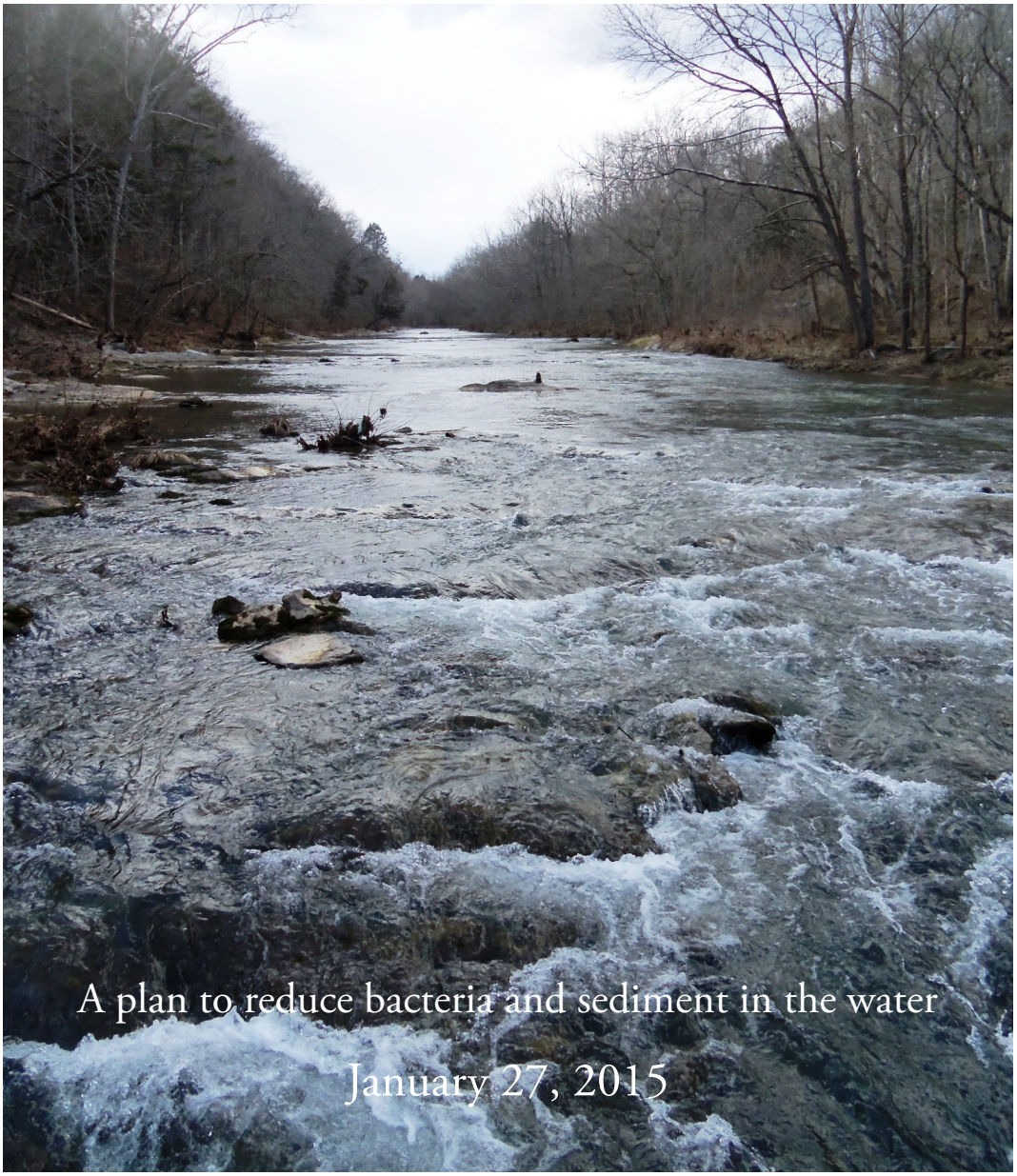
Water Quality Improvement Plan

BUFFALO, COLLIERS & CEDAR CREEKS



Prepared by

The Virginia Department of Environmental Quality

In Cooperation with

Local Stakeholders

Department of Biological Systems Engineering,

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A landowner's guide to Buffalo and Cedar Creeks

Buffalo and Cedar Creeks are beautiful streams, rich in history. Buffalo Creek is known by Rockbridge County residents to offer wonderful opportunities for canoing, kayaking and fishing, while Cedar Creek runs under Natural Bridge, one of the most notable scenic and historically valuable places in the Commonwealth. In addition, Buffalo Creek was recently designated as a Special Project Area by the VA Outdoors Foundation due to the fact that it is one of the last largely forested connections between the Alleghany and Blue Ridge Mountains. Despite the fact that large portions of theses watersheds remain pristine, Buffalo Creek (including the North and South Forks), Colliers and Cedar Creeks are all included on Virginia's list of impaired streams. Water quality monitoring has shown that these streams have high concentrations of bacteria, which means that people face an increased risk of illness or infection when coming into "primary contact" with the water (swimming and splashing water into your eyes or mouth). In addition, Colliers Creek does not support a healthy and diverse population of aquatic life due to excess sediment in the creek.

A study of the streams and the sources of bacteria and sediment in their watersheds was completed by the VA Department of Environmental Quality in 2013. Bacteria sources include failing septic systems and straight pipes (pipes discharging untreated sewage into the stream), runoff of manure from pasture and cropland, livestock access to the streams, and wildlife. Primary sediment sources in Colliers Creek include pasture, hay and developed areas. This plan has been developed in order to provide a road map to address these issues, working closely with landowners in the watersheds. A series of actions has been identified that will lead to restoration of these streams so that they are once again considered safe for primary contact and supportive of aquatic life. Examples of these actions include: repairing and replacing failing septic systems, excluding livestock from streams, implementing rotational grazing systems, and utilizing continuous no-till on cropland. It is expected that it will take about ten years to remove the streams from the Commonwealth's impaired waters list. Within 15 years, sufficient actions could be implemented to prevent the streams from ever violating the state's water quality standard for bacteria.

Many of the actions included in this plan have the potential to benefit water quality in the streams *and* offer economic gains to landowners. These may include reduced veterinary bills for farmers with livestock, and higher property values for homeowners with functional septic systems. However, the upfront cost of some of these best management practices can be considerable. The estimated cost to remove these streams from the impaired waters list is about $9.2M. The good news is that a large portion of this money would be returned to the local economy through the use of local contractors to construct fences, install wells and repair septic systems. Outreach will be critical to increasing landowner adoption of these practices. It is estimated that one full time position will be needed in order to work with landowners. The Natural Bridge Soil and Water Conservation District (SWCD) could house this position should funding be located. Successful implementation of this plan will depend on strong partnerships. Key partners include: Rockbridge County, USDA Natural Resource Conservation Service, the SWCD, the Health Department, and local landowners.

What is needed to remove the Buffalo and Cedar Creeks and their tributaries from Virginia's impaired waters list?

The list of actions below is an estimate of what it would take to remove the creeks from Virginia's impaired waters list. While the list is long and the extent of work needed is large, it is important to remember that if everyone makes small changes in their daily lives, it will make a BIG difference in the creeks.

Residential/urban best management practices needed:

- 424 septic tank pumpouts
- 209 septic system repairs
- 180 septic system replacements with conventional systems
- 53 septic system replacements with alternative waste treatment systems
- 2 pet waste stations
- 7 acres treated with stormwater BMPs (stormwater clarifer and rain gardens)

Agricultural best management practices needed:

- 32 miles of livestock stream exclusion fence (includes length of fence on both sides of the stream)
- 16,156 acres of improved pasture management
- 18 acres of permanent vegetative cover on critical areas of pasture (highly eroded or denuded areas)
- 195 acres of reforestation of highly erodible pasture
- 5 small acreage grazing systems (for equine)
- 2 waste storage facilities
- 769 acres of pasture treated by water control structures
- 20 acres of continuous no till
- 3 acres of contour stripcropping
- 6 acres of streamside buffers on cropland
- 3,000 feet of streambank stabilization

For information on how you can help:

- Technical and financial assistance with agricultural best management practices
  Natural Bridge Soil and Water Conservation District
  website: www.naturalbridgeswcd.com phone: (540)463-7124
- Information about septic system maintenance, repairs and replacements
  Rockbridge County Health Department
  website: www.vdh.virginia.gov/LHD/CentralShenanoah/ phone: (540)463-3185 ext. 4
- Information about water quality, citizen monitoring, and TMDL implementation
  Virginia Department of Environmental Quality
  website: www.deq.virginia.gov phone: (540)574-7850

INTRODUCTION

The Clean Water Act (CWA) requires that all of our streams, rivers, and lakes meet the state water quality standards.

The CWA also requires that states conduct monitoring to identify polluted waters that do not meet standards. Through our monitoring program, the state of Virginia has found that many streams do not meet state water quality standards for protection of the five beneficial uses: recreation, the production of edible and marketable natural resources, aquatic life, wildlife, and drinking. When streams fail to meet standards they are placed on the state's impaired waters list, and the state must then develop a Total Maximum Daily Load (TMDL) for each pollutant. A TMDL is a "pollution budget" for a stream, meaning that it sets limits on the amount of pollution that a stream can tolerate and still maintain water quality standards. In order to develop a TMDL, background concentrations, point source loadings, and non-point source loadings are considered. Non-point source pollution occurs when pollutants from multiple sources are transported across the land to a body of water when it rains. Point source pollution occurs when pollutants are directly discharged into a stream. Through the TMDL process, states establish water-quality based controls to reduce pollution and meet water quality standards.

Water quality problems in Buffalo, Colliers and Cedar Creeks:

TMDLs were completed for the North and South Forks of the Buffalo, Colliers and Cedar Creek in 2013 after water quality monitoring showed that:

1) The creeks were violating the State's water quality standard for bacteria. This standard is based on the concentration of *E. coli* bacteria in the water, and is designed to minimize the risk of illness or infection after coming into contact with the water. The standard states that the *E. coli* bacteria count should not exceed a geometric mean of 126 cfu per 100 mL of water for two or more samples taken over a 30-day period, and that it should not exceed 235 cfu per 100 mL at any time. Table 1 shows the frequency at which the creeks were violating this standard based on monitoring by the Virginia Department of Environmental Quality (VADEQ).

2) Colliers Creek was violating the general (benthic) standard for aquatic life use. This standard states that all state waters should support "the propagation and growth of a balanced indigenous population of aquatic life..." (State Water Control Board, 2006). Based on biological monitoring conducted by the Virginia Department of Environmental Quality (VADEQ), it was concluded that the creek was not meeting this designation. After an in depth review and analysis of available data by a Technical Advisory Committee, the primary stressor on the aquatic community in Colliers Creek was identified as sediment (VADEQ, 2013).

Table 1. Monitoring stations on Buffalo, Colliers and Cedar Creeks and tributaries and violation rates of the *E.coli* water quality standard.

