Water Quality Improvement Plan

WOODS CREEK

A plan to reduce bacteria in the water

Technical Document

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Prepared for
VA Department of Environmental Quality

Prepared by
Virginia Tech Biological Systems Engineering

In Cooperation with
Local Stakeholders

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Boxerwood Educational Association
City of Lexington
Natural Bridge Soil & Water Conservation District
Rockbridge Area Conservation Council
Rockbridge County
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1. INTRODUCTION

1.1 Background

The Clean Water Act (CWA) that became law in 1972 requires that all U.S. streams, rivers, and lakes meet their state's water quality standards. The CWA also requires that states conduct monitoring to identify polluted waters or those that do not meet standards. Through this required program, the state of Virginia has found that many streams do not meet state water quality standards for protection of the five beneficial uses: fishing, swimming, shellfish, aquatic life, and drinking.

When streams fail to meet standards, Section 303(d) of the CWA and the U.S. Environmental Protection Agency's (EPA) Water Quality Management and Planning Regulation both require that states develop a Total Maximum Daily Load (TMDL) for each pollutant. A TMDL is a "pollution budget" for a stream. That is, it sets limits on the amount of pollution that a stream can tolerate and still maintain water quality standards. In order to develop a TMDL, background concentrations, point source loadings, and non-point source loadings are considered. A TMDL accounts for seasonal variations and must include a margin of safety. Through the TMDL process, states establish water-quality based controls to reduce pollution and meet water quality standards.

Once a TMDL is developed, measures must be taken to reduce pollution levels in the stream. Virginia's 1997 Water Quality Monitoring, Information and Restoration Act (WQMIRA) states that the "Board shall develop and implement a plan to achieve fully supporting status for impaired waters". A TMDL Implementation Plan (IP) describes control measures, which can include the use of better treatment technology and the installation of best management practices (BMPs), to be implemented in order to meet the water quality goals established by the TMDL.

1.2 Designated Uses and Applicable Water Quality Standards

Water quality standards are designed to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law (§62.1-44.2 et

seq. of the Code of Virginia) and the federal Clean Water Act (33 USC §1251 et seq.). Virginia Water Quality Standard 9 VAC 25-260-10 (Designation of uses.) states:

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

1.2.1 Bacteria Water Quality Criterion (9 VAC 25-260-170)

In order to protect human health during primary contact recreation (e.g., swimming), the Commonwealth of Virginia has set limits on the amount of specific fecal bacteria in all state waters. The bacteria criterion for freshwater in place when Woods Creek was initially listed as impaired was based on *Escherichia coli (E. coli)*. For a non-shellfish supporting water body to be in compliance with the Virginia *E. coli* bacteria standard for contact recreational use, the following criteria (Virginia Water Quality Standard 9 VAC 25-260-170) apply:

E. coli bacteria shall not exceed a geometric mean of 126 colony forming units (cfu)/100 mL in freshwater. If there are insufficient data to calculate monthly geometric means in freshwater, no more than 10.5% of the total samples in the assessment period shall exceed 235 *E. coli* cfu/100 mL.

For the 2014 assessment period, January 2007 through December 2012, the Virginia Department of Environmental Quality (VADEQ) monitoring station near the confluence with the Maury River (2AWDS000.10) had an exceedance rate of 25% of the maximum water quality assessment criterion concentration of 235 cfu/100mL, leading to the impaired classification for Woods Creek.

The Woods Creek bacteria TMDL was developed not to exceed the *E. coli* monthly geometric mean criterion of 126 cfu/100mL, and with an exceedance rate of less than 10.5% of the *E. coli* single sample assessment criterion of 235 cfu/100mL. Meeting this target provided consistency with VADEQ assessment guidance (VADEQ, 2017a).

1.3 Attainability of Designated Uses

All waters in the Commonwealth have been designated as "primary contact" for the swimming use regardless of size, depth, location, water quality or actual use. The bacteria standard described in Section 1.2 of this report is to be met during all stream flow levels and was established to protect bathers from ingestion of potentially harmful bacteria. However, many headwater streams are small and shallow during base flow conditions when surface runoff has minimal influence on stream flow. Even in pools, these shallow streams do not allow full body immersion during periods of base flow. In larger streams, lack of public access often precludes the swimming use.

Recognizing that all waters in the Commonwealth are not used extensively for swimming, Virginia has approved a process for re-designation of the swimming use for secondary contact in cases of: 1) natural contamination by wildlife, 2) small stream size, and 3) lack of accessibility to children, as well as due to widespread socio-economic impacts resulting from the cost of improving a stream to a “swimmable” status.

The re-designation of the current swimming use in a stream will require the completion of a Use Attainability Analysis (UAA). A UAA is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors as described in the Federal Regulations. The stakeholders in the watershed, Virginia, and EPA will have an opportunity to comment on these special studies.

In some streams for which TMDLs have been developed, water quality modeling indicates that even after removal of all of the sources of *E. coli* (other than wildlife), the stream will not attain standards. In such a case, after demonstrating that the source of *E. coli* contamination is natural and uncontrollable by effluent limitations and BMPs, the state may decide to re-designate the stream’s use for secondary contact recreation or to adopt site specific criteria based on natural background levels of *E. coli*. All site-specific criteria or designated use changes must be adopted as amendments to the water quality standards regulations. Watershed stakeholders and EPA will be able to provide comment during this process.

2. REQUIREMENTS FOR IMPLEMENTATION PLANS

There are a number of state and federal requirements and recommendations for TMDL IPs. The goal of this chapter is to clearly define what they are and explicitly state if the "elements" are a required component of an approvable IP or are merely a recommended topic that should be covered in a thorough IP. This chapter has three sections that discuss a) the requirements outlined by the WQMIRA that must be met in order to produce an IP that is approvable by the Commonwealth, b) the EPA recommended elements of IPs, and c) the required components of an IP in accordance with EPA Section 319 guidance.

2.1 State Requirements

The TMDL IP is a requirement of Virginia's 1997 Water Quality Monitoring, Information, and Restoration Act (§62.1-44.19:4 through 19:8 of the Code of Virginia), or WQMIRA. WQMIRA directs the SWCB to "develop and implement a plan to achieve fully supporting status for impaired waters." In order for IPs to be approved by the Commonwealth, they must meet the requirements as outlined by WQMIRA. WQMIRA requires that IPs include the following (VADEQ, 2017b):

- date of expected achievement of water quality objectives,
- measurable goals,
- necessary corrective actions, and
- associated costs, benefits, and environmental impact of addressing the impairment.

2.2 Federal Recommendations

Section 303(d) of the CWA and current EPA regulations do not require the development of implementation strategies. The EPA does, however, outline the minimum elements of an approvable IP in its 1999 *Guidance for Water Quality-Based Decisions: The TMDL* Process (USEPA, 1999). The listed elements include:

- a description of the implementation actions and management measures,
- a time line for implementing these measures,
- legal or regulatory controls,
- the time required to attain water quality standards, and
- a monitoring plan and milestones for attaining water quality standards.

It is strongly suggested that the EPA recommendations be addressed in the IP, in addition to the required components as described by WQMIRA.

2.3 Requirements for Section 319 Fund Eligibility

The EPA develops guidelines that describe the process and criteria used to award CWA Section 319 nonpoint source grants to States. The guidance is subject to revision and the most recent version should be considered for IP development. The "Nonpoint Source Program and Grant Guidelines for States and Territories" (USEPA, 2013) identifies the following nine elements that must be included in the IP to meet the 319 requirements:

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

3. REVIEW OF TMDL DEVELOPMENT

3.1 Background

Woods Creek (VAV-I35R_WOS01A00) was listed as impaired on Virginia's 2014 Section 303(d) Report on Impaired Waters due to water quality exceedances of the *E. coli* standard (VADEQ, 2017a). VADEQ has described the impaired segment as presented in Table 3-1 and Figure 3-1.

Table 3-1. Impaired stream segment addressed in the Woods Creek TMDL implementation plan.

Impaired Segment	Size	Initial Listing Year	Description
Woods Creek (VAV-I35R_WOS01A00)	6.05 miles	2012	extending from its headwaters to its mouth on the Maury River

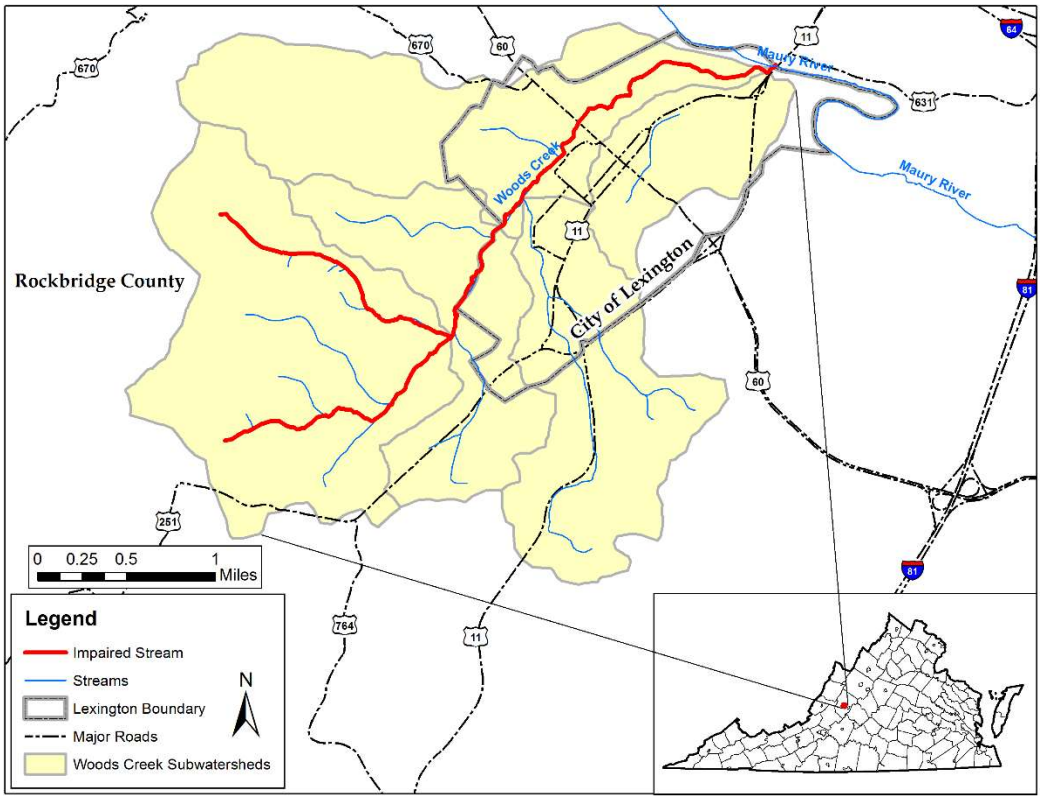

Figure 3-1. Bacteria impaired segment in the Woods Creek watershed.

