Bluestone River TMDL Implementation Plan Summary

Prepared for:

Virginia Department of Conservation and Recreation (VADCR)

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Submitted by:

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Executive Summary

Bluestone River drainage area included in this projects is approximately 49,000 acres and drains parts of Tazewell County, and the Town of Bluefield in Virginia and parts of Mercer County and the City of Bluefield in West Virginia. The drainage area is predominantly forested (73%). Agricultural lands account for approximately 19% (mostly pastureland) of the drainage area and developed lands account for approximately 7%. Three contiguous segments on the main stem were listed for bacteria impairment from the public water supply (PWS) upstream down to the Virginia/West Virginia state line for a total of 8.28 river miles. The lower section of the Bluestone River (from the Wrights Valley confluence to the Virginia/West Virginia state line) was also listed for violating the General Standard (aquatic life). An *E. coli* TMDL was developed in 2004. The General Standard TMDL was also developed in 2004 that identified sediment as the stressor to the aquatic life. These TMDLs were approved by EPA in September, 2004. The TMDLs called for reduction in loadings of bacteria and sediment to the Bluestone River. The implementation plan presented in this document deals with translating the reductions called for in the TMDLs into needed management practices with complete cost/benefit analysis.

Agricultural Best Management Practices (BMPs)

Streamside fencing is one of the best ways to reduce bacteria levels in the stream in areas of livestock access. This will remove direct livestock defecation in the stream and prevent the trampling of the stream banks which reduces erosion and excessive sedimentation.

The length of fencing required on perennial streams in the Bluestone River watershed is approximately 33 miles. Table E.1 shows the fencing systems needed to meet the livestock exclusion goal. Both the grazing land (SL-6) and streambank protection (WP-2T) practices include a 35-ft buffer component. Therefore, these practices will provide some of the best water quality benefits in terms of reducing both direct (cows defacating in the stream) and land- based (runoff of manure into the stream during rain events) contributions of bacteria to the stream. Table E.1 lists the number of SL-6 and WP-2T systems needed in the Bluestone River watershed.

Table E.1 SL-6 and WP-2T fence exclusion systems recommended for Stage I.

Watershed	SL-6 systems	WP-2T systems
Bluestone River	114	2

Due to the large reductions needed on land-based loads of *E. coli* bacteria, additional Best Management Practices (BMPs) for pasture and cropland are also needed. Estimates of all agricultural BMPs needed for Stage I, the first five years (delisting from the 303(d) list) in the watershed are provided in Table E.2.

Table E.2 Agricultural land based reduction BMPs recommended for Stage I.

Control Measure	Unit	Bluestone River
Improved Pasture Management	Acre	3,615
Loafing Lot Mnt. WP-4B	System	2
Waste Storage Facility – Cattle	System	2
Agricultural Sinkhole Prevention	Feet	4,000
Stream Bank Stabilization	Feet	2,000
Retention Ponds	Acre-treated	300
Vegetated Stream Buffer – Cropland	Acre	1

Residential Best Management Practices (BMPs)

All failing septic systems and straight pipes must be identified and replaced during implementation since a 99% - 100% load reduction from direct and nonpoint source (NPS) human waste is required to meet the TMDL goals. In addition, straight pipes are illegal in the Commonwealth of Virginia. The estimated numbers of straight pipes and failing septic systems were reported in the TMDL study and are shown in Table E.3.

Table E.3 Estimated number of failing septic systems and straight pipes.

Watershed	Potential Failing Septic Systems	Potential Straight Pipes
Bluestone River	454	14

The Bluestone River TMDL allocations for bacteria and sediment call for large reductions to land-based residential loads. In order to achieve

these reductions, the BMPs in Table E.4 must be implemented. The Residential Pet Waste Education Program shown in the table includes distributing information on how pet waste should be disposed. Riparian vegetated buffers should be utilized whenever possible around commercial land. These are simply vegetated areas along the streambank that are allowed to grow. They slow down runoff water from the surrounding land and allow the solids and *E. coil* bacteria to be filtered out before reaching a stream.

Table E.4 All residential BMPs recommended for Stage I.

Residential Control Measure Description	VA Cost-Share Practice Number	Bluestone River
Septic Systems Pump-out Program	RB-1	250
Failing Septic System Corrections:		
Sewer Connection	RB-2	43
Septic System Repair	RB-3	108
Septic System Installation/Replacement	RB-4	280
Alternative Waste Treatment System Installation	RB-5	23
Straight Pipe Corrections:		
Septic System Installation	RB-4	13
Alternative Waste Treatment System Installation	RB-5	1
Other BMPs:		
Residential Pet Waste Education Program		1
Erosion and Sediment Control (Acre-treated)		20
Vegetated Stream Buffer (Acre)		3.3
Rain Garden (Acre-treated)		20
Street Sweeping (Lane miles/yr)		1,400
Steam Bank Stabilization (Feet)		1,000

Urban/Industrial (BMPs)

In order to meet the required reductions in sediment and bacteria, additional BMPs are required on urban and industrial areas. The term industrial applies primarily to commercial logging operations. Table

E.5 shows the practices that must be implemented to accomplish the bacteria and sediment reduction requirements for the Stage I.

Table E.5 All urban/industrial BMPs recommended for Stage I.

Residential Control Measure Description	Bluestone River
Dirt Road Stabilization (Acre)	20
Forest Harvesting (Acre)	20
Vegetated Stream Buffer (Acre)	3.3
Retention Ponds (Acre-treated)	20
Street Sweeping (Lane miles/yr)	1,600
Streambank Stabilization (Feet)	1,000

Tables E.6 and E.7 show the estimated cost of installing the recommended agricultural and residential BMPs in Stages I (implementation years 1 - 5) and II (implementation years 6 – 10). The total cost for Stage I is $7.3 million. The total cost for full implementation comes to $16.0 million (Table E.8). All BMPs are expected to be completed by the end of Stage II. Stage III (implementation years 11 – 15) is considered a time of stabilization for the watershed after all BMPs have been utilized. A timeline with bacteria reductions expected is shown in Figure E.1. As for sediment, complete reduction goal is expected to be achieved by end of Stage I.