Station ID	Stream Name	# of samples	Violation rate	Sampling period
2-BFN000.07	NF Buffalo	12	16.7%	2007-2008
2-BFS000.15	SF Buffalo	23	47.8%	2007-2012
2-BLD000.22	Buffalo Creek	29	24.1%	2003-2012
2-CLL001.99	Colliers Creek	23	21.7%	2007-2012
2-CEC000.04	Cedar Creek	47	14.9%	2008-2012
2-CEC003.60	Cedar Creek	47	48.9%	2008-2012

Creating a TMDL Implementation Plan

Once a TMDL is developed for a stream, the next step is to create a plan that identifies how the pollutant reductions identified in the TMDL can be achieved. A TMDL Implementation Plan describes actions that can be taken by landowners in the watersheds that will result in improved water quality in the stream. There are nine components included in an implementation plan:

1. Causes and sources of bacteria and sediment that will need to be controlled to meet the water quality standards
2. Reductions in pollutants needed to achieve water quality standards
3. Management measures (BMPs) that will need to be implemented to achieve the pollutant reductions
4. Technical and financial assistance needed, associated costs, and the authorities that will be relied upon to implement the plan
5. An information/education component that will be used to enhance public understanding on the project and encourage participation in selecting and implementing best management practices
6. A schedule for implementation of the practices identified in the plan
7. Goals and milestones for implementing best management practices
8. A set of criteria for determining if bacteria and sediment reductions are being achieved and if progress is being made towards attaining water quality standards
9. A monitoring program to evaluate the effectiveness of the implementation effort

(VADCR & VADEQ, 2003)

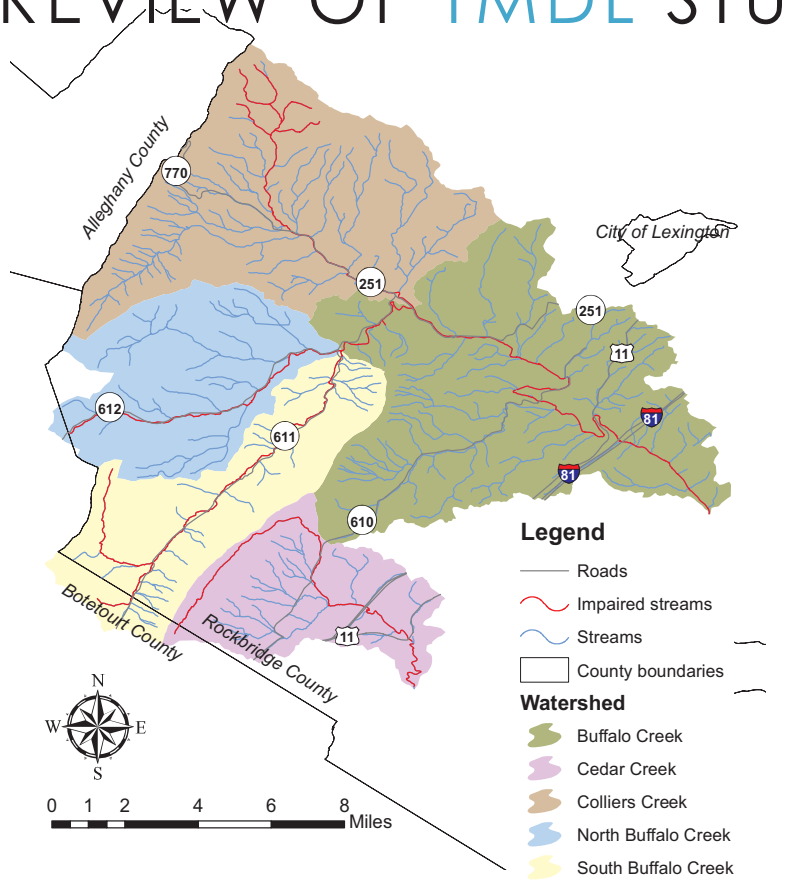


Figure 1. Location of the watersheds

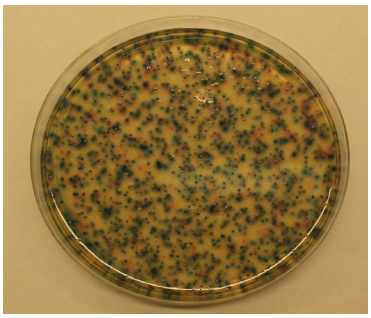
Watershed Characteristics

The North and South Forks of Buffalo Creek, Colliers and Cedar Creeks are located in Rockbridge County, Virginia. All four watersheds are part of the James River Basin and total approximately 79,226 acres (124 sq miles). Buffalo and Colliers Creeks drain into the Maury River, while Cedar Creek drains to the James River. Forest and pasture/hay are the predominant land uses in the watershed (74% and 21% respectively). According to the 2012 Census of Agriculture, the average farm in Rockbridge County is 202 acres, with over 57% of primary operators identifying their primary occupation as something other than farming. The county ranked 3rd in the state for the inventory of goats, and 7th for turkeys. The average net cash income for a farm in Rockbridge County was estimated at $2,239 (USDA, 2012).

As shown in Figure 1, the impaired segment of Colliers Creek extends 13.77 miles from the headwaters down to its confluence with Buffalo Creek The impairments on the North and South Fork of Buffalo Creek extend from their headwaters downstream to their confluence with the mainstem of Buffalo Creek, 7.28 and 13.24 miles, respectively. The impaired segment of Cedar Creek extends 11.49 miles downstream to its confluence with the James River (VADEQ, 2002, 2004, 2006, 2010, 2012).

Sources of Bacteria

Agricultural runoff, direct deposition of manure in streams by livestock, and wildlife have been identified as the primary sources of bacteria in the creeks. Non-point sources of bacteria in the watersheds include failing septic systems, livestock, wildlife, and domestic pets. Point sources including individual residences can contribute bacteria to streams through their permitted discharges. There are currently ten point sources permitted to discharge bacteria in the watersheds, nine of which are single family home permits (four in Buffalo Creek, four in Colliers Creek, and one in Cedar Creek). Natural Bridge Park and Historic Hotel, located in the Cedar Creek watershed, also has a permit to discharge bacteria (permitted *E.coli* concentration of 126 cfu/100mL, permitted *E.coli* load of 1.72 $x10^{11}$ cfu/year).



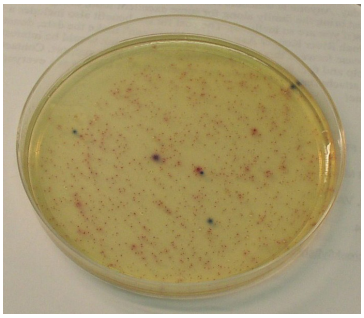


Photo shows coliscan plates, which reveal the presence and abundance of *E.coli* colonies (blue dots) and coliform bacteria colonies (red dots) in a stream where livestock have access (left) and where they have been excluded (right). Photo: Bobby Whitescarver, NRCS

Goals for Reducing Bacteria

The TMDL study completed for the creeks identified goals for reducing bacteria from the different sources in the watersheds. The goals shown in Table 1 below are based on what it would take to remove the creeks from the impaired waters list. This can occur when the single sample water quality standard for *E. coli* (235 cfu/100mL) is violated no more than 10.5% of the time. Greater reductions in non point source pollution will be needed in order to achieve a 0% violation rate, which were also identified in the TMDL. In addition, reductions from wildlife would be needed in order to meet the TMDL. Since even healthy streams violate the standard occassionally, and since the TMDL program does not address wildlife, the focus of planning efforts was on meeting the goals shown below.

Table 2. Bacteria reduction goals for removal of streams from the impaired waters list (VADEQ, 2013)

Watershed	**Fecal Coliform Reduction from Source Category (%)**				**% Violation of *E.coli* standard** (Single sample standard)
	Straight Pipes & Failing Septic	Livestock stream access	Pasture runoff	Cropland runoff	
Buffalo Creek	100%	50%	50%	10%	10.1%
Colliers Creek	100%	70%	50%	10%	9.9%
NF Buffalo Creek	100%	35%	35%	10%	10.3%
SF Buffalo Creek	100%	99%	50%	10%	10.5%
Cedar Creek	100%	99%	50%	10%	10.2%

Sources of Sediment

Based on the TMDL study results, the major source of sediment in Colliers Creek is runoff from pasture (an estimated 70% of the total sediment load). This is partly due to the fact that next to forest, pasture makes up the greatest amount of acreage in the watersheds. In addition, pasture is particularly susceptible to erosion when vegetative cover is minimal such as when overgrazing occurs or denuded areas develop where livestock frequently congregate (such as where hay is fed). Other nonpoint sources of sediment in the watersheds include runoff from developed areas, cropland and hayland. Stream channel erosion also contributes sediment to the stream. Point source contributions of sediment in the watershed are minimal, and include four single family home permits.

Goals for Reducing Sediment

Photo: Rockbridge Area Conservation Council

The Colliers Creek TMDL study includes an assessment of the sources of sediment in the watershed as well as the reductions that are needed from each source in order to restore the benthic community in the creek. Two potential scenarios were developed for the TMDL. An additional reduction scenario was proposed during the creation of this plan (Scenario 3. Table 3). Based on conditions in the watershed and costs associated with BMP implementation measures, this scenario was selected for implementation planning purposes.

Table 3. Goals for sediment reductions in Colliers Creek

Scenario	Sediment Loads and Reductions by Source Category						
	Cropland	**Pasture**	**Hay**	**Forest**	**Developed**	**Channel Erosion**	**Point Sources**
Existing load (T/yr)	78.3	8,689.4	1,355.2	1,185.1	755.0	103.7	103.4
TMDL Scenario 1: % reduction	0%	27.3%	27.3%	0%	27.3%	27.3%	0%
TMDL Scenario 2: % reduction	0%	33%	0%	0%	10%	33%	0%
Scenario 3: % reduction	15%	34%	0%	0%	0%	15%	0%

COMMUNITY PARTICIPATION

Collecting input from the local community on conservation and outreach strategies to include in the TMDL Implementation Plan was a critical step in this planning process.

A public meeting was held on the evening of May 8, 2014 at the Effinger Fire Hall to kick off the development of the implementation plan. This meeting served as an opportunity for local residents to learn more about the problems facing the creeks and work together to come up with new ideas to protect and restore water quality in their community. This meeting was publicized through notices to local media outlets, email announcements, invitations mailed to riparian landowners, and fliers posted throughout the watersheds. The meeting included a presentation by VADEQ staff on current water quality issues in the watersheds and development of the implementation plan. This presentation was followed by break out sessions to collect local input on characteristics of the watersheds and ideas regarding what to include in the plan. Approximately 40 people attended the meeting. A final public meeting was held on October 28, 2014 at the Natural Bridge Historic Hotel to present the completed draft plan to the public and collect local input. Over 80 people attended.

Two working groups (agricultural and residential) were formed in order to discuss implementation and outreach strategies suitable for different land uses in the watersheds. Each working group was made up of stakeholders who were familiar with land use management issues specific to their particular working group focus area. The residential working group met twice during the development of this plan, while the agricultural working group had three meetings.

The role of the Agricultural Working Group was to review conservation practices and outreach strategies from an agricultural perspective. During the first agricultural working group meeting, which was held as a break out session during the first public meeting in May, the group discussed the status

of farming in the region and characteristics of typical farms in the watershed. It was noted that there has not been much development of agricultural land in the region for many years, and that there are a significant number of conservation easements in place in the watersheds. The group also discussed livestock stream exclusion practices and obstacles to implementation. Concerns were expressed about long term maintenance requirements, the reliability of off stream watering systems, and the loss of land. The group discussed the potential development of a fencing insurance program to address maintenance concerns. In addition, participants stressed the importance of promoting the economic benefits of agricultural best management practices included in the plan. A second meeting was held on June 25, 2014 at the Palmer Community Center. During this meeting, the group reviewed a series of BMP implementation scenarios. It was noted that farmers may want to phase implementation of livestock exclusion systems, and start with installation of a small amount of fencing and limited access points to the stream before excluding all of their fields and installing off stream watering systems. The group also discussed the extent of agricultural land in the watersheds that is leased, and the challenges that this presents for farmers and landowners interested in installing agricultural BMPs. A third meeting was held on August 7, 2014 at the Palmer Community Center. During this meeting, the group reviewed a final BMP implementation scenario and discussed associated costs and an appropriate timeline. The group agreed that 10 years would be a good goal for accomplishment of BMPs needed to remove the streams from the impaired waters list. An interest was expressed in initiating a citizen monitoring network. In addition, concerns were expressed about the future of regulation of the agricultural community in an effort to protect water quality.

