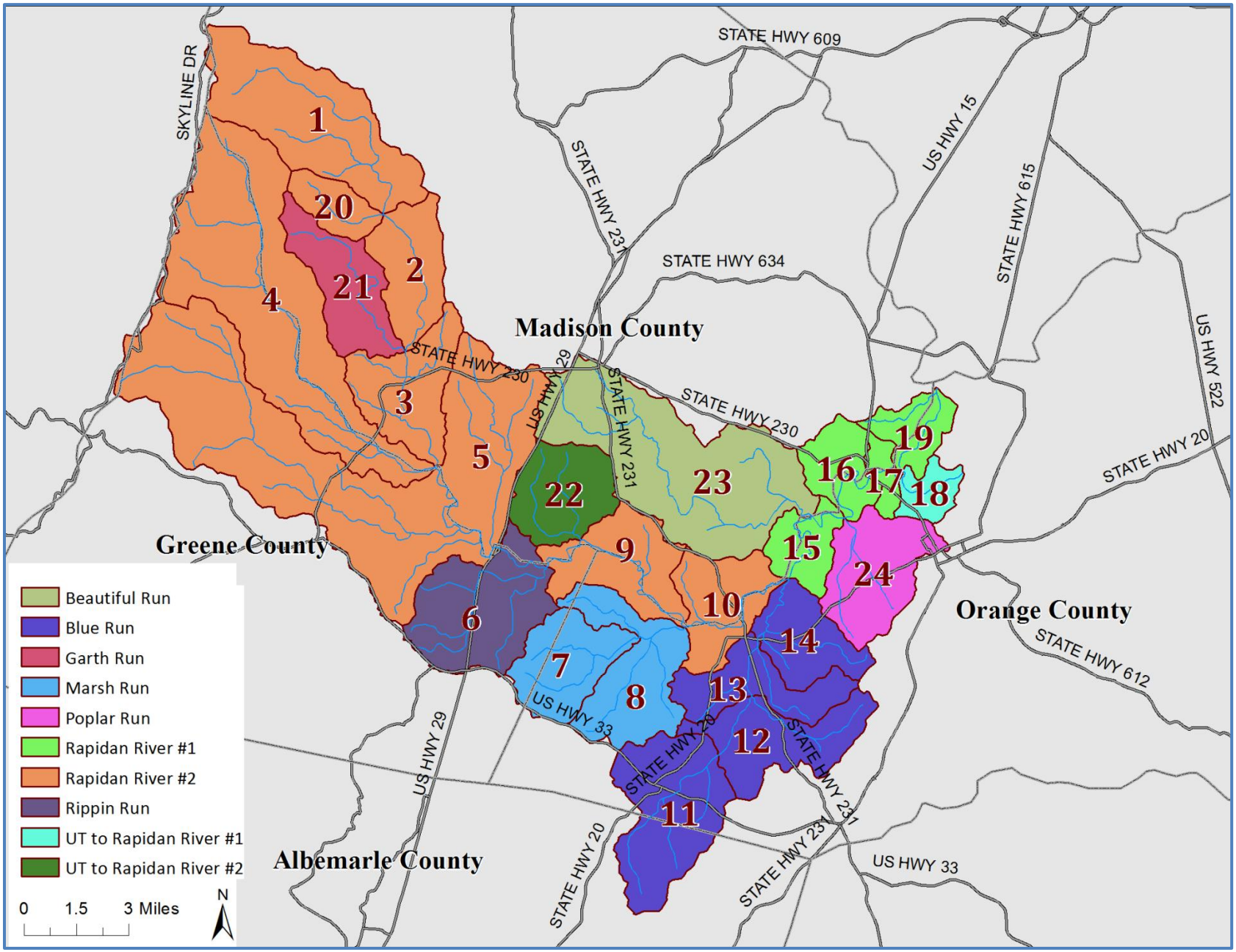

Figure 5. Subwatershed division for impaired watersheds.

Table 29. Subwatershed priority ranking for livestock exclusion fencing installation.

Overall WIP Priority	Subwatershed	Impairment	SWCD Office
1st	5	Rapidan River #2	Culpeper
2nd	23	Beautiful Run	Culpeper
3rd	12	Blue Run	Culpeper
4th	24	Poplar Run	Culpeper
5th	6	Rippin Run	Culpeper
6th	11	Blue Run	Thomas Jefferson, Culpeper
7th	4	Rapidan River #2	Culpeper
8th	13	Blue Run	Culpeper
9th	3	Rapidan River #2	Culpeper
10th	16	Rapidan River #1	Culpeper
11th	9	Rapidan River #2	Culpeper
12th	10	Rapidan River #2	Culpeper
13th	22	UT to Rapidan River #2	Culpeper
14th	8	Marsh Run	Culpeper
15th	15	Rapidan River #1	Culpeper
16th	19	Rapidan River #1	Culpeper
17th	14	Blue Run	Culpeper
18th	1	Rapidan River #2	Culpeper
19th	21	Garth Run	Culpeper
20th	7	Marsh Run	Culpeper
21st	18	UT to Rapidan River #1	Culpeper
22nd	2	Rapidan River #2	Culpeper
23rd	17	Rapidan River #1	Culpeper
24th	20	Rapidan River #2	Culpeper

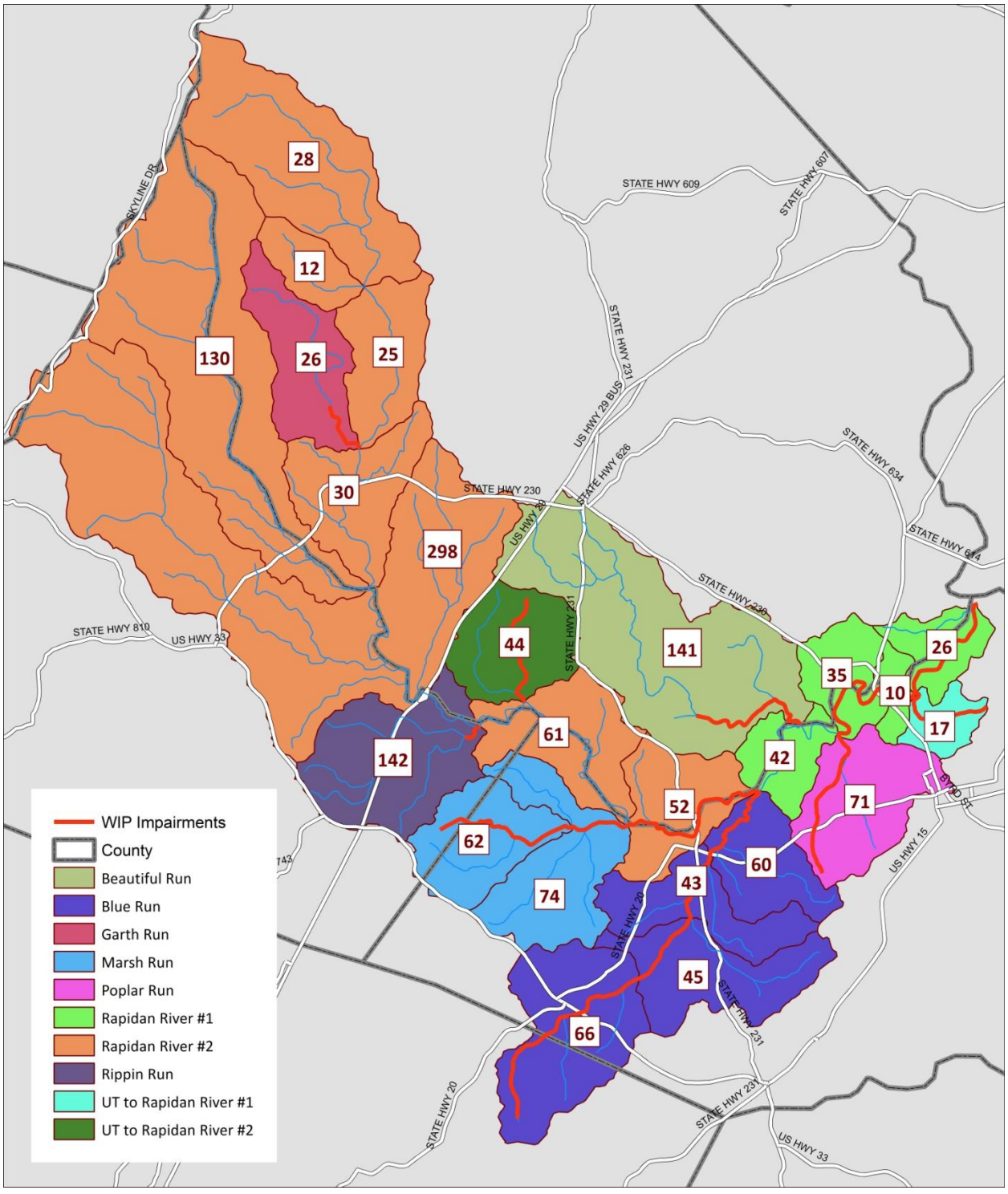

Figure 6. Failed septic system estimates per subwatershed.

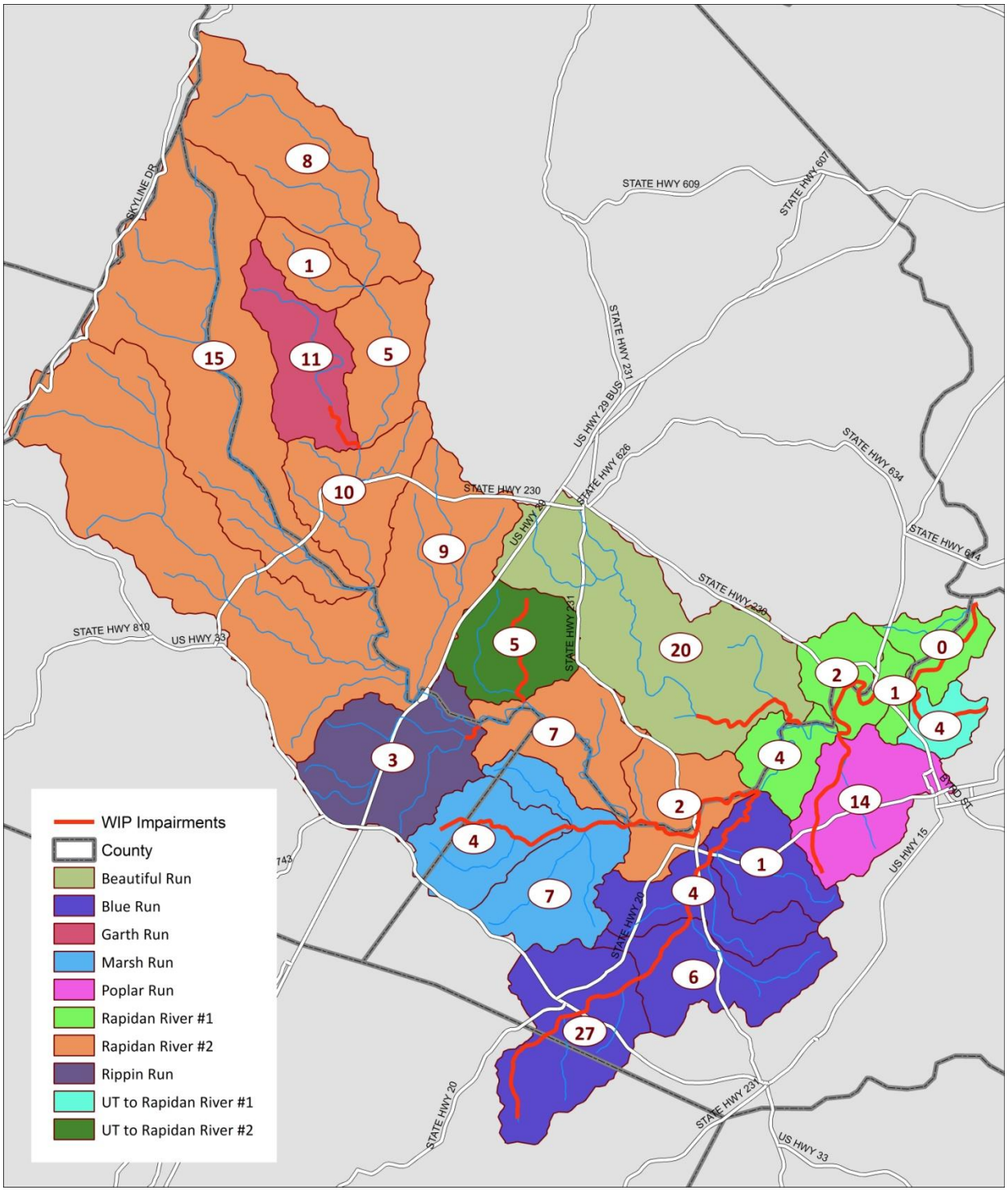

Figure 7. Straight pipe estimates per subwatershed.

Table 30. Subwatershed priority ranking for correcting failing septic systems and replacing straight pipes.

Overall WIP Priority	Subwatershed	Impairment	VDH Office	SWCD Office
1st	23	Beautiful Run	Madison	Culpeper
2nd	11	Blue Run	Albemarle, Orange	Thomas Jefferson, Culpeper
3rd	4	Rapidan River #2	Madison, Greene	Culpeper
4th	5	Rapidan River #2	Greene	Culpeper
5th	24	Poplar Run	Orange	Culpeper
6th	8	Marsh Run	Orange	Culpeper
7th	9	Rapidan River #2	Madison, Orange	Culpeper
8th	6	Rippin Run	Madison, Greene	Culpeper
9th	7	Marsh Run	Greene, Orange	Culpeper
10th	21	Garth Run	Madison	Culpeper
11th	3	Rapidan River #2	Madison	Culpeper
12th	12	Blue Run	Orange	Culpeper
13th	1	Rapidan River #2	Madison	Culpeper
14th	22	UT to Rapidan River #2	Madison	Culpeper
15th	13	Blue Run	Orange	Culpeper
16th	15	Rapidan River #1	Madison, Orange	Culpeper
17th	10	Rapidan River #2	Madison, Orange	Culpeper
18th	14	Blue Run	Orange	Culpeper
19th	2	Rapidan River #2	Madison	Culpeper
20th	18	UT to Rapidan River #1	Orange	Culpeper
21st	16	Rapidan River #1	Madison, Orange	Culpeper
22nd	20	Rapidan River #2	Madison	Culpeper
23rd	19	Rapidan River #1	Madison, Orange	Culpeper
24th	17	Rapidan River #1	Madison, Orange	Culpeper

Water Quality 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 Garth Run, Rippin Run, Marsh Run, Blue Run, Beautiful Run, Poplar Run, UT to Rapidan River #1, UT to Rapidan River #2, Rapidan River #1, and Rapidan River #2 watersheds. Monitoring results are accessible by contacting the VADEQ regional office.

Thirteen VADEQ monitoring stations were utilized to assess water quality in the Garth Run, Rippin Run, Marsh Run, Blue Run, Beautiful Run, Poplar Run, UT to Rapidan River #1, UT to Rapidan River #2, Rapidan River #1, and Rapidan River #2 watersheds (Figure 8). Stations are classified as a "trend station" or "watershed station". 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. Station 3-RAP045.08 on the Rapidan River is a trend station and the remaining stations are watershed stations. Several stations in the watershed were in the 2014 monitoring plan and will continue 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. CSWCD, Old Rag Master Naturalists, Center for Natural Capital, and Shenandoah National Park have conducted physical, chemical, and biological monitoring in the area for some time and could assist with additional monitoring needs during the implementation phase.

The AWG, RWG, 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. Monitoring stations for Garth Run, Rippin Run, Marsh Run, Blue Run, Beautiful Run, Poplar Run, UT to Rapidan River #1, UT to Rapidan River #2, Rapidan River #1, and Rapidan River #2 impairments are listed in Table 31 and Figure 8.

Table 31. Monitoring *sta*tion identification, station location, last sampled, and draft Integrated Report (IR) exceedance rate for VADEQ monitoring stations in the watershed.