Table E.6 Costs to implement Stage I (years 1 - 5) for the Bluestone River.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Urban/Industrial BMPs ($)	Technical Assistance ($)	Total ($)
Bluestone River	$3,455,975	$2,735,430	$586,640	$500,000	$7,278,045

Table E.7 Costs to implement Stage II (years 6 - 10) for the Bluestone River.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Urban/Industrial BMPs ($)	Technical Assistance ($)	Total ($)
Bluestone River	$629,963	$833,400	$7,035,840	$250,000	$8,749,203

Table E.8 Total cost for implementation in the Bluestone River watershed.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Urban/Industrial BMPs ($)	Technical Assistance ($)	Total ($)
Bluestone River	$4,085,938	$3,568,830	$7,622,480	$750,000	$16,027,248

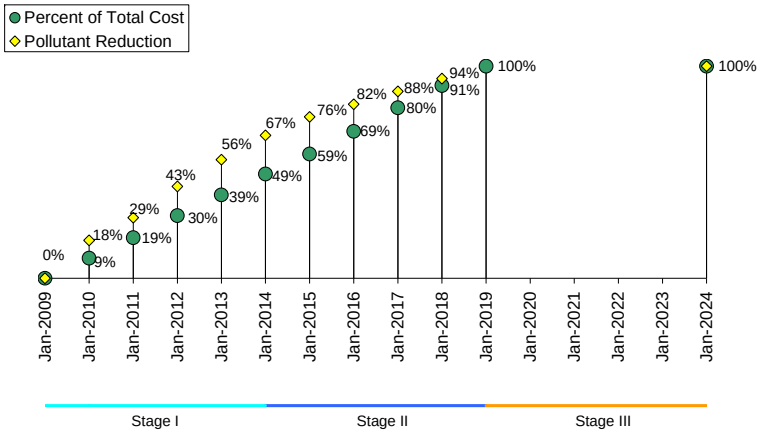

Figure E.1 Timeline for bacteria implementation in the Bluestone River watershed.

Introduction

The Clean Water Act (CWA) that became law in 1972 requires that all U.S. streams, rivers, and lakes meet certain water quality standards. The CWA also requires that states conduct monitoring to identify polluted waters or those that do not meet standards. Through this required program, the state of Virginia has found that many stream segments do not meet state water quality standards for protection of the six beneficial uses: recreation, aquatic life (benthic), wildlife, fishing, shellfishing, and drinking water. Benthic is a term that describes the macroinvertebrate organisms (bugs) that live on the bottom of the stream; a benthic impairment indicates that pollutants have impaired the natural existence of these organisms.

When a stream fails to meet the standards, it is listed as impaired on the CWA's Section 303(d) list, also known as the Dirty Waters List. The Bluestone River was first listed as impaired on the 1996 list, due to

violations of Virginia's General Standard (not supporting aquatic life) and Bacteria Standard (swimming). It has been listed on all subsequent 303(d) lists.

The Bluestone River is located in Tazewell County Virginia and flows through the Town of Bluefield before entering Mercer County in West Virginia. A portion of the drainage area impacting the impaired segment comes from West Virginia (about 25% of the total land area). This watershed is part of the New River basin, which drains via the Mississippi River to the Gulf of Mexico.

For every stream on the Dirty Waters List, the CWA and the U.S. Environmental Protection Agency (EPA) both require that states develop a Total Maximum Daily Load (TMDL) for each pollutant (40 CFR Part 130). A TMDL is a "pollution budget" for a stream. That is, it sets limits on the amount of pollution that a stream can tolerate and still maintain water quality standards. The TMDL results are explained in the Review of the TMDL Development Study section of this booklet.

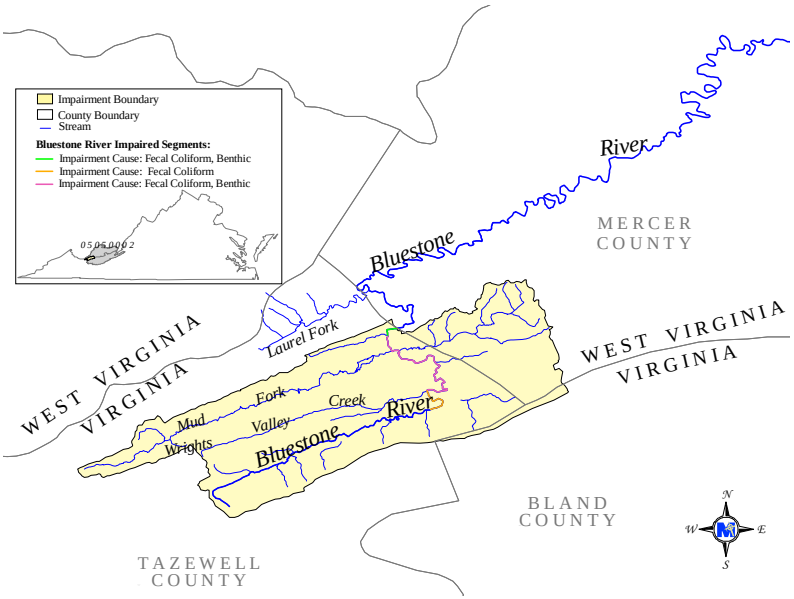

Figure 1. The impaired segment of the Bluestone River.

Once a TMDL is developed and approved by the EPA and the State Water Control Board (SWCB), measures must be taken to reduce pollution levels in the stream. The next step in the process is the development of an Implementation Plan (IP). This plan dictates how the TMDL goals can be accomplished in the watershed (drainage area) with the impaired streams. The 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. This booklet summarizes the IP for the *E. coli* bacteria and sediment TMDLs developed in 2004 and approved in September 2004.

The General Standard is meant to protect the health of aquatic life. The health of the aquatic life is measured through assessment of the benthic macroinvertebrate community, which is integral to the food chain that supports higher-level organisms (fish). It also serves as a fallback monitoring program to identify problems that are not detected by the ambient monitoring system (for example: pollutant discharges that occur intermittently or isolated incidents of pollutant discharge, etc). The specific pollutant being addressed for the Bluestone River General Standard TMDL is sediment, also known as total suspended solids (TSS).

In fulfilling the state's requirement for the development of a TMDL IP, a framework has been established for reducing *E. coli* levels and sediment levels and achieving the water quality goals for the Bluestone River impaired segment. With successful completion of the IP, Virginia begins the process of meeting these water quality goals, and natural resources will be enhanced. Additionally, approval of the IP will increase the opportunities for funding during implementation.