The primary role of the Residential Working Group was to discuss methods needed to reduce human sources of bacteria entering the creeks, recommend methods to identify and correct or replace failing septic systems and straight pipes, and provide input on the BMPs to include in the plan. At their first meeting on May 8th, the residential working group discussed the need for increased education and outreach regarding septic system maintenance. The group identified a number of strategies to reach the community with informational materials. In addition, estimates of repairs and replacements needed were reviewed. It was noted that there are not many alternative waste treatment systems in the watersheds. A second residential working group meeting was held on July 10, 2014 at the Natural Bridge Hotel. During this meeting, the group agreed that a septic tank pumpout assistance program could serve as a valuable outreach tool. The group reviewed the costs of septic system practices and identified a timeline of seven years to accomplish BMP goals. Targeting strategies for outreach were discussed and several areas with high potential for malfunctioning septic systems and straight pipes were identified including homes along Possum Hollow Road, Colliers Creek as it exits the national forest, and Rapps Mill in the South Fork Buffalo watershed. The group discussed the potential for other residential BMPs including sediment filtering practices such as rain gardens. It was agreed that opportunities for these kinds of practices are very limited in residential areas of the watersheds.

The Steering Committee met on September 11, 2014 at the Palmer Community Center to discuss plans for the final public meeting and to review a draft of the implementation plan. The final public meeting was held on October 28, 2014 at the Natural Bridge Historic Hotel. A community supper was provided by the Upper James RC&D and many partners set up informational displays.

IMPLEMENTATION ACTIONS

Photo: Bill Howard, Downstream Project

An important part of the implementation plan is the identification of specific actions that will improve water quality in the watersheds.

This section provides a summary of what is needed to achieve the bacteria and sediment reductions specified in the TMDL study. Since this plan is designed to be implemented by landowners on a voluntary basis, it is necessary to identify actions including management strategies that are both financially and technically realistic and suitable for this particular community. As part of this process, the costs and benefits of these actions must be examined and weighed. Once the best actions were identified for implementation, estimates of the number of each action that would be needed in order to meet water quality goals were developed.

Management Actions Selected through Stakeholder Review

While management actions such as livestock exclusion and correction of failing septic systems were directly prescribed by the TMDL, a number of additional measures were needed to control bacteria and sediment coming from land-based sources. Various scenarios were developed and presented to the working groups, who reviewed both economic costs and the water quality benefits. The majority of agricultural best management practices (BMPs) in this plan are included in state and federal agricultural cost share programs that promote conservation. The final set of practices identified and the efficiencies used in this study are listed in Table 4. It should be noted that an adaptive management strategy will be utilized in the implementation of this plan. BMPs that are easiest to implement, provide the greatest water quality benefits, and offer the greatest economic return to landowners will be implemented first. The effectiveness of these practices will be continually evaluated, and adjustments to actions will be made as appropriate. As new technologies and innovative BMPs to address bacteria and sediment become available, these practices should also be evaluated for implementation in the watersheds.

Table 4. Bacteria and sediment reduction efficiencies for best management practices

BMP Type	Description	Bacteria Reduction	Sediment Reduction	Reference
Livestock stream exclusion	Livestock exclusion from waterway	100%	LU Change	1, 4
Streambank stabilization	Streambank stabilization	N/A	54.25 lbs/ ft/yr	5
Pasture	Streamside buffer (35-100 feet)	40%	40%	2, 5
	Improved pasture management	50%	30%	3, 5
	Permanent vegetative cover on critical areas	LU Change	LU Change	4
	Reforestation of highly erodible pasture/cropland	LU Change	LU Change	4
	Small acreage grazing system (equine)*	40%	40%	2, 5
	Manure storage facility	80%	N/A	3
	Stormwater control structure	88%	49%	7
Cropland	Stripcropping	25%	25%	2, 5
	Continuous no-till	70%	70%	2, 5
	Riparian buffers	40%	40%	2, 5
Straight pipes and septic systems	Septic tank pumpout	5%	N/A	6
	Septic system repair	100%	N/A	1
	Septic system replacement	100%	N/A	1
	Alternative waste treatment system	100%	N/A	1
Pet waste	Pet waste disposal station	100%	N/A	1
Developed	Bioretention filters	80%	80%	8
	Stormwater clarifier	97%	99%	9

*Practice includes a livestock stream exclusion requirement, but is shown under pasture BMPs in order to demonstrate the land based components and associated pollution reduction benefits.

References

1. Removal efficiency is defined by the practice
2. Bacteria efficiency assumed to be equal to sediment efficiency.
3. VADCR and VADEQ. 2003. Guidance manual for Total Maximum Daily Load Implementation Plans. Available at: www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/TMDLImplementationPlanGuidanceManual.aspx
4. Based on differential loading rates to different land uses.
5. Chesapeake Assessment Scenario Tool - BMP effectiveness values by land use andHGMR and pollutant
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7. Center for Watershed Protection. 2007. National Pollutant Removal Performance Database, Version 3.
8. USEPA-CBP. 2006. Nonpoint source best management practices currently used in Scenario Builder for Phase 5.0 of the Chesapeake Bay Program Watershed Model. Revised 02/09/2011
9. Horsley (1995) in: Design of Filtering Systems, Richard A. Claytor, Chapter 4, pg. 27

LIVESTOCK IN THE STREAMS

Photo: Mike Phillips, NRCS

A 40%-99% reduction in the deposit of waste by livestock in the water is needed to de-list the streams, making some form of stream fencing necessary.

To estimate fencing needs, stream segments that flowed through or were adjacent to pasture were identified using GIS mapping. Not every pasture has livestock on it at any given point in time; however, it is assumed that all pasture areas have the potential for livestock access, meaning that livestock exclusion fencing should be installed. It is expected that the majority of fencing will be accomplished through the VA Agricultural BMP Cost Share Program and federal NRCS cost share programs. In order to determine the appropriate mix of fencing practices, tax parcel data was utilized in conjunction with local data from the VADCR Agricultural BMP Database to determine typical characteristics of livestock exclusion systems in the region (e.g., streamside fencing length per practice). In addition, input was collected from the Agricultural Working Group, NRCS and the Natural Bridge SWCD regarding typical components of each system, associated costs, and preferred fencing setbacks. Data on stream fencing already in place was collected and subtracted from the total fencing needed. A total of 17.7 miles of fencing was installed in the watersheds between August 1998 and June 2012. An estimated 32 miles of fencing (includes fencing on both sides of the stream where applicable) will be needed to remove the streams from the impaired waters list. In addition, 3,000 feet of streambank stabilization will be needed to achieve sediment reduction goals for Colliers Creek, which can be done in conjunction with livestock exclusion projects.

Table 5. Fencing needs assessment

Description	Buffalo Creek	Colliers Creek	NF Buffalo	SF Buffalo	Cedar Creek
% livestock stream exclusion needed for de-listing	50%	55%	40%	99%	99%
Stream fencing needed (ft)	46,855	51,624	8,700	25,015	23,799

A summary of cost share programs available to farmers interested in installing fencing is provided on pages 38-41. The codes shown in blue in the paragraph below were taken from these programs. Incentive payments vary based on the width of the streamside buffer that is installed between the fence and the stream. The portion of fencing that will be accomplished using different fencing practices was based on historical data and input from farmers and agricultural conservation professionals.

Farmers who cannot give up 35 feet or more for a streamside buffer can receive 50% cost share for the installation of fencing with a 10-foot setback, cross fencing, and an alternative water source for their livestock. It is estimated that **60%** of fencing in the watersheds will be installed using this practice (code LE-2T). If a landowner can afford to give up 35 feet for a buffer along the stream, then they are eligible to receive cost share at a rate of 75%-85% for stream fencing, cross fencing and providing alternative water. It is estimated that **30%** of the total fencing will be installed using this practice (codes LE-1T and SL-6T). In cases where a watering system already exists, a WP-2T system is a more appropriate choice. This system includes streamside fencing and a 35-ft buffer from the stream. This practice includes an up-front cost share payment of 50 cents per linear foot of fence installed to assist in covering fencing maintenance costs. Since financial assistance with development of alternative water sources is a significant incentive for farmers to install fencing, this practice is used infrequently because it does not provide cost share for the installation of a well. Consequently, it was estimated that only **5%** of fencing in the watersheds would be accomplished using this practice. For those who are willing to install a 35 foot buffer or larger and plant trees in the buffer, USDA-NRCS's Conservation Reserve Enhancement Program (CREP) is an excellent option. This practice provides cost share and incentive payments ranging from 50% to 115% for fencing and planting materials. This program has not been very popular in the watersheds to date; consequently, it is estimated that only **5%** of fencing in the watersheds will be installed through CREP.

Implementation of a "Flexible Fencing Program" in the watersheds using private funding was identified as a way to increase interest in livestock stream exclusion. More information on this potential program is provided in the Funding for Implementation section of the document on page 41.

Table 6. Livestock exclusion BMPs (feet and number of exclusion systems)

Watershed	Fencing by Exclusion System Type (linear feet and # of practices)							
	LE-1T/SL-6T		LE-2T		WP-2T		CREP	
	Feet	#	Feet	#	Feet	#	Feet	#
Buffalo Creek	14,057	7	28,113	16	2,343	2	2,343	1
Colliers Creek	19,768	10	39,536	22	3,295	3	3,295	1
NF Buffalo	2,284	1	4,568	3	381	0	381	0
SF Buffalo	7,505	4	15,009	8	1,251	1	1,251	1
Cedar Creek	7,140	4	14,279	8	1,190	1	1,190	0

IMPLEMENTATION ACTIONS FOR PASTURE

Photo: Rockbridge Area Conservation Council

Runoff from pastures can carry with it sediment from exposed ground and bacteria from manure deposited on the land on its way to the stream.

Improved pasture management can prevent overgrazing by livestock, thereby reducing runoff, increasing filtration and vegetative uptake of pollutants, and allowing farmers to better utilize their pastures. This practice includes: maintaining minimum forage height during the growing season, application of lime and fertilizer when needed, following a nutrient management plan, controlling woody vegetation, distributing manure through managed rotational grazing, a sacrifice area for feeding during winter and summer droughts, and reseeding if necessary. Vegetated buffers act as filters, trapping pollutants before they run into the stream. Farmers can utilize cost share programs to convert highly erodible pasture such as areas with steep slopes and poor vegetative cover to forest. These types of pasture typically produce a lower yield of forage for livestock making them less optimal for grazing or cutting hay. In addition, waste storage facilities (dry stack facilities) where manure can be scraped up and stored can be useful for producers with larger operations. Water retention structures have the capacity to treat large volumes of runoff before it enters the stream. Table 7 shows pasture BMPs needed in order to reduce bacteria and sediment to a level at which the streams can be removed from the impaired waters list.

Table 7. Pasture BMPs

BMP	BMP (acres unless otherwise specified)					
	Buffalo Creek	**Colliers Creek**	**NF Buffalo**	**SF Buffalo**	**Cedar Creek**	**TOTAL**
Improved pasture management	7,588	4,380	1,307	1,062	1,819	**16,156**
Reforestation of erodible pasture	89	48	17	22	19	**195**
Permanent vegetative cover on critical areas	9	5	3	1	0	**18**
Small acreage grazing (equine)* (systems)	2	2	0	1	0	**5**
Waste storage facility (beef cattle)	1	1	0	0	0	**2**
Water retention structures (ac. treated)	0	0	0	769	0	**769**

*Practice includes a stream exclusion fencing requirement, but is shown here to demonstrate land based component

IMPLEMENTATION ACTIONS FOR CROPLAND

Bacteria and sediment can run off of cropland when soils fertilized with manure are exposed to rainfall. These pollutants will make their way to the stream unless filtering practices like riparian buffers are in place to trap it.