The Woods Creek watershed is part of the Maury River basin (USGS HUC 02080202) and comprises part of state hydrologic unit I35 (National Watershed Boundary Dataset JU76). The Woods Creek watershed is approximately 4,974 acres in size and covers portions of the City of

Lexington and Rockbridge County. The watershed is predominantly developed (Table 3-2, Figure 3-2), which is mostly located in the downstream portion of the watershed. The upper region is mainly pasture land with less significant area in forest and development. One notable feature of the Woods Creek watershed is a pipe inflow in sub-watershed 5 (Upper Woods Creek). The pipe is fed by the Lexington Reservoir, which is located at the headwaters of Moores Creek, approximately 10 miles southwest of the watershed. This input plays an important role in the Woods Creek watershed because it provides a continuous flow of pristine water throughout the year, and at times it may be the only source of base flow.

Table 3-2. Land use acreage and percent total watershed acreage by land use category.

	Area	
Land use	**Acres**	**%**
Forest	1,180	24
Pasture/Hayland	1,397	28
Residential	2,394	48
Water	3	<1
TOTAL	**4,974**	

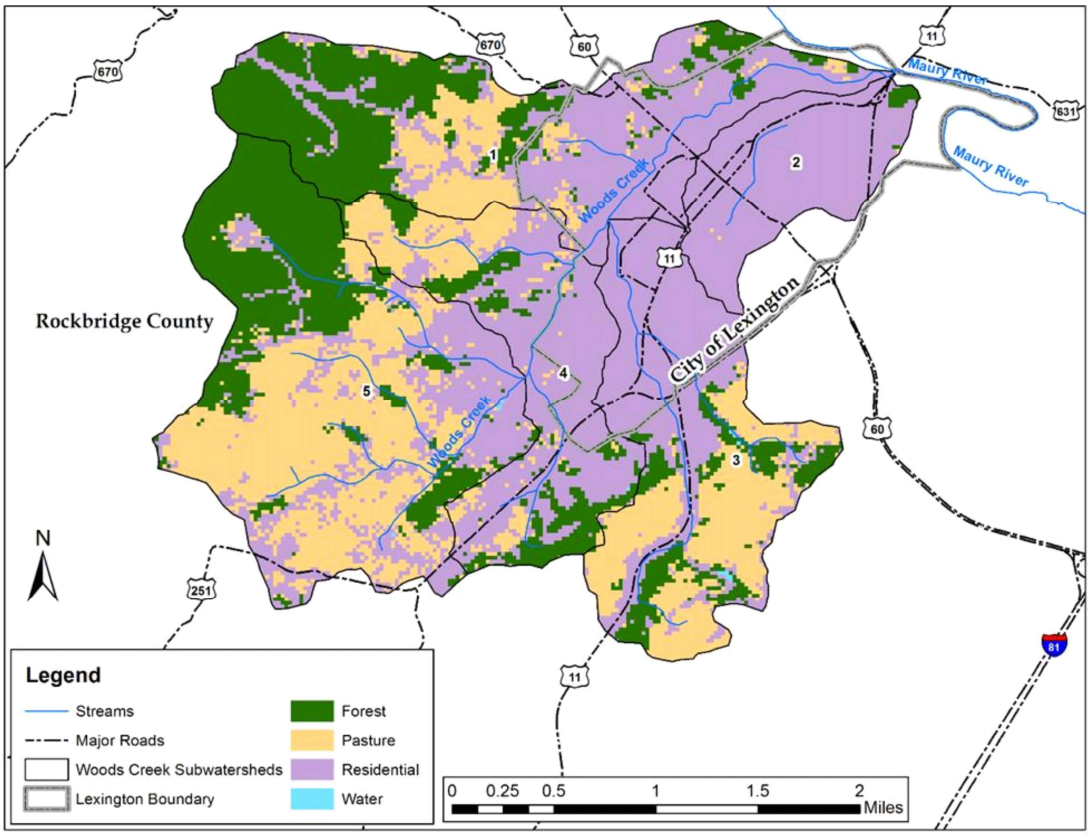

Figure 3-2. Land use in the Woods Creek watershed.

Virginia Tech's Department of Biological Systems Engineering was contracted by VADEQ to develop the Woods Creek TMDL in 2016, and the TMDL study was completed in May 2017 (VADEQ, 2017a). The final TMDL report is available by contacting the VADEQ Valley Regional Office TMDL Coordinator.

3.2 Water Quality Monitoring Data

Data collected from the water quality monitoring station in Woods Creek at Jordan's Point Park (2AWDS000.10) was used to list the stream as impaired by *E. coli*. An additional water quality monitoring station off Ross Road was included to prepare for TMDL development. Table 3-3 provides a summary of the data collected from these stations and Figure 3-3 shows the locations of the stations.

Table 3-3. VADEQ water quality monitoring stations in the Woods Creek watershed.

Station ID	Stream Name	Description	Number of Samples	Exceedance Rate	Period of Record
2AWDS000.10	Woods Creek	At Jordan's Point Park	36	36.1%	2008-2016

Station ID	Stream Name	Description	Number of Samples	Exceedance Rate	Period of Record
2-WDS002.17	Woods Creek	Off Rt. 687 (Ross Road)	24	20.8%	2015-2016

3.3 Water Quality Modeling

The Hydrologic Simulation Program – FORTRAN (HSPF) version 12 (Bicknell et al., 2005; Duda et al., 2001) was used to model fecal coliform transport and fate in the watersheds. ArcGIS 10.4 GIS software was used to display and analyze landscape information for the development of input for HSPF. The HSPF watershed model simulates pollutant accumulation, die-off, and washoff according to the distribution of land uses, soils, and geographic features in a watershed. HSPF then simulates the routing of water and pollutants through the stream channel network, considering instream processes such as die-off. In the Woods Creek bacteria TMDL, a source assessment of fecal coliform bacteria was performed for the watershed. Fecal coliform was then simulated as a dissolved pollutant using the HSPF model, and concentrations were translated to *E. coli* concentrations using VADEQ's translator equation (VADEQ, 2003).

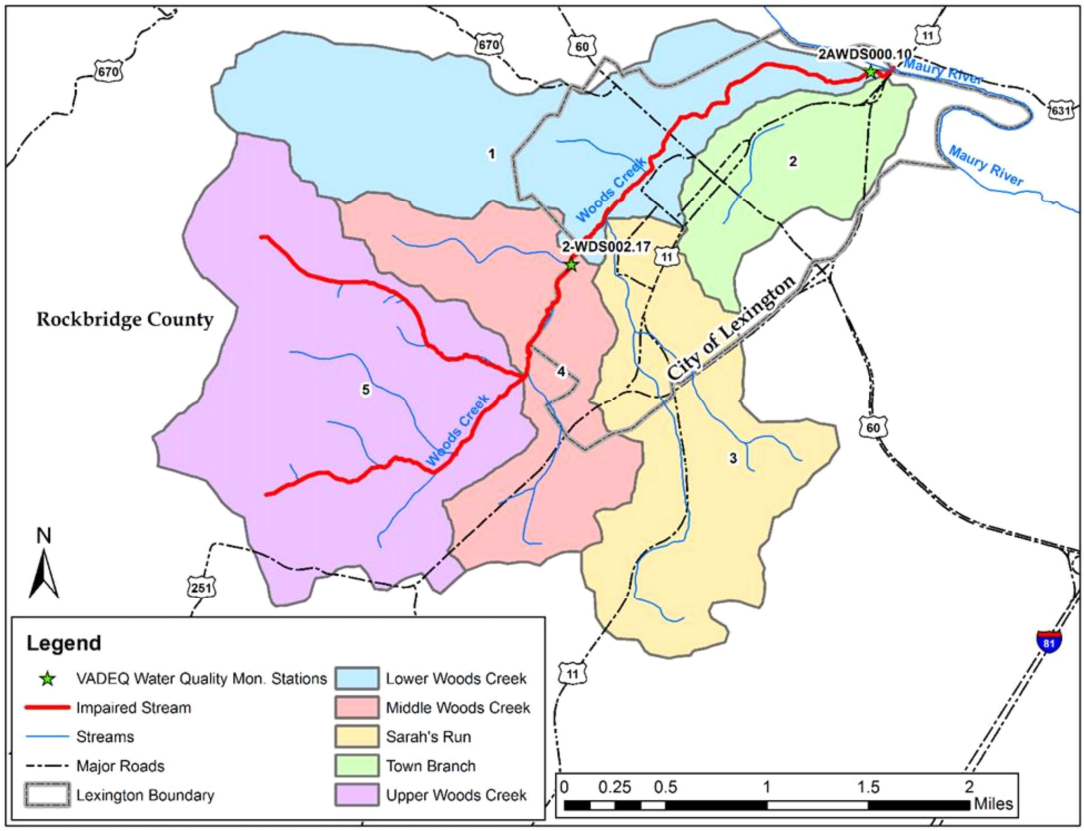

Figure 3-3. Sub-watersheds and VADEQ water quality monitoring stations in the Woods Creek watershed.