This booklet is an abbreviated version of the technical report, which can be obtained by contacting the VADEQ or the Virginia Department of Conservation and Recreation (VADCR) offices. Agency contact information can be found on the back of this pamphlet.

Key components of the implementation plan are:

- Review of the TMDL Development Study
- Public Participation
- Assessment of Needs
- Implementation
- Costs and Benefits
- Stakeholders' Roles and Responsibilities

Review of the Total Maximum Daily Load (TMDL) Study

The Bluestone River watershed is located in Tazewell County, Virginia and Mercer County, West Virginia. The Bluestone River is part of the New River basin and is located within USGS hydrologic unit code 05050002. In 2003, the estimated human population within the Bluestone River watershed was 23,131. The major land use in this watershed is forest and the watershed size is approximately 49,000 acres.

The *E. coli* bacteria TMDL Study and the sediment TMDL Study for the Bluestone River watershed were approved in Septembers 2004 by the EPA and is posted at www.deq.virginia.gov.

This TMDL study was conducted because the Bluestone River was not meeting the state water quality standards for the recreation use (swimming) and the General Standard (aquatic life). In order to meet the water quality goals established by the TMDL study, any bacteria water sample from the stream must be equal to or less than 235 colony forming units per 100 milliliters (cfu/100mL) at all times. If multiple samples are collected within a 30-day period, a geometric mean is applied and it must be equal to or less than 126 cfu/100mL. Sediment load reductions to meet the TMDL were estimated by comparing sediment loads from the Bluestone River with a stream that was unimpaired for aquatic life (the Dry River in Rockingham County, VA)

During the TMDL study, bacteria source tracking (BST), a water quality analysis method, was performed on water samples from the the Bluestone River. BST is intended to aid in identifying the sources of bacteria contamination in water bodies (i.e., human, pets, livestock, or wildlife). All four sources were present in the Bluestone River stream samples with livestock being the dominant source (Figures 2 and 3). Figures 2 and 3 show the weighted average BST results for Bluestone River taking into consideration the *E. coli* concentratons and number of isolates. These averages were calculated from the 12 monthly samples from each monitoring location collected during TMDL development. The weighting process favors the values that are associated with highest *E. coli* concentrations because those concentrations often exceed the water quality standard and it is more important to know what the dominant sources of bacteria are when *E. coli* exceeds the water quality standard.

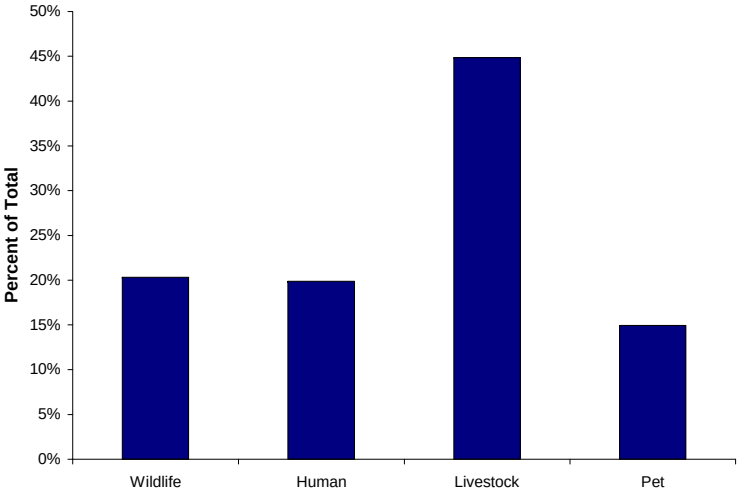

Figure 2. The BST results for the Bluestone River at 9-BST066.80.

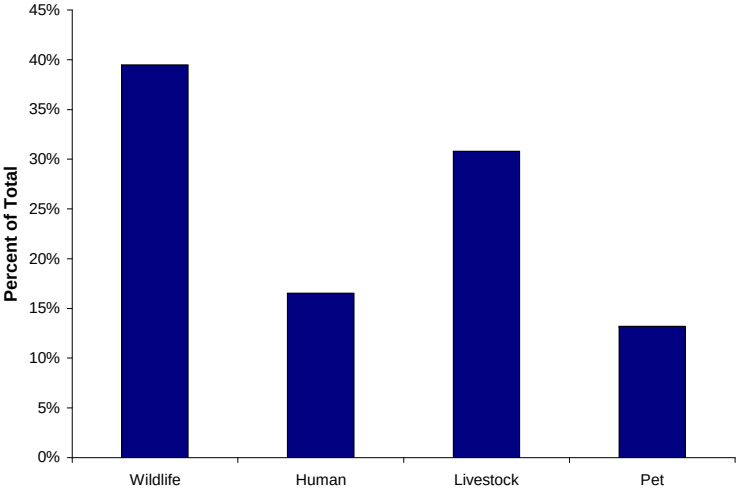

Figure 3. The BST results for the Bluestone River at 9-BST073.32.

A summary of the *E. coli* reductions by sources from the TMDL study for Stage I and Stage II is provided in Table 1. The Stage I scenario results in *E. coli* concentrations that may allow for de-listing of the Bluestone River from the Impaired Waters List for bacteria. Stage II is the scenario that will meet the two-part Virginia bacteria standard including the geometric mean and single-sample maximum. The removal of straight pipes and correction of failing septic systems is a requirement of the *E. coli* TMDL and will also benefit the sediment TMDL by reducing suspended solids entering the streams. Livestock exclusion from streams will contribute towards this goal as well. Reductions to wildlife *E. coil* bacteria are not addressed in this implementation plan (gray in Table 1.)

Table 1. *E. coli* bacteria load reductions scenarios for the Bluestone River.

Stage	Direct Wildlife	NPS Forest Wetland	Direct Livestock	NPS Ag.	NPS Res.	Direct Human
Stage I	0%	0%	100%	60%	60%	100%
Stage II (Final)	0%	74%	100%	99%	99%	100%

Sediment comes from erosion of land surfaces, straight pipes, and point sources. The land uses used in the analyses are transitional, cropland, forest, disturbed forest, pasture, and residential.

The sediment reductions needed in the Bluestone River watershed to attain the sediment TMDL allocation are shown in Table 2. Reductions of sediment from transitional, cropland, disturbed forest, streambank erosion, and straight pipes are recommended. The allocation of 5,646 tons/yr is attained based on the Stage I implementation goals. Implementation plan is designed in a way to achieve all the reductions needed to meet the sediment TMDL through control measures only in the Virginia portion of the watershed.