Bacteria and sediment from cropland can end up in a stream unless the appropriate management practices are in place. Runoff of bacteria from manure spread on cropland can be reduced by using practices that limit the amount of runoff that can occur. Reducing tillage of the soil, increasing soil organic content and allowing better cover will reduce the degree of runoff and soil loss from cropland during rain events. Many farmers in Rockbridge County are already using some form of reduced tillage on cropland. Consequently, this plan includes a modest amount of continuous no till since it is already commonly used in the region. Contour stripcropping can serve as an effective way of reducing runoff and filtering sediment and bacteria out of the water before it enters the stream as well. In this practice, planned rotations of row crops, forages, and small grains are planted in alternating strips across the contours of a field. Riparian buffers are another effective practice for filtering of polluted runoff. There are limited opportunities for cropland buffers in the watersheds since most of the agricultural land next to the streams is currently in pasture. Table 8 shows the estimated extent of cropland BMPs needed in order to remove the streams from the impaired waters list.

Table 8. Cropland BMPs needed

BMP	BMP Acres					
	Buffalo Creek	Colliers Creek	NF Buffalo	SF Buffalo	Cedar Creek	TOTAL
Continuous no-till	4	3	2	1	10	**20**
Contour stripcropping	0	0	0	0	3	**3**
Riparian buffers	2	1	1	1	1	**6**

STRAIGHT PIPES AND FAILING SEPTIC SYSTEMS

Since state law requires that failing septic systems and straight pipes be corrected, a 100% reduction in bacteria from these sources is needed.

Estimates of the percentages of households with failing septic systems and straight pipes (pipes directly discharging untreated sewage into the stream) in the watersheds are shown in Table 7. These estimates were developed as part of the TMDL study. They are based on the age of homes in the watershed, and in the case of straight pipes, the proximity of homes to the stream. Estimates of needed repairs and replacements of failing systems with conventional and alternative systems were based on input from the Health Department and observations from septic system maintenance projects in the region. Based on existing conditions in the watersheds, it was estimated that approximately 20% of septic system replacements would be done with alternative waste treatment systems while the remaining 80% could be done using conventional septic systems. No opportunities for connection to public sewer were identified in the watersheds. A septic tank pumpout program could be utilized to help educate homeowners in the watersheds about septic system maintenance and to locate and correct failing septic systems. This program could be implemented on a limited basis, targeting homes closest to streams. The estimates shown in Table 9 are based on pumping out septic tanks for 25% of households.

Table 9. Residential wastewater treatment BMPs

Watershed	Failing septic systems	Straight pipes	Septic system repair	Alternative waste treatment system	Septic system replacement (conventional)	Septic system replacement with pump	Septic tank pumpout
Buffalo Creek	180	5	90	21	55	19	185
Colliers Creek	111	6	56	16	35	12	114
NF Buffalo	31	2	16	4	11	4	32
SF Buffalo	42	6	21	8	14	5	41
Cedar Creek	54	5	26	9	18	6	52
TOTALS	**418**	**24**	**209**	**58**	**133**	**46**	**424**

URBAN IMPLEMENTATION ACTIONS

In order to treat bacteria running off of developed land, BMPs to reduce and filter stormwater runoff will be necessary.

Due to the largely agricultural land base of the watersheds, opportunities for stormwater BMPs are relatively limited. However, several opportunities were identified at the Natural Bridge Hotel in the Cedar Creek watershed. The hotel and tourist attraction includes close to ten acres of parking lots, for which upgrades in stormwater management could be implemented. Several potential projects are identified in Table 10 below. Rain gardens are specially designed to catch runoff from pavement and rooftops and allow it to infiltrate down through the soil where pollutants are filtered out. A stormwater clarifier serves as a settling tank that removes solids, oil, gas and other pollutants from stormwater runoff. The clarifier consists of a series of chambers and filters that allow for settling and filtration of pollutants. The hotel was also identified as a suitable place for the installation of pet waste stations by the residential working group. The group also discussed the potential for stormwater BMPs in the Colliers Creek watershed where a sediment impairment exists; however, opportunities for these practices could not be identified by participants.

Table 10. Developed area BMPs (Cedar Creek watershed)

BMP	Units	Extent
Rain gardens	acres treated	5
Stormwater clarifier	ac treated	7
Pet waste station	stations	2

EDUCATION AND OUTREACH

In order to get landowners involved in implementation, education and outreach and assistance with the design and installation of best management practices will be needed.

In order to get landowners involved in implementation, it will be necessary to initiate education and outreach strategies and provide technical assistance with the design and installation of various best management practices. There must be a proactive approach to contact farmers and residents to identify the practices that will help meet the goal of improved water quality while also meeting their needs as private landowners. Economic costs and benefits must be considered in this process. The working groups recommended several education/outreach techniques, which will be utilized during implementation.

The following additional education and outreach strategies were identified:

Agricultural Programs

- Make contact with landowners in the watersheds to make them aware of cost-share assistance, and voluntary options that are available to agricultural producers interested in conservation. Simplify paperwork as much as possible and provide funding committments in writing.
- Provide technical assistance for agricultural programs (e.g., survey, design, layout).
- Develop and distribute educational materials. Include concrete economics with respect to costs and benefits of BMPs. Distribute materials through existing media outlets including: *The Weekender, Farm Credit Newsletter and Knowledge Center*, Rockbridge Co-op Bulletin Board, Farm Bureau, Tractor Supply, and Ruritan Clubs
- Organize educational programs for farmers including farm tours in partnership with VA Cooperative Extension. Share information on how to address issues with implementing BMPs on leased land. Host a field day to highlight the benefits of rotational grazing on a local farm.
- Establish a "rainy day fund" or fencing insurance program to cover repair costs when livestock stream exclusion fencing is washed out.
- Locate funds for a "Flexible Fencing Program" modeled after the program implemented in the Shenandoah Valley. Explore opportunities to partner with the Chesapeake Bay Funders Network or other organizations to secure private funds to support the program.
- Establish a citizen monitoring program in the watersheds.

Residential Programs

- Identify straight-pipes and failing septic systems (e.g., contact landowners through mailings)
- Develop and distribute educational materials (e.g., septic system maintenance guide).
- Provide additional outreach and financial assistance to low income property owners in the watershed. Consider current literacy rates in development of outreach strategies to reach this sector of the population. Develop a volunteer labor force with assistance from within the community. Potential partners include: universities, churches, Habitat for Humanity, Rockbridge Area Conservation Council, Ruritan Clubs, Natural Bridge/VA Conservation Legacy Fund and the Community Foundation.
- Identify funding opportunities for a program offering long term low interest loans to homeowners who cannot afford their portion of the cost of a repair or a septic system replacement.
- Partner with VA Cooperative Extension's Master Well Owner Network to host a clinic on well safety and potential drinking water contamination from failing septic systems.
- Consider partnerships with non governmental organizations in development of a septic system assistance program. Distrust of the government will be an obstacle to effective outreach and having local partners could help to address this issue
- Establish a citizen monitoring program to locate problem areas in the watersheds. Interest was expressed in targeted monitoring in the South Fork of the Buffalo watershed. Explore partnerships with the Effinger Ruritan Club and local churches (Rapps Mill Church, Collierstown United Methodist Church, Oxford Presbyterian Church, & Collierstown Presbyterian Church).

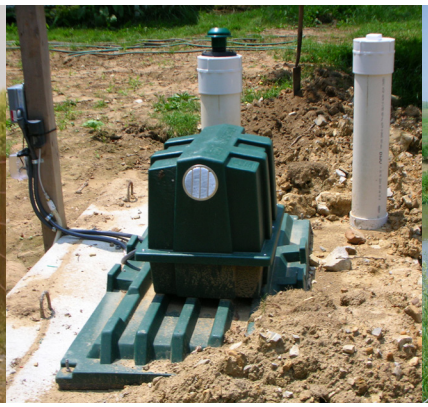
In addition to the specific outreach activities mentioned above, opportunities for more general education and outreach were identified. Boxerwood Education Association was noted as a key partner for outreach to local schools. Through their direct connections with area schools and teachers, they could work with local students to generate fliers and videos about the project along with residential and agricultural BMPs. These projects would thus educate local students and their families.

Staffing Needed for Outreach and Technical Assistance

A critical component in the successful implementation of this plan is the availability of knowledgeable staff to work with landowners on implementing conservation practices. While this plan provides a general list of practices that can be implemented in the watershed, property owners face unique management challenges to implementation of practices. Consequently, technical assistance is a key component to successful BMP implementation. Technical assistance includes helping landowners identify suitable BMPs for their property, designing BMPs and locating funding.

The staffing level needed to implement this plan was estimated based on discussions with stakeholders and the staffing levels used in similar projects including the Hays Creek TMDL implementation project in Rockbridge County. It was determined that 1 position would be needed for agricultural and residential implementation. The Natural Bridge Soil and Water Conservation District currently houses one position that is focused on TMDL implementation. Should funding become available, the SWCD would be well suited to administer both the agricultural and residential BMP programs.

IMPLEMENTATION COSTS



Costs: Agricultural BMPs

The costs of agricultural best management practices included in the implementation plan were estimated based on data for Rockbridge County from the VADCR Agricultural BMP Database, the NRCS and Natural Bridge SWCD Cost Lists,input from SWCD and NRCS staff, and input from the agricultural working group (Table 11).

The total cost of livestock exclusion systems includes not only the costs associated with fence installation and maintenance, but also the cost of developing alternative water sources for SL-6, LE-1T, LE-2T, and CREP practices. It should be noted that CREP does not pay for cross fencing to establish a rotational grazing system; however, this program is commonly combined with state programs that can cover these costs. The cost of fence maintenance was identified as a deterrent to participation. Financial assistance with maintaining fences is available through the WP-2T practice and includes an annual 25% tax credit, and an up front incentive payment on $0.50 per linear foot of fence to assist with fencing maintenance. However, this practice has not been commonly used in the watershed since it does not provide cost share for alternative water systems. In addition, the average cost of fence maintenance is typically significantly higher. In developing the cost estimates for fence maintenance, a figure of $3.50/linear foot of fence was used. It was estimated that approximately 10% of fencing would need to be replaced over the timeline of this plan.

The majority of agricultural practices recommended in this plan are included in state and federal cost share programs. These programs offer financial assistance with implementing the practices and may also provide landowners with an incentive payment to encourage participation. However, it should be noted that these programs typically cover 75% of the cost of a BMP and require that the landowner cover the full cost of the practice up front and then receive reimbursement. Reimbursements are usually issued quickly and there is a low interest loan program available through VADEQ; however, this may still be an obstacle for some landowners interested in participating.

Table 11. Estimated agricultural BMP costs to achieve de-listing goal

Practice	Cost share code	Units	Unit cost	Cost by watershed					TOTAL
				Buffalo Creek	Colliers Creek	NF Buffalo	SF Buffalo	Cedar Creek	
Livestock exclusion with riparian buffers	CREP	system	$40,683	$38,124	$53,615	$6,194	$20,354	$19,364	$137,651
	WP-2T	system	$8,500	$16,594	$23,337	$2,696	$8,860	$8,429	$59,916
	LE-1T/SL-6T	system	$32,830	$230,737	$324,494	$37,489	$123,188	$117,196	$883,105
Livestock exclusion with reduced setback	LE-2T	system	$31,305	$488,932	$687,602	$79,440	$261,035	$248,338	$1,765,347
Livestock exclusion fence maintenance (15 yrs)	N/A	feet	$3.50	$16,399	$23,063	$2,664	$8,755	$8,330	$59,211
Streambank stabilization	WP-2A	feet	$150	$0	$450,000	$0	$0	$0	$450,000
Improved pasture management	EQIP (529, 512)	acres	$100	$758,800	$438,000	$130,700	$106,200	$181,900	$1,615,600
Reforestation of erodible pasture	FR-1	acres	$330	$29,370	$15,840	$5,610	$7,260	$6,270	$64,350
Permanent vegetative cover on critical areas	SL-11	acres	$1,200	$10,800	$6,000	$3,600	$1,200	$0	$21,600
Small acreage grazing system (equine)	SL-6AT	system	$20,000	$40,000	$40,000	$0	$20,000	$0	$100,000
Waste storage facility (beef cattle)	WP-4	facility	$75,000	$75,000	$75,000	$0	$0	$0	$150,000
Water retention/control structure	WP-1	ac.treated	$138	$0	$0	$0	$106,122	$0	$106,122
Continuous no till	SL-15	acres	$100	$400	$300	$200	$100	$1,000	$2,000
Contour stripcropping	SL-3	acres	$100	$0	$0	$0	$0	$300	$300
Riparian buffers on cropland	FR-3/WQ-1	acres	$1,000	$2,000	$1,000	$1,000	$1,000	$1,000	$6,000
TOTAL ESTIMATED COST				$1,707,156	$2,138,251	$272,639	$664,074	$592,127	$5,374,247

Costs: Residential and Urban/Developed Area BMPs

The costs of recommended residential BMPs shown in Table 12 were estimated using input from the Rockbridge County Health Department, local septic system contractors, and the residential working group.