To clearly identify sources of fecal coliform, each watershed was divided up into smaller sub-watersheds (Figure 3-3). The sources and their respective fecal coliform contributions were identified for each smaller sub-watershed based on land use and climate data, and human, livestock, pet and wildlife populations. The HSPF model was then used to simulate the transport of these pollutant loads to the streams.

3.4 Bacteria Source Assessment

Potential sources of bacteria considered in the development of the TMDL included point source, sewer system influence, and nonpoint source contributions.

3.4.1 Point Sources

A TMDL's waste load allocation accounts for the portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Point sources of *E. coli* bacteria in the watersheds include all municipal and industrial plants that treat human waste, as well as private residences that fall under general permits. These point sources are required to maintain a monthly geometric mean *E. coli* discharge concentration no greater than 126 cfu/100mL. Virginia issues Virginia Pollutant Discharge Elimination System permits for point sources. There is currently one point source permitted to discharge bacteria in the watershed, a domestic sewage general permit. Table 3-4 lists the permitted source, along with the permitted discharge and load allocation in the TMDL. The waste load allocation for the point source was set at the permitted load.

Table 3-4. Permitted bacteria point source discharging in the Woods Creek watershed.

Permit Number	Facility Name	Sub-watershed	Design Flow (mgd*)	Permitted *E. coli* Conc. (cfu/100 mL)	*E. coli* Load (cfu/year)
VAG408056	Boxerwood Gardens	4	0.001	126	1.74×10^9

* million gallons per day

3.4.2 Sewer System Influence

A substantial portion of the Woods Creek watershed is serviced by the City of Lexington sewer system. Access to sewer systems reduces the need for septic systems, which are liable to failure, and single-family home permits. However, aging sewer infrastructure is also subject to issues and can become a source of bacteria. Three primary sewer issues were examined during the development of the bacteria TMDL: infiltration and inflow (I&I), sanitary sewer overflow

(SSO), and leaky pipes (exfiltration). I&I occurs when water seeps into the sewer pipes. Since sewer pipes are rated for a specific capacity designed to handle a set number of households, I&I can cause the pipes to exceed capacity. I&I that occurs in pipes crossing Woods Creek and its tributaries results in streamflow loss. SSO occurs when the sewer lines experience overcapacity flows which can result in ruptures of the lines or overflows from manhole covers. The bacteria that escapes during these events may pollute the land surface or enter directly into the stream. Exfiltration is the leakage of sewage from cracked pipes. Exfiltration may result in contaminated soils and increased instream bacteria concentrations. These sewer incidents were accounted for in the Woods Creek TMDL.

3.4.3 Nonpoint sources

Nonpoint source pollution originates from sources across the landscape (e.g., agriculture and urban land uses) and is delivered to waterbodies by rainfall and snowmelt. In some cases, a precipitation event is not required to deliver nonpoint source pollution to a stream (e.g., pollution from leaking sewer lines or livestock directly defecating in a stream). Nonpoint sources of bacteria in the watershed included residential sewage treatment systems, land application of waste, livestock, wildlife, and domestic pets. During TMDL development, bacteria loads were represented either as land-based loads (where they were deposited on land and available for wash off during a rainfall event) or as direct loads (where they were directly deposited into the stream). Land-based nonpoint sources are represented as an accumulation of bacteria on the land, where some portion is available for transport in runoff. The amount of accumulation and availability for transport vary with land use type and season. The maximum accumulation was adjusted seasonally to account for changes in die-off rates, which are dependent on temperature and moisture conditions. Direct loads such as animal defecation in the stream are modeled similarly to point sources since they do not require a runoff event for delivery to the stream. Nonpoint sources of bacteria, including sewer system influence, in the watershed are summarized in Table 3-5.

In addition to considering total land based loads of bacteria in the watershed, their relative contributions towards in stream bacteria concentrations must also be considered during TMDL development and implementation planning. While livestock in the stream is a comparatively small bacteria load when compared to pasture, land based loads require precipitation events to

transport fecal coliform to the stream. In addition, not all of the load is available for wash off since bacteria die off over time. Therefore, the relative contributions of land based and direct sources to instream water quality are often considerably different than overall watershed loads. Table 3-6 shows how each of these sources impacts *E. coli* concentrations in the stream.

3.5 TMDL Allocation Scenarios

The TMDL includes reduction scenarios needed to meet the *E. coli* water quality standard. Different scenarios were evaluated to identify scenarios for implementation that meet the calendar-month geometric mean bacteria standard (126 cfu/100 mL for *E. coli*) with zero violations. The margin of safety (MOS) was implicitly incorporated into each TMDL by conservatively estimating several factors affecting bacteria loadings, such as animal numbers, production rates, and contributions to streams. A preferred scenario was selected by a technical advisory committee during the TMDL development process (* Includes all illicit sewer discharges (e.g., I&I, SSO, exfiltration)

Table 3-7). The TMDL for Woods Creek was derived from the preferred reduction scenario identified in the TMDL report (Table 3-8). An implicit margin of safety is included in the TMDL equations.

Table 3-5. Estimated annual nonpoint fecal coliform loadings to the stream by source and land use categories in the Woods Creek watershed.

Source	Fecal coliform loading ($x10^{12}$ cfu/yr)	Percent of total loading
Direct loading to streams		
Livestock in stream	2.2	<1
Wildlife in stream	1.2	<1
Loading to land surfaces		
Pasture	2,417.0	90
Livestock	*2,406.3*	*90*
Wildlife	*10.7*	*<1*
Residential	249.9	9
Human (Septic) *	*7.0*	*<1*
Pet	*226.3*	*8*
Wildlife	*16.6*	*<1*
Forest	10.7	<1
Sewer Overflows**	0.5	<1
Total	**2,681.5**	

* Based on available data and stakeholder input, no straight pipes are present in the Woods Creek watershed

** Includes all illicit sewer discharges (e.g., I&I, SSO, exfiltration)

Table 3-6. Relative contributions of different *E. coli* sources to the overall *E. coli* concentration for existing conditions in the Woods Creek watershed.

Source	Relative Daily Contribution by Source Woods Creek
Nonpoint source loadings from forest (pervious)	<1%
Nonpoint source loadings from pasture (pervious)	60%
Nonpoint source loadings from residential (pervious and impervious area)	9%
Direct nonpoint source loadings to the stream from livestock	20%
Direct nonpoint source loadings to the stream from wildlife	10%
Interflow and groundwater contribution	<1%
Permitted point source loadings and sewer overflows*	<1%

* Includes all illicit sewer discharges (e.g., I&I, SSO, exfiltration)

Table 3-7. Bacteria reduction scenario needed to meet the *E. coli* standard for Woods Creek.

	E. coli Loading Reductions (%)					% Exceedance of *E. coli* standard	
Watershed	Livestock direct deposit	Pasture	Sewer Overflows*	Failing Septic Systems	Residential**	Geometric Mean Criterion	Single Sample Maximum Assessment Criterion***
Woods Creek	85%	70%	100%	100%	25%	0.0	10.1

* Includes all illicit sewer discharges (e.g., I&I, SSO, exfiltration)
** Does not include loads from failing septic systems or illicit sewer discharges.
*** The single sample maximum assessment criterion allows up to 10.5 % exceedance rate.

Table 3-8. TMDL equations for Woods Creek expressed as an average annual and a maximum daily load.

	Wasteload Allocation (WLA)		Load Allocation (LA)		Margin of Safety (MOS)	TMDL	
Watershed	Annual (cfu/yr)	Daily (cfu/day)	Annual (cfu/yr)	Daily (cfu/day)		Annual (cfu/yr)	Daily (cfu/day)
Woods Creek	3.97×10^{11}	1.09×10^{9}	3.91×10^{13}	1.91×10^{11}	Implicit	3.95×10^{13}	1.92×10^{11}

During the TMDL development process, the technical advisory committee also selected a Stage 1 scenario (Table 3-9). The goal of the Stage 1 scenario is to reduce the bacteria loadings from controllable sources such that violations of the single sample maximum criterion (235 cfu/100mL) are less than 10.5 percent. Implementation of practices included in Stage 1 is expected to result in the removal of Woods Creek from the impaired waters list.

Table 3-9. Bacteria reduction scenario needed to achieve delisting goal.

Watershed	*E. coli* Loading Reductions (%)					% Exceedance of *E. coli* standard (Single sample)
	Livestock direct deposit	Pasture	Sewer Overflows*	Failing Septic Systems	Residential	
Woods Creek	70%	70%	100%	100%	25%	10.2

* Includes all illicit sewer discharges (e.g., I&I, SSO, exfiltration)

3.6 Implications of the TMDL on the Implementation Plan

Based on the bacteria reductions developed for the TMDL, it is clear that significant reductions will be needed to meet the water quality standard for bacteria, particularly with respect to direct deposition from livestock. In addition, all uncontrolled discharges, failing septic systems, leaking sewer lines, and overflows must be identified and corrected.

However, there are subtler implications as well. Implicit in the requirement for 100% correction of uncontrolled discharges is the need to maintain all functional septic systems. Wildlife bacteria loads will not be explicitly addressed by this implementation plan. All efforts will be directed at controlling anthropogenic sources.