Impairment	Station ID	Station Location	Last Sampled	Draft 2014 IR Exceedance Rate
Garth Run	3-GAR000.95	Route 665	Dec. 2012	6 of 11 samples (54%)
Rippin Run	3-RIP000.22	Route 609	Jan. 2011	3 of 11 samples (27%)
Marsh Run	3-MAS001.55	Route 644	Dec. 2012	4 of 11 samples (36%)
Blue Run	3-BLU000.80	Route 641	Dec. 2014	2 of 12 samples (17%)
	3-BLU002.60	Route 20	Dec. 2014	Not included, sampled in 2005
	3-BLU008.33	U.S. Highway 33	Dec. 2014	2 of 5 samples (40%)
Beautiful Run	3-BFL000.90	Route 620	Dec. 2014	4 of 5 samples (80%)
	3-BFL002.90	Route 616	Sep. 2011	5 of 12 samples (42%)
Poplar Run	3-POL000.10	Route 633	Dec. 2012	3 of 10 samples (30%)
UT to Rapidan River #1	3-XBO000.26	Route 621	Dec. 2014	5 of 7 samples (71%)
UT to Rapidan River #2	3-XEZ000.12	Private Road	Dec. 2014	4 of 5 samples (80%)
Rapidan River #1	3-RAP045.08	U.S. Highway 15	Dec. 2014	8 of 32 samples (25%)
Rapidan River #2	3-RAP055.84	Route 231	Dec. 2014	2 of 10 samples (20%)

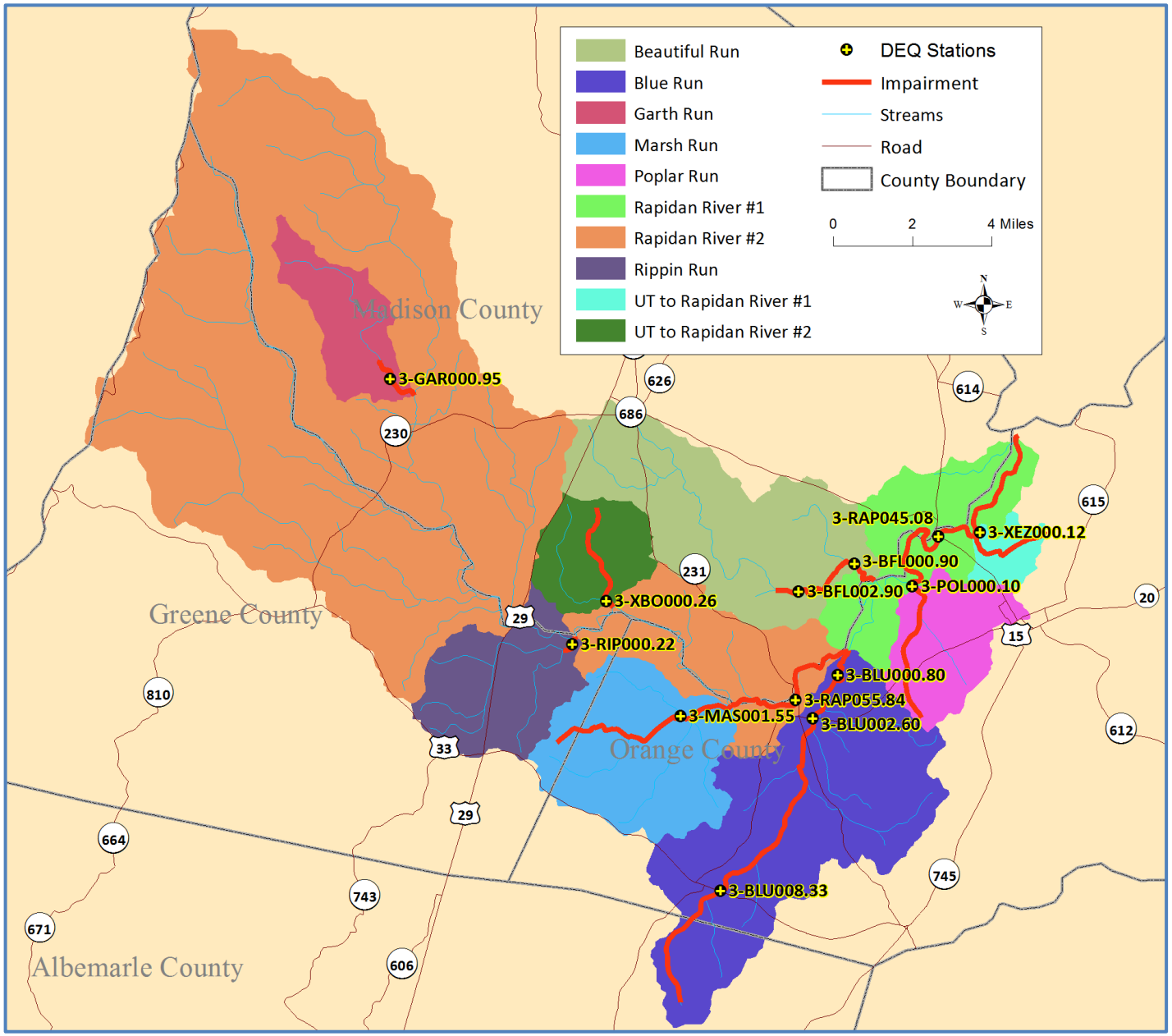

Figure 8. Location of VADEQ monitoring stations in the watersheds.

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

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. CSWCD and TJSWCD will have prominent roles during implementation. CSWCD and TJSWCD will provide cost-share funds, lead education and technical assistance efforts, and track best management practice implementation for the agricultural and residential programs. The RRRC will lead education and outreach efforts, coordinate funding distribution to homeowners, and report best management practice implementation for the pet waste program. Other partners may assist with implementation of educational programs.

In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. State government has the authority to establish state laws that control delivery of pollutants to local waters. Local governments in conjunction with the state can develop ordinances involving pollution prevention measures. In addition, citizens have the right to bring litigation against persons or groups of people who can be shown to be causing some harm to the claimant. Through hearing the claims of citizens in civil court, and the claims of government representatives in criminal court, the judicial branch of government also plays a significant role in the regulation of activities that impact water quality. State agencies conducting regulatory, education, or funding procedures related to water quality in Virginia include: VADEQ, VADCR, VDH, VADACS, VDGIF, VADOF, VCE, and VOF. Governmental, agricultural, residential action items during implementation are included in Tables 32 through 34, respectively. List of acronyms used in tables can be found on page 98.

Table 32. 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,Grants	SWCD, Citizen Volunteers, Shenandoah National Park, Old Rag Master Naturalists, Center for Natural Capital
Local government incentives	Ordinance/code options to improve water quality	Local Government, Grants	Local Government, PDC, SWCD
Inadequate tracking of on-site sewage disposal systems	Develop tracking and reporting system for non-cost shared practices	VDH, Local Government, VADEQ, WQIF	VDH, SWCD

Table 33. 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 34. Residential/urban implementation action items.

Source Issues	Corrective Actions	Potential Funding Source	Who will assist?
Lack of septic system maintenance	Regular maintenance	WQIF, Homeowners, Section 319 Funds	VDH, SWCD, PDC
Septic system failure and/or straight pipes	Septic system repairs, replacement, hook-ups, & maintenance	WQIF, Homeowners, Block Grants, Section 319 Funds	VDH, Local Government, SWCD, PDC, SERCAP
No septic system pump out tracking	Computerized tracking system	VDH	VDH, Local Government, SWCD
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	Realtors, Teachers, VDH, School Groups, Community Interest Groups, PDC, SWCD
No pet waste management	Education, bag stations, composters, structural practices in concentrated canine areas (kennels)	SWCD, WQIF, NFWF grant, Roundtables	Interest Groups, Local Governments, Hunt Clubs, Veterinarians, SPCA, PDC, HOWS
Stormwater runoff BMPs	Targeting locations for runoff reduction BMPs	Grants, VCAP	Citizens, Volunteers, Landowners, SWCD
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	VCAP, Homeowners, Developers, NFWF grant, VADOF, Private Foundations	Local Government, Interest Groups, SWCD
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:

CSWCD and **TJSWCD**: The Culpeper and Thomas Jefferson Soil and Water Conservation Districts are local units of government responsible for the soil and water conservation work within Orange, Madison, Greene, and Albemarle 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.

Orange, Madison, Greene, and Albemarle 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.

FOR (Friends of the Rappahannock): A group of dedicated employees and volunteers committed to environmental advocacy and education and engaged in restoration projects involving the rivers within the Rappahannock River watershed. FOR may assist with educational programs, stormwater installations, and monitoring.

HOWS (Houses of Wood and Straw): Community service project helping to provide more appropriate shelter for dogs kept outside all year long by their owners. The organization and their volunteers provide wooden dog houses, straw, and other assistance to aid these animals in Greene, Orange, and Albemarle Counties. A big part of their program is educating dog owners on their dog's needs. HOWS has agreed to participate in the pet waste educational aspect of this project.

ORMN (Old Rag Master Naturalists): The Old Rag Chapter of the Virginia Master Naturalist program is based in Madison, Virginia and serves the Rapidan–Upper Rappahannock Watershed. The service area includes the counties of Culpeper, Rappahannock, Madison, Greene, Orange, and the western portions of Fauquier. The large geographic area of these counties, rural in nature, includes major natural resources rich in biodiversity. Among these are the headwaters and tributaries of the Rapidan and

Rappahannock Rivers, Shenandoah National Park, and two Virginia Wildlife Management Areas. ORMN is a knowledgeable group of volunteer educators and citizen scientists. ORMN volunteers may participate in a stream monitoring efforts and other educational efforts in the area.

PEC: Piedmont Environmental Council safeguards the landscapes, communities and heritage of the Piedmont by involving citizens in related public policy and land conservation.

Rappahannock-Rapidan Regional Commission: Environmental planning is a long-standing area of emphasis of the RRRC, which is complementary to the TMDL process. RRRC continues to promote efficient development of the environment by assisting and encouraging local governmental agencies to plan for the future. RRRC will support pet waste control measure implementation with assistance from localities and SWCDs. Additionally, RRRC will continue to work with VADEQ and the Steering Committee to periodically revisit implementation progress and suggest plan revisions as needed.

Shenandoah National Park(SNP): SNP encompasses part of the Blue Ridge Mountains in the Virginia. This national park is long and narrow, with the broad Shenandoah River and Valley on the west side, and the rolling hills of the Virginia Piedmont on the east. The headwaters of the Upper Rapidan watershed are in the SNP. Staff from their Air and Water Quality program conduct monitoring and many other natural resource research that not only provide information for the park but also the adjacent communities. SNP will work with partner groups on efforts to provide educational information to the general public.

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 and IPs to USEPA and the SWCB for approval. VADEQ administers Section 319 Program providing funding and technical support for the implementation of NPS components of IPs. 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. Under the Virginia Stormwater Management Program, VADEQ is also 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, as well as the management of some local stormwater programs.

VADCR: Because of the magnitude of the NPS component in the TMDL process, VADCR is an important participant in the TMDL process. 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. Their primary role in the TMDL program is through the implementation of agricultural BMPs and coordination with the 47 SWCDs.

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 Orange, Madison, Greene, and Albemarle Counties Comprehensive Plans
- Madison County Asset Management Plan
- Chesapeake Bay Watershed Implementation Plan
- Robinson River / Little Dark Run, Upper Hazel River, Upper York River, and Moores Creek TMDL Implementation Plans
- Piedmont Environmental Council Strategic Plan
- Trout Unlimited Strategic Plan
- Upper Rapidan Brook Trout Restoration Initiative

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.

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 VADEQ. Detailed description of each funding source (*i.e.*, eligibility requirements, specifications, incentive payments) can be obtained from the CSWCD, TJSWCD, RRRC, VADCR, VDH, VADEQ, VADGIF, VCE, VOF, and NRCS. Table 35 illustrates various financial opportunities that exist from selected cost-share programs for agricultural and residential implementation needs. Sources include:

Federal Funding Sources

Federal Clean Water Act Section 319 Incremental Funds

USEPA develops guidelines that describe the process and criteria to be used to award CWA Section 319 NPS grants to states. States may use up to 20% of the Section 319 incremental funds to develop NPS TMDLs as well as to develop watershed-based plans for Section 303(d) listed waters. The balance of funding can be used for implementing watershed-based plans for waters that have completed TMDLs. Implementation of both agricultural and residential BMPs is eligible. VADCR administers the money, in coordination with the Nonpoint Source Advisory Committee (NPSAC), to fund watershed projects, demonstration and educational programs, nonpoint source pollution control program development, and technical and program staff. VADCR reports annually to the USEPA on the progress made in nonpoint source pollution prevention and control. http://www.epa.gov/owow/nps/319/319stateguide-revised.pdf

USDA Conservation Reserve Enhancement Program (CREP)

In Virginia, this is a partnership program between the USDA and the Commonwealth of Virginia, with the VADCR being the lead state agency. The program uses financial incentives to encourage farmers to enroll in contracts of 10 to 15 years or perpetual easements to remove lands from agricultural production. This program is an "enhancement" of the existing USDA CRP Continuous Sign-up. It has been "enhanced" by increasing the cost-share rates from 50% to 75% and 100%, increasing the rental rates, and offering a flat rate incentive payment to place a permanent "riparian easement" on the enrolled area. Pasture and cropland (as defined by USDA) adjacent to streams, intermittent streams, seeps, springs, ponds and sinkholes are eligible to be enrolled. Buffers consisting of native, warm-season grasses on cropland, to mixed hardwood trees on pasture, must be established in widths ranging from the minimum of 30% of the floodplain or 35 feet, whichever is greater, to a maximum average of 300 feet. Cost-sharing (75% - 100%) is available to help pay for fencing to exclude livestock from the riparian buffer, watering facilities, hardwood tree planting, filter strip establishment, and wetland restoration. In addition, a 40% incentive payment upon completion is offered and an average rental rate of $70/acre on stream buffer area for 10-15 years. The State of Virginia will make an additional incentive payment to place a perpetual conservation easement on the enrolled area. The statewide goal is 8,000 acres. The landowner can obtain and complete CREP application forms at the FSA center. The forms are forwarded

to local NRCS and SWCD offices while FSA determines land eligibility. If the land is deemed eligible, NRCS and the local SWCD determine and design appropriate conservation practices. A conservation plan is written, and fieldwork is begun, which completes the conservation practice design phase. FSA then measures CREP acreage, conservation practice contracts are written, and practices are installed. The landowner submits bills for cost-share reimbursement to FSA. Once the landowner completes BMP installation and the practice is approved, FSA and the SWCD make the cost-share payments. The SWCD also pays out the state's one-time, lump sum rental payment. FSA conducts random spot checks throughout the life of the contract, and the agency continues to pay annual rent throughout the contract period. http://www.dcr.virginia.gov/soil_&_water/crep.shtml

USDA Conservation Reserve Program (CRP)

The program offers annual rental payments, incentive payments for certain activities, and cost-share assistance to establish approved cover on cropland. Contract duration is between 10 and 15 years, and cost-share assistance is provided up to 50% of costs. Incentive payments for wetlands hydrology restoration equal 25% of the cost of restoration. Offers are accepted and processed during fixed signup periods that are announced by Farm Service Agency (FSA). All eligible (cropland) offers are ranked using a national ranking process. Payments are based on a per-acre soil rental rate. Cost-share assistance is available to establish the conservation cover of tree or herbaceous vegetation. The per-acre rental rate may not exceed the Commodity Credit Corporation's maximum payment amount, but producers may elect to receive an amount less than the maximum payment rate, which can increase the ranking score. To be eligible for consideration, the following criteria must be met: 1) cropland was planted or considered planted in an agricultural commodity two of the five most recent crop years; and 2) cropland is classified as "highly-erodible" by NRCS. Eligible practices include planting these areas to trees and/or herbaceous vegetation. Application evaluation points can be increased if certain tree species, spacing, and seeding mixtures that maximize wildlife habitats are selected. Land must have been owned or operated by the applicant for at least 12 months prior to the close of the signup period. http://www.nrcs.usda.gov/programs/crp/

USDA Environmental Quality Incentives Program (EQIP)

This program was established in the 1996 Farm Bill to provide a single voluntary conservation program for farmers and landowners to address significant natural resource needs and objectives. Approximately 65% of the EQIP funding for the state of Virginia is directed toward “Priority Areas.” These areas are selected from proposals submitted by a locally led conservation work group. Proposals describe serious and critical environmental needs and concerns of an area or watershed, and the corrective actions they desire to take to address these needs and concerns. The remaining 35% of the funds are directed toward statewide priority concerns of environmental needs. The purposes of the program are achieved through the implementation of an EQIP plan of operation, which includes structural and land management practices on eligible lands. Contracts up to ten years are written with eligible producers. Cost-share of 75%, 25% tax credit, and/or incentive payments are made available to implement one or more eligible conservation practices, such as animal waste management facilities, terraces, filter strips, tree planting, and permanent wildlife habitat. Incentive payments can be made to implement one or more management practices, such as nutrient management, pest management, and grazing land management. http://www.nrcs.usda.gov/programs/eqip/

USDA Agricultural Conservation Easement Program (ACEP)

The program provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. Under the Agricultural Land Easements component, NRCS helps Indian tribes, state and local governments and non-governmental organizations protect working agricultural lands and limit non-agricultural uses of the land. Under the Wetlands Reserve Easements component, NRCS helps to restore, protect and enhance enrolled wetlands.

NRCS provides financial assistance to eligible partners for purchasing Agricultural Land Easements that protect the agricultural use and conservation values of eligible land. In the case of working farms, the program helps farmers and ranchers keep their land in agriculture. The program also protects grazing uses and related conservation values by conserving grassland, including rangeland, pastureland and shrubland. Eligible partners include Indian tribes, state and local governments and non-governmental organizations that have farmland or grassland protection programs. Under the Agricultural Land component, NRCS may contribute up to 50 percent of the fair market value of the agricultural land easement. Where NRCS determines that grasslands of special environmental significance will be protected, NRCS may contribute up to 75 percent of the fair market value of the agricultural land easement.

Through the wetland reserve enrollment options, NRCS may enroll eligible land through:

Permanent Easements – Permanent easements are conservation easements in perpetuity. NRCS pays 100 percent of the easement value for the purchase of the easement. Additionally, NRCS pays between 75 to 100 percent of the restoration costs.

30-year Easements – 30-year easements expire after 30 years. Under 30-year easements, NRCS pays 50 to 75 percent of the easement value for the purchase of the easement. Additionally, NRCS pays between 50 to 75 percent of the restoration costs.

Term Easements - Term easements are easements that are for the maximum duration allowed under applicable State laws. NRCS pays 50 to 75 percent of the easement value for the purchase of the term easement. Additionally, NRCS pays between 50 to 75 percent of the restoration costs.

30-year Contracts – 30-year contracts are only available to enroll acreage owned by Indian tribes, and program payment rates are commensurate with 30-year easements.

For wetland reserve easements, NRCS pays all costs associated with recording the easement in the local land records office, including recording fees, charges for abstracts, survey and appraisal fees, and title insurance.

USDA Regional Conservation Partnership Program (RCPP)

The program promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners. NRCS provides assistance to producers through partnership agreements and through program contracts or easement agreements. RCPP combines the authorities of four former conservation programs – the Agricultural Water Enhancement Program, the Chesapeake Bay Watershed Program, the Cooperative Conservation Partnership Initiative and the Great Lakes Basin Program. Assistance is delivered in accordance with the rules of EQIP, CSP, ACEP and HFRP; and in certain areas the Watershed Operations and Flood Prevention Program. RCPP encourages partners to join in efforts with producers to increase the restoration and sustainable use of soil, water, wildlife and related natural resources on regional or watershed scales. Through RCPP, NRCS and its partners help producers install and maintain conservation activities in selected project areas. Partners leverage RCPP funding in project areas and report on the benefits achieved.