Table 12. Estimated residential and urban/developed BMP costs to achieve de-listing goal for Buffalo (NF and SF). Colliers and Cedar

Practice	Cost share code	Units	Unit cost	Cost by watershed					
				Buffalo Creek	Colliers Creek	NF Buffalo	SF Buffalo	Cedar Creek	TOTAL
Septic tank pumpout	RB-1	pumpout	$285	$52,725	$32,490	$9,120	$11,685	$14,820	**$120,840**
Septic system repair	RB-3	repair	$3,000	$270,000	$168,000	$48,000	$63,000	$78,000	**$627,000**
Conventional septic system replacement	RB-4	system	$8,000	$448,000	$288,000	$80,000	$120,000	$144,000	**$1,080,000**
Conventional septic system replacement w/pump	RB-4P	system	$9,000	$171,000	$108,000	$27,000	$45,000	$54,000	**$405,000**
Alternative waste treatment system	RB-5	system	$20,000	$400,000	$260,000	$80,000	$140,000	$180,000	**$1,060,000**
Pet waste stations	N/A	station	$150	$0	$0	$0	$0	$2,600	**$2,600**
Rain gardens	N/A	ac. treated	$12,000	$0	$0	$0	$0	$60,000	**$60,000**
Stormwater clarifier	N/A	ac. treated	$1,500	$0	$0	$0	$0	$10,500	**$10,500**
TOTAL ESTIMATED COST				$1,341,725	$856,490	$244,120	$379,685	$543,920	$3,365,940

Table 13 Total estimated costs of BMP implementation to achieve de-listing goals.

BMP Type	Buffalo Creek	Colliers Creek	NF Buffalo	SF Buffalo	Cedar Creek	TOTAL
Agricultural	$1,707,156	$2,138,251	$272,639	$664,074	$592,127	$5,374,247
Residential/developed	$1,341,725	$856,490	$244,120	$379,685	$543,920	$3,365,940
TOTAL	$3,048,881	$2,994,741	$516,759	$1,043,759	$1,136,047	$8,740,187

Costs: Technical Assistance

Technical assistance costs were estimated for 1 position using a cost of $50,000/per year. This figure is based on the existing staffing costs included in the Virginia Department of Environmental Quality's grant agreement with the Natural Bridge Soil and Water Conservation District for the Hays Creek implementation project in Rockbridge County. Based on the ten year timeline for achieving de-listing goals (described in great detail in the Implementation Timeline section of this plan), this would make the total cost of technical assistance approximately $500,000. When factored in to the cost estimate for BMP implementation shown in Table 13, this would make the total cost of implementation approximately $9.2M. The cost of fully achieving the TMDL (never violating the water quality standard) including technical assistance is estimated at $11.25M (see Goals and Milestones section for additional information on this goal and associated BMP implementation levels).

IMPLEMENTATION BENEFITS

The primary benefit of implementing this plan will be cleaner water in Buffalo and Cedar Creeks and their tributaries. This may lead to enhanced quality of life for the local community as well as potential economic benefits.

Specifically, *E. coli* contamination in the creeks will be reduced to meet water quality standards. In addition, sediment levels in the Colliers Creek will be reduced to a level that allows the stream to host a healthy and diverse population of aquatic life. It is hard to gage 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, the incidence of infection from *E. coli* sources through contact with surface waters should be reduced considerably following the implementation of the measures outlined in this plan. The restoration of the aquatic community in Colliers Creek through reductions in sediment loading to the creek may result in improvements to quality of life for local residents. Recreational opportunities like fishing and birdwatching may be enhanced as improvements to the aquatic community make their way up the food chain.

An important objective of the implementation plan is to foster continued economic vitality. 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 and residential practices recommended in this document will provide economic benefits to the community, as well as the expected environmental benefits. Specifically, alternative (clean) water sources, exclusion of cattle from streams, rotational grazing, and private sewage system maintenance will each provide economic benefits to land owners. Additionally, money spent by landowners and other stakeholders in the process of implementing this plan will stimulate the local economy.

Benefits: Agricultural Practices

It is recognized that every farmer faces unique management challenges that may make implementation of some BMPs more cost effective than others. Consequently, costs and benefits of the BMPs recommended in this plan must be weighed on an individual basis. The benefits highlighted in this section are based on general research findings. Additional economic costs and benefits analyses of these practices at the local level was identified as a much needed outreach tool by the agricultural working group in order to convince many agricultural landowners to implement BMPs.

Restricting livestock access to streams and providing them with a clean water source has been shown to improve weight gain and milk production in cattle (Zeckoski et al., 2007). Studies have shown that increasing livestock consumption of clean water can lead to increased milk and butterfat production and increased weight gain (Landefeld et al, 2002). Table 14 shows an example of how this can translate into economic gains for producers. In addition, keeping cattle in clean, dry areas has been shown to reduce the occurrence of mastitis and foot rot. The VCE (1998) reports that mastitis costs producers $100 per cow in reduced quantity and quality of milk produced. Installation of streamside fencing and well managed loafing areas will reduce the amount of time that cattle have access to these areas. Implementing a prescribed grazing management strategy in conjunction with a providing livestock with a clean water source will also provide economic benefits for the producer. Standing forage utilized directly by the grazing animal is less costly and of higher quality than forage harvested with equipment and fed to the animal.

Table 14. Example of increased revenue due to installing off-stream waterers (Surber et al., 2005)

Typical calf sale weight	Additional weight gain due to off-stream waterer	Price	Increased revenue due to off stream waterer
500 lb/calf	5% or 25 lb	$0.60 per lb	$15 per calf

Note: Table from Zeckoski et al. (2007)

Benefits: Residential Practices

The residential program will play an important role in improving water quality since human waste can carry human viruses in addition to bacterial and protozoan pathogens. In terms of economic benefits to homeowners, an improved understanding of on-site sewage treatment systems, including knowledge of what steps can be taken to keep them functioning properly, 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 to 25 years if

properly maintained. Proper maintenance includes: knowing the location of the system components and protecting them (e.g., 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 3 to 5 years. The cost of proper maintenance, as outlined here, is relatively inexpensive ($250 per pumpout) in comparison to repairing or replacing a system ($6,000 to $25,000).

In addition to the benefits to individual landowners, the local economy will be stimulated through expenditures made during implementation, and the infusion of dollars from funding sources outside of the watersheds. Building contractors and material suppliers who deal with septic system pump-outs, private sewage system repair and installation, fencing, and other BMP components can expect to see an increase in business during implementation.

Benefits: Urban Stormwater Practices

Opportunities for enhanced stormwater management have been identified at the Natural Bridge Hotel, located in the Cedar Creek watershed. The primary benefits of stormwater management practices to private property owners include flood mitigation and improved water quality. In addition, urban BMPs have a number of economic benefits to localities. Increased retention of stormwater on site can lower peak discharges, thereby reducing the drainage infrastructure needed to prevent flooding. This can result in cost savings to local governments through reduced engineering and land acquisition costs, and reduced materials and installation costs for stormwater culverts and streambank armoring to prevent scour. Lastly, implementation of urban BMPs greatly reduces soil erosion and sediment transport to our rivers, streams and lakes. A 1993 study of the economic cost of erosion-related pollution showed that national off-site damages from urban sediment sources cost between $192 million and $2.2 billion per year in 1990 dollar values (Paterson et al, 1993). This cost range would be far greater today if adjusted for inflation.

Benefits: Watershed Health

Focusing on reducing bacteria in the watersheds and sediment in Colliers Creek will have associated watershed health benefits. Reductions in streambank erosion, excessive nutrient runoff, and water temperature are additional benefits associated with streamside buffer plantings. In turn, reduced nutrient loading and erosion and cooler water temperatures improves habitat for fisheries, which provides benefits to anglers and the local economy.

Riparian buffers can also improve habitat for wildlife such as ground-nesting quail and other sensitive species. Data collected from Breeding Bird Surveys in Virginia indicate that the quail population declined 4.2% annually between 1966 and 2007. Habitat loss has been cited as the primary cause of this decline. As a result, Virginia has experienced significant reductions in economic input to rural communities from quail hunting. The direct economic contribution of quail hunters to the Virginia economy was estimated at nearly $26 million in 1991, with the total economic impact approaching $50 million. Between 1991 and 2004, the total loss to the Virginia economy was more than $23 million from declining quail hunter expenditures (VDGIF, 2009). Funding is available to assist landowners in quail habitat restoration (see Funding Sources section).

GOALS AND MILESTONES

The end goal of implementation is restored water quality in Buffalo and Cedar Creeks and there tributaries. It is expected that this will occur over a 10-year period.

Two types of milestones will be used to evaluate progress over the implementation period: implementation milestones and water quality milestones. The implementation milestones establish goals for the extent of the different best management practices installed within certain time frames, while the water quality milestones establish the corresponding goals for improvements in water quality.

Following the idea of a staged implementation approach, resources and finances will be concentrated on the most cost-efficient control measures and areas of highest interest first. For instance, the TMDL study indicated that runoff from pasture is the source of approximately 94% of total bacteria in Buffalo Creek. Concentrating on implementing pasture management practices within the first several years may provide the highest return on water quality improvement with less cost to landowners.

While the focus of this plan is to remove these streams from the impaired waters list, full achievement of the TMDL must also be demonstrated. This means that the BMPs needed to accomplish a 0% violation rate of the bacteria standard and full support of the aquatic life use standard must be identified, along with associated costs and a timeline. Based on input from the working groups regarding BMP adoption rates, it is estimated that it would take a total of 15 years to fully implement the TMDLs. The overall timeline for implementation has been divided into two stages: 2015–2025 and 2025–2030. Implementation of practices included in Stage 1 is expected to result in removal of the streams from the impaired waters list and full support of the aquatic life use standard in Colliers Creek, while Stage 2 goals demonstrate what it would take to meet the TMDL goal exclusive of the reductions

in wildlife contributions called for in the study. Table 15 shows the cost of BMP implementation in each watershed at each stage while tables 16-20 show implementation and water quality improvement goals for each watershed in each implementation stage.