4. PUBLIC PARTICIPATION

Collecting input from the public on conservation and outreach strategies to include in the TMDL Implementation Plan was a critical step in this planning process. Since the plan will be implemented by watershed stakeholders on a voluntary basis, local input and support are the primary factors that will determine the success of this plan.

4.1 Public Meetings

A public meeting was held on the evening of October 24, 2018 at Waddell Elementary School in Lexington 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 Woods Creek and work together to come up with new ideas to protect and restore water quality in their community. This meeting was publicized through e-mail announcements, flyers posted throughout the watershed, and direct outreach to landowners. Approximately 25 people attended the meeting.

Prior to the meeting, attendees had the opportunity to learn about the Woods Creek water quality studies of students from Lexington schools. This provided an opportunity for local residents to learn about the condition of the creek, share information about the area, and become involved in the process of local water quality improvement. The meeting included a brief presentation by VADEQ on the process to be used to complete a TMDL IP for Woods Creek. The presentation also included information on existing water quality conditions in the stream and what types of actions and information could be included in the implementation plan to improve water quality.

A second and final public meeting was held on the evening of May 8, 2019 at the Rockbridge Regional Library in Lexington to present the draft implementation plan to the public and kick off the 30-day public comment period. The meeting included a presentation by DEQ on the draft plan and an opportunity for attendees to ask questions. The Director of Public Works for the City of Lexington also spoke briefly about the status of the City's sewer system upgrades, and a representative from the local volunteer water quality monitoring group presented the group's recent results from the Woods Creek watershed. Approximately 15 people attended the meeting.

4.2 Agricultural Working Group

The role of the Agricultural Working Group was to review conservation practices and outreach strategies from an agricultural perspective, identify any obstacles (and solutions) related to BMP implementation, and to provide estimates on the type, number, and costs of BMPs.

During their first meeting on November 7, 2018, the agricultural working group discussed the general state of agriculture in the watershed, noting that there is some development pressure but it is limited by available sewer capacity and connections. It was estimated that 65% of agricultural land in the watershed is leased, making installation of livestock exclusion practices challenging. The group felt that the amount of cropland in the watershed is minimal and does not need to be specifically addressed in the IP. Another topic of discussion was the increasing number of horses in the watershed and the possibility of including some equine-specific BMPS in the IP. Based on their knowledge of the watershed, participants suggested some changes to livestock population estimates as well as the BMPs they thought would be most appealing to landowners. VADEQ staff asked participants about potential outreach opportunities. Participants suggested flyers or brochures placed in public places, as well as an ongoing farming column in the News Gazette.

A second agricultural working group meeting was held at the Natural Bridge Soil & Water Conservation District office on December 11, 2018. The group reviewed summaries of the extent of BMP implementation that would be needed to remove Woods Creek from the impaired waters list and discussed potential BMP implementation scenarios. Participants suggested a number of changes to the cost and extent of potential BMPs based on their knowledge of the watershed. Challenges to BMP implementation were also discussed, with participants noting that equine operations often do not meet the eligibility requirements of the Virginia Agricultural BMP Cost-Share (VACS) Program. Eligibility concerns can also arise for intermittent streams, and pasture management BMPs available through the VACS program are limited. The group briefly discussed options for BMP funding beyond the VACS Program. Participants agreed that a ten-year timeline was appropriate for the needed implementation efforts.

4.3 Residential Working Group

The primary role of the Residential Working Group was to discuss methods needed to reduce human and pet sources of bacteria entering Woods Creek, recommend methods to identify and correct or replace failing septic systems, and provide input on the BMPs to include in the plan.

At their first meeting on November 7, 2018, the residential working group discussed sewer overflows, septic system maintenance needs, and pet waste in the watershed. City of Lexington representatives stated that they have implemented measures in specific locations to address the overflows and that a capital improvement project is in the works to provide a more permanent solution. Currently there are no septic systems in use within the city limits. Participants discussed ways to identify septic system maintenance needs, including the use of a septic pump-out program and mailings to owners of septic systems in the watershed. The group discussed the possibility of adding more pet waste stations in the watershed, potential locations for those stations, and ideas for a pet waste education campaign. VADEQ staff noted that since Lexington does not have an MS4 permit, grant funding could be used towards stormwater retrofit practices to reduce bacteria. It was noted that smaller BMPs to address specific concerns would be beneficial, and that perhaps an education component could be included as well.

A second residential working group meeting was held on December 11, 2018 at the Natural Bridge Soil & Water Conservation District office. The group reviewed summaries of the extent of BMP implementation that would be needed to remove Woods Creek from the impaired waters list and discussed potential BMP implementation scenarios. A representative from the Rockbridge County Public Service Authority shared that sewer connections in the County are currently only allowed for new construction. Participants agreed that a septic pump-out program would be an effective way to increase awareness about septic maintenance and identify septic system problems. The group also discussed stormwater BMPs, which tend to be more expensive and hard to site, and were therefore proposed for later in the implementation period. Challenges associated with implementing the different types of BMPs were also discussed, and the group reviewed some of the potential funding sources that could support BMP implementation. The

Residential Working Group agreed that the ten-year timeframe for implementation was reasonable.

4.4 Steering Committee

The Steering Committee met on March 26, 2019 at Natural Bridge Soil & Water Conservation District office to discuss plans for the final public meeting and to review the draft implementation plan prior to the final public meeting on May 8, 2019. The group provided comments on the draft plan and discussed an agenda for the final public meeting.

5. IMPLEMENTATION ACTIONS

An important part of the implementation plan is the identification of specific best management practices and associated technical assistance needed to improve water quality in the watersheds. Since this plan is designed to be implemented by landowners on a voluntary basis, it is necessary to identify management practices that are both financially and technically realistic and suitable for this particular community. As part of this process, the costs and benefits of these practices must be examined and weighed. Once the best practices have been identified for implementation, we must also develop an estimate of the number of each practice, associated costs, and funding sources that would be needed in order to meet the water quality goals established during the TMDL study.

5.1 Identification of Best Management Practices

Potential best management practices, their associated costs and efficiencies, and potential funding sources were identified through review of the TMDL, input from the working groups, and literature reviews. Measures that can be promoted through existing programs were identified, as well as those that are not currently supported by existing programs and their potential funding sources. Some best management practices had to be included in order to meet the water quality goals established in the TMDL, while others were selected through a process of stakeholder review and analysis of their effectiveness in these watersheds. These measures are discussed in sections 5.1.1 and 5.1.2, respectively.

5.1.1 Control Measures Implied by the TMDL

The reductions in bacteria identified by the TMDL study dictated some of the control measures that must be employed during implementation in order to meet the pollutant reductions specified in the TMDL.

Livestock Exclusion

In order to meet the bacteria reductions in direct deposition from livestock, some form of stream exclusion is necessary. Fencing is the most obvious choice; however, the type of fencing, distance from the stream bank, and most appropriate management strategy for the fenced pasture are less obvious. While it is recognized that farmers will want to minimize the cost of fencing and the amount of pasture lost, the inclusion of a streamside buffer helps to reduce bacteria, sediment and nutrient loads in runoff. The incorporation

of effective buffers could reduce the need for more costly control measures. From an environmental perspective, the best management scenario would be to exclude livestock from the stream bank 100% of the time and establish permanent vegetation in the buffer area. This prevents livestock from eroding the stream bank, provides a buffer for capturing pollutants in runoff from the pasture, and establishes (with the growth of streamside vegetation) one of the foundations for healthy aquatic life. From a livestock-production perspective, the best management scenario is one that provides the greatest profit to the farmer. Taking even a small amount of land out of production may seem contrary to that goal. However, a clean water source has been shown to improve milk production and weight gain. Clean water will also improve the health of animals (*e.g.,* cattle and horses) by decreasing the incidence of waterborne illnesses and exposure to swampy areas near streams. State and federal conservation agencies including Virginia Department of Conservation and Recreation (VADCR) and the Natural Resources Conservation Service (NRCS) have incorporated livestock exclusion practices into their agricultural cost-share programs that offer farmers greater flexibility in fencing options. This flexibility allows farmers with limited pasture acreage to exclude livestock from the stream while reducing the amount of grazing land that is taken out of production.

Septic Systems

The 100% reduction in loads from failing septic systems is a pre-existing legal requirement. The options identified for correcting failing septic systems included: repair of an existing septic system, installation of a septic system, and installation of an alternative waste treatment system.

Public Sanitary Sewer System

Infiltration and inflow (I&I) of subsurface water into cracks in the sewage collection system, and sanitary sewer overflows (SSO) are a source of human bacteria within the Woods Creek watershed. Reduction of SSOs and discharges associated with I&I will result in direct reductions in bacteria loads. The TMDL allocation scenarios were generated under the assumption that the sewer lines will continue to be enhanced and the human bacteria loading to Woods Creek from illicit sewer discharges will be reduced.

Sewer infrastructure in the Woods Creek watershed is managed by the City of Lexington and the Rockbridge County Public Service Authority. The City of Lexington has undertaken recent and ongoing projects to reduce I&I problems in the Woods Creek watershed by lining and repairing sewer pipes, and replacing gravity sewer pipe and associated laterals in the Enfield Area. The City has identified additional sewer system improvements through 2023 in the *Lexington, Virginia Capital Improvements Plan FY2019-FY2023* (2018).