Agricultural or silvicultural producer associations, farmer cooperatives or other groups of producers, state or local governments, American Indian tribes, municipal water treatment entities, water and irrigation districts, conservation-driven nongovernmental organizations and institutions of higher education. Under RCPP, eligible producers and landowners of agricultural land and non-industrial private forestland may enter into conservation program contracts or easement agreements under the framework of a partnership agreement.

U.S. Fish and Wildlife Service Conservation Grants

Funds states to implement conservation projects to protect federally listed threatened or endangered species and species at risk. http://www.fws.gov/grants/state.html

U.S. Fish and Wildlife Service Private Stewardship Program

Funds individuals or groups engaged in local, private, and voluntary conservation efforts to benefit federally listed, proposed, or candidate species, or other at risk species.
http://www.fws.gov/endangered/grants/private_stewardship/index.html

Virginia Funding Sources

Virginia Agricultural Best Management Practices Cost-Share Program

The Program is administered by VADCR to improve water quality in the state's streams, rivers and the Chesapeake Bay. The basis of the program is to encourage the voluntary installation of agricultural best management practices to meet Virginia's NPS pollution water quality objectives. This program is funded by the state Water Quality Improvement Fund (WQIF) and the federal Chesapeake Bay Program Implementation Grant monies through local Soil and Water Conservation Districts (SWCDs). Farmers and landowners are encouraged to use BMPs on their land to better control sediment, nutrient loss, and transportation of pollutants into our waters due to excessive surface flow, erosion, leaching, and inadequate animal waste management. Program participants are recruited by SWCDs based upon those factors, which have a great impact on water quality. The objective is to solve water quality problems by fixing the worst problems first. Cost-share is typically 75% of the actual cost, not to exceed the local maximum. Each practice under the cost-share program has specifications and a lifetime during which the practice must be maintained. http://www.dcr.virginia.gov/sw/costshar.htm.

Virginia Agricultural Best Management Practices Tax Credit Program

The program provides a tax credit for approved agricultural BMPs that are installed to improve water quality in accordance with a conservation plan approved by the local SWCD. The goal of this program is to encourage voluntary installation of BMPs that will address Virginia's NPS pollution water quality objectives. For all taxable years, any individual or corporation engaged in agricultural production for market, who has in place a soil conservation plan approved by the local SWCD, shall be allowed a credit against the tax imposed by Section 58.1-320 of an amount equaling 25% of the first $70,000 expended for agricultural best management practices by the individual. "Agricultural best management practices" are approved measures that will provide a significant improvement to water quality in the state's streams and rivers, and is consistent with other state and federal programs that address agricultural nonpoint source pollution management. Any practice approved by the local SWCD Board shall be completed within the taxable year in which the credit is claimed. The credit shall be allowed only for expenditures made by the taxpayer from funds of his/her own sources. The amount of such credit shall not exceed $17,500 or the total amount of the tax imposed by this program, whichever is less, in the year the project was completed, as certified by the Board. If the amount of the credit exceeds the taxpayer's liability for such taxable year, the excess may be carried over for credit against income taxes in the next five taxable years until the total amount of the tax credit has been taken. This program can be used independently or in conjunction with other cost-share programs on the stake holder's portion of BMP costs. It is also approved for use in supplementing the cost of repairs to streamside fencing. http://www.dcr.virginia.gov/sw/costshar.htm.

Virginia Conservation Assistance Program (VCAP)

The program provides financial reimbursement to property owners installing specific conservation landscaping practices. A plan is first proposed to the District, after which a site visit verifies the projects eligibility, and installation can begin. These practices can be installed in small acreage settings, at the source of stormwater discharges. All non-agricultural property owners in the identified districts are eligible to apply – residential, business, public, and private.

The program provides financial incentives for 11 practices to help non-agricultural landowners reduce their “stormwater footprint” and improve water quality.

Best Management Practices encompass a wide range of complexity, requiring different levels of engineering and construction requirements. Thus those practices that are generally small in scale and/or emphasize vegetative plantings over construction will typically be called “basic,” while practices that require more planning, engineering, and construction will be designated “intermediate” and “advanced” in a rough three-level approach. BMPs classified as "Basic" are Pet Waste Stations, Impervious Surface Removal, and Urban Nutrient Management Planning. BMPs classified as "Intermediate" are Conservation Landscaping, Rain Gardens, Rainwater Harvesting, and Vegetated Stormwater Conveyance. BMPs classified as "Advanced" are Bioretention, Constructed Wetlands, Permeable Pavement, and Green Roofs.

Virginia Water Quality Improvement Fund

This is a permanent, non-reverting fund established by the Commonwealth of Virginia in order to assist local stakeholders in reducing point and nonpoint nutrient loads to surface waters. Eligible organizations include local governments, SWCDs, and individuals. Grants for point sources are administered through VADEQ and grants for nonpoint sources are administered through VADCR. Most WQIF grants provide matching funds on a 50/50 cost-share basis. A request for proposals is distributed annually. Successful applications are listed as draft/public-noticed agreements, and are subjected to a public review period of at least 30 days. Information is available at http://www.dcr.virginia.gov/sw/wqia.htm.

Virginia Forest Stewardship Program

The program is administered by the VADOF to protect soil, water, and wildlife and to provide sustainable forest products and recreation. www.dof.virginia.gov/forms/resources/127.doc

Virginia Small Business Environmental Compliance Assistance Fund

The program provides financial assistance to small businesses by providing loans to small businesses for the purchase and installation of environmental pollution control equipment, equipment to implement voluntary pollution prevention measures, or equipment and structures to implement agricultural BMPs certified as eligible by VADCR. Interest rates are fixed at 3%, and the maximum loan available is $100,000. There is a $30 non-refundable application processing fee. The program will not be used to make loans to small businesses for the purchase and installation of equipment needed to comply with an enforcement action. To be eligible for assistance, a business must employ 100 or fewer people and be classified as a small business under the federal Small Business Act.
http://www.dba.state.va.us/financing/programs/small.asp

Virginia Clean Water Revolving Loan Programs

The Virginia Clean Water Revolving Loan Fund (VCWRLF), previously known as the Virginia Revolving Loan Fund, was created in 1987. The Department of Environmental Quality, on behalf of the State Water Control Board (SWCB), manages the VCWRLF, administering the policy aspects of the Fund, receiving applications and providing funding recommendations to the SWCB. The Virginia Resources Authority

(VRA) serves as the financial manager of the Fund. Initially, the VCWRLF included a single program which was established to provide financial assistance in the form of low-interest loans to local governments for needed improvements at publicly-owned wastewater treatment facilities and/or collection systems. In 1999, 2001 and 2003 the scope of VCWRLF activity was expanded by the State Water Control Board and DEQ implemented additional programs to provide low interest loans related to agricultural and other non-point source water quality issues. The following loan programs are now operated within the Virginia Clean Water Revolving Loan Fund. http://www.deq.state.va.us/cap/wwovrvew.html

Virginia Outdoors Foundation

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. Conservation incentives include the Purchase of Development Rights program, tax credits that can be sold to any Virginia tax payer, and 100% reimbursement for legal, accounting, appraisal fees, etc.

Virginia Trees for Clean Water

The USFS Chesapeake Watershed Forestry Program provides grant funding to improve water quality in the Chesapeake Bay by creating and supporting long-term and sustained tree canopy cover. Citizen groups, educational institutions, private citizens and local governments within the Chesapeake Bay watershed are encouraged to apply for grants under the "Virginia Trees for Clean Water" program. Grants are awarded through this program for planting riparian buffers or trees in neighborhoods and communities. The goal of the program is to plant trees that restore and improve the waters of the Chesapeake Bay for the benefit of current and future citizens of the Commonwealth. Types of eligible projects include riparian buffer tree planting as well as community and neighborhood tree plantings. Successful proposals will demonstrate "on-the-ground accomplishments" to obtain clean water in the Chesapeake Bay; the merit of the project and how the trees will be maintained in perpetuity. Funding is available on a 50/50 match basis. In-kind match, including volunteer time, is permissible.

Community Development Block Grant Program (HUD/CDBG)

The Community Development Block Grant (CDBG) program is a flexible program that provides communities with resources to address a wide range of unique community development needs. Beginning in 1974, the CDBG program is one of the longest continuously run programs at HUD. The CDBG program provides annual grants on a formula basis to 1180 general units of local government and States. http://www.hud.gov/offices/cpd/communitydevelopment/programs/

Regional Funding Sources

Southeast Rural Community Assistance Project (Southeast RCAP)

The mission of this project is to promote, cultivate, and encourage the development of water and wastewater facilities to serve low-income residents at affordable costs and to support other development activities that will improve the quality of life in rural areas. Staff members of other community organizations complement the Southeast RCAP central office staff across the region. They can provide (at no cost to a community): on-site technical assistance and consultation, operation and maintenance/management assistance, training, education, facilitation, volunteers, and financial assistance. Financial assistance includes $1,500 toward repair/replacement/installation of a septic system and $2,000 toward repair/replacement/installation of an alternative waste treatment system. Funding is only available for families making less than 125% of the federal poverty level. The federal poverty threshold for a family of four is $18,850. http://www.sercap.org

National Fish and Wildlife Foundation

Private, non-profit 501c(3) tax-exempt organization that fosters cooperative partnerships to conserve wildlife, plants, and the habitats on which they depend. A General Challenge Grants Program and a Special Grants Program are offered. Grants are available to federal, state, and local governments, educational institutions, and non-profit organizations through General Challenge Grants. Of particular interest are the Chesapeake Bay Small Watershed Grants Program, Innovative Nutrient and Sediment Reduction Program, and Chesapeake Targeted Watershed Grants Program. Offers are accepted throughout the year and processed during fixed signup periods. The signup periods are on a year-round, revolving basis, and there are two decision cycles per year. Each cycle consists of a pre-proposal evaluation, full proposal evaluation, and a Board of Directors decision. An approved pre-proposal is a pre-requisite to the submittal of the full proposal. Grants generally range between $10,000 and $150,000. Payments are based on need. Projects are funded in the U.S., and any international areas that host migratory wildlife from the U.S., marine animals, or endangered species. Grants are awarded for the purpose of conserving fish, wildlife, plants, and their habitats. If the project does not fall into the criteria of any special grant programs, the proposal may be submitted as a general grant if it falls under the following guidelines: 1) it promotes fish, wildlife and habitat conservation, 2) it involves other conservation and community interests, 3) leverages available funding, and 4) evaluates project outcomes. A pre-proposal that is not accepted by a special grant program may be deferred to the general grant program. http://www.nfwf.org/programs/grant_apply.htm

Skyline Community Action Partnership

The mission of Skyline CAP, Inc. is to give a hand up to those in need through actions promoting self-sufficiency. The partnership seeks to alleviate the impact of poverty in three-county service area of Orange, Madison, and Greene counties in central Virginia through programs focusing on education, affordable housing, and housing stability. Home Repair services are provided to owner-occupied dwellings that are in need of basic health and safety repairs. Priority is given to seniors and persons with disabilities. Repairs can also include modifications for handicap accessibility. Through partnerships, Skyline can also assist with homes that have no water or wastewater system or have a system that is failing or does not meet basic standards.

Trout Unlimited

A non-profit organization dedicated to the conservation of freshwater streams, rivers, and associated upland habitats for trout, salmon, other aquatic species, and people. Local chapter activities typically include stream restoration, education programs such as "Trout in the Classroom," and group activities. Stream restoration can include such things as removal of encroaching species of plant from stream banks, construction of retaining walls to prevent river erosion due to human use, and construction of weirs or small water breaks to provide trout habitat where none existed before.

Center for Natural Capital

The Center for Natural Capital creates grassroots programs and projects to link our economy with nature throughout the mid-Atlantic region of North America. The Center's mission is to create, optimize, and integrate natural capital solutions into the marketplace. Natural capital is viewed for more than its intrinsic value, and engage the power of entrepreneurism to improve our ecosystems and our economy. The primary channels of The Center for Natural Capital (CNC) are Energy, Rivers,Landscape, People, and the unlimited points of intersection among them.

Table 35. 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	16,200	1,800
	EQIP	System	75%	11,250	3,750
	SL-6	System	80%	28,400	7,100
Small Acreage Grazing System with 35 ft setback	SL-6A	System	50%	4,500	4,500
Livestock exclusion with 10 ft setback	LE-2	System	50%	6,000	6,000
Stream Protection	WP-2	System	75%	1,875	625
Pasture and hayland re-planting	512	Acres	$165/ac	165	130
Prescribed grazing	528	Acres	$30/ac	30	40
Stream exclusion	CCI-SE-1	Feet	$1/ft	1	0
Forested riparian buffer	CCI-FRB-1	Acre	$100/ac	100	0
Animal waste control facilities	WP-4	System	75% (NTE $70,000)	70,000	30,000
Permanent vegetative cover on cropland	SL-1	Acres	75% + $35/ac incentive	298	52
Aforestation of crop, hay and pastureland	FR-1	Acres	$25/ac	25	425
Woodland buffer filter area	FR-3	Acres	$100/ac	100	350
Cover crops	SL-8B	Acres	$40/acre	40	10
Grazing land management	SL-9	System	50%	5,000	5,000
Manure / biosolids soil incorporation	N/A	Acres	N/A	0	25
Retention ponds	N/A	Acres[2]	N/A	0	150
Septic Tank Pump-out	RB-1	System	50%	150	150
Connection to Public Sewer	RB-2	System	75% - 50%	7,500 – 5,000	2,500 - 5,000
Septic Tank System Repair	RB-3	System	75% - 50%	2,625 – 1,750	875 - 1,750
Septic Tank System Installation / Replacement	RB-4	System	75% - 50%	4,500 – 3,000	1,500 - 3,000
Septic Tank System Installation / Replacement w/ Pump	RB-4P	System	75% - 50%	6,000 – 4,000	2,000 - 4,000
Alternative On-site Waste Treatment System	RB-5	System	75% - 50%	18,750 – 12,500	6,250 - 12,500
Pet waste disposal station	PW-1	System	75%	375	125
Pet waste digester	PW-2	System	75%	37	13
Confined Canine Unit Waste Treatment System	N/A	System	N/A	0	20,000
Confined Canine Unit Dry Stacking/Composter System	N/A	System	N/A	0	4,600
Vegetated Buffers	N/A	Acres[2]	N/A	0	400
Bioretention	N/A	Acres[3]	N/A	0	15,000
Infiltration Trench	N/A	Acres[3]	N/A	0	11,300

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

LIST OF ACRONYMS

ACEP	Agricultural Conservation Easement Program
AWG	Agricultural Working Group
BMP	Best Management Practice
BRES	Blue Ridge Environmental Solutions, Inc.
CCU	Confined Canine Unit
CREP	Conservation Reserve and Enhancement Program
CRP	Conservation Reserve Program
CSWCD	Culpeper Soil and Water Conservation District
CWA	Clean Water Act
EQIP	Environmental Quality Incentive Program
FSA	Farm Service Agency
FTE	Full Time Equivalent
GWG	Government Working Group
HOA	Homeowners Association
IP	Implementation Plan
LID	Low Impact Development
NFWF	National Fish and Wildlife Foundation
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
NWBD	National Watershed Boundary Dataset
OSDS	On-Site Sewage Disposal System
PDC	Planning District Commission
RCPP	Regional Conservation Partnership Program
RRRC	Rappahannock- Rapidan Regional Commission
RWG	Residential Working Group
SWCB	State Water Control Board
TJSWCD	Thomas Jefferson Soil and Water Conservation District
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
WQIF	Water Quality Improvement Fund
WQMIRA	Water Quality Monitoring, Information and Restoration Act

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.

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

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

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

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

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.

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

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.

Fecal coliform - A 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.

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.

HSPF (Hydrological Simulation Program-Fortran) - A computer-based model that calculates runoff, sediment yield, and fate and transport of various pollutants to the stream. The model was developed under the direction of the U.S. Environmental Protection Agency (EPA).

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

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

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

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

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

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

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

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

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

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

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.

Single Sample Maximum Water Quality Standard - is the value of the water quality standard that should not be exceeded at any time. For example, the Virginia single sample maximum 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.

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

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

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.

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

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

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

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

APPENDIX A

Agricultural & Residential Working Groups Meeting Notes

Agricultural & Residential Working Group #1 Summary
January 28, 2015
Town of Orange Public Works; Orange, VA

Meeting Attendees

Grant Christie, citizen
Patti Christie, citizen
Cynthia DeCanis, citizen
Debbie Manzari, citizen (Residential)
Barabara Miller, citizen
Dave Miller, citizen
Kyle Ashmun, Ecosystem Services (Ag)
Cynthia Bowman, Orange Farm Service Agency (Ag)
Michael Collins, Center for Natural Capital
David Holtzman, Piedmont Environmental Council
Greg Wichens, Culpeper Soil and Water Conservation District
Henny Calloway, Culpeper Soil and Water Conservation District
Spencer Yager, Culpeper Soil and Water Conservation District (Ag)
Charlie Lunsford, Department of Environmental Quality
Rebecca Shoemaker, Department of Environmental Quality
May Sligh, Department of Environmental Quality
Bryant Thomas, Department of Environmental Quality
Byron Petrauskas, Blue Ridge Environmental Solutions
Jenny Biche´, Rappahannock-Rapidan Regional Commission
Michelle Edwards, Rappahannock-Rapidan Regional Commission

Welcome, Introduction, and Presentation

The meeting began at 6 PM. Rappahannock-Rapidan Regional Commission Planner Michelle Edwards welcomed attendees and introduced May Sligh, DEQ. Byron Petrauskas, Blue Ridge Environmental Solutions, presented an overview of the TMDL study, and May delivered a presentation on the public process for development of the Implementation Plan. Greg Wichelns, Culpeper Soil and Water Conservation District, also summarized the implementation successes that have occurred in surrounding watersheds. The PowerPoint presentations and map of impaired segments are available at

http://www.deq.virginia.gov/programs/water/waterqualityinformationtmdls/tmdl/tmdlimplementation/tmdlimplementationprogress.aspx.