Table 2. Sediment existing and allocated loads for the Bluestone River with the West Virginia load indicated.

Sediment Source Categories	Stream Sediment Load (T/yr)	Load Reduction (%)	Allocation Scenario Stream Sediment Load (T/yr)
LDR-PER	13.1		13.1
COM-PER	5.3		5.3
Transitional	**265.7**	**40**	**159.4**
Forest	161.5		161.5
Disturbed Forest	**628.0**	**40**	**376.8**
Urban Grass	2.0		2.0
Hay	3.7		3.7
Pastureland	**2,287.2**	**40**	**1,372.3**
Stream Edge-Access	**35.5**	**40**	**21.3**
Cropland	**1,608.7**	**23.2**	**1,235.5**
LDR-IMP	33.2		33.2
COM-IMP	68.9		68.9
Channel Erosion	**510.7**	**20**	**408.6**
WLA	81.4		81.4
Total Load – Including WLA	***5,704.9***	***31***	***3,943.0***
Total	**8,081.2**		**5,646.0**

Process for Public Participation

The actions and commitments described in this document are drawn together through input from citizens of the watershed, The County of Tazewell and Town of Bluefield governments, VADEQ, VADCR, Virginia Department of Health (VDH), Tazewell Soil and Water Conservation District (TSWCD), DOF, and NR-HRC&D, and MapTech, Inc. Every citizen and interested party in the watershed area is encouraged to become involved in the implementation process and contribute in any way that helps in restoring the health of the Bluestone River. Public participation in development of the plan took place on three levels: public meetings, working groups, and a steering committee.

First, open meetings were held to inform the public about the plan development process, outline the goals for improving water quality

through the implementation plan, and provide a forum for soliciting participation in the smaller, more targeted meetings. The first public meeting was held on April 29, 2008.

Second, specialized working groups were assembled to discuss specific implementation strategies for different sources of bacteria in this watershed and recommend actions for the plan. The working groups were divided into three focus areas: residential/urban, agricultural and governmental. Three meetings were held by the Agricultural Working Group on April 29, 2008, May 20, 2008, and July 30, 2008. The Residential/Urban Working Group met twice on April 29, 2008 and August 6, 2008. Finally, the Government Working Group held one meeting on May 20, 2008. The Agricultural Working Group and the Residential/Urban working group focused during their meetings on corresponding best management practices and constraints facing implementation actions. The Government Working group focus was the implementation development process and the various components and inputs to the plan.

Third, a Steering Committee was formed with representation from VADEQ, VADCR, VDH, NRCS, local government officials New River Highlands Resource Conservation and Development Council, the Tazewell SWCD, representatives from the working groups, and MapTech. The group met on November 20, 2008 to provide guidance on the content and presentation of the final IP and ensure that the working group recommendations were appropriately incorporated into the plan.

Assessment of Needs

The Bluestone River TMDLs require large reductions to bacteria and sediment loads. In order to meet these strict requirements, the BMPs (Best Management Practices) in Table 4 (pg. 16) must be implemented.

Agricultural BMPs

Streamside fencing is required on perennial and some intermittent streams that are next to pasture in the Bluestone River watershed. This will remove direct livestock defecation in the stream and prevent the trampling of the stream banks. The quantity of streamside fencing required during implementation was determined through spatial analyses of land uses, the stream network, and archived data.

Additionally, input from local agency representatives and citizens were used to verify the analyses.

The length of fencing required on perennial and intermittent streams in the Bluestone River watershed is approximately 171,000 feet. Based on this spatial analysis of land use, 114 Grazing Land Protection Systems (SL-6) and 2 Stream Protection Systems (WP-2T) are required to exclude livestock from the streams. Through staging (targeting) of the implementation efforts, any available funding will be directed, as needed, to efforts that are likely to have the largest impact first. Based on the TMDL and BST analyses, major efforts should be directed at livestock exclusion practices.

Due to the strict reductions on land-based loads of bacteria, additional BMPs are required on pasture and cropland. Improved pasture management includes the maintenance of an adequate forage height (3-inch minimum) during the growing season, control of woody vegetation, and distribution of manure through managed rotational grazing. Livestock waste storage facilities and loafing lot management systems help reduce the amount of manure that washes off the land and into flowing streams. A vegetated buffer is an area next to a stream where cattle are not allowed and vegetation is established. The area between the fence and stream filters bacteria from runoff from adjacent land. Buffers must be 35 feet from the stream on average to be eligible for any state cost-share money. Estimates of all agricultural BMPs needed for full implementation in the watershed are listed in Table 4 (pg. 16). The VADCR codes are shown in parenthesis.

Residential BMPs

All failing septic systems and straight pipes must be identified and replaced during implementation since a 100% load reduction from direct and nonpoint source (NPS) human waste is required to meet the TMDL goal. The estimated numbers of straight pipes and failing septic systems were reported in the TMDL and are shown in Table 3.

The Bluestone River TMDL requires large reductions to land-based residential pollutant loads. In order to meet these strict requirements, the BMPs in Table 4 (pg. 16) must be implemented. The Residential Pet Waste Education Program includes distributing information on how pet waste should be disposed of, along with posting signs and supplying trash cans and pick-up bags in dog walking areas. A septic tank pump-out program addressing 500 systems within the entire

watershed is included. Also included is Erosion & Sediment Control practice on 10% of the transitional land in the area.

Table 3. Estimated failing septic systems and straight pipes from the Bluestone River TMDL.

Watershed	Houses with Standard Septic Systems	Potential Failing Septic Systems	Potential Straight Pipes -
Bluestone River	1,884	454	14

Urban/Industrial BMPs

This category includes forestry BMPs because logging operations can be a significant source of sediment. The Virginia Department of Forestry (VDOF) is in charge of regulating all logging operations of commercial or private entities. There is a zero tolerance for sedimentation in nearby streams. Some BMPs that are recommended for logging areas are: not harvesting trees near streams (leaving a vegetated stream buffer), water bars, hardened stream crossings (culverts, bridges), and seeding and mulching bare areas upon completion. The BMPs required to meet the requirements for urban/industrial source reductions are shown in Table 4. More information on logging BMPs can be found at http://www.dof.virginia.gov/wq/index-bmp-guide.shtml.