5.1.2 Control Measures Selected through Stakeholder Review

In addition to the control measures that were directly prescribed by the TMDLs, a number of measures were needed to control fecal bacteria from land-based sources. Various scenarios were developed and presented to the working groups. All scenarios began with the best management practices that were prescribed by the TMDL such as livestock exclusion and eliminating all sewer system bacteria sources (I&I, exfiltration, sewer overflows) and failing septic systems. Next, a series of established best management practices were examined by the working groups, who considered both their economic costs and the water quality benefits that they produced. The majority of these practices are included in state and federal cost-share programs that promote conservation. In addition, innovative and site specific practices suggested by local stakeholders and technical conservation staff were considered.

The final set of BMPs identified and the efficiencies used in this study to estimate needs are listed in Table 5-1.

Table 5-1. Best management practices and associated pollutant reductions.

BMP Type	Description	Bacteria Reduction Efficiency	Reference
Direct deposit	Livestock exclusion from waterway	100%	1
Pasture	Streamside buffer (10 - 100 feet)	land use change + 40%	2, 3
	Improved pasture management	50%	4
	Permanent vegetative cover on critical areas	75%	4
	Afforestation of highly erodible pasture/cropland	land use change	5
Straight pipes and septic systems	Septic tank pump-out	5%	6
	Septic system repair	100%	1
	Septic system replacement	100%	1
	Alternative waste treatment system	100%	1
Residential/ Developed	Pet waste disposal station	75%	4
	Pet waste digester	100%	1
	Pet waste education program	50%	4
	Riparian buffer	50%	4
	Rain garden	55%	2,5

References

1. Removal efficiency is defined by the practice
2. Bacteria efficiency assumed to be equal to sediment efficiency.
3. Chesapeake Assessment Scenario Tool - BMP effectiveness values by land use and pollutant (February 2019)
4. VADEQ, 2017b. Guidance Manual for Total Maximum Daily Load Implementation Plans.
5. Based on differential loading rates to different land uses.
6. Bacteria efficiency assumed equal to nitrogen removal efficiency - Chesapeake Assessment Scenario Tool - BMP effectiveness values by land use and pollutant (February 2019)
7. Adapted from Swann, C. 1999. A survey of residential nutrient behaviors in the Chesapeake Bay. Widener Burrows, Inc. Chesapeake Bay Research Consortium. Center for Watershed Protection. Ellicott City, MD. 112 pp

5.2 Quantification of Control Measures

The quantity of control measures recommended during implementation was determined through spatial analyses, modeling alternative implementation scenarios, and using input from the working groups. Data on land use, stream networks, and elevation were used in spatial analyses to develop estimates of the number of control measures recommended overall in the watershed, and within smaller sub-watersheds. Data from the VADCR Agricultural BMP Database and the Natural Bridge SWCD showing where best management practices are already in place in the watershed were considered when developing these estimates. In addition, census data were used in order to quantify septic system repairs and replacements needed in order to meet the reductions specified in the TMDL. Estimates of the amount of residential on-site waste treatment systems, streamside fencing and number of full livestock exclusion systems were made through

these analyses. The quantities of additional control measures were determined through modeling alternative scenarios and applying the related pollutant reduction efficiencies to their associated bacteria loads.

Implicit in the TMDL is the need to avoid increased delivery of pollutants from sources that have not been identified as needing a reduction, and from sources that may develop over time. One potential for additional sources of the pollutants identified is future residential development. Care should be taken to monitor development and its impacts on water quality. Where residential development occurs, there is potential for additional pollutant loads from failing septic systems, sewer line overflows and leaks.

5.2.1 Agricultural Control Measures

Livestock Exclusion BMPs

In order to reduce bacteria in Woods Creek, livestock must be excluded from the stream. To estimate fencing needs, the stream network was overlaid with land use using GIS mapping software. Stream segments that flowed through or were adjacent to land use areas that had a potential for supporting cattle (e.g., pasture) were identified using 2016 VLCD, which is derived from aerial imagery, and the 2017 National Hydrography Dataset (NHD) streams layer. If the stream segment flowed through the land-use area, it was assumed that fencing was needed on both sides of the stream. If a stream segment flowed adjacent to the land-use area, it was assumed that fencing was required on only one side of the stream. Not every land-use area identified as 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. Following GIS analyses of fencing needs, the VADCR Agricultural BMP Database was queried to identify the amount of livestock exclusion systems already in place in the watershed. Approximately 8,648 linear feet of livestock exclusion fencing already exists in the Woods Creek watershed. This fencing was subtracted from the length of fencing needed to accomplish bacteria reductions from riparian pasture in the implementation plan (Table 5-2). As reviewed in Chapter 3, a 70% reduction of livestock direct deposition is needed for delisting Woods Creek (Table 3-9), and an 85% reduction is needed to meet the TMDL goal (* Includes all illicit sewer discharges (e.g., I&I, SSO, exfiltration)

Table 3-7). A map of potential streamside fencing required for streams in the watershed is shown in Figure 5-1.

Table 5-2. Stream fencing needs summary.
Note: % of total shown in parenthesis.

Sub-watershed	Estimated total length of streambank in pasture/hay (feet)	Approximate fencing installed to date (feet)	Fencing still needed	
			Stage 1 (feet)	Stage 2 (feet)
Lower Woods Creek	11,412	800	7,188	1,712
Town Branch	-	-	-	-
Sarah's Run	6,352	1,100	3,346	953
Middle Woods Creek	6,376	3,378	1,085	956
Upper Woods Creek	17,760	3,370	9,062	2,664
Total	41,900	8,648 (21%)	20,681 (49%)	6,285 (15%)

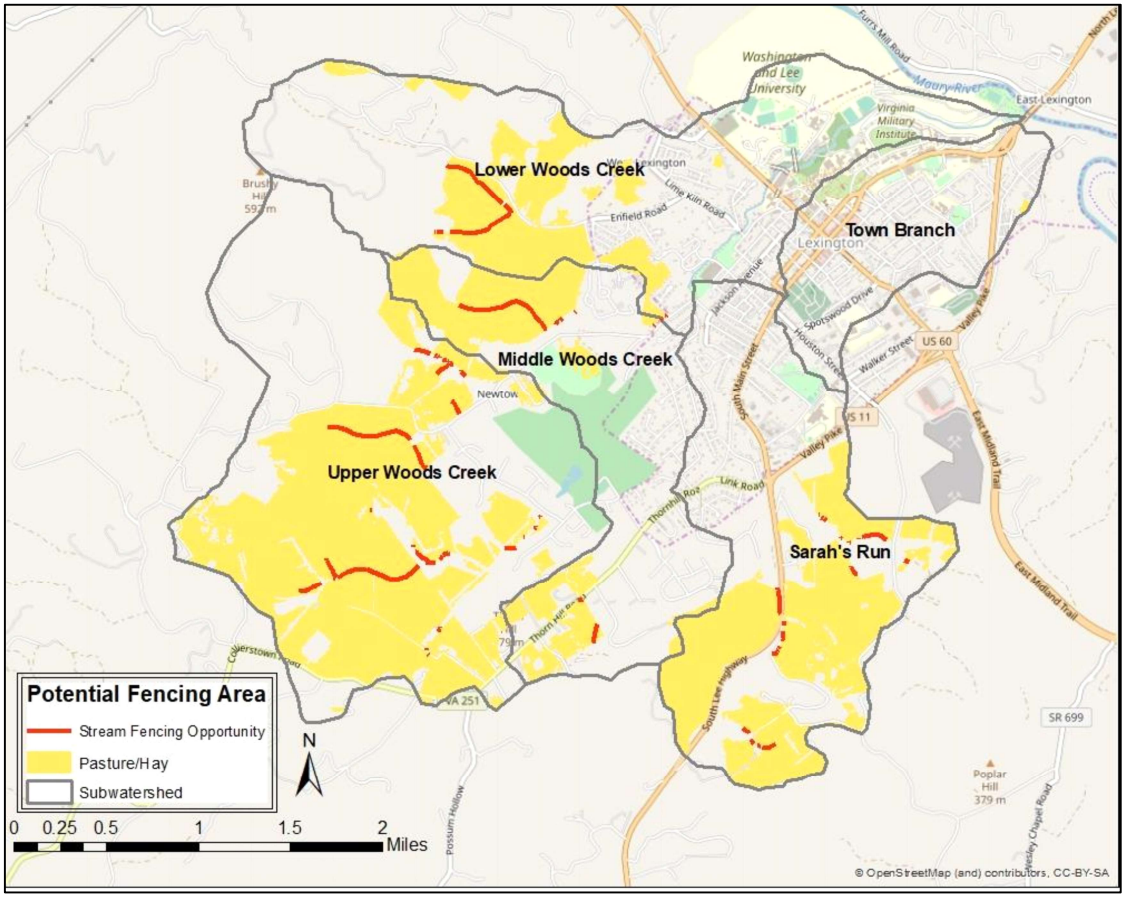

Figure 5-1. Potential livestock stream exclusion fencing areas (highlighted in red) in Woods Creek watershed. NOTE: Existing livestock exclusion practices are included in the highlighted areas.

It is expected that the majority of livestock exclusion fencing will be accomplished through the Virginia Agricultural BMP Cost-Share Program (VACS), VADEQ Non-Point Source BMP Implementation Program, and federal NRCS cost-share programs. Landowners have a number of options when it comes to installing livestock exclusion fencing through these programs. Some applicable cost-shared BMPs for livestock

exclusion in the programs are the LE-1T (Livestock Exclusion with Riparian Buffers for TMDL Implementation), the LE-2T (Livestock Exclusion with Reduced Setback for TMDL Implementation), the SL-6 (Stream Exclusion with Grazing Land Management), the SL-6AT (Small Acreage Grazing System), and CREP (Conservation Reserve Enhancement Program) practices.