Working Group Session

The residential and agriculture working group sessions were combined and began after the formal presentations. Discussion questions and participant feedback that followed included*:*

Are there any other bacteria sources, besides what is listed in TMDL study?

- No, there is no industry in the area.

What is the local perception regarding the presence of straight pipes, failing septic system, and failing on-site sewage disposal systems, sewered areas in the local watershed (s)?

- No response

Are there problems? Know areas with poor soils?

- No areas with poor soils are known.

How significant is the horse population?

- It is spotty at best.
- There are a couple of thoroughbred retirement and rescue facilities.

What would be the best ways to outreach to local citizens about grant funds for agriculture BMPs?

- Post flyers at the farmer co-op, Lowe's and Tractor Supply stores
- One-on-one basis
- Focus on portions of the watershed where the impairments are located
- The Center for Natural Capital has a crowd funding platform (*Crowdfunding is the practice of funding a project or venture by raising monetary contributions from a large number of people, typically via the internet)* that can be utilized, but the Center would need to be reimbursed for its efforts

What is the public perception about pets/dogs being a bacteria source?

- Pet waste is not seen as a problem
- The area is mostly rural; one dog on 200 acres is not really a problem

Are there hunt clubs, dog kennels, veterinary hospitals, boarding facilities that should be considered as potential sources?

- There is a kennel in Orange and a Chesapeake Bay retriever kennel adjacent to the Rapidan River; there may be other kennel/dog breeders in the watershed
- There are hunt clubs; contacting fox hunters was suggested

Is there any need of local pet waste ordinances?

- A comment was made that there is not a need for pet waste ordinances
- Many participants were unsure of whether there were existing ordinances and thus whether there was a need

Are there opportunities to improve stream buffers in the area? Do you know of specific areas where this may be possible?

- Lack of forested floodplain is a significant issue, and there is an opportunity to work with landowners to establish forested buffers
- The biggest issue is stream bank erosion, but stream fencing alone does not help; instead need stream buffers. The cost-shared practices for stream fencing offered through federal and state programs require vegetated buffers or forest buffers with various width requirements.
- Need to provide landowners with longer than CREP's 15-year funding in order to provide enough incentive
- Need to get Department of Forestry and Virginia Outdoors Foundation involved in the planning process if reforestation or conservation easements are discussed.

Agricultural & Residential Working Group #2 Summary
January 29, 2015
PVCC Eugene Giuseppe Center; Stanardsville, VA

Attendance

David Holtzman, Piedmont Environmental Council
Charlie Lunsford, DEQ
B. Bowman, citizen
Jane Dalton, citizen (Residential)
Kane Kashouty, Reporter
Jeff Green, citizen (Residential)
Tom Call, citizen
Brian Wagner, citizen
Fred Tuck, citizen
Davis Lamb, citizen
Kyle Ashmun, citizen (Ag)
Greg Wichens, Culpeper Soil and Water Conservation District
Henny Calloway, Culpeper Soil and Water Conservation District
Spencer Yager, Culpeper Soil and Water Conservation District
Bryant Thomas, Department of Environmental Quality
May Sligh, Department of Environmental Quality
Jen Carlson, Department of Environmental Quality
Byron Petrauskas, Blue Ridge Environmental Solutions
Jenny Biche, Rappahannock-Rapidan Regional Commission
Kate Gibson, Rappahannock-Rapidan Regional Commission

Welcome, Introduction, and Presentation

The meeting began at 6 PM. Rappahannock-Rapidan Regional Commission (RRRC) Planner Jenny Biche welcomed attendees and introduced Byron Petrauskas, Blue Ride Environmental Solutions and May Sligh, DEQ. Presentations were given by the consultant, DEQ and CSWCD staff. The PowerPoint presentations are available at:
http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/TMDL/TMDLImplementation/TMDLImplementationProgress.aspx.

Working Group Session

The working group sessions were combined and began right after the formal presentations. Comments, questions and answers that followed included*:*

Participant Observations:

Regarding septic systems:

In Madison County, residents are aware that there are no-compliant homesteads. This is usually due to financial hardship. A good tool to consider is the GIS system developed a few years ago in Madison County to track the location and ages of homes with septic systems. This is a great tool for targeting outreach to residents of the Upper Rapidan watershed in Madison for educational materials and cost share information regarding repair and replacement of septic systems.

A comment was made that in Madison County, there are many people who don't have enough land for the number of animals they keep, and the land is bare in these places. These residents may not be able to afford adding land. More education on this issue is needed. They also probably do not know about composting horse manure.

Q: On the agricultural side, are there areas to focus on?

A: Half of Madison County—the area between the two existing TMDL areas.

- One-on-one, people telling/asking their neighbors
- Newspaper
- Farmers markets (in Madison & Greene)
- Anonymous tips
- Door hangers
- Animal shelters—good places for education, people picking up new pets

Education is always helpful and always needed.

There are residents who have poultry in their backyard—selling eggs at farmers market. Some do compost chicken manure. (Could work with group of citizens and USDA to develop brochure).

Q: What is the public perception about pets as a source of bacteria?

A: This is not a concern in this area. Stanardsville does have a pet waste station. There may be interest in having more stations in the parks.

Q: Are there any pet waste ordinances?

A: No, there is not a pet waste ordinance in Greene County, but there is a leash law .(In Albemarle County, in addition to a leash law there is a requirement under the Water Resources Protection ordinance that states that pet waste must be prevented from entering storm sewers or natural streams. The requirements in all 4 counties will be further discussed at the Government Working Group meeting.)

Q: Have any control measures recently been installed*?* Are there any existing water quality projects?

A: (No answer was given by participants but it is noted that Agricultural BMPs have been installed throughout the watershed. There have also been river clean-ups led by the Center for Natural Capital, area students and landowners in recent years).

Barboursville Fire Hall was suggested as a possible location for the working group meetings in March. Kyle Ashmun and Fred Tuck agreed to participate in the Steering Committee.

Agricultural & Residential Working Group #3 Summary
April 16, 2015
PVCC Eugene Giuseppe Center; Stanardsvile, VA

Meeting Attendees

Kyle Ashmun, Ecosystem LLC
Jenny Biche', Rappahannock-Rapidan Regional Commission
Robert Bradford, Culpeper Soil and Water Conservation District Director and Orange County farmer
Henny Calloway, Culpeper Soil and Water Conservation District
Ashleigh Cason, Culpeper Soil and Water Conservation District
Michelle Edwards, Rappahannock-Rapidan Regional Commission
Byron Petrauskas, Blue Ridge Environmental Solutions
Robert E. Runkle, Culpeper Soil and Water Conservation District Board and Greene County farmer
Rex Rexrode, National Resources Conservation Service
Rebecca Shoemaker, Virginia Department of Environmental Quality
May Sligh, Virginia Department of Environmental Quality
Alan Spivey, Citizen
Greg Wichelns, Culpeper Soil and Water Conservation District
Spencer Yager, Culpeper Soil and Water Conservation District

Welcome and Introduction

- May Sligh welcomed attendees and distributed handouts

Agricultural Working Group Discussion

Byron Petrauskas provided an overview of practices/programs handout and requested feedback from attendees on the various topics addressed, beginning with land use. Attendees responded with the following comments and questions:

- A lot of hay fields and timber tracts have been converted into crop land over the last five years.
- There has been an increase in poultry farms. Many are new, but some are existing operations that are expanding (i.e. three operations in Orange County).
- There is evidence of intensive horse grazing in the watershed, many new horse rescue organizations where the average ratio of horse per acre is 10 to 1.
- When asked if manure composting and/or rotational grazing practices should be included in the TMDL-IP, attendees stated that some horse managers would use manure composters, but to really make progress, education targeting horse owners is needed. In the past, Virginia Cooperative Extension, Piedmont Environmental Council, Virginia Grasslands and Forage Council, and Soil and Water Conservation Districts have offered educational

programs and hosted events targeting horse owners, but had very little attendance. Virginia Grasslands and Forage Council found that integrating the educational component into an event promoting a well-known horse professional helped reach more horse owners. It was further stated, that any direct outreach to horse owners should be conducted by a professional horse person.

- While many horse farms do not allow horses to have direct access to streams, runoff is a significant issue that needs to be addressed. Little to no buffers exist, the soil is badly compacted exacerbating runoff, and often the manure pile is placed close to tributaries.

- It was recommended that DEQ & DCR partner with state equine organizations such as the Virginia Horse Council. However, it should be noted that many equine organizations are very fragmented; broken down by specific breeds and disciplines (dressage, reining, racing, etc.) and it may be difficult to reach all of them. Both mass outreach from the state-level and local one-on-one grassroots outreach may be needed.

- Many horse owners may not be the highest priority when prioritizing BMP outreach strategies. However, those with very high stocking rates and poor forage management should be targeted.

- Many horse owners do not seem to understand that they are a contributing source of bacteria and may be adding to the stream's bacteria impairment.

- Creative partnerships are an important part of every TMDL IP. Many partnerships currently exist between the various conservation agencies, Virginia Cooperative Extension and producer groups. Virginia Cooperative Extension may be a good partner to assist with outreach to the equine industry. While Virginia Tech does not currently have an Equine Specialist on staff, Extension Agents are quite knowledgeable. Relationships between Extension Agents and horse owners may need to be established, however. Other partnerships with established equine groups could be considered.

- Much of the farmland in the region is leased, both farmland and cropland. It does not impact participation in the cost-share programs, because lessees are eligible provided they have 10-year lease at minimum.

- There are a lot of absentee landowners in the watershed, but there is usually a tenant that can be worked with.

- When asked if there are opportunities in the Upper Rapidan to improve stream buffers, attendees replied that there are, but that not all farmers may be willing to participate in the cost share programs. It was recommended that farmers with no stream buffers be targeted

first with information, focusing on those areas of the stream that are most affected on their property.

- As you move further up the watershed, it becomes harder to get participation with stream buffers, because the farmer loses a lot of land. To address this issue, attendees recommended that much smaller setbacks be required for those areas and that DEQ/DCR consider a no setback BMP for the farmers with many small tributaries needing fencing.

- A discussion began about flash grazing in buffers. This practice had been allowed in the past but is not currently included in the state BMP specification for fencing. Someone stated there had been an abuse of the system in the past - some producers were not closing gates and removing animals from the buffer after flash grazing. When asked if requiring a management plan would help, attendees again reiterated that some farmers would continue to disregard the limited grazing requirements and therefore DCR was very unlikely to approve the flash grazing practice again *(note: the SL-6T, SL-6AT, LE-1T, LE-2T and WP-2T cost shared practices all require a Grazing Plan and Operations and Maintenance plan.)* When staff conducted spot checks, some gates to the exclusion fencing and cross fencing were open and there was very little grazing management being implemented. The end result was that farmers spent the cost-share money but were not complying with the agreements and so the full benefit of the buffer was not being realized in a few isolated situations.

- The Virginia Forage and Grassland Council will be offering a grazing mentoring program that will include the entire state. It will include information on soil retention, nutrient management, electric fencing, definition of flash grazing, etc. It was recommended this information be shared with Soil and Water Conservation Districts and VA Cooperative Extension.

- When asked if there were any suggestions on how to provide outreach to farmers, attendees replied that information is best shared one on one through recognized local government staff with the Soil and Water Conservation District, NRCS and Virginia Cooperative Extension who have experience and knowledge in farming practices and have the existing relationships with producers and producer groups. Visibility is the key and trust is needed.

- A generational shift is occurring where children and grandchildren of farmers, who recognized the damage that poor farming practices create and who helped develop organizations such as Soil and Water Conservation Districts, are not aware of how their farming practices are affecting the soil, water and environment. Many farmers think because they do no-till farming, they do not need to implement other conservation practices.

- When asked if running programs on local television shows like Virginia Farming would be helpful, attendees agreed that it has been done in the past and would be helpful.

- When asked if there are other partnerships missing, the Conservation District referenced all of its current relationships with government agencies and producer groups, including but not limited to Virginia Farm Bureau and the Central Virginia Cattleman's Association. Other grazing groups were suggested for inclusion. The Culpeper SWCD sends an annual mailing to the Farm Bureau's mailing list, and expects to continue this. Attendees also recommended that education and outreach programs be targeted to the Virginia Cooperative Extension, large animal vets, horse owners and farriers.

- Paying the taxes on the cost-share money received was a barrier to one attendee, due to the large bill during the first year until depreciation occurs. Attendees inquired whether a tax credit may be developed if a long-term maintenance agreement was included. An attendee suggested conservation easements as a potential tax credit avenue, while another pointed out that many farmers do not want the paperwork and legal hassle involved*. Currently, there are 60 tax credit BMPs available in the VACS program.*

Attendees were asked to fill out a form ranking agricultural BMPs from 1-7 according to those they felt would be the most helpful practice and what would be the least helpful. They also ranked obstacles to BMP installation. Here are the results:

Ranking of potential best management practices for consideration:

Please rank the practices included in the table below (7 total) with 1 being the highest priority practice (one that you feel is most applicable in the area) and 7 being the very lowest priority (one that you feel is the least applicable to area farms)

Best management practice	**Description**	**Rank (1-7)**
Streamside livestock exclusion fencing	Excluding livestock from streams with fencing, providing alternative water sources or limited access points to the stream	1
Rotational grazing	Establishing a series of grazing paddocks with cross fencing and rotating livestock to maximize forage production while preventing overgrazing	3.6
Forested streamside buffers	Planting trees and shrubs in strips (35 foot minimum) along streams adjacent to pasture and cropland	3.7

Grassed streamside buffers	Planting grasses in strips (35 foot minimum) along streams adjacent to pasture and cropland)	3.7
Forestation of crop, pasture or hayland	Convert existing pasture, crop or hayland to forest (hardwood or conifers)	5.6
Continuous no-till	Cropland is planted and maintained using no-till methods, only effective in reducing bacteria for cropland receiving manure applications (not commercial fertilizer)	5.3
Manure composting/storage facilities (equine) or other animal waste storage facilities (dairy, beef, poultry)	Construction of planned system designed to manage solid equine waste from areas where horses are concentrated either through composting or storage OR animal waste storage lagoons for dairy, beef cattle or poultry	5.1

Ranking of obstacles to streamside livestock exclusion:

In order to address the bacteria problem in the Upper Rapidan River watershed, livestock will have to be excluded from the stream. In order to identify the best way to accomplish this, it's important to understand the obstacles to fencing livestock out. Please rank the following obstacles to fencing livestock out of streams 1-5 with 1 being the most common and relevant obstacle to address and 5 being the least common or relevant obstacle.

Obstacle	**Rank (1-5)**
The cost of installing fencing and off stream water is too high, even with cost share assistance from federal and state programs	3.3
Cannot afford to give up the land for a 35 foot buffer	1.3
General maintenance of fencing is time consuming and expensive	2.9
Grazing land is rented with short term leases and landowners are not interested in installing and/or maintaining streamside fencing and off stream water	4.3
People do not trust the government and do not want to work through state and federal cost share programs to installing fencing systems	4

Other: One write-in mentioned that **tax implications** were his number 1 concern

Byron provided an aerial map of the watershed via PowerPoint presentation showing where exclusion fencing exists and where it is needed. Attendees were asked to review the map and provide comments. A handout was provided listing the costs and estimates of what BMPs are needed for the TMDL-IP. Attendees responded with the following comments and questions:

- Culpeper Soil and Water Conservation District is contracting with the state to verify BMP data from the mid-1990's, and will then be used to update the Chesapeake Bay TMDL model. The data should be available next year and could be incorporated into the Upper Rapidan TMDL-IP.

- When asked if a lot of farms are being sold in the watershed, attendees responded no but some sales are happening. It becomes a problem for cost-share implementation when some of the family members are interested in conservation practices, while others want to sell the farm or subdivide it.

- May pointed out that funding for the TMDL-IP development is not tied to a particular sub-watershed, but to the entire Upper Rapidan watershed. It is important to include recommended practices and quantities by sub-watershed, as is shown in the various tables for both residential and agricultural BMPs, as it may help in targeting where to begin implementation.

- Attendees pointed out that SL-6 will be decreasing once 100% cost-share ends. Byron responded that it will not have a bearing on the TMDL-IP because it will use average costs.

Attendees were asked to send their comments to DEQ after reviewing all of the materials provided at the meeting.

- An inquiry was made as to whether the data shown in the Tables would be used for the TMDL-IP with regard to the various BMP practices, as the 100% cost-share for SL-6 will be reduced to 80% in the future. Byron replied that the current data displayed in the tables would be used for the TMDL-IP's and then adjusted as needed during the implementation phase. Other sources of funding will be researched to help address the 20% reduction, an example being the Krebser Fund which assisted with the Upper Hazel TMDL-IP.

Residential Working Group Discussion

The group reviewed the residential practices and programs handout. May stated that a lot of good information on the residential component was collected at the Government Working Group meeting where staff from the Virginia Department of Health participated. Attendees responded to the list of questions on the handout with the following comments and questions:

- Generally homeowners in the watershed are aware they have a septic system, but while most know that maintenance should be done, they do nothing until they experience a problem. A lot of people do not know that maintenance can extend the life septic systems.