Table 15. BMP implementation costs by stage

Stage	Buffalo Creek	Colliers Creek	NF Buffalo	SF Buffalo	Cedar Creek	TOTAL
Stage 1 (Years 1-10)	$3,152,482	$3,131,678	$511,049	$1,135,004	$1,127,717	$9,057,930
Stage 2 (Years 10-15)	$790,922	$794,772	$143,794	$0	$0	$1,729,488

Table 16. Timeline for implementation in the Buffalo Creek watershed

BMP Type	BMP	Units	Stage 1		Stage 2	
			Extent	% Land use treated	Extent	% Land use treated
Livestock stream exclusion	Livestock exclusion w/riparian buffers	feet/systems	18,742/10	20%	19,142/10	30%
	Livestock exclusion w/reduced setback	feet/systems	28,113/16	30%	28,713/16	29%
Pasture	Improved pasture management	acres	7,588	86%	0	0%
	Reforestation of erodible pasture	acres	89	1%	0	0%
	Permanent vegetation on critical areas	acres	9	0.1%	0	0%
	Small acreage grazing system (equine)[t]	acres/systems	8/2	0.1%	0	0%
	Waste storage facility	facility	1	N/A	0	N/A
Cropland	Continuous no till	acres	4	5%	90	2%
	Riparian buffers	acres	2	29%	0	0%
Residential* Septic	Septic tank pumpout	pumpout	185	25%	0	0%
	Septic system repair	repair	90	50%	0	0%
	Conventional septic system	system	56	30%	0	0%
	Conventional septic system w/pump	system	19	10%	0	0%
	Alternative waste treatment	system	20	10%	0	0%
Average annual *E.coli* load (cfu/yr)			1.44×10^{14}		1.23×10^{14}	
% Violation of Single Sample *E. coli* standard (235 cfu/100mL)			10.47%		6.57%	
% Violation of Geometric mean *E. coli* standard (126 cfu/100mL)			22.92%		6.25%	

[t]Small acreage grazing system practice includes stream exclusion in addition to pasture management; practice is shown under pasture BMPs to account for associated land based reductions. Livestock should be excluded from waterways when this practice is applied.

*percent land use treated: percent calculation based on total number of failing septic systems and straight pipes with exception of septic tank pumpouts (based on the total number of dwellings with septic systems)

Table 17. Timeline for implementation in the Colliers Creek watershed

BMP Type	BMP	Units	Stage 1		Stage 2	
			Extent	% Land use treated	Extent	% Land use treated
Livestock stream exclusion	Livestock exclusion w/riparian buffers	feet/systems	26,358/14	22%	11,036/6	18%
	Livestock exclusion w/reduced setback	feet/systems	39,356/22	33%	16,553/9	26%
Streambank stabilization	Streambank stabilization	feet	4,000	4%*	0	0%
Pasture	Improved pasture management	acres	4,380	92%	309	8%
	Reforestation of erodible pasture	acres	48	1%	49	1%
	Permanent vegetation on critical areas	acres	5	0.1%	0	0%
	Small acreage grazing system (equine)[t]	acres/systems	10/2	0.2%	0	0%
	Waste storage facility	facility	1	N/A	0	N/A
	Water retention/control structure	ac. treated	0	0%	2,114	45%
Cropland	Continuous no till	acres	3	5%	0	0%
	Riparian buffers	acres	1	35%	0	0%
Residential* Septic	Septic tank pumpout	pumpout	114	25%	0	0%
	Septic system repair	repair	56	50%	0	0%
	Conventional septic system	system	36	30%	0	0%
	Conventional septic system w/pump	system	12	10%	0	0%
	Alternative waste treatment	system	13	10%	0	0%
Average annual *E.coli* load (cfu/yr)			4.70×10^{13}		2.87×10^{13}	
% Violation of Single Sample *E. coli* standard (235 cfu/100mL)			10.40%		6.98%	
% Violation of Geometric mean *E. coli* standard (126 cfu/100mL)			29.17%		14.58%	
Average annual sediment load (T/yr) (TMDL goal = 9,289.27)			9,289.22		8,966.06	
% Reduction in sediment load (TMDL goal = 24%)			24%		27%	

[t]Small acreage grazing system practice includes stream exclusion in addition to pasture management; practice is shown under pasture BMPs to account for associated land based reductions. Livestock should be excluded from waterways when this practice is applied.

*percent land use treated: percent calculation based on total number of failing septic systems and straight pipes with exception of septic tank pumpouts (based on the total number of dwellings with septic systems)

Table 18. Timeline for implementation in the North Fork Buffalo Creek watershed

BMP Type	BMP	Units	Stage 1		Stage 2	
			Extent	% Land use treated	Extent	% Land use treated
Livestock stream exclusion	Livestock exclusion w/riparian buffers	feet/systems	3,045/2	16%	3,480/2	14%
	Livestock exclusion w/reduced setback	feet/systems	4,568/3	24%	5,220/3	21%
Pasture	Improved pasture management	acres	1,307	77%	0	0%
	Reforestation of erodible pasture	acres	17	1%	0	0%
	Permanent vegetation on critical areas	acres	3	0.2%	0	0%
Cropland	Continuous no till	acres	2	5%	0	0%
	Riparian buffers	acres	1	13%	0	0%
Residential* Septic	Septic tank pumpout	pumpout	32	25%	0	0%
	Septic system repair	repair	16	50%	0	0%
	Conventional septic system	system	10	30%	0	0%
	Conventional septic system w/pump	system	3	10%	0	0%
	Alternative waste treatment	system	4	10%	0	0%
Average annual *E.coli* load (cfu/yr)			4.18×10^{13}		3.72×10^{13}	
% Violation of Single Sample *E. coli* standard (235 cfu/100mL)			10.27%		5.13%	
% Violation of Geometric mean *E. coli* standard (126 cfu/100mL)			27.08%		0.00%	

*percent land use treated: percent calculation based on total number of failing septic systems and straight pipes with exception of septic tank pumpouts (based on the total number of dwellings with septic systems)

Table 19. Timeline for implementation in the South Fork Buffalo Creek watershed

BMP Type	BMP	Units	Stage 1		Stage 2	
			Extent	% Land use treated	Extent	% Land use treated
Livestock stream exclusion	Livestock exclusion w/riparian buffers	feet/systems	10,006/5	40%	0/0	0%
	Livestock exclusion w/reduced setback	feet/systems	15,009/8	59%	0/0	0%
Pasture	Improved pasture management	acres	1,062	99%	0	0%
	Reforestation of erodible pasture	acres	22	2%	0	0%
	Permanent vegetation on critical areas	acres	1	0.1%	0	0%
	Small acreage grazing system (equine)[t]	acres/systems	6/1	0.6%	0	0%
	Water retention/control structure	ac. treated	769	72%	0	0%
Cropland	Continuous no till	acres	1	5%	0	0%
	Riparian buffers	acres	1	31%	0	0%
Residential* Septic	Septic tank pumpout	pumpout	41	25%	0	0%
	Septic system repair	repair	21	50%	0	0%
	Conventional septic system	system	15	30%	0	0%
	Conventional septic system w/pump	system	5	10%	0	0%
	Alternative waste treatment	system	7	10%	0	0%
Average annual *E.coli* load (cfu/yr)			1.15×10^{13}		1.15×10^{13}	
% Violation of Single Sample *E. coli* standard (235 cfu/100mL)			10.47%		10.47%	
% Violation of Geometric mean *E. coli* standard (126 cfu/100mL)			18.75%		18.75%	

[t]Small acreage grazing system practice includes stream exclusion in addition to pasture management; practice is shown under pasture BMPs to account for associated land based reductions. Livestock should be excluded from waterways when this practice is applied.

*percent land use treated: percent calculation based on total number of failing septic systems and straight pipes with exception of septic tank pumpouts (based on the total number of dwellings with septic systems)

Table 20. Timeline for implementation in the Cedar Creek watershed

BMP Type	BMP	Units	Stage 1		Stage 2	
			Extent	% Land use treated	Extent	% Land use treated
Livestock stream exclusion	Livestock exclusion w/riparian buffers	feet/systems	9,519/5	40%	0/0	0%
	Livestock exclusion w/reduced setback	feet/systems	14,279/8	59%	0/0	0%
Pasture	Improved pasture management	acres	1,819	98%	0	0%
	Reforestation of erodible pasture	acres	19	1%	0	0%
Cropland	Continuous no till	acres	10	10%	0	0%
	Contour stripcropping	acres	3	3%		
	Riparian buffers	acres	1	50%	0	0%
Residential* Septic	Septic tank pumpout	pumpout	152	25%	0	0%
	Septic system repair	repair	26	50%	0	0%
	Conventional septic system	system	18	30%	0	0%
	Conventional septic system w/pump	system	6	10%	0	0%
	Alternative waste treatment	system	9	10%	0	0%
Pet waste	Pet waste stations	station	2	9.52%	0	0%
Developed	Rain gardens	ac. treated	5	0.7%	0	0%
	Stormwater clarifier	ac. treated	7	1%	0	0%
Average annual *E.coli* load (cfu/yr)			1.78×10^{13}		1.78×10^{13}	
% Violation of Single Sample *E. coli* standard (235 cfu/100mL)			10.18%		10.18%	
% Violation of Geometric mean *E. coli* standard (126 cfu/100mL)			16.67%		16.67%	

*percent land use treated: percent calculation based on total number of failing septic systems and straight pipes with exception of septic tank pumpouts (based on the total number of dwellings with septic systems)

Water Quality Monitoring

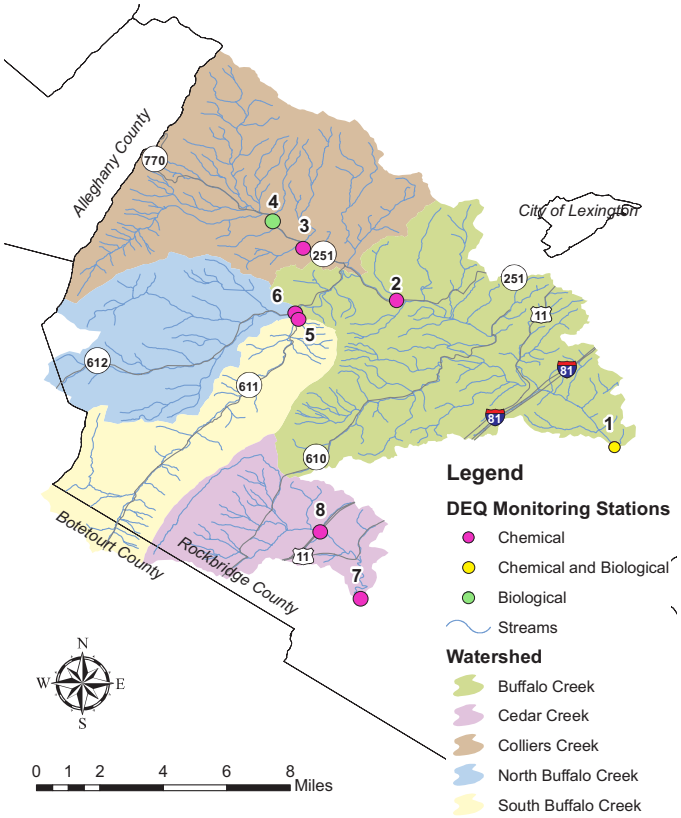


Figure 2. VADEQ monitoring stations. See Table 21 for station location descriptions.

Improvements in water quality will be evaluated through water quality monitoring conducted at VADEQ monitoring stations as shown in Figure 2. The map shows stations that are part of VADEQ's Ambient Monitoring Program, wherein bi-monthly watershed monitoring takes place on a rotating basis for two consecutive years. Monitoring will begin no sooner than the second odd numbered calendar year following the initiation of TMDL implementation efforts in the watersheds. This will help ensure that sufficient time has passed for BMPs to have become functional and improvements in water quality are detectable. At a minimum, the frequency of sample collections will be every other month for two years. After two years of bi-monthly monitoring an assessment will be made to determine if the segments are no longer impaired. Once full restoration has been achieved, monitoring will be suspended.

There is the potential for additional monitoring at a subset of stations in the watersheds where continual VADEQ monitoring is conducted on a bi-monthly basis beginning on the next odd number calendar year after the initiation of implementation. This will require additional funding and can only be accomplished with sufficient resources to support needs of the data users, and only if watershed conditions and stakeholder support are suitable to this strategy. These monitoring stations will be located in the watersheds based on TMDL implementation funds, either state, federal, or other sources, becoming available. Citizen monitoring is another very useful tool for measuring improvements in water quality. Virginia Save Our Streams is a program of the Izaak Walton League of America that trains individuals in biological monitoring methods, including many Rockbridge County residents. VADEQ also provides citizen monitoring training and funding for Coliscan monitoring for bacteria.