Table 4. Control measures (BMPs) needed in the Bluestone River watershed for Stages I and II with associated costs.

Best Management Practice	Unit	Cost/ Unit	Stage I	Stage II
Agricultural:				
Grazing Land Protection System (SL-6)	System	$25,000	114	0
Stream Protection System (WP-2T)	System	$4,425	2	0
Streamside Fence Maintenance	Feet	$3.50	0	12,853
Farm Retention Ponds - Pasture	Acre-treated	$138	300	2,854
Improved Pasture Management	Acre	$75	3,615	655
Waste Storage Facility (WP-4) – Cattle	System	$55,000	2	0
Agricultural Sinkhole Protection (WQ-11)	Feet	$3.00	4,000	0
Loafing Lot Management	System	$10,000	2	0
Vegetated Buffer – Cropland	Acre	$600	1	0
Streambank Stabilization	Feet	$71	2,000	2,000
Residential:				
Septic Systems Pump-out Program (RB-1)	System	$220	250	250
Sewer Connection (RB-2)	System	$2,500	43	0
Septic System Repair (RB-3)	System	$3,000	108	0
Septic System Installation/Replacement (RB-4)	System	$6,000	293	0
Alternative Waste Treatment System Installation	System	$11,400	24	0
Residential Pet Waste Education Program	Program	$3,750	1	0
Erosion and Sediment Control	Acre-Treated	$2,000	0	20
Vegetated Stream Buffers	Acre	$600	3.3	0
Rain Garden	Acre – Treated	$5,000	20	130
Street Sweeping	Lane-Miles/yr	$29	1,400	600
Streambank Stabilization	Feet	$71	1,000	1,000
Urban/Industrial:				
Streambank Stabilization	Feet	$71	1,000	1,000
Dirt Road Stabilization	Acre	$10,000	20	20
Forest Harvesting	Acre	$10,000	20	580
Vegetated Stream Buffer	Acre	$600	3.3	0
Retention Ponds	Acres - Treated	$3,363	20	280
Street Sweeping	Lane-Miles/yr	$29	1,600	800

Full-Time Equivalents (FTEs)

Two FTEs are needed per year during the first five years of implementation (Stage I) and one FTE is needed in years six through ten (Stage II) of implementation in the Bluestone River watershed. The Tazewell SWCD will be in charge of the technical assistance during the implementation of the agricultural BMPs. The Tazewell SWCD has also agreed to assist with pursuing other sources of funding and to work with DCR and other local entities to apply for grants for implementation practices.

Implementation

Potential Funds

Potential funding sources available during implementation were identified during plan development. Detailed descriptions of each source can be obtained from the Tazewell SWCD, VADCR, EPA, NRCS, VCE, and VADEQ. Sources include:

- Virginia Agricultural Best Management Practices Cost-Share Program
- Virginia Agricultural Best Management Practices Tax Credit Program
- Virginia Agricultural Best Management Practices Loan Program
- Virginia Small Business Environmental Assistance Fund Loan Program
- Virginia Water Quality Improvement Fund
- Community Development Block Grant Program
- Conservation Reserve Program (CRP)
- Conservation Reserve Enhancement Program (CREP)
- Environmental Quality Incentives Program (EQIP)
- Wildlife Habitat Incentive Program (WHIP)
- Wetland Reserve Program (WRP)
- Clean Water State Revolving Fund
- Virginia Landowner Incentive Program (LIP)

Timeline and Milestones

The end goals of implementation are restored water quality of Bluestone River and the removal of these streams from Virginia's Dirty Waters List. Progress toward end goals will be assessed during

implementation through tracking of BMP installations and continued water quality monitoring.

Expected progress in implementation is established with two types of milestones: *implementation milestones* and *water quality milestones*. Implementation milestones establish the amount of BMPs installed each year, while water quality milestones establish the corresponding improvements in water quality that can be expected. The milestones described here are intended to achieve full implementation within 10 years, leaving five years to assess water quality for de-listing. Timelines with bacteria reductions expected are shown in Figure 3.

Following the idea of a staged implementation approach, resources and finances will be concentrated on the most cost-efficient BMPs first where the Stage I goals will focus on the more cost-efficient BMPs. By the end of Stage I, bacteria load reduction is expected to be at 67% of the final reduction goal.

As for sediment, all target reductions will be achieved by the end of Stage I (if all bacteria reduction measures called for in Stage I were implemented). Additional sediment reduction measures were added for Stage II in case not all bacteria reduction measures recommended for Stage I are implemented. Following Stage I implementation, the Steering Committee should evaluate water quality improvements and determine how to proceed to complete implementation during Stage II and whether the bacteria and sediment reduction measures specified for Stage II are still needed.

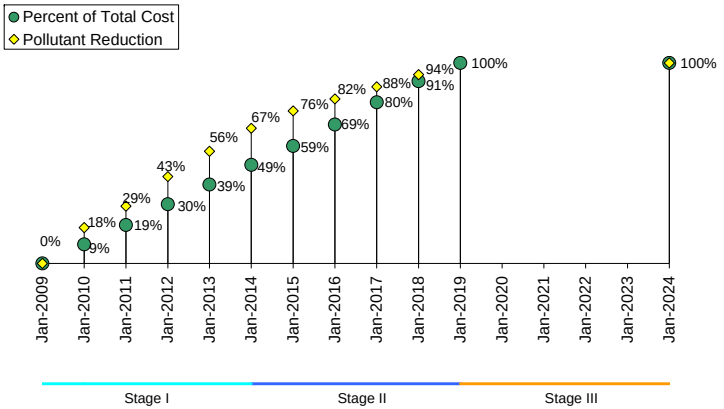

Figure 3. Timeline for implementation for bacteria in the Bluestone River watershed.

Table 5 shows installation goals for Stage I and Stage II as a percent for each BMP. Table 5 also shows the expected progress towards the reduction goals for bacteria and sediment by the end of each stage. The percent exceedence expected for the instantaneous bacteria standard is also shown along with the percentage of total cost for each implementation stage. Stage I will end at the beginning of 2014; Stage II will be complete with all BMPs installed by 2019. It is anticipated that the de-listing of the impaired segments from the Dirty Waters List will occur by 2024 at the latest. It should be emphasized here that Tazewell SWCD has been receiving funds and implementing practiced since the beginning of 2007. These practiced were accounted for in this implementation plan, and management practices described in Stage I and Stage II represent the remaining BMPs that have to be implemented.