- When asked about the best way to reach homeowners, CSWCD staff recommended going door-to-door and speaking one-on-one. Word-of-mouth in residential subdivisions has been very effective. CSWCD provides educational brochures to the homeowners and distributes the information through various venues (handout was provided). Churches and the Health Department were especially helpful in getting the word out. Information is also printed in local newspapers and signs are displayed at homeowners houses when a cost-share program is being implemented, helping to bring awareness to neighbors and the community. The CSWCD, NRCS and Virginia Cooperative Extension agricultural staff has also been helpful in referring farmers to the residential cost-share programs. In the Upper Hazel IP several septic systems were installed due to information provided by NRCS.

- Many homeowners do not know where their septic tank is, and it can be embarrassing to admit they have a problem. Incentives to help address the problem can help mitigate that.

- Rental properties can be a hot spot for septic issues, because of renters flushing undesirable "flushable" products that are not made for septic systems. Attendees expect to see an increase in failing septic systems in the future due to this issue since disposable products are marketed as being septic system friendly.

- Many homeowners are hesitant to seek help for fear of a VDH violation and possibly opening the door to higher costs if VDH requires substantial repairs.

- It was recommended that a septic tank pump out program not be limited to homes within a certain distance from the stream (*currently pump-outs are <u>not</u> limited to homes within a certain distance of a stream).* It would be difficult to market a pump-out program when half of the audience is ineligible. When homeowners are told they are not eligible, they often tell their friends and neighbors, spreading negative publicity to potentially eligible homeowners. It was recommended that areas near streams be targeted instead of limiting cost-share to these areas.

- Attendees felt there was more of an issue of grey water in the watershed than straight pipes. Examples include horse stables washing horse blankets, homeowners with washers and dryers in the basement below the septic system running grey water to a floor drain.

- It was recommended 100% cost-share be considered for low-income homeowners needing septic systems, particularly those near streams. Partnerships with other agencies, such as

Rural Development, could be developed to make this possible, if DEQ does not want to provide the full 100%.

- There are currently some alternative waste treatment systems attendees were aware of in Orange County, where there are many unbuildable lots with poor soils that don't perk. Attendees felt the systems were fairly new, so were not aware of any maintenance problems but thought it was possible in the future as the systems age.

- When asked about pet waste stations, attendees recommended focusing on kennels and hunt clubs rather than towns and parks. There are many kennels and hunt clubs, including fox hunting, in Orange and Madison counties. Greene and Madison Counties had once required residents with a certain number of dogs to get a kennel license, and would have that data available. A portion of the Town of Orange, which is included in the Upper Rapidan watershed, may also have popular dog walking areas in need of pet waste bag stations.

- HOWS (Houses of Wood and Straw, a non-profit serving confined outdoor dogs with houses and straw in winter), was recommended to assist with outreach for pet waste programs, such as educational brochures and leash bag holders.

- Attendees recommended that pet waste stations be placed at parking lots and entrances to the Shenandoah National Park such as White Oak Canyon and Old Rag.

- Attendees discussed bio-retention, rain gardens and infiltration trenches and recommended they be included in phase 2. It could help address runoff from concentrations of domestic pets (dogs & cats) and serve as an alternative to picking up after ones pet, possibly.

After completing all the questions for the Residential Working Group, Byron asked a few more questions regarding agriculture:

- How prevalent are cover crops? Attendees stated that they are widely used, both traditional and harvestable, and are steadily increasing.

- Which BMPs take up most of CSWCD's time? CSWCD staff replied 100% livestock exclusion and cover crops.

- Attendees also commented that crop farmers growing right up to the edge of the stream, with no grass buffer, is a major issue, although this practice is not necessarily related to bacteria impairments.

APPENDIX B

Governmental Working Group Meeting Notes

Governmental Working Group Meeting Summary
March 31, 2015
Madison County Cooperative Extension Office; Madison, VA

Attendance

Jenny Biche', Rappahannock-Rapidan Regional Commission
Brian Daniel, Madison County
Dwayne Dixon, Madison County Health Department
Michelle Edwards, Rappahannock-Rapidan Regional Commission
Edward Furlow, Virginia Department of Forestry
Alan Mazurowski, Greene County Health Department
Emily Nelson, Thomas Jefferson Soil and Water Conservation District
Byron Petrauskas, Blue Ridge Environmental Solutions
Dan Ratzlaff, Greene County
Rebecca Shoemaker, Virginia Department of Environmental Quality
May Sligh, Virginia Department of Environmental Quality
Greg Wichelns, Culpeper Soil and Water Conservation District
Whitney Wright, Virginia Department of Health
Spencer Yager, Culpeper Soil and Water Conservation District

Welcome / Introductions

May Sligh welcomed attendees and distributed hand outs. Attendees reviewed the Government Working Group Fact Sheet. The discussion then focused on overview of programs/tools in the counties (Madison, Greene, Orange, Albemarle) that address Agriculture, On-site sewage disposal systems/Sewer connections, Pets, Education/Outreach.

Overview of Local Programs - Residential On-site Sewage Systems

Byron Petrauskas provided an overview of practices/programs hand out and requested feedback from attendees on the various topics addressed, beginning with residential practices and programs. Upon asking whether the costs seemed reasonable, attendees responded with the following comments and questions:

- Whitney Wright stated that the $15,000 listed as average cost for an alternative on-site waste treatment system (RB-5) is on the low end of actual cost to install.
- In Greene County, public sewer hook up is $10,000, while Madison County has no tap fee (although service is only for the town of Madison at this time, which is not in the watershed)
- An inquiry was made as to whether the average unit costs figures in the hand out are actual costs, or what 319 grant funding allows. Attendees discussed, and May Sligh suggested both cost figures be shared and compared. *It is noted that the average unit costs should be based on the cost of the practice installation as opposed to a specific amount allowed from a grant program (e.g. 319, VACS, EQIP,etc.).*

- May asked attendees if they knew of any areas that have public sewer hook-up options. Orange and Stanardsville have some. Does RSA run out to Ruckersville? No, it stops at Ruckersville. DEQ staff will inquire about sewer overlays for Orange and Stanardsville (Greene).

- The $300 cost for pump-outs is the average cost state-wide. Madison charges $300 (VDH).

- It was suggested that Byron look at what other TMDLs cost share and use the average. The Health Department does not see any of the invoices so they do not see project total costs, they just provide the permits.

- RB-2—no taps, less than $10,000. Madison costs $10,000 (out of project area). $4,500 payment cost share? Just from house to line/infrastructure plus tap fee.

- RB1 costs $300. Grinder pump station costs $6,000. Tap cap costs $10,000. Additional money for the pipe. For RB-2, the $16,000 cost listed is on the low end of the actual cost; the true cost is $20,000.

- May mentioned that there has been discussion during previous TMDLs about providing cost-share assistance where there have been septic failures beyond simply paying for the sewer hook-up. Whitney replied that SERCAP and other programs provide such assistance. SERCAP has low interest/no interest loans available.

- During Robinson WQIF project Dwayne suggested that there was some price gouging by contractors. He recommended homeowners get three estimates when requesting cost share. Greg added that there were (and are) times that the SWCD does not pay on all invoiced items; we review invoices, and there are some contractors that seem to charge more. Dwayne stated Fauquier SWCD experienced some price gouging as well. *This concern would be addressed through TMDL implementation program bid requirements. There will be some modified bid procedures coming out in the 2016 DEQ TMDL BMP Implementation Guidelines. For non–Ag projects less than $5,000 bids are not required, although greater than this amount will require bids.*

- For the repair average cost of $3,500, those are component replacements not full replacement (ie. Partial drain field, D-box). Greg replied that RB-3 repair cost is okay.

- Full system replacement—health department doesn't see invoices or prices. The full system replacement costs (RB-4 and RB-4P) seem reasonable.

- Alternative system installation total cost (RB-5) should be a minimum of $20,000, based on of treatment units, and new nitrogen standards. State pays $10,000 at 50%. True cost $20K-$25K. Whitney asked if the cost listed includes construction costs, as well as design costs and health department permit fees? May Sligh found the practice in the BMP manual during the meeting and found that engineering design and proper septic tank closure are included (not permitting). Greg Wichelns stated costs have been as high as $29K for an alternative system to be installed, including the design fees, but costs for this practice vary a lot and can be much higher than $29K.

- With alternative systems there are price differences on fees—less than 1,000 gallons per day has one fee and over 1,000 gallons per day has a higher fee. VDH permit application fee is $1,250. The fees are on the health department website. Whitney & Dwayne will send May a breakdown of the fees. (these costs would be the responsibility of the homeowner)

- In the past 5 years, Madison has not had that many new alternative systems, whereas in Greene County there have been about 15-20 alternative systems in that time period, mostly new construction.

- May asked attendees if they were aware of any areas that are prone to problem septics? Poor soils? In Madison County/Rapidan Watershed, the soils are decent. In the Robinson Watershed—Rt. 15 corridor, there are problem soils, especially where the Rapidan & Robinson merge—likely suspect areas, homeowners could use assistance.

- Any areas of old homes on flat land? Garth Run area—older vacation style homes that are now full time residences—could be why Garth Run area is impaired. Septic systems may be unsuitable for year round usage.

- Failing septics were identified by using census data and the age of homes—not by looking at soils. "Failing" just means in need of repair or replacement, not necessarily failed. Straight pipes were identified by taking the 150 foot corridor with buildings and census data and the "other" category from the census.

- Whitney recommended doing a table similar to Table 1 for houses on public sewer. May replied that she would try to get the sewer layers for Orange and Stanardsville.

- May asked attendees if the numbers in Table 3 seem reasonable. Dwayne replied that it should be accurate if the numbers are adjusted to reflect true costs as previously discussed. Greg commented that based on Dwayne's information Garth Run will probably need more RB-4Ps than RB-4s with a 70:30 split. Another suggested a 50:50 split.

- Discussed the ratio of a conventional gravity flow vs. pump. For a lot of houses a pump system is needed in this watershed—Madison County—in particular Garth Run (steep and rocky).

- Table 1—estimates from Census? Derived from census years 1990, 2000, 2005—1990 was the last time they used the "other" category.

- Table 1 numbers for failing septic look really high. Really that many failures? Greg responded that failing can mean the system needs repair/maintenance and is based on the age of the home—not necessarily that it failed. Byron stated that high numbers are based on the modeling. May agreed that the title may need to be changed (i.e. Septic Systems in Need of Repair).

Overview of Local Programs - Agriculture

Byron moved on to the agricultural practices and programs section of the handout, stating that the major task on the agriculture side is to identify where livestock have access to the stream using aerial photography and stream overlays. Once we come up with the estimate the soil and water conservation district provides comments and then DEQ cost-share data is added to determine existing fencing. Upon asking whether the costs seemed reasonable, attendees responded with the following comments and questions:

- Greg asked how current the stream fencing data is, and Byron replied that he received the data from DEQ in February 2015. Greg recommended the figures be updated in July 2015 once all the people signed up for the 100% cost share are identified. *The amount of signed up fencing based on the 100% can be referenced in the IP, but only installed fencing can actually be credited towards the IP implementation goals for each of the impaired watersheds.*
- Emily asked if the GIS data on the fencing can be shared with TJSWCD? Byron replied yes.
- May asked if the fencing numbers seem reasonable for Albemarle, and Emily replied that they seem high but she will confirm. They have worked with the 3 major landowners in the Albemarle portion of Blue Run watershed (one is Barboursville Vineyards).
- Greg asked if the SL-6 numbers in Tables 5 and 6 figures assume 100% cost-share, to which Byron replied yes. Since the 100% cost-share ends this year and there will instead by a big push for CREP, Greg recommended adjusting the numbers. Byron stated that for past TMDLs he had usually assumed 60-70% to SL-6 and the rest to CREP. Greg agreed that would be best. Also, LE-2T and WP-2T need to be in the mix.
- Length of fencing went dramatically up in feet when 100% cost share became available
- Total # of systems—adjust for SL-6 and CREP
- Stream protection? LE-2 10 ft buffer with 50% cost share vs. 35 ft. set back
- Greg questioned why CCI is in table 6 but not 5? According to Charlie Lunsford, whatever is existing—apply to everything—all fencing that is out there now or what we need
- Dan asked whether there was a regulatory buffer requirement for livestock? There is no regulatory requirement in general, but in order to receive cost-share funds you have to have meet set-back requirements. However, it is a voluntary program.
- Dan asked about the probability that farmers will install the fencing. CSWCD had $5 million in cost-share spent on BMPs. 35ft set back is 100% cost share, 10 ft setback has 50% cost share and no set back allows for a 25% tax credit. *(Fencing installed at top of stream bank can be done under an SL - 6B and as such has no cost share but is eligible for a 25% BMP tax credit up to $17, 500 per applicant per year.)*

- All voluntary but requires a 10 year maintenance agreement

Potential Funding Sources

Looking at potential funding sources, Byron explained that there has been some consolidation of programs due to Farm Bill. RCPP is a new grant this year, which brings together non-government partners with district/state agencies. The focus for this working group may be the regional and private sources. Attendees responded with the following comments and questions:

- May Sligh asked Ed Furlow of VDOF to give an overview of their Stewardship Program. Ed stated it was a planning program and was not aware of any available cost share associated with the program. Ed stated that Barbara White does have some money that she can use for tree planting that may be available next year, but it is dependent on DCR and Chesapeake Bay funds. Greg added the program is called the Virginia Trees for Clean Water, but is only for urban tree planting to reduce turf.

- Greg related a funding source developed through a past TMDL in Rappahannock County through Piedmont Environmental Council and the Krebser Fund, which donated $50K to use as an extra $0.50 per foot incentive—farmers got $0.60 per food if first time cost share recipient. Are there any private sources like this in the area? (no one knew of any at this time)

- May asked whether Center for Natural Capital could offer any incentive funds (possibly just as matching funds) or any Foundations or private funders. Greg suggested adding Rapidan Better Housing and USDA Rural Development to the list of potential funding sources.

- Byron pointed out that the Agricultural Cost-share and Landowner Cost Share tables are intended to give examples of what it would cost the farmer/homeowner.

- Greg suggested referencing the Virginia Conservation Assistance Program (VCAP). May stated that she has information that can be added and will provide it to Byron.

- Are there any financial incentives to farmer and to homeowners to do bmps? Yes. (see link at the bottom of notes for full details of TMDL cost share program)

- Dan asked whether there is any stormwater component to the IP or any incentives for developers? Greg and Brian responded that there are publically-funded assistance programs (SLAF – SW Local Assistance Fund) for new construction. New construction is covered by regulatory requirements.

- There are some tools-nutrient credit trading—haven't seen a lot in Greene county and don't expect to see any unless it becomes more densely populated

- Dan asked what was expected from localities regarding stormwater for this TMDL-IP? May responded that education/outreach will be needed (e.g. encouraging rain barrels). In Greene County, Cooperative Extension currently does that, but Dan stated the County could partner with them. Greg suggested the County could inform the SWCD of any agriculture land that has a change in land use and goes into development, or septic issues noticed during construction site inspections.

- Pet Waste—in rural areas pet waste digesters hard to get buy in from community, but pet waste stations are popular.

- Outreach—let people know of failing septic systems, identify places for pet waste stations, stormwater retrofits—kennel and hunt club locations, concentration of dog walkers, etc. List counties as assisting with education/outreach (with their permission)—stormwater/erosion & sediment control staff could help with that.

- Michelle suggested adding RRRC/Friends of the Rappahannock Rainscape Retrofit program and CSWCD residential stormwater cost share programs (VCAP). May added that these programs are geared towards nutrient and sediment reductions but they will provided the added benefit of bacteria reductions in some situations.

Program and Tools

- Greg recommended adding WP-4 and SL-9 to go on Ag list

- Whitney Wright asked if the resident practices lists all of the ones for septic? Are there any incentives for voluntary septic system upgrades? VDH permit was not possible to grant to someone who did not have a failing septic system but who wanted to make improvements to their septic system (add nitrogen reduction, etc.) so VDH changed their code so they could issue voluntary upgrade. Whitney will ask Charlie Lunsford, and May agreed to check if failure is necessary for the cost-share practices. *In the descriptions for RB-4, RB-4P and RB-5, it has to be a failed system, or a system not VDH approved that can potentially impact water quality (bacteria). See the link below for additional details for each practice.*

- Madison County developed a sewer database during the Robison River TMDL-IP that covered the entire county and is accessible by record look up. Brian stated that records are listed by tax map number.

- Greene & Albemarle Counties have their septic data scanned and accessible. Orange County has no database, but all counties can map structures by age.

- No counties have ordinances requiring mandatory pump-outs.

- Orange has a pet waste ordinance and requires a license for dog kennels. None of the other counties do that the group is aware of. Could cross number of dog licenses per address for Madison County. Could do a target mailing to older homes and/or dog owners if there is a budget for that. CSWCD goes door to door instead of using a mailing for their outreach programs. Some other areas include a mailing in the water or electric bill by partnering with utilities.

- Greg recommended offering 100% cost share for straight-pipe conversion as a pilot program to see whether it would yield an improvement in sign-up, since straight pipes are difficult to find. He will talk to Charlie Lunsford. Attendees responded that the Garth Run community would respond well to 100% cost share.

- May asked whether any areas of Garth Run would warrant a community system. Lost Valley Subdivision is the only one but there are not any problems there, so a community system would not be appropriate.

- May pointed out that there was interest at the public meetings for additional monitoring in the IP to identify hot spots and determine where to get started on IP/BMP out reach. *A monitoring component is a required element of an IP. The monitoring plan always addresses DEQ on-going and/or planned future monitoring in the impaired watersheds. This is also how citizen monitoring is also discussed in the monitoring plan.* Citizen monitoring has not always been included in past TMDL IP 319 projects, but it is good to have as a place holder in the IP case funding becomes available. Greg recommended instead of conducting hot spot monitoring, which is presumptive, conducting sub-watershed monitoring to provide better background data for targeting and avoiding any finger-pointing which can be counter-productive(*hotspot monitoring is intended to be an internal term used to help describe more targeted bacteria source monitoring*).