Table 21. Station location descriptions for VADEQ monitoring stations.

Station #	Stream	River mile	Description
1	Buffalo	0.22	Private Br. off Rt. 700
2	Buffalo	11.9	Rt. 251 Bridge, near Murat
3	Colliers	1.99	Rt. 644 Bridge
4	Colliers	3.21	~1/2 mile downstream of Rt. 655
5	SF Buffalo	0.15	Rt. 611 Bridge
6	NF Buffalo	0.07	Rt. 611 Bridge
7	Cedar	0.04	Rt. 608 Bridge
8	Cedar	3.60	Rt. 609 Bridge

Targeting Implementation

Implicit in the process of a staged implementation is targeting of best management practices. Targeting ensures optimal utilization of limited technical and financial resources. The agricultural working group discussed potential targeting strategies for fencing practices and other agricultural BMPs. Citizen monitoring was identified as a good way to identify these areas. The working group discussed the challenges of BMP implementation on rented land, and agreed that it might be more worthwhile to focus outreach efforts in the Buffalo and Colliers Creek watersheds where there are more large, operator owned farms.

The residential working group identified areas in the watersheds that are most likely to have straight pipes and failing septic systems and should therefore be targeted for implementation first. These areas included homes along Possum Hollow Road, Colliers Creek as it comes out of the National Forest, and Rapps Mill in the South Fork Buffalo watershed. Citizen monitoring was also identified as a good tool for improved targeting of outreach efforts for residential BMPs and locating failing septic systems and straight pipes.

Fencing Prioritization by Subwatershed

In order to prioritize segments of the creeks for livestock exclusion fencing, each watershed was divided up into a series of smaller subwatersheds, and an analysis of the water quality benefits of livestock exclusion was performed for each subwatershed based on 1) the extent of pasture next to the stream 2) the number of livestock in the watershed and 3) the proximity of the stream segment to the headwaters. The subwatersheds were then ranked in ascending order based on the ratio of bacteria loading per fence length, and proximity to the headwaters. These rankings were modified to reflect input from the agricultural working group regarding characteristics of farms in the watersheds (Figure 3). Due to the fact that there are a greater number of large, operator-owned farms in the Buffalo and Colliers Creek watersheds, it was determined that fencing would be of greater interest in these areas. The South and North Forks of the Buffalo and Cedar Creek have more rented land, making livestock exclusion more challengeing

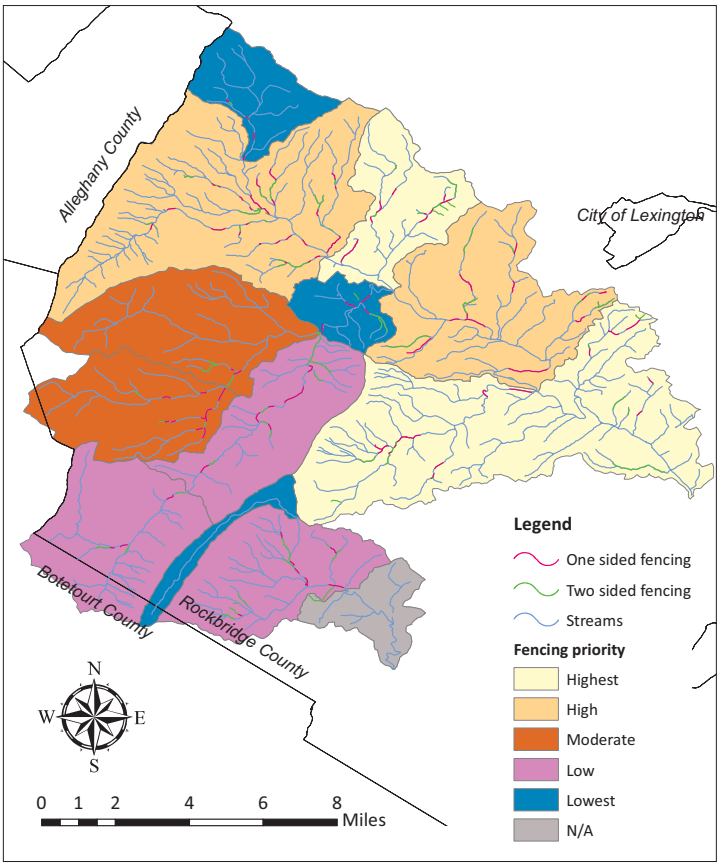


Figure 3. Livestock stream exclusion prioritization

PARTNERS AND THEIR ROLE IN IMPLEMENTATION

Agricultural and Residential Landowners

SWCD and NRCS conservation staff often consider characteristics of farms and farmers in the watersheds that will affect the decisions farmers make when it comes to implementing conservation practices. For example, the average size of farms is an important factor to consider, since it affects how much cropland or pasture a farmer can give up for a riparian buffer. The age of a farmer may also influence their decision to implement best management practices. Table 22 provides a summary of relevant characteristics of farms and producers in Rockbridge County from the 2012 Agricultural Census. These characteristics were considered when developing implementation scenarios, and should be utilized to develop suitable education and outreach strategies.

Table 22. Characteristics of farms and farmers in Rockbridge County, VA (USDA, 2012)

Characteristic		Number
Number of farms		833
Land in farms (acres): full owners		64,002
Land in farms (acres): part owners	Rented land in farms	54,222
	Owned land in farms	44,042
Operators identifying farming as their primary occupation		353
Operators identifying something other than farming as their primary occupation		480
Average age of primary operator		61
Average size of farm (acres)		202
Average market value of farmland and buildings ($/acre)		$4,296
Average net cash farm income of operation ($)		$2,239
Average farm production expenses ($)		$39,055
Farms with internet access		601

In addition to local farmers, participation from homeowners, local government staff and elected officials is critical to the success of this plan. Elected officials and local government staff make important decisions with respect to land use and development that are likely to affect water quality. It is critical that the goals of this plan are considered as these decisions are evaluated and made. Residential property owners will need to ensure that their septic systems are regularly pumped and inspected (every 3-5 years). Though the amount of bacteria that is coming from failing septic systems and straight pipes is minimal compared to livestock, human waste carries with it pathogens that can cause health problems above and beyond those associated with livestock manure.

Natural Bridge Soil and Water Conservation District and Natural Resource Conservation Service

Both the SWCD and NRCS are continually reaching out to farmers in the watersheds and providing them technical assistance with conservation practices. Currently, dedicated staff is not available to work solely in the five watersheds that are covered in this plan, meaning that agricultural BMP implementation goals cannot be met without additional resources. SWCD and NRCS staff responsibilities include promoting available funding and the benefits of BMPs, and providing assistance in the design and layout of agricultural BMPs. SWCD and NRCS staff can assist with conducting outreach activities in the watersheds to encourage participation in conservation programs; however, staff time for very targeted outreach is limited. Such activities include mailing out newsletters and organizing field days. Should funding for additional staff become available for targeted outreach in these watersheds, the Natural Bridge SWCD would be well suited to administer an agricultural BMP program.

Dedicated staff is currently not available to lead efforts to correct failing septic systems and straight pipes as well. The Natural Bridge SWCD is currently implementing a residential septic program in the nearby Hays Creek watershed. Since they have trained and experienced staff, they could take the lead in administering a residential cost share program as well should funding become available.

Rockbridge County

Decisions made by local government staff and elected officials regarding land use and zoning will play an important role in the implementation of this plan. This makes the Rockbridge County Board of Supervisors and the Planning Commission key partners in long term implementation efforts. Currently, Rockbridge County has zoning and land use policies in place that support the preservation of agricultural land and encourage good stewardship of natural resources. The county administers an easement agreement program, which has helped to encourage land conservation across the county. Based on feedback from the agricultural working group, the Buffalo and Cedar Creek watersheds and their tributaries have not been subject to intense development pressures, making it likely that the predominant land uses in the watershed will remain agriculture and forest. Local government support of land conservation will become increasingly important as greater numbers of conservation measures are implemented across the watersheds. Ensuring that land remains in agriculture and forest will allow the practices installed to continue to benefit water quality. The Rockbridge Area Conservation Council may serve as a critical partner in this effort.

Virginia Department of Environmental Quality

The Virginia Department of Environmental Quality has a lead role in the development of TMDL implementation plans. VADEQ also provides available grant funding and technical support for TMDL implementation. VADEQ will work closely with project partners including the Natural Bridge Soil and Water Conservation District to track implementation progress for best management practices. In addition, VADEQ will work with interested partners on grant proposals to generate funds for

projects included in the implementation plan. When needed, VADEQ will facilitate additional meetings of the steering committee to discuss implementation progress and make necessary adjustments to the implementation plan.

VADEQ is also responsible for monitoring state waters to determine compliance with water quality standards. VADEQ will continue monitoring water quality in Buffalo and Cedar Creeks and their tributaries in order to assess water quality and determine when restoration has been achieved and the streams can be removed from Virginia's impaired waters list.

Virginia Department of Conservation and Recreation

The Virginia Department of Conservation and Recreation (VADCR) administers the Virginia Agricultural Cost Share Program, working closely with Soil and Water Conservation Districts to provide cost share and operating grants needed to deliver this program at the local level and track implementation. In addition, VADCR administers the state's Nutrient Management Program, which provides technical assistance to producers in appropriate manure storage and manure and commercial fertilizer

Virginia Department of Health

The Virginia Department of Health (VDH) is responsible for adopting and implementing regulations for onsite wastewater treatment and disposal. The Sewage Handling and Disposal Regulations require homeowners to secure permits for handling and disposal of sewage (e.g. repairing a failing septic system or installing a new treatment system). VDH staff provide technical assistance to homeowners with septic system maintenance and installation, and respond to complaints regarding failing septic systems and straight pipes.

Other Potential Local Partners

There are numerous additional opportunities for future partnerships in the implementation of this plan. Additional potential partners in implementation include:

- VA Cooperative Extension (VCE)
- Chesapeake Bay Funders Network
- Master Well Owner Network (through VCE)
- Rockbridge Area Conservation Council
- Local churches and Ruritan Clubs
- Valley Conservation Council
- Boxerwood Education Association, Inc.
- Conservation Partners, LLC
- Farm Credit
- Natural Bridge Park and Historic Hotel
- VA Conservation Legacy Fund
- Upper James RC&D

INTEGRATION WITH OTHER WATERSHED PLANS

Photo: Rockbridge Area Conservation Council

Each watershed in the state is under the jurisdiction of a multitude of water quality programs and activities, many of which have specific geographic boundaries and goals. Coordination of implementation efforts with these existing programs could make additional resources available and increase participation by local landowners.