Straight pipe supplying untreated human waste to a creek.

Table 5. Stage I and Stage II BMP installation goals.

Control Measure	Unit	Stage I	Stage II
Agricultural			
Grazing Land Protection System (SL-6)	System	100%	0%
Stream Protection System (WP-2T)	System	100%	0%
Waste Storage Facilities (WP-4) - Cattle	System	100%	0%
Loafing Lot Management (WP-4B) - Cattle	System	100%	0%
Farm Retention Ponds - Pasture	Acres	10%	90%
Improved Pasture Management - Pasture	Acres	85%	15%
Vegetated Buffer - Cropland	Acre	100%	0%
Agricultural Sinkhole Protection (WQ-11)	ft	100%	0%
Streamside Fence Maintenance - perennial	ft	0%	100%
Streambank Stabilization	ft-stream	50%	50%
Residential			
Septic Systems Pump-out Program (RB-1)	System	50%	50%
Sewer Connection (RB-2)	System	100%	0%
Septic System Repair (RB-3)	System	100%	0%
Septic System Installation/Replacement	System	100%	0%
Alternative Waste Treatment System Installation	System	100%	0%
Residential Pet Waste Education Program	Program	100%	0%
Erosion and Sediment Control	Acre - treated	0%	100%
Streambank Stabilization	ft-stream	50%	50%
Vegetated Stream Buffer	Acres of buffer	100%	0%
Rain Garden	Acre - treated	13%	87%
Street Sweeping	Lane-mi/yr	100%	0%
Industrial			
Dirt Road Stabilization	Acre	50%	50%
Forest Harvesting BMPs	Acre	3%	97%
Vegetated Stream Buffer	Acre of buffer	100%	0%
Retention Ponds	Acre - treated	7%	93%
Street Sweeping	lane-miles/yr	67%	33%
Streambank Stabilization	ft-stream	50%	50%
Exceedance of Instantaneous EC Standard (235 cfu/100mL) (%)		20%	14%
Progress Towards Bacteria Reduction		67%	100%
Progress Towards Sediment Reduction		100%	100%
Cost (% of Total)		49%	100%

Targeting

The purpose of targeting is to identify subwatersheds where BMP installation would result in the greatest return in water quality improvement. Targeting ensures optimal utilization of resources. Efforts should be made to prioritize outreach in the targeting order (Table 6). However, interested people should not be turned away if their land is within a low ranking subwatershed.

The subwatersheds of the Bluestone River watershed are shown in Figure 4 along with areas of proposed streamside fencing. Table 6 shows the subwatershed order for targeting streamside fencing and straight pipe and failing septic system corrections in the watershed.

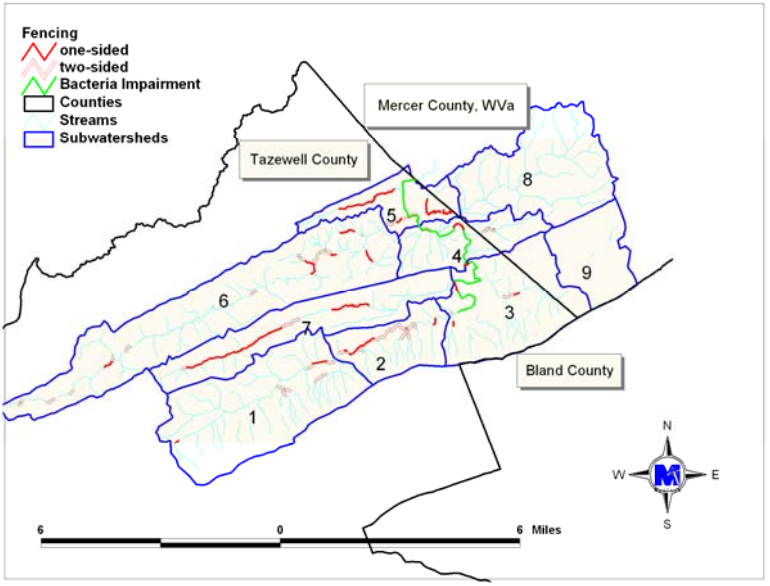

Figure 4. The location of the Bluestone River subwatersheds, bacteria impairment, and areas of streamside fencing.

Table 6. Targeting subwatershed order for residential waste BMPs and streamside fencing.

Stream	Straight Pipe and Failing Septic Systems	Streamside Fencing
Bluestone River	1, 7, 3, 6, 5, 2, 4	3, 1, 2, 7, 6, 5, 4

Costs and Benefits

Costs

Associated cost estimates of agricultural, residential, and urban/industrial BMPs were calculated by multiplying the unit cost by the number of units needed for each practice (Table 7).

Table 7 shows the estimated cost of installing the recommended agricultural BMPs as $4.1 million. Residential BMP costs sum to $3.6 million and urban/industrial costs sum to $7.6 million.

It was determined that it would require $50,000 to support the salary, benefits, travel, training, and incidentals for one technical full time employee (FTE). The maximum total cost to provide technical assistance during implementation is expected to be $0.75 million. Factoring in technical assistance costs, the total cost for full implementation in the watershed comes to approximately $16 million dollars. Only less than half this money is expected to be spent during Stage I.

Table 7. Total estimated costs to meet the Bluestone River TMDLs.

Stage	Agricultural BMPs ($)	Residential BMPs ($)	Urban/ Industrial BMPs ($)	Tech. Assist. ($)	Total ($)
Stage I	3,455,975	2,735,430	586,640	500,000	7,278,045
Stage II	629,963	833,400	7,035,840	250,000	8,749,203
Total	4,085,938	3,568,830	7,622,480	750,000	16,027,248

Benefits

The primary benefit of implementation is cleaner waters in Virginia. Specifically, *E. coli* contamination in the Bluestone River will be reduced to meet water quality standards and allow for safe swimming. It is difficult to gauge the impact that reducing *E. coli* contamination

will have on public health, as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, because of the reductions required to bacteria entering the streams, the incidence of infection from *E. coli* sources, through contact with surface waters, should be considerably reduced.

Additionally, the return of a healthy aquatic community is a goal of this project. Streambank protection will improve the aquatic habitat in these waters. The vegetated buffers that are established will also serve to reduce sediment as well as other pollutants transported to the stream from upslope locations. In areas where pasture management is improved, soil losses should be reduced and infiltration of precipitation should be increased, decreasing peak flows downstream. The aquatic life will return to the Bluestone River with appropriate and diverse populations to allow for healthy fish populations.