- May reported on previous supplemental monitoring conducted by CSWCD and others in the Upper York and asked whether there were citizen groups or students in the watershed who might do citizen monitoring. The Center for Natural Capital student interns from Woodbury Forest and Madison County has a 4H wildlife cub could be possible groups interested in more monitoring in certain areas of the watershed. The CSWCD could also continue with some supplemental monitoring. *Master Naturalists may also be interested in assisting.*

- The question was raised as to why Garth Run is the only impaired stream segment in that whole area; there is quite a distance downstream before further impairment. Rebecca stated it may be due to a lack of monitoring data, or Garth Run data may be just over the impairment threshold. Rebecca will research it and let May know the result. Dwayne Dixon recommended DEQ be prepared to answer that question at the public meeting. There is a bridge at Garth Run that could be used for an additional monitoring station. May stated that citizens can nominate additional stream segments to be considered for DEQ monitoring. (*Rebecca explained that the monitoring station further up in the watershed is for benthic macro-invertebrate monitoring and not bacteria (Station 3-GAR003.56). The impairment is not borderline as originally mentioned; the impairment at Station 3-GAR000.95 (not on the project map but just downstream from where the upper reach of the impairment in "red" is shown) was 6 of 11 samples (54.5%). The recreation use was not assessed prior to 2014. The northern portion of Garth Run (VAN-E11R_GAR02A06) had not been assessed for the recreation use as of the 2014 assessment. There is a new station farther up in the watershed where monitoring just began in 2015, and so far it has shown 2 bacteria violations during the month of January 2015. The monitoring at this station will only be done for 2015. May will have the raw data available in case there are questions at the final public meeting*).

Steering Committee

May provided an overview of the Steering Committee, which will meet before the final public meeting and review the first draft of the IP. Whitney Wright volunteered for the committee.

For additional information on cost share amounts for various practices see the TMDL Implementation Cost share Guidance:

http://www.deq.state.va.us/Portals/0/DEQ/Water/NonpointSource/DEQTMDLGuidelines-Specifications.pdf

APPENDIX C

Steering Committee Meeting Summary

Steering Committee Meeting Summary
July 10, 2015
Madison County Virginia Cooperative Extension Office; Madison, VA

Attendance

Jenny Biche, Rappahannock-Rapidan Regional Commission
Jaylan Cummings, Shenandoah National Park
Jane Dalton, Citizen
Michelle Edwards, Rappahannock-Rapidan Regional Commission
Kathleen Harrigan, Friends of the Rappahannock
Charlie Lunsford, Department of Environmental Quality
Kip Mumaw, Ecosystem Services
Byron Petrauskas, Blue Ridge Environmental Solutions
Alyson Sappington, Thomas Jefferson Planning District Commission
May Sligh, Department of Environmental Quality
Greg Wichelns, Culpeper Soil and Water Conservation District
Whitney Wright, Virginia Department of Health

Welcome and Introductions

Jenny Biche welcomed attendees and distributed hand outs. Introductions were made.

Working Group Reports

Agricultural Working Group Summary

Kip Mumaw provided the following Agricultural Working Group Report to the Steering Committee:

- Land Use – A brief discussion took place regarding land use accuracy and trends/changes that are/have taken place in the watershed which may trigger/require an adjustment to the model. The consensus was that a lot of hay fields and timber tracts have been cleared and converted for agricultural use in the last five years. In addition, a number of poultry farms have also grown via the addition of new facilities, or expansion of existing facilities.
- Horses – Horse rescue and other high density facilities are of concern in the watershed in relation to runoff and water quality. It was estimated by Culpeper SWCD that an average of 10 horses per acre are found on these grazing intensive operations. DEQ suggested if certain BMPS such as rotational grazing or composting should be included in the IP and the workgroup concluded that education/outreach targeting horse owners and including horse experts when approaching these individuals is important and hopefully prove to be effective. Creative partnerships with equine groups also could be considered.
- Stream/Riparian Buffers – The consensus of the group is that willingness of the landowner to participate is the deciding factor. As you move higher up into the watershed, it becomes more difficult as landowners may have to give up more land to establish buffers. A suggestion was made to vary the setbacks depending on the specific circumstances and amount of land to be retired. Another suggestion is to have DCR/DEQ establish a no setback BMP for farms that contain many small tributaries that need fencing. It was agreed that farms with no stream buffers be targeted first.

- Flash Grazing – Currently, flash grazing in buffers is not included in the fencing BMP specification. Past abuse of the system and farmers not following a grazing management plan is an issue. Suggestions on improving this primarily revolved around the face to face outreach from recognized SWCD staff. Building trust and being visible are two key components of successful outreach and progress.
- BMPs were ranked for consideration/inclusion into the TMDL IP (see attached PDF) and the top ranked BMP was streamside livestock exclusion fencing followed by rotational grazing and streamside buffers (forest and grass)
- A list of obstacles to implementing the streamside exclusion fencing BMP was ranked by the group as well (see below). Top ranked obstacle was the landowner/famer cannot afford to retire land out of AG use with the 35 foot buffer. Other obstacles that ranked high were the general maintenance of fencing is too costly and secondly the cost of installing the fence and providing alternative water sources for livestock is too high and cost share does not help enough.
- Aerial map was provided showing where existing livestock fencing is and where more is needed. It was suggested that more recent aerial imagery is needed in combination with field inspections to verify the accuracy of the desktop review/assessment. The contractor responded that he used the most recent available aerial views for this exercise (ESRI basemap layer 2010).

Best management practice	Description	Rank (1-7)
Streamside livestock exclusion fencing	Excluding livestock from streams with fencing, providing alternative water sources or limited access points to the stream	1
Rotational grazing	Establishing a series of grazing paddocks with cross fencing and rotating livestock to maximize forage production while preventing overgrazing	3.6
Forested streamside buffers	Planting trees and shrubs in strips (35 foot minimum) along streams adjacent to pasture and cropland	3.7
Grassed streamside buffers	Planting grasses in strips (35 foot minimum) along streams adjacent to pasture and cropland)	3.7
Forestation of crop, pasture or hayland	Convert existing pasture, crop or hayland to forest (hardwood or conifers)	5.6
Continuous no-till	Cropland is planted and maintained using no-till methods, only effective in reducing bacteria for cropland receiving manure applications (not commercial fertilizer)	5.3

Manure composting/storage facilities (equine) or other animal waste storage facilities (dairy, beef, poultry)	Construction of planned system designed to manage solid equine waste from areas where horses are concentrated either through composting or storage OR animal waste storage lagoons for dairy, beef cattle or poultry	5.1

Ranking of obstacles to streamside livestock exclusion:

In order to address the bacteria problem in the Upper Rapidan River watershed, livestock will have to be excluded from the stream. In order to identify the best way to accomplish this, it's important to understand the obstacles to fencing livestock out. Please rank the following obstacles to fencing livestock out of streams 1-5 with 1 being the most common and relevant obstacle to address and 5 being the least common or relevant obstacle.

Obstacle	**Rank (1-5)**
The cost of installing fencing and off stream water is too high, even with cost share assistance from federal and state programs	3.3
Cannot afford to give up the land for a 35 foot buffer	1.3
General maintenance of fencing is time consuming and expensive	2.9
Grazing land is rented with short term leases and landowners are not interested in installing and/or maintaining streamside fencing and off stream water	4.3
People do not trust the government and do not want to work through state and federal cost share programs to installing fencing systems	4

Other: One write-in mentioned that **tax implications** were his number 1 concern

Residential Working Group Summary

Greg Wichelns provided the Residential Working Group Report to the Steering Committee. Highlights, recommendations and challenges include:

- The group recognized that septic system maintenance and repairs are frequently neglected until problems arise, which often leads to failure.
- Significant discussion was spent on "flushable products" that are not, in fact, "flushable" and can contribute to maintenance and repair issues. The group recommended an educational component be developed to address this issue.

- Based on its experience with residential cost share programs, Culpeper Soil and Water Conservation District noticed many homeowners feel a perceived threat from the regulatory community, including the Health Department, causing a reluctance to participate in the Department's residential cost share program. It is noted that educational efforts will be especially important if and when this occurs.
- Care should be taken not to spread negativity about cost-share programs, particularly when discussing the lack of availability of cost share funds. Word spreads quickly throughout the community and can affect the participation rate in the program.
- Education on pet waste management is needed, but should focus more on kennels and hunt clubs rather than towns and parks.
- Storm water Best Management Practices such as rain gardens should also play a role in residential areas to address pet waste.

Following Greg Wichelns' summary, an inquiry was made as to the definition of confined canine unit, to which May Sligh replied that it referred to kennels. There is no specific set of minimum requirements that need to be met, such as a specific numerical threshold of animals, however some towns issue kennel licenses for homes and businesses over a certain number of dogs. It was also stated that HOWS (Houses of Wood and Straw, a non-profit serving confined outdoor dogs with houses and straw in winter) expressed an interest in assisting with pet waste management education and outreach. There are many existing pet waste education programs and partnerships available that can share success stories to be used as models.

Governmental Working Group Summary

Whitney Wright provided the Government Working Group Report to the Steering Committee. The following key topics and recommendations resulted from the meeting:

Residential Septic

- The $15,000 listed average cost of an Alternative Onsite Sewage Disposal System should be increased.
- To better determine an average cost of residential practices it was recommended that a survey of existing TMDL practices be examined.
- Support of the implementation of program bid requirements for residential practices.
- Due to the topography in the Upper Rapidan watershed it was projected that more RB-4P practices (conventional onsite sewage system with a pump) may be required, particularly in Garth Run.
- Agreed that the term "Failed" in Table 1 should be changed to "In need of repair".
- Town of Orange and Stanardsville were identified as potential public sewer connections.

Agriculture

- Average length of fencing for SL-6 Stream Exclusion with Grazing Land Management increased when DCR cost-share was increased to 100%.

- It is projected that an increase in CREP will occur and the estimated distribution of cost-share funding should reflect this trend.
- It was determined that there was no regulatory requirement for livestock buffers. Although it is voluntary it is projected that farms will install exclusion fencing.

Potential Funding Sources

- Southeast Rural Community Assistance Project, Inc. (SERCAP) helps small rural towns and communities needing aid in upgrading their water and wastewater systems.
- VDOF reported that they were unaware of any current funding sources, although there is some money available for tree planting that may be available next year (VA Trees for Clean Water).
- Rapidan Better Housing and USDA Rural Development were suggested as potential funding sources.
- There are two urban cost share programs designed to address homeowner/commercial stormwater issues serving the Rappahannock watershed at this time. RRRC has partnered with Friends of the Rappahannock (FOR) to promote the FOR Rainscape Retrofit Program and the Virginia Conservation Assistance Programs (VCAP), administered through participating SWCDs, has been reaching homeowner and commercial properties with best management practices geared towards nutrient and sediment reductions. The practices constructed through both of these programs will provide some benefit to bacteria reductions in certain situations.

Programs and Tools

- Suggested adding a 100% cost share rate for straight–pipe conversion as a pilot program due to the difficulty in identifying them.
- Recommended added WP-4 and SL-9 to go on AG list.
- Explore possibilities of creating a database for existing septic systems similar to the one done by Madison County for Robinson River TMDL–IP with WQIF funding.
- No mandatory pump out requirements for Counties located in this watershed.
- Including a monitoring component in the IP for monitoring "hot spot "locations during the project phase may help further target implementation. There will be several targeting scenarios identified in the IP based on livestock densities and stream access areas by subwatersheds as well as numbers of failing septic systems and straight pipes by subwatersheds. "Hot spot" type monitoring by citizen monitors and other groups may help direct BMP implementation within one of those subwatersheds
- The Center for Natural Capital student interns from Woodbury Forest and Madison County 4H wildlife club could be possible groups interested in monitoring.
- It was suggested that targeting older homes and/or dog owners for mailing outreach.
- It was suggested that partnering with utility companies could also be a targeted mailing outreach tool.

Review of Draft Upper Rapidan River TMDL IP Public Plan

Byron Petrauskas provided a review of the Draft Upper Rapidan TMDL Implementation Plan to the Steering Committee through a power point presentation. The following comments and recommendations were made:

Byron inquired as to whether or not the six animal waste structures recommended in the plan needed to have a location identified. Charlie Lunsford suggestion that they not be mapped, but instead note the watershed in which the structures are located. Mr. Petrauskas went on to explain his methodology for determining the recommended animal waste structures and asked the Steering Committee if his approach was acceptable, to which the attendees agreed.

Greg Wichelns stated four of the six structures were beef dry stacks in Orange County and the Orange Agriculture Cooperative Extension Agent offered to assist with education and outreach for them. Mr. Lunsford commented that 319 funds will not provide cost-share for animal waste structures, and inquired as to whether the animal waste structures were planned for Phase 2 of the plan, or if they should be in Phase 1. Greg Wichelns recommended they be put in both phases.

Greg Wichelns asked how cover crops fit into the modeling. Byron stated that cover crops provide a 20% bacteria load reduction. He assumed 65% cover crop in each impairment. The question was raised whether the bacteria is coming from manure or poultry litter in this case? The Agricultural Working Group was asked when they met if cover crops were prevalent, to which they responded yes, but maybe not for manure application, probably poultry litter.

Alyson Sappington inquired if cost share was available for cover crops if manure is applied, to which Charlie Lunsford stated there are currently no 319 funding available for cover crops for bacteria impairments. In watersheds with sediment impairments, cover crops have been funded by 319 funds. There are no reductions in the Chesapeake Bay Model for implementing cover crops unless manure is used, which then would require a nutrient management plan.

Greg Wichelns inquired as to whether or not farmers with no buffers should be targeted first or if monitoring data should direct priorities (addressing page 14, paragraph 3 in the draft plan). Byron stated that the information in that section of the plan was taken out of the working group meetings. Charlie Lunsford stated that recommendations of working groups are to be considered during implementation but may not be fully carried out because of program restrictions, policies and guidance. Charlie added that the monitoring data is often limited and therefore may not be effective in pinpointing priority areas. Greg stated that in the Upper Hazel, for example, there are some areas where the loading is obviously higher, and recommended rewording the draft plan to use “multiple criteria.”

Greg Wichelns questioned the validity of the cost to install a retention pond used in the plan, feeling that $150/acre treated is much too low. Attendees agreed. The cost of a dry pond is $6,000/acre treated and a retention pond is $8,000/acre treated. Charlie Lunsford recommended the funding for WP-1 (retention ponds) be increased. For the Upper York TMDL-IP the cost used was $2,000/acre treated, which attendees felt was not unrealistic depending on topography, soil, etc. Charlie also recommended that “Sediment Retention, Erosion or Water Control Structures WP-1” be used instead of the term retention basin.

Greg pointed out that the draft plan suggests that 11 square miles of land will drain to retention ponds, which is lot of square miles and they cannot be located near a stream. Byron responded that these facilities are used in the plan as a backstop when the bacteria load reduction cannot be met using pasture management, buffers, etc. However, streams have been delisted without implementing any of the WP-1 practices called for in the TMDL Implementation Plans.

Byron Petrauskas asked for feedback on the number of FTEs allocated in the draft plan, and how the FTEs should be distributed between the two soil and water conservation districts. Alyson Sappington stated that only 500 acres of the watershed is within the Thomas Jefferson Soil and Water Conservation District. Charlie Lunsford stated that the plan only needed to identify how many FTEs needed to be funded, but did not need to determine where they would be located. Greg Wichelns and Alyson Sappington felt that $50,000 for the Agriculture FTE and $50,000 for the Residential FTE was too low. It was recommended that the figures be increase to $60,000 for both.

Byron Petrauskas asked if the cost share percentages for SL-6 needed to be changed. Charlie Lunsford replied that both 319 and VACS are now funding SL-6 at 80% cost-share. The LE-1T practice is at 85% cost-share.

Greg Wichelns asked how CCI fits into the plan. CCI is a VACS practice that pays $1 per foot to maintain existing fencing that is not under contract. Byron researched what is currently available and then made future predictions, assuming potential for expansion.

Kip Muman stated that NGO conservation grants and programs should be considered as funding sources in the IP as they can have funding available for fencing, water alternatives, etc with more flexibility on compensation. Examples include National Fish and Wildlife Foundation, Nature Conservancy, etc. that have been used in past TMDL implementation. These private sources may be especially useful in cases where a farmer is disinclined to work with government, and can also help with outreach. May Sligh inquired as to whether or not these programs are restricted to specific areas. Kip replied that the target areas vary each year according to need, and since the IP has such a long time span (15 years), it would be good to include them so that the watershed can be considered in the future if not already included in their current target area. May agreed that they should be included as funding sources.

Byron Petrauskas asked if $1,000 each for Greene, Madison and Orange/Albemarle Counties was sufficient for pet waste education. Alyson Sappington stated that Thomas Jefferson Soil and Water Conservation District had a very difficult time getting residents to participate in pet waste composter cost share programs and could not even give them away for free. Jenny Biche stated that the Rappahannock-Rapidan Regional Commission had similar results, adding that the pet waste composters could only be used 6 months out of the year since they do not work when ground temperatures are below 40 degrees. Greg Wichelns pointed out that the residential workgroup had determined that kennels would be a better target than individual pet owners. Charlie Lunsford stated that there is not currently enough data available to determine what the impact of kennels are to the bacteria load, and recommended engaging local governments in discussions to assist in determining the impact. May Sligh stated that she has received some data from Orange County on kennel licensing and that she will share that information with Byron to be included in the IP. Attendees suggested workshops be held for this sector early on to get a dialogue started and gather information on current practices.

It was recommended that pet waste management programs start with education and outreach, then identify the best way to use funding to address it. $20,000 for Phase 1 for the entire watershed was

suggested. Kip Muman stated that the James River Roundtable utilized 319 funds for pet waste education. Watershed Organizations can help with pet waste outreach and can share successful models and lessons learned.