In order to develop an estimate of the number of fencing systems needed in the watershed, tax parcel data was utilized in conjunction with local data from the VADCR Agricultural BMP Database to determine typical characteristics (e.g., streamside fencing length per practice) of livestock exclusion systems in the region. In addition, input was collected from the agricultural working group and the Natural Bridge SWCD regarding typical components of each system, associated costs, and preferred fencing setbacks. These characteristics were then utilized to identify the mix of fencing practices available through state and federal cost-share programs to include in the implementation plan (Table 5-3).

The VADEQ Non-Point Source BMP Implementation Program includes a series of livestock exclusion practices that may be used to meet exclusion goals in priority implementation watersheds. Livestock Exclusion with Riparian Buffers (LE-1T) offers 85% cost-share for off stream watering, establishment of a rotational grazing system, stream crossings, and stream exclusion fencing with a 35-foot setback (required). Based on discussions with the agricultural working group, it was determined that this practice would be the most appealing to producers in the watershed due to the high cost-share rate and the buffer setback requirement. Greater buffer setbacks were discussed, but working group members felt that even with additional financial incentives, a setback greater than 35 feet would be unlikely. It was estimated that approximately 60% of fencing in the watershed would be installed using the LE-1T practice. The SL-6 practice may also be used to meet the 35-foot fencing setback goal, but the higher cost-share rate for the LE-1T (85%) would generate more interest than the 80% cost-share rate for the SL-6 practice.

Table 5-3. Livestock exclusion needed to achieve reduction of bacteria load from livestock direct deposition.
Assumes one exclusion system averages 2,300 linear feet of fencing.

Sub-watershed	Fencing needed	LE-1T/SL-6/SL-6AT (35 foot buffer): 60%		LE-2T (10 foot buffer): 40%	
	feet	feet	systems	feet	systems
Stage 1					
Lower Woods Creek	7,188	4,313	2	2,875	2
Sarah's Run	3,346	2,008	1	1,339	1
Middle Woods Creek	1,085	651	1	434	1
Upper Woods Creek	9,062	5,437	3	3,625	2
Total Stage 1	20,681	12,409	7	8,273	6
Stage 2					
Lower Woods Creek	1,712	1,027	1	685	1
Sarah's Run	953	572	1	381	1
Middle Woods Creek	956	574	1	382	1
Upper Woods Creek	2,664	1,598	1	1,066	1
Total Stage 2	6,285	3,771	4	2,514	4
Total	26,967	16,180	11	10,787	10

A livestock exclusion practice with a reduced setback requirement is offered through VADEQ's cost-share program. The Livestock Exclusion with Reduced Setback practice (LE-2T) only requires a 10 foot setback for stream fencing. Cost-share is provided for stream fencing and cross fencing, stream crossings, and off stream waterers at a rate of 50%. Agricultural working group members thought that this practice would be applicable in a limited number of situations, but that the lower cost-share rate would be a deterrent to producers. It was estimated that 40% of livestock exclusion would be completed through the LE-2T practice.

The Small Acreage Grazing System practice (SL-6AT) is similar to the LE-1T practice, but is intended specifically for horse operations and includes 50% cost-share. This practice includes stream exclusion fencing, establishment of grazing paddocks, development of heavy use or sacrifice areas, and establishment of walkways to facilitate livestock movement. The agricultural working group discussed potential application of this practice in the watershed due to the fact that there are a significant number of small horse farms in the area.

While the suite of BMPs outlined in this plan will satisfy the bacteria reductions needed to meet water quality goals, the quantity and details of these BMPs are subject to change in the future to reflect updates to related policies and programs, including cost share programs.

Land Based Agricultural BMPs

In order to meet the bacteria reductions outlined in the TMDL, best management practices to treat land-based sources of bacteria must also be included in implementation efforts. Table 5-4 provides a summary of land based agricultural BMPs by watershed needed to achieve water quality goals.

Table 5-4. Land based agricultural BMPs needed to achieve reduction of pasture bacteria load.

BMP	Lower Woods Creek	Sarah's Run	Middle Woods Creek	Upper Woods Creek	Total
	Acres				
Riparian buffers (woodland)	3	1	1	3	8
Improved pasture management (beef)	173	306	144	594	1,217
Small acreage grazing system (equine)	14	24	11	47	96
Afforestation of erodible pasture	3	5	2	10	20
Permanent vegetative cover on critical areas	3	6	3	10	22

Riparian Buffers

For modeling purposes, it was assumed that a typical vegetative buffer would be able to receive and treat runoff from an area two times its width. For example, a buffer that was 35 feet wide and 1,000 feet long would treat runoff from an area that was 70 feet wide and 1,000 feet long. At greater than two times the buffer width, it was assumed that the runoff would be in the form of channelized flow rather than the sheet flow that a buffer can trap.

Grazing Systems and Improved Pasture Management

Establishment of rotational grazing systems for cattle was recommended in conjunction with livestock exclusion projects. The majority of fencing programs will provide cost-share for the establishment of cross fencing and alternative watering sources in order to establish these systems. In cases where livestock exclusion is not necessary, improved pasture management was prescribed. Like a grazing system, improved pasture

management allows a farmer to better utilize grazing land and associated forage production. Improved pasture management includes:

- Implementing a current nutrient management plan
- Maintaining adequate soil nutrient and pH levels
- Managing livestock rotation to paddock subdivisions to maintain minimum grazing height recommendations and sufficient rest periods for plant recovery
- Maintaining adequate and uniform plant cover (≥ 60%) and pasture stand density
- Locating feeding and watering facilities away from sensitive areas
- Managing distribution of nutrients and minimizing soil disturbance at hay feeding sites by unrolling hay across the upland landscape in varied locations
- Designating a sacrifice lot/paddock to locate cattle for feeding when adequate forage is not available in the pasture system. Sacrifice lot/paddock should not drain directly into ponds, creeks or other sensitive areas and should not be more than 10% of the total pasture acreage.
- Chain harrowing pastures to break-up manure piles after livestock are removed from a field at least twice a year to uniformly spread the manure load, or manage manure distribution through rotational grazing

Afforestation of Erodible Pasture

A small portion of pastureland was identified for tree planting. This practice will be performed on pasture that is not well suited for agriculture due to slope and other characteristics. The intent of including this practice is not to reduce the presence of agriculture in the watershed, but rather to optimize the use of suitable pastureland in the watershed and prevent runoff and soil loss from marginal agricultural lands. Cost-share funding is available for tree planting, and a flat rate payment per acre is also made through this practice depending on the length of the BMP contract.

5.2.2 Residential Control Measures

Failing Septic Systems and Straight Pipes

All failing septic systems and straight pipes must be identified and corrected during implementation based on preexisting legal requirements. Table 5-5 shows the estimated number of failing septic systems in the watershed. The number of failing septic systems in the Woods Creek watershed was developed based on a substandard system assessment by the Virginia Department of Health (VDH). In this assessment, VDH surveyed each Virginia jurisdiction for data on the number of substandard systems. The percent substandard for Rockbridge County is 5% which means approximately 5% of all

unsewered systems are failing septic systems or are straight pipes. Based on conversations with the stakeholders during TMDL development, it was determined that there are no straight pipes in the Woods Creek watershed.

Table 5-5. Estimated failing septic systems in the Woods Creek watershed.

Sub-watershed	Total septic systems	Estimated failing septic systems
Lower Woods Creek	25	1
Town Branch	-	-
Sarah's Run	36	2
Middle Woods Creek	21	1
Upper Woods Creek	89	4
Total	171	8

Based on data collected from several existing septic system cost-share programs in nearby counties (Augusta and Rockingham), it was estimated that 50% of failing septic systems could be corrected with a repair, and that the remaining 50% would need to be replaced. VADEQ administers a septic BMP cost-share program for targeted watersheds with approved implementation plans. This program provides cost-share for two kinds of septic system repairs, those requiring a permit, and those consisting of an inspection and repair that does not require a permit. It was estimated that 25% of repairs would be minor in nature and thus not require a permit, while the remainder would be significant enough that one would be required. Of the systems that need to be replaced, it was estimated that half will require alternative waste treatment systems due to the geology present at the site, or a lack of space necessary for a conventional drainfield. Table 5-6 shows a breakdown of the estimated septic system repairs and replacements. No opportunities for connection to public sewer for existing homes were identified in the watershed. A septic tank pump-out program was also discussed as a good way to heighten local awareness of septic system maintenance needs and to locate failing septic systems. The estimates shown in Table 5-6 are based on pumping out septic tanks for 33% of households in each watershed.

Table 5-6. Repairs and replacements of failing septic systems in the Woods Creek watershed.

Septic system repair		Replace with conventional system		Replace with alternative system	Septic tank pump-out
non-permitted	w/ permit	w/o pump	w/ pump		
3	1	1	1	2	57

Residential Stormwater and Pet Waste

Based on modeling results during TMDL development, the primary source of *E. coli* in the Woods Creek watershed is runoff from pasture and livestock in the stream; however, the residential working group agreed that bacteria and sediment from urban and residential areas should be addressed in a similar manner to agricultural sources. This presents a more comprehensive approach to management of the watershed, and assigns some degree of responsibility to all pollutant source sectors within the watershed. Urban/residential pollutant sources are primarily located in the City of Lexington. The working group agreed that the City would be the most suitable location for any stormwater management practices, and for a targeted pet waste education program and associated BMPs (Table 5-7).

Table 5-7. Residential stormwater and pet waste BMPs for the Woods Creek watershed.