Livestock stream exclusion example.

Fresh clean water is the primary nutrient for livestock (horses, cattle, sheep, etc.). Many livestock illnesses can be spread through contaminated water supplies. A clean water source can prevent illnesses that reduce production and incur the added expense of avoidable veterinary bills.

Taking the opportunity to initiate an improved pasture management system in conjunction with installing clean water supplies will also provide economic benefits for the producer. Improved pasture management can allow a producer to feed less hay in winter months, and increase stocking rates by 30 - 40%. 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. In general, many of the agricultural BMPs being recommended will provide both environmental and economic benefits.

Off stream watering source for cattle.

The residential programs will play an important role in improving water quality, since human waste can carry human viruses in addition to the bacterial and protozoan pathogens that all fecal matter can potentially carry with it. In terms of economic benefits to homeowners, an improved understanding of private sewage systems (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. 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 (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 the entire system.

An important objective of the implementation plan is to foster continued economic vitality and strength. This objective is based on the recognition that healthy waters improve economic opportunities for Virginians, and a healthy economic base provides the resources and funding necessary to pursue restoration and enhancement activities.

The agricultural, residential, and industrial practices recommended in this document are expected to provide economic benefits, as well as environmental benefits, to the landowner.

Stakeholders' Roles and Responsibilities

Monitoring

The Steering Committee, Tazewell SWCD, VDH, and VADEQ will assess progress toward end goals during implementation through tracking of control measure installations and continued water quality monitoring.

The success of the implementation measures will be determined by monitoring conducted by VADEQ through the agency's monitoring program. VADEQ will monitor water quality at six monitoring locations (Table 8) in the Bluestone River watershed. While station 9-BST066.80 will be sampled every other month for the duration of the implementation, other stations rotate with bi-monthly sampling starting in 2011 for 2 years followed by no monitoring for four years at these stations (Figure 5). Station 9-BST066.80 is also the site for biological monitoring that is scheduled for 2008 and 2011. Additional citizen's monitoring is in the planning for the watershed.

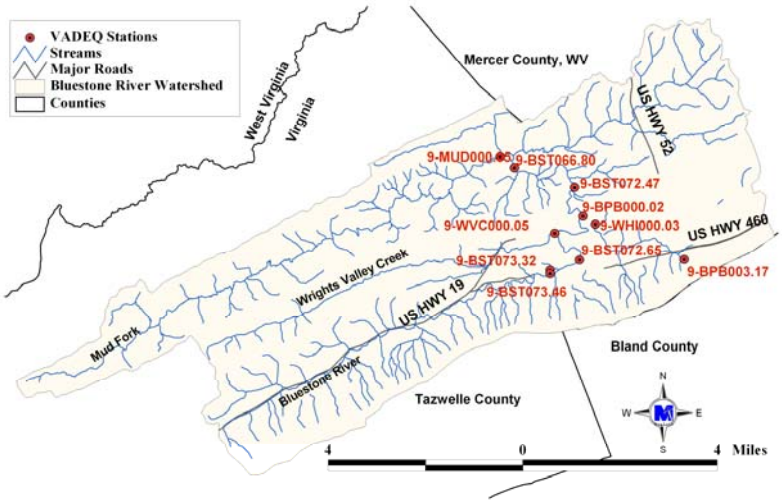

Figure 5. VADEQ monitoring stations in the Bluestone River watershed.

Table 8. Monitoring station IDs, station locations, and monitoring schedules for the Bluestone River watershed VADEQ stations.

Station ID	Station Location	Monitoring Period
9-BST066.80	RT. 717 BRIDGE OFF RT 102 AT GAGE - FALL	Every other month continuous – ambient Biological 2008 and again 2011
9-BST073.32	ONE LANE BRIDGE ON PRIVATE RD IN RICHWOO	Citizen monitoring- bacteria
9-MUD000.05	Bri. # 1047 on Rt. 102 off Rt. 460	every other month for 2 years beginning in 2011 then it will rotate out for 4 years
9- BIG000.12	Big Branch	every other month for 2 years beginning in 2011 then it will rotate out for 4 years
9- BST062.47	Bluestone at Nemours	every other month for 2 years beginning in 2011 then it will rotate out for 4 years
9-LRR001.39	Laurel Fk	every other month for 2 years beginning in 2011 then it will rotate out for 4 years

Education

Personnel from the Tazewell SWCD, along with the FTEs, will initiate contact with stakefolders in the Bluestone River watershed to encourage the installation of BMPs. This one-on-one contact will facilitate communication of the water quality problems and the corrective actions needed. The FTEs will conduct a number of outreach activities in the watershed to encourage community support and participation in reaching the industrial program milestones, and to make the community aware of the TMDL requirements. Such activities will include information exchange through newsletters, mailings, field days, organizational meetings, etc. The FTEs will work with organizations such as Virginia Cooperative Extension to educate the public.

Stakeholders' Roles and Responsibilities

Stakeholders are individuals who live or have land management responsibilities in the watershed, including government agencies, businesses, private individuals and special interest groups. Stakeholder participation and support is essential for achieving the goals of this TMDL implementation plan effort.

Environmental Protection Agency

The EPA has the responsibility for overseeing the various programs necessary for the success of the Clean Water Act. However, administration and enforcement of such programs falls largely to the states. In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. The state agencies responsible for regulating activities that impact water quality include: VADEQ, VADCR, VDH, DMME, VCE, VDOF, and Virginia Department of Agriculture and Consumer Services (VDACS).

Department of Environmental Quality

DEQ has responsibility for monitoring the waters to determine compliance with state standards and for requiring permitted point dischargers to maintain loads within permit limits. They have the regulatory authority to levy fines and take legal action against those in violation of permits. Beginning in 1994, animal waste from confined animal facilities in excess of 300 animal units (cattle and hogs) has been managed through a Virginia general pollution abatement permit. These operations are required to implement a number of practices to prevent groundwater contamination. In response to increasing demand from the public to develop new regulations dealing with animal waste, in 1999 the Virginia General Assembly passed legislation requiring DEQ to develop regulations for the management of poultry waste in operations having more than 200 animal units of poultry (about 20,000 chickens) (ELI, 1999). On January 1, 2008 the Virginia Department of Environmental Quality (DEQ) assumed regulatory oversight of all land application of treated sewage sludge, commonly referred to as biosolids. DEQ's Office of Land Application Programs within the Water Quality Division to manages the biosolids program. The biosolids program includes having and following nutrient management plans for all fields receiving biosolids, unannounced inspections of the land application sites, certification of persons land applying biosolids, and payment of a $7.50 fee per dry ton of biosolids land applied.