It was recommended that the number of pet waste digesters be further than 2.5% to some nominal amount if not eliminated and the number of pet waste stations be changed from 10 to 20, with the bulk of them located around Orange. Input from Citizen Monitoring Groups and localities can help identify where to place the pet waste stations. The Town of Gordonsville has a pet waste ordinance, but the Town of Orange does not. It was recommended that Pet Waste Ordinances be encouraged.

With regard to roles and responsibilities, it was decided that Ag would fall under Culpeper Soil and Water Conservation District and pet waste would fall under the Rappahannock-Rapidan Regional Commission (with cost share responsibilities to remain with Culpeper Soil and Water Conservation District).

With regard to Table 12 & 13 in the draft plan, Greg Wichelns stated that Virginia Cooperative Extension be removed as a funding source and to follow up with them to see if they would be willing to help with education and outreach.

For Table 11, Charlie Lunsford stated he did not understand why the tracking system from VDH was in the plan and recommended that it be removed. Whitney Wright stated that all septic implementations will be tracked by VDH. He said that any alternative system installed after December 2011 will have sampling requirements and that the Virginia Department of Health would have that data available. What is needed is a way to get that VDH data on RB-5s spatially located by the TMDL watersheds and reported to DEQ.

Jane Dalton stated she would send her comments to the Steering Committee for their review and consideration.

Review of Presentation Prepared for Final Public Meeting

May Sligh invited attendees to the final public meeting at Montpelier's Lewis Hall on August 13, 6:00-8:00pm. Byron Petrauskas provided an overview of the draft power point presentation for the public meeting to the Steering Committee. The following comments and recommendations were made:

- Byron will update the list of acknowledgements to include attendees from this meeting.
- The slide showing the 15 year timeline should remove the 0% exceedance rate statement since the stream would be delisted once the bacteria loads were less than 10.5%, and instead add "water quality criteria".
- CCI are unit costs of $1 and should add words "stream exclusion maintenance" to the slide
- Charlie Lunsford stated that IPs haven't built in CCI in the past, don't know what is being gained by including it
- "Implementation Reduction by Source" slide should be changed to total, not broken down by source
- "Cost of Implementation" slide should take out the numbers
- Charlie recommended removing total cost and instead use cost for delisting by watershed in the public document.

- Emphasize how much money comes into the localities, boosts economic development
- Kathleen Harrigan recommended that Charlie have IP success story publications available to share at the Final Public Meeting
- Measurable Goals & Milestones Slide—change meet water quality standards-put into stage I & II, include in both stages
- Remove Wetland Reserve Program (WRP) from the Potential Funding Sources slide; it is no longer available. Greg Wichelns will send Byron an update on WRP easement program.

APPENDIX D

Public Meetings Summary

January 28, 2015 Public Meeting Summary

Town of Orange Public Works; Orange, VA

Meeting Attendees

Grant Christie, citizen
Patti Christie, citizen
Cynthia DeCanis, citizen
Debbie Manzari, citizen (Residential)
Barabara Miller, citizen
Dave Miller, citizen
Kyle Ashmun, Ecosystem Services (Ag)
Cynthia Bowman, Orange Farm Service Agency (Ag)
Michael Collins, Center for Natural Capital
David Holtzman, Piedmont Environmental Council
Greg Wichens, Culpeper Soil and Water Conservation District
Henny Calloway, Culpeper Soil and Water Conservation District
Spencer Yager, Culpeper Soil and Water Conservation District (Ag)
Charlie Lunsford, Department of Environmental Quality
Rebecca Shoemaker, Department of Environmental Quality
May Sligh, Department of Environmental Quality
Bryant Thomas, Department of Environmental Quality
Byron Petrauskas, Blue Ridge Environmental Solutions
Jenny Biche´, Rappahannock-Rapidan Regional Commission
Michelle Edwards, Rappahannock-Rapidan Regional Commission

Welcome, Introduction, and Presentation

The meeting began at 6 PM. Rappahannock-Rapidan Regional Commission Planner Michelle Edwards welcomed attendees and introduced May Sligh, DEQ. Byron Petrauskas, Blue Ridge Environmental Solutions, presented an overview of the TMDL study, and May delivered a presentation on the public process for development of the Implementation Plan. Greg Wichelns, Culpeper Soil and Water Conservation District, also summarized the implementation successes that have occurred in surrounding watersheds. The PowerPoint presentations and map of impaired segments are available at

http://www.deq.virginia.gov/programs/water/waterqualityinformationtmdls/tmdl/tmdlimplementation/tmdlimplementationprogress.aspx.

Q: Are streams that don't have a green or yellow marker (on the map) monitored? Does flow affect the results?

A: *Yes, high flows and low flows affect the concentration of bacteria in the water. DEQ monitoring protocols account for this in the data. DEQ collects samples on a fixed schedule, which catches variable conditions—both high and low flow rates. The samples are generally collected bi-monthly, six times a year at our ambient stations. Long term trend stations are sampled bi-monthly as well.*

Q: Are there any tributaries you would want more monitoring on? Are there any future potential monitoring sites?

A: *Citizen monitoring can help identify hot spots and measure BMP effectiveness. DEQ is not looking for more monitoring stations. The monitoring stations are moved around. They collect samples at one location for 2 years, then stop monitoring at that station for 4 years, then go back to that station and collect samples again for 2 years. The TMDL is based on the whole watershed and considers bacteria sources throughout the whole watershed. The monitoring stations target specific areas but the TMDL and TMDL-IP includes the whole watershed, not just the impaired segments.*

Q: Are the streams denoted in blue on the map not impaired because there is no bacteria or due to the fact that they are not monitored?

A*: Generally blue stream reaches indicate those streams either not impaired at the time the TMDL was done or since the last Integrated Report (draft 2014), but there may be cases where there is a lack of sufficient monitoring data to make the determination that the stream is meeting water quality standards. The DEQ monitoring stations are denoted with green markers on the project map that has been distributed.*

Q: What is the single largest contributor of bacteria?

A: *The livestock load is probably the largest bacteria contributor (According to the TMDL study, runofffrom pastures used for grazing animals accounts for the largest loading (indirect) with the consideration of other variables, including precipitation, proximity to streams, etc). Straight pipes are illegal and 100% of them need to be identified and replaced.*

Q: Will the TMDL-IP include a geographic prioritization?

A: *As a group, won't identify geographic prioritization at tonight's meeting, but in future meetings we will want your input on what those geographic prioritization areas might be. With such a large area, the district(s) and other partners would want to start implementation in an area where there is a larger concentration of BMP opportunities (lots of cows that need to be fenced in from the streams, for example).*

Q: How do you advertise these public meetings? How do you intend to get the word out? A: *It's difficult to know how to best reach people. RRRC/DEQ staff distributed fliers around the area, submitted information to the local newspapers, and sent e-mail notifications to stakeholders*

requesting that they share the information with others. Any suggestions on how best to accomplish this are welcomed.

Posting signs and mailing letters to landowners was suggested. Specific areas for the fliers/posters include The Light Well restaurant and other popular local businesses. Using social media was also suggested.

Q: Is there an agency who can identify folks who live along the river that you can send e-mails to?

A: *No, there is no agency that has contact information of landowners along the river. We have compiled an extensive stakeholder contact list, but there is no one agency that has that information. We piece together what we can.*

Q: That seems like an amazing amount of work [CSWCD] has done. It is very encouraging to see. Is that unusual in the state?

A: *A few Districts are going after the 100% cost share money. There are 47 SWCDs in the state and 12 have a high work load—Thomas Jefferson, Lord Fairfax, for example. The Rapidan TMDL was completed in 2007. Since then, 52 miles of stream fencing has been installed in the CSWCD district portion. Another 21 miles includes volunteer fencing, which is fencing that was installed without using any cost share monies. Farmers are paid $1 per foot per exclusion fencing if maintained for 5 years. If cost share is used, then the maintenance agreement is for 10 years.*

In total there are 73 miles offencing that includes cost share & volunteer fencing.

Q: When does cost-share end, when the money runs out or when the goals are completed?A: *Cost-share is distributed on a competitive basis dependent on the funding available. Even if traditional sources offunding are not available (ie., 319),DEQ and various stakeholders involved in the implementation projects will look for other funding sources to assist with BMP cost share needs.*

Working Group Session

The residential and agriculture working group sessions were combined and began after the formal presentations. Discussion questions and participant feedback that followed included*:*

Are there any other bacteria sources, besides what is listed in TMDL study?

- No, there is no industry in the area.

What is the local perception regarding the presence of straight pipes, failing septic system, and failing on-site sewage disposal systems, sewered areas in the local watershed (s)?

- No response

Are there problems? Know areas with poor soils?

- No areas with poor soils are known.

How significant is the horse population?

- It is spotty at best.
- There are a couple of thoroughbred retirement and rescue facilities.

What would be the best ways to outreach to local citizens about grant funds for agriculture BMPs?

- Post flyers at the farmer co-op, Lowe's and Tractor Supply stores
- One-on-one basis
- Focus on portions of the watershed where the impairments are located
- The Center for Natural Capital has a crowd funding platform (*Crowdfunding is the practice of funding a project or venture by raising monetary contributions from a large number of people, typically via the internet)* that can be utilized, but the Center would need to be reimbursed for its efforts

What is the public perception about pets/dogs being a bacteria source?

- Pet waste is not seen as a problem
- The area is mostly rural; one dog on 200 acres is not really a problem

Are there hunt clubs, dog kennels, veterinary hospitals, boarding facilities that should be considered as potential sources?

- There is a kennel in Orange and a Chesapeake Bay retriever kennel adjacent to the Rapidan River; there may be other kennel/dog breeders in the watershed
- There are hunt clubs; contacting fox hunters was suggested

Is there any need of local pet waste ordinances?

- A comment was made that there is not a need for pet waste ordinances
- Many participants were unsure of whether there were existing ordinances and thus whether there was a need

Are there opportunities to improve stream buffers in the area? Do you know of specific areas where this may be possible?

- Lack of forested floodplain is a significant issue, and there is an opportunity to work with landowners to establish forested buffers
- The biggest issue is stream bank erosion, but stream fencing alone does not help; instead need stream buffers. The cost-shared practices for stream fencing offered through federal and state programs require vegetated buffers or forest buffers with various width requirements.
- Need to provide landowners with longer than CREP's 15-year funding in order to provide enough incentive
- Need to get Department of Forestry and Virginia Outdoors Foundation involved in the planning process if reforestation or conservation easements are discussed.

January 29, 2015 Public Meeting Summary
PVCC Eugene Giuseppe Center; Stanardsville, VA

Attendance

David Holtzman, Piedmont Environmental Council
Charlie Lunsford, DEQ
B. Bowman, citizen
Jane Dalton, citizen (Residential)
Kane Kashouty, Reporter
Jeff Green, citizen (Residential)
Tom Call, citizen
Brian Wagner, citizen
Fred Tuck, citizen
Davis Lamb, citizen
Kyle Ashmun, citizen (Ag)
Greg Wichens, Culpeper Soil and Water Conservation District
Henny Calloway, Culpeper Soil and Water Conservation District
Spencer Yager, Culpeper Soil and Water Conservation District
Bryant Thomas, Department of Environmental Quality
May Sligh, Department of Environmental Quality
Jen Carlson, Department of Environmental Quality
Byron Petrauskas, Blue Ridge Environmental Solutions
Jenny Biche, Rappahannock-Rapidan Regional Commission
Kate Gibson, Rappahannock-Rapidan Regional Commission

Welcome, Introduction, and Presentation

The meeting began at 6 PM. Rappahannock-Rapidan Regional Commission (RRRC) Planner Jenny Biche welcomed attendees and introduced Byron Petrauskas, Blue Ride Environmental Solutions and May Sligh, DEQ. Presentations were given by the consultant, DEQ and CSWCD staff. The PowerPoint presentations are available at:
http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/TMDL/TMDLImplementation/TMDLImplementationProgress.aspx.

Comments, questions and answers that followed included:

Q: Is it correct that if you accept cost share money you have to claim it on your taxes?

A: Yes, any cost share monies received over $600 must be claimed on your taxes. A Form 1099- G is sent for the cost-share amount to the landowner, but there is an option for the payment to install a septic system practice to be made directly to the contractor. In this case the Form 1099-M would be sent to the contractor. For this option, paperwork must be completed by the landowner ahead of time and the contractor must agree to the arrangement.

Q: Has there been any monitoring of the streams in the examples that were shared since the BMP implementations? What were the results?

A: Recently EPA conducted their annual NPS Program review in Virginia by visiting implementation sites in the Upper Hazel watershed. Based on DEQ and CSWCD evaluation monitoring results for some of those stream segments and others in the area are being considered for delisting. Mountain Run (Upper York IP), Robinson River (Robinson and Little Dark Run IP) and the Upper Hazel are all possible candidates for success stories in Virginia. One of the handouts provided tonight shows some examples of success stories of streams in other parts of the state that have been delisted or are demonstrating improving water quality trends, attributed to the high rate of implementation efforts in those watersheds.

Q: Will these interventions ever become mandatory?

A: With the exception of removing straight pipes, which are illegal, none of the interventions are mandatory. If the Health Department finds a failing septic system, they will work with the homeowner to fix the problem, but can take the homeowner to court if it comes to that. Before a notice is issued, the Health Department will work with the resident and refer them to eligible assistance programs if available.

Q: What is the Health Department's involvement in the septic BMPs?

A: The Health Department will refer residents to the program, and all septic projects must be permitted by the Health Department.

Q: Has it been your experience that the Health Department gives out notices?

A: They will report if necessary. It is complaint driven, they aren't out actively looking for them.

Q: Are the streams regularly tested? Or is there something that triggers DEQ to begin monitoring them?

A: The streams are monitored regularly, generally twelve times for a two year period. Some stations are considered "Trend Stations" in which case DEQ monitors them continually every other month. One of the hand-outs provided shows where the monitoring stations and trend stations are located in the watershed. An "Integrated Report" that shows state wide how the streams are doing is developed every two years. Citizens can also provide monitoring as part of the implementation plan to identify hot spots and measure BMP progress. If there are any groups you are aware of, such as students, who may be interested in helping with citizen monitoring, please let us know.

Q: Is there a correlation between bacteria levels and nutrient levels in the streams?

A: These could come from the same source, but it depends on the source. You would not see this with commercial fertilizer. Nutrient levels can be an indicator of bacteria, but not necessarily, it depends on the source of the pollutants. Someone commented on a study that was done nearby to measure bacteria in area streams, and the only source could have been wildlife. It was mentioned that even in remote and pristine areas, there could be the potential for bacteria inputs from camps, etc. Wildlife is a component of the TMDL, but we only address the reduction of bacteria sources from humans in the implementation plan. DEQ is not aware of a direct correlation between bacteria and aquatic life.

Q: Are there any BMPs dealing with roads?

A: Not so much with bacteria impairments.

Working Group Session

The working group sessions were combined and began right after the formal presentations. Comments, questions and answers that followed included*:*

Participant Observations:

Regarding septic systems:

In Madison County, residents are aware that there are no-compliant homesteads. This is usually due to financial hardship. A good tool to consider is the GIS system developed a few years ago in Madison County to track the location and ages of homes with septic systems. This is a great tool for targeting outreach to residents of the Upper Rapidan watershed in Madison for educational materials and cost share information regarding repair and replacement of septic systems.

A comment was made that in Madison County, there are many people who don't have enough land for the number of animals they keep, and the land is bare in these places. These residents may not be able to afford adding land. More education on this issue is needed. They also probably do not know about composting horse manure.

Q: On the agricultural side, are there areas to focus on?

A: Half of Madison County—the area between the two existing TMDL areas.

- One-on-one, people telling/asking their neighbors
- Newspaper
- Farmers markets (in Madison & Greene)
- Anonymous tips
- Door hangers
- Animal shelters—good places for education, people picking up new pets

Education is always helpful and always needed.

There are residents who have poultry in their backyard—selling eggs at farmers market. Some do compost chicken manure. (Could work with group of citizens and USDA to develop brochure).

Q: What is the public perception about pets as a source of bacteria?

A: This is not a concern in this area. Stanardsville does have a pet waste station. There may be interest in having more stations in the parks.

Q: Are there any pet waste ordinances?

A: No, there is not a pet waste ordinance in Greene County, but there is a leash law .(In Albemarle County, in addition to a leash law there is a requirement under the Water Resources Protection ordinance that states that pet waste must be prevented from entering storm sewers or natural streams. The requirements in all 4 counties will be further discussed at the Government Working Group meeting.)

Q: Have any control measures recently been installed*?* Are there any existing water quality projects?

A: (No answer was given by participants but it is noted that Agricultural BMPs have been installed throughout the watershed. There have also been river clean-ups led by the Center for Natural Capital, area students and landowners in recent years).

Barboursville Fire Hall was suggested as a possible location for the working group meetings in March. Kyle Ashmun and Fred Tuck agreed to participate in the Steering Committee.

August 13, 2015 Public Meeting Summary

James Madison's Montpelier; Orange, VA

Attendance

Jenny Biche, Rappahannock-Rapidan Regional Commission
Bradford, Citizen
Betsy Brantley, Citizen
Henny Calloway, Culpeper Soil and Water Conservation District
Jane Dalton, Citizen/Old Rag Master Naturalists
Michelle Edwards, Rappahannock-Rapidan Regional Commission
Darrell Scott Fox, Citizen
Nancy Frost, Citizen
Amber Galaviz, Orange Newspaper
Kathleen Harrigan, Friends of the Rappahannock
Douglas Jennings, Citizen
Charlie Lunsford, Department of Environmental Quality
Byron Petrauskas, Blue Ridge Environmental Solutions
Dr. H. Putz, Citizen
Putz, Citizen
Mike Saxton, Citizen
May Saxton, Citizen
Rebecca Shoemaker, Department of Environmental Quality
May Sligh, Department of Environmental Quality
Jeffrey Walker, Rappahannock-Rapidan Regional Commission
Greg Wichelns, Culpeper Soil and Water Conservation District
Spencer Yager, Culpeper Soil and Water Conservation District

Welcome and Introduction

Jeffrey Walker welcomed attendees and introductions were made.