Land use	BMP	Units	Extent
Residential	Rain gardens	Acres treated	2
	Riparian buffers - trees	Acres treated	1
	Riparian buffers - grass	Acres treated	1
	Pet waste disposal station	Station	5
	Pet waste digester	Digester	13
	Pet waste education program	Program	1

With input from the working group and Lexington staff, it was determined that there may be areas throughout the city well-suited for installation of urban stormwater BMPs, including a possibility to collaborate with Washington and Lee University and Virginia Military Institute. Implementation of a targeted pet waste education program would encourage pet owners to pick up after their pets and facilitate proper disposal of pet waste. Such a program would include the development and distribution of educational materials, installation of pet waste disposal stations with collection bags in several neighborhoods, and the promotion of pet waste BMPs including pet waste digesters.

Further research will be needed to identify which neighborhoods are the best fit for pet waste stations. A pet waste digester allows a homeowner to collect their pet's waste and safely compost it outside. There are several types of digesters, some requiring more maintenance than others. A septic-style digester (e.g. Doggie Dooley® system) is inserted in the ground (2-4 feet below the surface) with a lid on top. Pet waste is added to the digester along with water and a special enzyme to accelerate decomposition. Traditional digesters may also be used to treat pet waste.

There is currently an ordinance in the City of Lexington making it unlawful to keep or raise fowl, poultry or livestock within the City. However, the Steering Committee noted that the City is considering an amendment to the ordinance that would allow the keeping of chickens in Lexington. Implicit in this water quality improvement plan is the need to avoid increased delivery from sources that may develop over time. If an amendment is approved allowing the keeping of poultry or other livestock within City limits, additional control measures should be implemented to eliminate the associated bacteria from reaching Woods Creek.

5.3 Technical Assistance and Education

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 articulate exactly what the TMDL means to them and what practices will help meet the goal of improved water quality. The working groups recommended several education/outreach techniques, which will be utilized during implementation.

The following general tasks associated with agricultural and residential programs 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.
- Provide technical assistance for agricultural programs (e.g., survey, design, layout).

- Give presentations at meetings of local Farm Bureau, Ruritans, and other groups. Provide information for distribution with newsletters.
- Organize educational programs for farmers including farm tours in partnership with VA Cooperative Extension and Farm Bureau.
- Work with NRCS and Natural Bridge SWCD to conduct door to door outreach regarding agricultural BMPs
- Work with VA Cooperative Extension to hold rotational grazing workshops and "fencing school" programs in the watersheds. These have been offered in other areas in the northern Valley and have been well received by the agricultural community
- Work with county Board of Supervisors representatives to contact agricultural landowners in the watershed to discuss water quality issues and potential management strategies
- Handle and track cost-share
- Assess and track progress toward BMP implementation goals
- Coordinate use of existing agricultural programs and suggest modifications

Residential Programs

- Identify failing septic systems (*e.g.*, contact landowners in older homes, septic pump-out program)
- Handle and track cost-share
- Develop and distribute educational materials (e.g., septic system maintenance guide). Emphasize how the residential septic cost-share program can help reduce costs to the homeowner
- Encourage a partnership between the Department of Health and local realtors to share the capacity of a home's septic system with potential buyers
- Conduct outreach at homeowners association and public service board meetings
- Launch a newspaper campaign about septic system maintenance. Emphasize the connection between proper maintenance, groundwater science and financial assistance available
- Provide educational materials to residents on proper composting of manure before applying to flower and vegetable gardens to destroy all *E. coli* bacteria.
- Utilize Boxerwood Educational Association's successful educational program with the local schools
- Use the annual Envirothon competition as an opportunity for community outreach
- Assess progress toward implementation goals

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 including both design

challenges and financial barriers to implementation of practices. Consequently, technical assistance from trained conservation professionals is a key component to successful BMP implementation. Technical assistance includes helping landowners identify suitable BMPs for their property, designing BMPs and locating funding to finance implementation.

The staffing level needed to implement the agricultural and residential components of the plan was estimated based on discussions with stakeholders and the staffing levels used in similar projects. Staffing needs were quantified using full time equivalents (FTE), with one FTE being equal to one full-time staff member. Based on the size of the watershed, the extent of implementation needed, and the overall project timeline, an estimate of one FTE was used for technical assistance. This estimate was based on similar implementation projects in other watersheds where one staff member is administering both the residential stormwater, septic, pet waste and agricultural programs. It is expected that City of Lexington and Rockbridge County staff would be directly involved in any urban stormwater BMPs, serving as the project lead on any of these efforts in their locality with support from the Natural Bridge SWCD.

6. COSTS AND BENEFITS

6.1 BMP Cost Analysis

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 2019 NRCS cost lists for BMP components, and considerable input from the Natural Bridge SWCD and agricultural working group.

The total cost of livestock exclusion systems includes not only the costs associated with fence installation, repair, and maintenance, but also the cost of developing alternative water sources for SL-6, LE-1T, LE-2T, and SL-6AT. The cost of fence maintenance can often be a deterrent to participation. In developing the cost estimates for fence maintenance shown in Table 6-1, a figure of $3.50/linear foot of fence was used. It was estimated that approximately 5% of fencing would need to be replaced over the 10 year timeline of this project.

The majority of agricultural practices recommended in the implementation plan are included in state and federal cost-share programs. These programs offer financial assistance in implementing the practices and may also provide landowners with an incentive payment to encourage participation. Consequently, both the potential cost to landowners and the cost to state and federal programs must be considered. Table 6-1 shows total agricultural BMP costs by watershed.

Residential areas contribute a small percentage (less than ten percent) of overall bacteria to Woods Creek. Therefore, the number of BMPs needed to reduce bacteria runoff from residential sources is less than those needed to reduce agricultural sources. The estimated costs of recommended residential BMPs were approximated based on input from the residential working group and other implementation plans in the vicinity. Table 6-2 shows total residential BMP costs for each scenario.

Total estimated costs for implementation practices needed to meet the bacteria TMDL goal are summarized in Table 6-3 for the two planned stages of implementation. These stages and the associated timeline are explained in greater detail in Chapter 7.

Table 6-1. Agricultural BMP implementation costs by Woods Creek subwatersheds.

Practice	Cost-share code	Units	Unit cost	Cost by Watershed				TOTAL
				Lower Woods Creek	Sarah's Run	Middle Woods Creek	Upper Woods Creek	
Livestock exclusion with riparian buffers	LE-1T, SL-6, SL-6AT	system	$30,000	$90,000	$60,000	$60,000	$120,000	$330,000
Livestock exclusion with reduced setback	LE-2T	system	$30,000	$90,000	$60,000	$60,000	$90,000	$300,000
Exclusion fence maintenance (10 yrs)	N/A	feet	$3.50	$1,558	$752	$358	$2,052	$4,720
Riparian buffers (woodland)	FR-3	acres	$1,500	$4,500	$1,500	$1,500	$4,500	$12,000
Improved pasture management (beef)	SL-9, SL-10T, EQIP 528	acres	$100	$17,300	$30,600	$14,400	$59,400	$121,700
Small acreage grazing system (equine)	SL-6AT	acres	$550	$7,700	$13,200	$6,050	$25,850	$52,800
Afforestation of erodible pasture	FR-1	acres	$560	$1,680	$2,800	$1,120	$5,600	$11,200
Critical area stabilization	SL-11	acres	$2,550	$7,650	$15,300	$7,650	$25,500	$56,100
TOTAL ESTIMATED COST				**$220,388**	**$184,152**	**$151,078**	**$332,902**	**$888,519**

Table 6-2. Residential BMP implementation costs for the Woods Creek watershed.

Practice	Cost-share code	Units	Unit cost	TOTAL
Septic tank pump-out	RB-1	system	$300	$17,100
Septic tank system repair	RB-3	repair	$5,000	$5,000
Septic system inspection and non-permitted repairs	RB-3R	repair	$2,000	$6,000
Septic tank system installation or replacement	RB-4	system	$7,500	$7,500
Septic tank system installation/replacement w/ pump	RB-4P	system	$9,000	$9,000
Alternative waste treatment system	RB-5	system	$15,000	$30,000
Pet waste disposal station	PW-1	station	$300	$1,500
Pet waste digester	PW-2	digester	$100	$1,300
Pet waste education program	N/A	program	$4,000	$4,000
Rain gardens	RG	acres treated	$20,000	$40,000
Riparian buffers - grassed	CL – Meadow Filter Strip	acres treated	$350	$350
Riparian buffers - trees	CL – Tree Planting	acres treated	$700	$700
TOTAL ESTIMATED COST				**$122,450**

Table 6-3. Total BMP implementation costs by stage.

BMP Application	Cost by Stage		TOTAL
	Stage 1 (Years 1 – 5)	Stage 2 (Years 6 – 10)	
Agricultural	$634,160	$242,360	**$888,519**
Residential/urban	$80,800	$41,650	**$122,450**
TOTAL ESTIMATED COST	$714,960	$284,010	**$1,010,970**

6.2 Technical Assistance

Technical assistance costs were estimated for one full time position using a cost of $60,000/position per year. This figure is based on the existing staffing costs included in the Virginia Department of Environmental Quality's grant agreements with the Soil and Water Conservation Districts across the state to provide technical assistance to landowners in TMDL implementation watersheds. Based on the 10-year timeline of this plan (described in great detail in the Implementation Timeline section of this plan), this would make the total cost of technical assistance approximately $600,000. When factored

into the cost estimate for BMP implementation shown in Table 6-3, this would make the total cost of implementation approximately $1.61M.

6.3 Benefit Analysis

The primary benefit of implementing this plan will be cleaner water in Woods Creek. Specifically, *E. coli* contamination in the creek will be reduced to meet water quality standards. 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, because of the reductions required, the incidence of infection from *E. coli* sources through contact with surface waters should be reduced considerably.