Department of Conservation and Recreation

VADCR holds the responsibility for addressing nonpoint sources (NPS) of pollution. Historically, most VADCR programs have dealt with agricultural NPS pollution through education and voluntary incentive programs. These cost-share programs were originally developed to meet the needs of voluntary partial participation and not the TMDL-required 100% participation of stakeholders. It should be noted that VADCR does not have regulatory authority over the majority of NPS issues addressed here.

Tazewell Soil and Water Conservation District

The Tazewell SWCD will provide outreach, technical and financial assistance to farmers and property owners in the Bluestone River watershed through the Virginia Agricultural BMP Cost-Share and Tax Credit programs. Their responsibilities will include promoting implementation goals, identify available funding and the benefits of BMPs and providing assistance in the survey, design, layout, and approval of agricultural BMPs. Education and outreach activities are a significant portion of their responsibilities. The Tazewell SWCD is currently receiving technical assistance funding to support their duties.

Virginia Department of Agriculture and Consumer Services

Through Virginia's Agricultural Stewardship Act, the VDACS Commissioner of Agriculture has the authority to investigate claims that an agricultural producer is causing a water quality problem on a case-by-case basis. If deemed a problem, the Commissioner can order the producer to submit an agricultural stewardship plan to the local soil and water conservation district, pay a fine of up to up to $5,000 per day, or even shut down all or part of an agricultural activity. The enforcement of the Agricultural Stewardship Act is entirely complaint-driven.

Virginia Department of Health

VDH is responsible for maintaining safe drinking water measured by standards set by EPA. Their duties also include septic system regulation and, historically, regulation of biosolids land application. Like VDACS, VDH's program is complaint-driven. Complaints can range from a vent pipe odor that is not an actual sewage violation and takes very little time to investigate, to a large discharge violation that may take many weeks or longer to effect compliance. In the scheme of this TMDL IP, VDH has the responsibility of enforcing actions to

correct or eliminate failed septic systems and straight pipes, respectively.

Local Governments

Local governments can develop ordinances involving pollution prevention measures and play a very active role in the TMDL implementation process.

The local governments can play a very active role in the implementation process. For example, they could promote a septic system maintenance program. This could be done by handing out literature when individuals apply for a building permit. It is recommended (if they have not done so already) that Tazewell County adopt a reserve area for land parcels using on-site wastewater treatment of equal size to the approved on-site disposal system for use in the event the on-site disposal system fails. Further, the reserve area shown must be of equal capacity to the primary drainfield using the same technology as the primary system. Nothing shall be constructed within the reserve area. County governments could also play an active role in the proper disposal of pet waste. When licenses for dog kennels are issued the owners should be required to produce a plan for the proper disposal of waste from the facility. Future subdivisions should be developed with sustainable growth practices that minimize of eliminate storm water runoff.

Citizens

Successful implementation depends on stakeholders taking responsibility for their role in the process. This could include using pet waste composters if they have dogs, getting septic tanks pumped on a regular basis and talking with friends and neighbors about things they can do to protect water quality. While the primary role falls on the landowner, 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. While it is unreasonable to expect that the natural environment (e.g., streams and rivers) can be made 100% free of risk to human health, it is possible and desirable to minimize anthropogenic problems. Virginia's approach to correcting NPS pollution problems has been, and continues to be, encouragement of participation through education and financial incentives. However, if progress is not made toward restoring water quality using this voluntary approach, regulatory controls may be established and enforced.

Water Quality Programs and Activities

Each watershed in the state is under the jurisdiction of a multitude of individual yet related water quality programs and activities, many of which have specific geographic boundaries and goals. These include but are not limited to TMDLs, roundtables, water quality management plans, erosion and sediment control regulations, stormwater management, a source water protection program, and local comprehensive plans. Coordination of the implementation project with these existing programs could result in additional resources and increased participation.

Virginia's Wildlife Action Plan (WAP) was developed to both keep wildlife from becoming endangered and to keep common wildlife species common. The Plan helps achieve these goals by identifying Virginia's species of greatest conservation need, the habitats these species rely upon, the issues impacting these species and/or their habitats, and the conservation actions needed to address these issues. The WAP was created with the help of dozens of partners and an extensive public review process. The WAP is scheduled to be updated in 2015.

Using information provided within the WAP, there are 10 species of fish, three mussels, two aquatic insects, a sail, three crayfish and one amphibian species of greatest concern in the New River Basin Ridge and Valley habitat area. As such, the Bluestone River TMDL implementation plan compliments the Virginia Wildlife Action Plan by creating strategies to improve aquatic habitats that dozens of species of greatest conservation need depend upon.

An electronic copy of the WAP can be found on the Internet at http://www.bewildvirginia.org/wildlifeplan/. The New River in the Ridge and Valley habitat area and the highest priority species within that drainage are discussed in Chapter 7.

List of Acronyms

BMP Best Management Practice
BST Bacterial Source Tracking
cfu/100mL Colony forming units of bacteria per 100 millileters of water
CREP Conservation Reserve and Enhancement Program
CWA Clean Water Act
EPA Environmental Protection Agency
EQIP Environmental Quality Incentive Program
FTE Full Time Equivalent
IP Implementation Plan
Kg Kilogram
NPS Non Point Source
NRCS Natural Resources Conservation Service
Section 303(d) List Dirty Waters List
SE/R-CAP Southeast Rural Community Assistance Project
SL-6 Grazing Land Protection System
SWCB Soil and Water Conservation Board
SWCD Soil and Water Conservation District
t/yr Metric tons per year
TMDL Total Maximum Daily Load
VADCR Virginia Department of Conservation and Recreation
VADEQ Virginia Department of Environmental Quality
VCE Virginia Cooperative Extension
VDACS Virginia Department of Agriculture and Consumer Services
VDH Virginia Department of Health
VDOF Virginia Department of Forestry
WP-2T Streambank Protection
WP-4 Waste Storage Facility
WQIA Water Quality Improvement Fund

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