Rockbridge County Land Use Plan

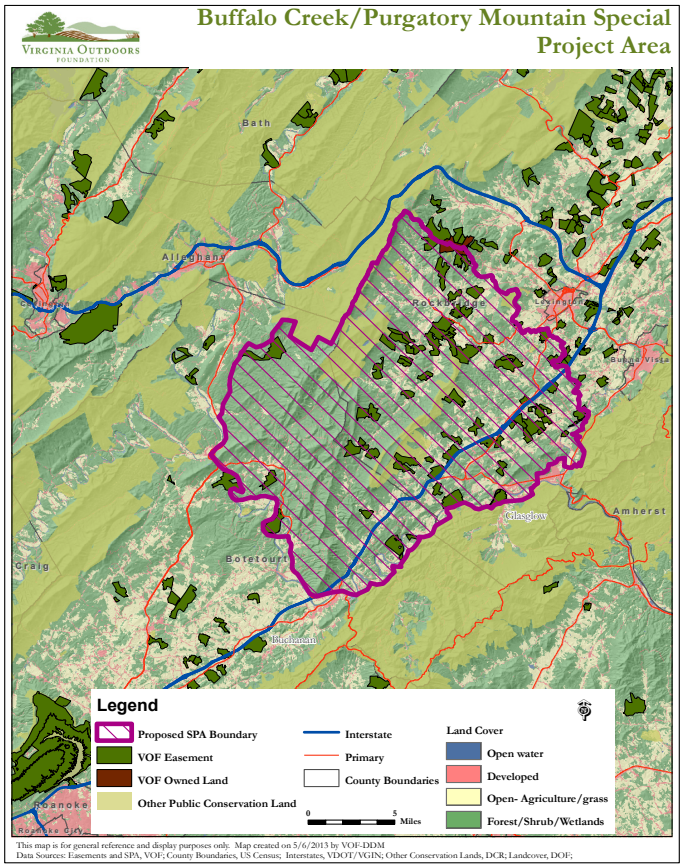
One of the objectives of Rockbridge County Land Use Plan is the "conservation of open space with the County and...long-term preservation and maintenance of valuable natural resource areas..." Several of the strategies listed in the plan supporting this objective will also help to meet the goals of this water quality improvement plan including:

- Define specific valuable natural resources (i.e. viewsheds, aquifer recharge areas, drainage ways and open space) which the County wants to preserve and identify these resoures on a map to be used as a planning base map.
- Identify specific measures to aid the County in its ongoing efforts to preserve rivers and streams for the purpose of preserving their natural beausty and environmnetal attributes, while maximizing recreation potential and conservation opportunities, and locate specific geographic areas where these measures may be applied.
- Develop a wellhead protection program to safeguard public water supply systems.
- Coordinate environmental presevation efforts with neighboring jurisdictions and establish an action plan targeting environmental concerns that require a regional approach.

Virginia's Phase II Chesapeake Bay Watershed Implementation Plan

Virginia's Watershed Implementation Plan (WIP) outlines a series of BMPs, programs and regulations that will be implemented across the state in order to meet nitrogen, phosphorous, and sediment loading reductions called for in the Chesapeake Bay TMDL, completed in December 2010. The TMDL is designed to ensure that all pollution control measures needed to fully restore the Bay are in place by 2025, with at least 60 percent of the actions completed by 2017. A number of the BMPs included in this implementation plan are also found in Virginia's WIP. Consequently, Rockbridge County will be able to track and receive credit for progress in meeting Phase II WIP goals while also working towards implementation goals established in this plan to improve local water quality. For more information about Virginia's Phase II WIP, please visit VADEQ's Bay TMDL webpage: http://www.deq.virginia.gov/Programs/Water/ChesapeakeBay.aspx

Buffalo Creek/Purgatory Mountain Special Project Area



The Buffalo Creek-Purgatory Mountain Special Project Area (SPA) was established by the VA Outdoors Foundation (VOF) in June 2013. The 178,000 acre area includes the watersheds covered in this water quality improvement plan, in addition to land in northern Botetourt County. With this designation, this area has been recognized by VOF for its unique natural resources, making conservation easements of particular importance for the purposes of preservation and habitat improvement. This area serves as an important wildlife corridor, as it is one of the last largely forested connections between the Allegheny and Blue Ridge Mountains. Consequently, Rockbridge Area Conservation Council and other state and local partners are working with VOF to conduct outreach on land conservation, easement opportunities, and the importance of wildlife corridors. The objectives of this water quality improvement effort go hand in hand with those of the SPA initiative. Opportunities to collaborate on outreach efforts should be considered as partners move forward with implementation of the water quality improvement plan.

FUNDING FOR IMPLEMENTATION

A list of potential funding sources available for implementation has been developed. Detailed descriptions can be obtained from the Natural Bridge SWCD, VADCR, Natural Resources Conservation Service, and Virginia Cooperative Extension. While funding is being provided to the Natural Bridge SWCD for agricultural BMPs and technical assistance for farmers, an additional funding commitment is needed to fully implement the agricultural, residential and urban practices included in the plan.

Virginia Agricultural Best Management Practices Cost-Share Program

This program is funded with state and federal monies through local SWCDs. SWCDs administer the program to encourage landowners to use BMPs on their land to better control 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. Cost-share is typically 75% of the actual cost, not to exceed local caps.

Virginia Agricultural Best Management Practices Tax Credit Program

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, is allowed a credit against the tax imposed by Section 58.1-320 of the Code of Virginia equaling 25% of the first $70,000 expended for agricultural BMPs by the individual. The amount of the credit cannot exceed $17,500 or the total amount of the tax imposed by this program (whichever is less) in the year the project was completed. This program can be used in conjunction with other cost-share programs on the landowner's portion of BMP costs. It is also approved for use in supplementing the cost of repairs to streamside fencing.

Virginia Agricultural Best Management Practices Loan Program

Loan requests are accepted through VADEQ. The interest rate is 3% per year and the term of the loan coincides with the life span of the practice. To be eligible for the loan, the BMP must be included in a conservation plan approved by the local SWCD Board. The minimum loan amount is $5,000 with no maximum limit. Eligible BMPs include structural practices such as animal waste control facilities, and grazing land protection systems. Loans are administered through participating lending institutions.

Virginia Small Business Environmental Assistance Fund Loan Program

The Fund, administered through VADEQ, is used to make or guarantee loans to small businesses for the purchase and installation of environmental pollution control equipment, or equipment and structures to implement agricultural BMPs. Loans are available up to $50,000 and will carry an interest rate of 3%, with repayment terms based on the borrower's ability to repay and the life of the equipment or BMP. 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.

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 recipients include local governments, SWCDs, and individuals. Grants for point and nonpoint sources are administered through VADEQ.

Conservation Reserve Program (CRP)

Through this program, cost-share assistance is available to establish cover of trees or herbaceous vegetation on cropland. To be eligible for consideration, the following criteria must be met: 1) cropland was planted or considered planted in an agricultural commodity for two of the five most recent crop years, and 2) cropland is classified as "highly-erodible" by NRCS. The payment to the participant is up to 50% of the cost for establishing ground cover.

Conservation Reserve Enhancement Program (CREP)

This program is an "enhancement" of the existing Farm Service Agency (FSA) CRP Continuous Sign-up. It has been "enhanced" by increasing the rental rates, and offering incentive payments to place the enrolled area under a 10-15 year contract. The average cost share payment in this program is 75%; however, additional incentives are available to raise this rate if a landowner is willing to install addtional control measures. Pasture and cropland adjacent to streams, seeps, springs, ponds and sinkholes are eligible to be enrolled. Buffers consisting of native, warm-season grasses on cropland, and 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. Federal cost-sharing (50%) 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. The Natural Bridge SWCD also provides a cost share payment. The State of Virginia will make an additional payment to landowners who elect to place a perpetual easement on the enrolled area.

Environmental Quality Incentives Program (EQIP)

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. The remaining 35% of the funds are directed toward statewide priority concerns of environmental needs. EQIP offers up to 10-year contracts to landowners and farmers to provide financial assistance, and/or incentive payments to implement conservation practices and address the priority concerns statewide or in the priority area. Eligibility is limited to persons who are engaged in agricultural production.

EPA Section 319 Grant Project Funds

Through Section 319 of the Federal Clean Water Act, Virginia is awarded grant funds to implement NPS programs. The VADEQ administers the money annually on a competitive grant basis to fund TMDL implementation projects, outreach and educational activities, water quality monitoring, and technical assistance for staff of local sponsor(s) coordinating implementation. In order to meet eligibility criteria established for 319 funding, all proposed project activities must be included in the TMDL

implementation plan covering the project area. In addition, this plan must include the nine key elements of a watershed based plan identified by EPA (see Guidance Manual for TMDL Implementation Plans, VA Departments of Conservation and Recreation and Environmental Quality, July 2003).

Regional Conservation Partnership Program (RCPP)

RCPP was authorized through the 2014 Farm Bill. This 5-year 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. The RCPP competitively awards funds to conservation projects designed by local partners specifically for their region. Partners such as SWCD's and non profit organizations can then work with interested landowners to utilize these funds for BMP implementation. The Chesapeake Bay watershed is one of eight "Critical Conservation Areas" identified in this program. These areas receive 35% of program funding.

Wildlife Habitat Incentive Program (WHIP)

WHIP is a voluntary program for landowners who want to develop or improve wildlife habitat on private agricultural lands. Participants work with NRCS to prepare a wildlife habitat development plan. This plan describes the landowner's goals for improving wildlife habitat and includes a list of practices and a schedule for installation. A 10-year contract provides cost-share and technical assistance to carry out the plan. Cost-share assistance of up to 75% of the total cost of installation (not to exceed $10,000 per applicant) is available for establishing habitat. Types of practices include: prescribed burning, converting fescue to warm season grasses, creating habitat for waterfowl, and installing field borders.

Wetland Reserve Program (WRP)

This program is a voluntary program to restore and protect wetlands on private property. Landowners who choose to participate in WRP may receive payments for a conservation easement or cost-share assistance for a wetland restoration agreement. The landowner will retain ownership but voluntarily limits future use of the land. To be eligible for WRP, land must be suitable for restoration (formerly wetland and drained) or connect to adjacent wetlands. A landowner continues to control access to the land and may lease the land for hunting, fishing, or other undeveloped recreational activities.

Southeast Rural Community Assistance Project (SER-CAP)

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 SE/R-CAP staff across the region. They can provide (at no cost): 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.

National Fish and Wildlife Foundation (NFWF)

NFWF administers the Chesapeake Bay Stewardship Fund, which is dedicated to the protection and restoration of the Chesapeake Bay. The Stewardship Fun is supported through partnerships with government agencies and private corporations, and typically awards $8 million to $12 million per year through two competative grant programs (Innovative Nutrient and Sediment Reduction Grants and Small Watershed Grants) and a technical assistance program. A request for proposals is typically issued in the spring and awards are made in the fall.

Virginia Natural Resources Commitment Fund

This fund was established in the Virginia Code as a subfund of the Water Quality Improvement Fund in 2008. Monies placed in the fund are to be used solely for the Virginia Agricultural BMP Cost Share Program as well as agricultural needs for targeted TMDL implementation areas.

Clean Water State Revolving Fund

EPA awards grants to states to support their Clean Water State Revolving Funds (CWSRFs). The states then make loans for priority water quality activities. As recipients make payments, money is available for new loans to be issued to other recipients. Eligible projects include point source, nonpoint source and estuary protection projects. Point source projects typically include building wastewater treatment facilities, combined sewer overflow and sanitary sewer overflow correction, urban stormwater control, and water quality aspects of landfill projects. Nonpoint source projects include agricultural, silvicultural, rural, and some urban runoff control; on-site wastewater disposal systems (septic tanks); land conservation and riparian buffers; leaking underground storage tank remediation, etc.

Chesapeake Bay Funders Network

The Funders Network is a collaborative of funding organizations that provides opportunities for funders to pool resources and work together on shared interests in the Chesapeake Bay watershed. The funders make collaborative decisions on funding initivatives and specials projects (unsolicited proposals are not excepted. Implementation of a "Flexible Fencing Program" in the watersheds using private funding was identified as a way to increase interest in livestock stream exclusion. The program that has been implemented in the Shenandoah Valley with support from the Chesapeake Bay Funders Network was identified as a good model. Typically a 5-year contract is required, and farmers are offered more flexibility with the materials that they use and where the fence is placed. Should funding become available, some of the fencing goals established in this plan would be met using this program.

Wetland and Stream Mitigation Banking

Mitigation banks are sites where aquatic resources such as wetlands, streams, and streamside buffers are restored, created, enhanced, or in exceptional circumstances, preserved for the purpose of providing compensatory mitigation in advance of authorized impacts to similar resources. Mitigation banking is a commercial venture which provides compensation for aquatic resources. Mitigation banks are required to be protected in perpetuity, to provide financial assurances, and long term stewardship. The mitigation banking processes is overseen by the Inter-Agency Review Team (IRT) consisting of state and federal agencies and chaired by VADEQ and the Army Corps of Engineers.

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