Implementation Activity in Adjacent Watersheds

Greg Wichelns provided an overview of the Upper Hazel, Upper York and Robinson River Watershed TMDL implementation activities and successes, due in part to the availability of 100% cost share for livestock stream exclusion practices. Several streams in each of the three watersheds showed marked improvement in water quality due to the implementation actions. At least one stream in each of the three watersheds has been de listed from DEQ's impaired waters list or is close to being de listed.

After the completion of Greg Wichelns presentation, an inquiry was made as to whether or not attendees would be informed of this effort's plans for improving the water quality in the Upper Rapidan Watershed, to which Greg Wichelns replied that the information was going to be shared during the next presentation.

Summary of Draft Upper Rapidan Watershed Implementation Plan

Byron Petrauskas delivered a presentation summarizing the Draft Upper Rapidan Watershed Implementation Plan (IP). A list of implementation actions, cost analysis, benefit analysis, measureable goals and milestones, public participation process, stakeholder roles and responsibilities, and potential funding sources were included.

Questions and Answers

Following Byron Petrauskas's presentation, May Sligh and Michelle Edwards fielded questions from attendees. The following questions, comments and answers were shared:

Q: "My wife and I own 946 acres along Beautiful Run. There are only three people that live along this stream. How serious is *E.coli* pollution in this area when there is only one cow per one and half acres of land? How did you investigate and measure *E. coli*? You took samples in January and February, but there are no cows in the water during January and February. Who pays me for the loss of land due to setbacks or conversion to cropland or woodland? Why are you only blaming farmers; what about the urban situation?" The attendee left without waiting for an answer.

Q: "What were the primary barriers to implementation for the past IPs discussed in the Culpeper Soil and Water Conservation District (CSWCD) presentation? Do we anticipate similar issues in the Upper Rapidan IP, and can we try to address them before they become barriers?"

A: Greg Wichelns stated that CSWCD has more farmers signed up for cost-share programs than they have funding for. "CSWCD tends to run out of funding for both agricultural and residential cost-share programs. That said, not everyone is signing up to participate in cost-share. The reason they do not participate is often complicated and complex. For some it has to do with family dynamics, some of the family wants to participate but others do not. Some generations want to participate and some do not. Often a decision cannot be made because one person in the family can't decide or doesn't agree. There are a myriad of factors."

Q: "Are people afraid to come forward and admit they have a failing septic system?"

A: Henny Calloway, CSWCD, stated that once residents know there is cost-share money available, they tend to participate. Greg Wichelns, CSWCD, added that there is sometimes hesitancy from low-income residents. Charlie Lunsford, DEQ, stated that the Health Department tries to work with residents who do come forward, and not necessarily through enforcement, providing homeowners ample time to address the issue. It was suggested that more education be directed to low-income residents, letting them know what their out of pocket costs would be and partnering with other agencies and non-profits to help with financial assistance.

Q: "Who or what organization has overall, primary responsibility for implementation? Who is in charge?"

A: May Sligh, DEQ, stated that after the IP is approved by EPA, DEQ works with a variety of organizations to implement it. DEQ releases a Request for Proposal (RFP) and the Soil and Water Conservation Districts (or other sponsor) submit project proposals, with sometimes more than one Soil and Water Conservation District working together on a single project where jurisdictional boundaries overlap. The Soil and Water Conservation Districts typically take the lead on implementation projects, working with the other partners. Each project is designed to be holistic, covering a broad range of goals; it cannot only address agriculture issues for example. Charlie Lunsford, DEQ, commented that each DEQ region has a Non-point Source Coordinator, and in this region, the Coordinator is May Sligh, who is the facilitator of IP development and implementation. While DEQ is the lead agency in this process, there are many organizations working together to make implementation happen.

Q: "Is there any data that suggests what the economic benefits would be in terms of return on investment to the area (i.e. increased recreation use)? This might suggest other funding sources."

A: Greg Wichelns, CSWCD, stated that the 100% cost-share program brought in a significant amount of work to the region for fencing needs, plumbing, well drilling, fence materials, water troughs, etc. and It was all completed with local jobs. Many of these businesses offered to conduct the cost-share program outreach for the CSWCD. Michelle Edwards, RRRC, added that livestock studies have demonstrated that clean water improves herd health and therefore can increase famers' revenue. Jeffrey Walker, RRRC, commented that the better the region works together as a community the more competitive the region becomes in securing other grant funding, such as financial assistance for roads, attracting employers to the region, etc. It also makes the region more desirable when neighbors work together and neighboring counties support one another. Additionally, May Sligh, DEQ, pointed out that the Shenandoah National Park is within the watershed and draws many tourists who come and spend money locally. The Rapidan River is also known nationwide for its trout fishing. Charlie Lunsford, DEQ, suggested the cost/benefit section of the Technical Plan expand on the recreational benefits of the streams, pointing out that improving the water quality will protect and enhance these benefits.

Q: "Are there potential synergistic incentives encouraging landowners to establish riparian buffers with multiple uses? For example, could riparian buffers be established that are part of a recreational pedestrian greenway? If so, would there be funding and incentives available for residential landowners?"

A: Greg Wichelns, CSWCD, stated that the cost-share program for riparian buffers includes a list of plant species that must be used, that are chosen because they attract and benefit wildlife. May Sligh, DEQ, commented that while DEQ has not worked on a recreational pedestrian greenway in the past as part of an IP project, it is a good idea and could be an opportunity to work with other partners. There may be opportunities for other funding sources to be blended with 319 funds, such as Land and Water

Conservation Funds. Jane Dalton, citizen and Old Rag Master Naturalist, pointed out that the Hawksbill Greenway in Luray, Virginia is a good example of a protected riparian corridor that has multiple uses.

Q: "What is the best way for potential volunteers to get involved?"

A: May Sligh, DEQ, replied that anyone interested in volunteering should contact her. Volunteers are needed for things like citizen monitoring, assistance with installing rain gardens and planting trees. Michelle Edwards, RRRC, stated that the RRRC's Backyard Rainscaping Program is always looking for volunteers. Kathleen Harrigan, Friends of the Rappahannock (FOR), recommended volunteers become ambassadors in their communities, telling their friends, family and neighbors about the program available and incentives offered. People are more likely to listen to a friend or someone they know, than take advice from a person from outside the community.

Q: "My property has multiple springs and a pond, and is in an area that serves 15 homes. I have no livestock, just geese, and no septic system issues. How can I get water quality testing done on my property? I am right across from Poplar Run, just upstream."

A: Greg Wichelns, CSWCD, stated that if the resident was willing to pay for the analysis, he could connect him with a business that conducts water quality testing. May Sligh, DEQ, stated that citizen monitoring may be an option. She also suggested that he and his neighbors should consider getting their septic tanks pumped, if they have not already, as part of regular maintenance. She recommended they get in touch with Henny Calloway, CSWCD. Rebecca Shoemaker, DEQ, stated that the monitoring station on Popular Run is not a DEQ station. She will research the matter, and if it is a citizen monitoring station, connect him with the citizen group to see if they are willing to assist him. (Since the meeting it was discovered that the map provided at the meeting for orientation did not include the monitoring station for Poplar Run because it was just listed as part of the 2014 Integrated Report and those maps have not yet been released, so the RRRC did not yet have access to them through the DEQ website. The listing station for the Poplar Run impairment is located at the confluence of Poplar Run and the Rapidan River, and is included on the map (Figure 4) in the draft IP document. The station at the headwaters of Poplar Run shown on the map at the meeting is believed to be an older macroinvertebrate citizen monitoring station.)

With no more questions being asked, the meeting was concluded. Jeffrey Walker, RRRC, thanked James Madison's Montpelier for their generosity and hospitality in providing the meeting space. May Sligh encouraged attendees to review the draft TMDL-IP and associated materials available on DEQ's website. The public comment period extends for 30 days.

Please send comments on the Draft IP by September 14, 2015 to May Sligh at may.sligh@deq.virginia.gov

Documents can be found for review at:
http://www.deq.virginia.gov/programs/water/waterqualityinformationtmdls/tmdlimplementation/tmdlimplementationprogress.aspx

APPENDIX E

Public Comments Summary

Response to Dr. Putz's Comments of August 23, 2015:

This is Putz Farms J.V. 1825 Locust Grove Church Rd. in Madison County, VA. We are the owner and operator of 948 acres of farm/ranch/woodland along 1 ¼ mile of the Beautiful Run. Permit me to comment primarily regarding your plans covering Beautiful Run of the Upper Rapidan River Watershed project. As an observer of the waters of the Beautiful Run for more than 25 years I am very disappointed how you approached the issues. Your plan is substantial and materially faulted You failed to:

1) define what level of "water quality" the program intends to meet

Response to Question 1: Implementation of control measures quantified in the implementation plan within the Beautiful Run watershed is scheduled for 15 years. The water quality objective is to improve water quality so that the swimming designated use in Beautiful Run is met. In order for this to happen, bacteria source loadings from direct and indirect sources as identified in the TMDL study need to be reduced. Once the measured *E. coli* does not exceed 235 cfu/100 ml in more than 10% of the water samples collected during a DEQ assessment period, the swimming designated use has been attained and the stream will be removed from the impaired waters list.

2) determine the strains of the escherinchia coli in BR. A majority of strains of EC are HARMLESS and BENEFICIAL to our body – ergo your general statement e-coli exists in the stream is highly misleading.

Response to Question 2: In accordance with EPA guidance, Virginia has established water quality criteria for bacteria to protect human health for primary contact recreation in freshwater and saltwater, and the harvesting of shellfish. The freshwater criterion consists of a geometric mean of 126 cfu/100 ml when four or more samples are taken during any calendar month. If insufficient data exists to calculate a geometric mean, then no more than 10% of samples during an assessment period are to exceed 235 cfu/100 ml. Bacteria TMDLs in Virginia are based on establishing bacteria load reductions for point sources and nonpoint sources in a specific watershed to meet these appropriate criteria. TMDL implementation plans identify the various management measures than can be implemented locally to attain the needed bacteria reductions. In the TMDL study and implementation planning process the state does not identify the various strains of *E. coli* in local streams.

Since the 1920s, public health agencies have used the detection of certain, relatively easily identifiable species of bacteria normally found in the mammalian gut as surrogates for numerous other fecal bacteria species, to identify waterbodies that are contaminated with fecal material. These bacteria are considered **indicator species** and if found in water, they indicate a source of fecal contamination. Indicator bacteria may not be pathogenic themselves, but if detected in a waterbody, their presence is an indication that fecal material is present and that other, more pathogenic species of bacteria or viruses or intestinal parasites may also be present in the waterbody. It is impractical to try to screen environmental water samples for every potential pathogen because of the large number of

potential bacteria species, parasites or viruses, many of which may be difficult to detect, so indicator species are monitored instead. Fecal contamination and its indicators are considered "pathogen indicators". Swimming in fecal-contaminated water can cause a variety of adverse health effects including gastrointestinal illness, ear aches, skin rashes, and sometimes respiratory illness.

The U. S. Environmental Protection Agency (EPA) recommends that in freshwater, *Escherichia coli*, or *E. coli,* is the most reliable species of fecal bacteria to use as an indicator of fecal contamination. EPA found a good correlation between the detection of *E. coli* and reported illness in several epidemiological studies. Based on those studies, EPA has issued recommendations for allowable concentrations of *E. coli* bacteria in freshwater to reduce risk to people who use the waterbody for recreation. The Virginia water quality criterion for *E. coli* is based on EPA's recommended criterion. *Escherichia coli* is used as an indicator bacterium that detects the presence of bacteria normally found in the mammalian gut. We are not so much concerned with the various strains of *E. coli* causing illness as we are about the other pathogenic species of bacteria, parasites and virus that are likely to be also present in freshwaters when *E. coli* is found at elevated concentrations. If we can find a way of identifying the source of the *E. coli*, we will also be identifying the source of the fecal contamination. If we can take measures to control and reduce contamination by fecal matter, as indicated by the detection of *E. coli,* then the various fecal pathogens should also be controlled and reduced to levels that pose a reduced and acceptable risk to recreation.

3) adhere to the proper method of water sampling such as (i) sampling the full length of the Beautiful Run from origin in Pratts with a fairly sizeable population to the end; (2) determine the velocity of the water stream including precipitation at the prior days at sampling. High or low velocity and increased/decreased flow distorts the bacteria account.

Response to Question 3: There are currently 3 DEQ sampling stations in Beautiful Run, including the most upstream station, #3-BFL006.28 (located in the unimpaired section of Beautiful Run, at the crossing of Rt. # 621 (Beautiful Run Rd) , #3-BFL002.90 (Rt. # 616 (Locust Grove Church Rd) and the one closer to the confluence with the Rapidan, #3-BFL000.90 (Rt. # 620 (Tatums School Rd). Please note that the numeric value in each of these station numbers indicates the distance, in miles, upstream of the confluence with the Rapidan River. The map used for the meetings was typically the one with only the 2012 Integrated Report (IR) stations listed because the map was produced by the Rappahannock Rapidan Regional Commission and they only had access, at the time the project began, to the stations associated with the 2012 IR. The upstream and downstream stations were included in the 2014 IR, which was submitted as a final draft version, after receiving public comment, to EPA during our Upper Rapidan IP development process. We included the data from those stations because they also exceeded the water quality standard (please note the table we sent you before summarizing the data collected for Beautiful Run). So, it is felt that the current number of stations is adequate for determining the stream's condition. The second part of your question refers to the determination of the velocity of the water during the sampling event, as well as precipitation data prior to sampling. First, it is possible to get the precipitation data for all of those sampling dates in the table we prepared for you on July 22nd. For example, at station 3-BFL000.90 on 7/9/14 at 11:54 am, the *E. coli* value was 1075. The closest weather

station, Madison, received 0.72 inches between 7/7/14 and 7/10/2014. It is certainly possible that the high values on 7/9/14 were related to runoff just prior to the sampling event. It is also important to note that the models we use to characterize each sub-watershed account for precipitation events (amount, duration, intensity, distribution, timing), steam flow, soil erodibility and other characteristics. All of this information is used to help us predict how pollutants will behave in the landscape under various conditions.

4) determine the source and reason why in the winter the e-coli count jumped as high as 2000 units according to your spreadsheet while your spread sheet in the warm month show a normal count between 100 to 250. This seems to contradict your statement life stock enters in the warm months streams contaminating the water.

Response to Question 4: Our contention was not that the livestock entering streams in the warm months are the only possible source for bacteria entering the stream. Rather, livestock entering streams are a direct source and are more often observed in warmer summer months. It is also not appropriate to draw conclusions from one high value in the winter and several low values in the summer months. Interestingly, on 2/4/2014 when the 2000 cfu/100 ml *E.coli* value was noted, there had been a total of 1.72 inches of rain (2/3/14and 2/4/14) so it is possible that manure runoff from the fields could have entered the waterway. It is also possible that geese and other wildlife contributed to the higher value, or even a faulty septic system in the watershed. The 2000 cfu/100 ml value that you mention on 2/4/2014 was also taken at the farthest downstream station, where there is the opportunity for more bacteria sources to impact the stream at that location.

5) incorporate in your documents any research paper that wildlife and livestock contaminates streams with dangerous E-coli. Remember, the Colonialists wrote extensively how clean the streams were when they arrived and how much wildlife existed – ergo your theory that animals are the culprit of contaminating is wrong - IT IS PEOPLE.

Response to Question 5: During the period of 2000 – 2010, DEQ conducted bacteria source tracking by collected water samples in impaired streams monthly for a year prior to the TMDL study. What was learned from that effort was that the four major bacteria source contributors were livestock, humans, pets, and wildlife (not necessarily in the order listed here in each case). As mentioned in the response to question #2, in order to meet the bacteria water quality criteria we cannot just focus on a single source but need reductions across multiple sectors. Attached is a one page document, *Daily Fecal Coliform Production by Source*, (American Society of Agricultural Engineers; MapTech, Inc.; Metcalf and Eddy; U.S. Environmental Protection Agency) that provides daily fecal coliform production by livestock, humans, pets and wildlife. It provides some comparative information on the amount of bacteria these various sources generate.

6) provide evidence that a proportionate amount of farm/ranch owner/operators supporting your plan. During your presentation there were only two farmers present of which we objected to the plan. That is not a representative sample to state ag supports the plan.

Response to Question 6: While we have provided numerous ways for the public to be involved in the process, we have not received specific support from many farmers other than those who participated in the Agricultural working group. We advertised in area newspapers, posted flyers at libraries and co-ops, Virginia Register, provided e-mail announcements to a list of approximately 178 individuals, many of whom are farmers (please reference your FOIA request), and posted signs about the final meeting. Even with the many meeting and informational opportunities we offer during an IP process, we may not get notification of direct support of the plan….but I can tell you we also do not necessarily get the opposite either. There are many farmers in the surrounding watersheds who have participated in the various BMP cost share programs over the last several years. Farmers in the Upper Rapidan watershed are well aware that they too may be the recipients of assistance to not only better manage their herd through grazing management systems and livestock exclusion but also improve their farm productivity and herd health. While they may not have voiced their support directly, their actions – we hope – will show that they agree with this plan to improve water quality in the Upper Rapidan watershed. As well, many of the partner groups including NRCS and CSWCD have shown their support and they provide a voice for most farmers in the region.

One of your last comments addresses the issue of livestock fencing restricting wildlife access. It is not our intention, or any landowners either, to provide a barrier to wildlife reaching the waterways. Perhaps this issue needs more research. Our goal is to remove as many of the bacteria sources from the watershed as possible, and since a cow's daily fecal production rate far exceeds that of any wildlife (see attached table) we must work with farmers to restrict herd access to the stream wherever possible.