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 livestock from streams, improved pasture management, and private sewage system maintenance will each provide economic benefits to land owners. Additionally, money spent by landowners and state agencies in the process of implementing this plan will stimulate the local economy.

6.3.1 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.

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 and Bettinger, 2003). Table 6-4 shows an example of how this can translate into economic

gains for producers. Fresh clean water is the primary nutrient for livestock, with healthy cattle consuming, on a daily basis, close to 10% of their body weight during winter and 15% of their body weight in summer.

Table 6-4. Example of increased revenue due to installing off-stream waterers (Surber et al., 2003).

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

Many livestock illnesses can be spread through contaminated water supplies. For instance, coccidia can be delivered through feed, water and haircoat contamination with manure (VCE, 2000). Additionally, keeping cattle in clean, dry areas has been shown to reduce the occurrence of mastitis and foot rot. Horses drinking from marshy areas or areas accessed by wildlife or cattle carrying Leptospirosis tend to have an increased incidence of moonblindness associated with Leptospirosis infections (VCE, 1998a; VCE, 1998b). A clean water source can prevent illnesses that reduce production and incur the added expense of avoidable veterinary bills.

Taking the opportunity to implement an improved pasture management system in conjunction with installing clean water supplies will also provide economic benefits for the producer. Improved pasture management can allow a producer to feed less hay in winter months, increase stocking rates by 30 to 40% and, consequently, improve the profitability of the operation. With feed costs typically responsible for 70 to 80% of the cost of growing or maintaining an animal, and pastures providing feed at a cost of 0.01 to 0.02 cents/lb of total digestible nutrients (TDN) compared to 0.04 to 0.06 cents/lb TDN for hay, increasing the amount of time that cattle are fed on pasture is clearly a financial benefit to producers (VCE, 1996). Standing forage utilized directly by the grazing animal is always less costly and of higher quality than the same forage harvested with equipment and fed to the animal. In addition to reducing costs to producers, intensive pasture management can boost profits by allowing higher stocking rates and increasing the amount of gain per acre. Another benefit is that cattle are closely confined allowing for quicker examination and handling. In general, many of the agricultural BMPs recommended in this document will provide both environmental benefits and economic benefits to the farmer.

6.3.2 Residential Septic Practices

The residential programs will play an important role in improving water quality, since human waste can carry with it human viruses in addition to the bacterial and protozoan pathogens that all fecal matter can potentially carry. 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 and the need for regular maintenance, will give homeowners the tools needed for extending the life of their systems and reducing the overall cost of ownership. The average septic system will last 20 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 ($300) in comparison to repairing or replacing an entire system ($2,000 to $15,000). Additionally, the repair/replacement and pump-out programs will benefit owners of private sewage (*e.g.,* septic) systems, particularly low-income homeowners, by sharing the cost of required maintenance.

6.3.3 Residential and Urban Stormwater Management Practices

The primary benefits of urban stormwater management practices to private property owners include flood mitigation and improved water quality. A 2004 study assessing the economic benefits of stormwater management showed that these services can be valued at up to 5% of the market value of a home (Braden and Johnston, 2004). In flood prone and waterfront communities these services can be assigned an even greater value by property owners (Thunberg and Shabman, 1991).

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. Additional savings may be realized by local governments through reduced pollution treatment costs, particularly in communities with combined sewers. By

reducing storm sewer flows through increased infiltration of stormwater, localities can subsequently reduce stormwater treatment costs, overflow damages and storage costs (Braden and Johnston, 2004). 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 to $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.

6.3.4 Watershed Health and Associated Benefits

Focusing on reducing bacteria in the watershed will have associated watershed health benefits as well. Woods Creek was also listed for a benthic impairment due to exceedance of the general aquatic life (benthic) standard. The most probable stressor contributing to the benthic impairment was identified as a combination of hydrologic modifications and organic matter. Many sources in Woods Creek that contribute to the bacteria impairment also contribute organic matter. As a result, the bacteria reductions described in this plan will also reduce the organic matter load to Woods Creek.

Reductions in streambank erosion, excessive nutrient runoff, and water temperature are additional watershed health benefits associated with streamside buffer plantings. In turn, reduced nutrient loading and erosion and cooler water temperatures improves habitat for fisheries, which provides associated 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 Chapter 9).

In addition to the benefits to individual landowners, the economy of the local community will be stimulated through expenditures made during implementation, and the infusion of dollars from funding sources outside the impaired areas. 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. Additionally, income from maintenance of these systems should continue long after implementation is complete. As will be discussed in greater detail in Chapter 9, a portion of the funding for implementation can be expected to come from state and federal sources. This portion of funding represents money that is new to the area and will stimulate the local economy. In general, implementation will provide not only environmental benefits to the community, but economic benefits as well, which in turn will allow for individual landowners to participate in implementation.

7. MEASUREABLE GOALS AND MILESTONES

Based upon the scope of work involved with implementing this TMDL, full implementation could be expected within 10 years provided that full funding for technical assistance and BMP cost-share are available. De-listing from the Virginia Section 305(b)/303(d) list can be expected approximately 5 years after full implementation, when BMPs would attain their maximum reduction efficiencies. A timeline for implementation, water quality and implementation goals and milestones, and strategies for targeting of best management practices are described in this section.

7.1 Milestone Identification

The end goals of implementation are restored water quality of the impaired water and subsequent de-listing of the water from the Commonwealth of Virginia's Section 305(b)/303(d) list within 15 years. Progress toward end goals will be assessed during implementation through tracking of best management practices through the Virginia Agricultural BMP Cost-Share Program and continued water quality monitoring.

Expected progress in implementation is established with two types of milestones: *implementation milestones* and *water quality milestones*. Implementation milestones establish the amount of control measures installed within certain timeframes, while water quality milestones establish the corresponding improvements in water quality that can be expected as the implementation milestones are met. The milestones described here are intended to achieve full implementation of the TMDL within 10 years.

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, concentrating on implementing livestock exclusion fencing within the first several years may provide the highest return on water quality improvement with less cost to landowners. Implementation has been divided into two stages: Stage 1 includes years 1 through 5 and Stage 2 includes years 6 through 10. Table 7-1 shows implementation and water quality improvement goals for *E. coli* bacteria for the Woods Creek watershed in each implementation stage.

Table 7-1. Staged implementation goals and percent land use receiving BMPs by stage.

BMP Type	Description	BMP code	Units	Extent		% Land use treated	
				Stage 1	Stage 2	Stage 1	Stage 2
Direct deposit	Livestock exclusion with riparian buffers	LE-1T/SL-6/ SL-6AT	feet	12,409	3,771		
	Livestock exclusion with reduced setback	LE-2T		8,273	2,514		
	Exclusion fence maintenance	N/A		674	674		
Pasture	Riparian buffers (woodland)	FR-3	acres	6	2	0.43	0.14
	Improved pasture management (beef)	SL-10T, EQIP 528		1,217	0	87.20	0
	Small acreage grazing system (equine)	SL-6AT		96	0	6.86	0
	Afforestation of hay and pasture land	FR-1		20	0	1.44	0
	Permanent vegetation on critical areas	SL-11		22	0	1.56	0
Residential septic	Onsite sewage system repair	RB-3	repair	1	0		
	Full inspection and non-permitted onsite sewage system repair	RB-3R		3	0		
	Onsite sewage system installation/replacement	RB-4	system	1	0		
	Onsite sewage system installation/replacement w/ pump	RB-4P		1	0		
	Alternative sewage system	RB-5		1	0		
	Septic tank pump-out	RB-1	pump-out	57	0		
Pet waste	Pet waste disposal station	PW-1	station	3	2		
	Pet waste digester	PW-2	digester	13	0		
	Pet waste education program	N/A	program	1	0		
Residential stormwater	Rain gardens	N/A	acres treated	0	2	0	0.08
	Riparian buffers - grassed	N/A		0	1	0	0.04
	Riparian buffers - trees	N/A		0	1	0	0.04
Average annual fecal coliform load (cfu/yr) Existing load = 2.68×10^{15}				9.57×10^{14}	9.13×10^{14}		
% Reduction in fecal coliform load				64%	66%		
% Exceedance of the Single Sample Maximum *E. coli* criterion (235 cfu/100 mL) Existing condition = 27.6%				10.4%	10.1%		
% Exceedance of the Geometric Mean *E. coli* criterion (126 cfu/100 mL) Existing condition = 41.7%				12.5%	0.0%		

7.2 Water Quality Monitoring

7.2.1 DEQ Monitoring

Improvements in water quality will be evaluated through water quality monitoring conducted at VADEQ monitoring stations located in the watersheds as shown in Figure 7-1. These stations are part of VADEQ's Ambient Monitoring Program, wherein bi-monthly watershed monitoring takes place on a rotating basis for two consecutive years of a six-year assessment cycle. At these stations, monitoring will begin no sooner than the second odd numbered calendar year following the initiation of TMDL implementation. Beginning implementation monitoring after 2 to 3 years of TMDL implementation will help ensure that time has passed for remedial measures to have stabilized and BMPs to have become functional. 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. If full restoration, as defined in the current or most recent version of the DEQ Final Water Quality Assessment Guidance Manual, has been achieved, monitoring will be suspended. If the two listing stations shown on the map, or any other stations associated with this implementation plan have three or more exceedances of the bacteria standard within this two year period, monitoring will be discontinued for two years. Bi-monthly monitoring will be resumed for another two years on the odd numbered calendar year in the third two-year period of the six year assessment window. After this, the most recent two years of data will be evaluated, and the same criteria as was used for the first two year monitoring cycle will apply.

Intensive, one-year monthly sampling may occur within any single calendar year. It is generally preferred to conduct sampling over a two year period to help minimize the effect of fluctuating climate conditions related to dry and wet events.

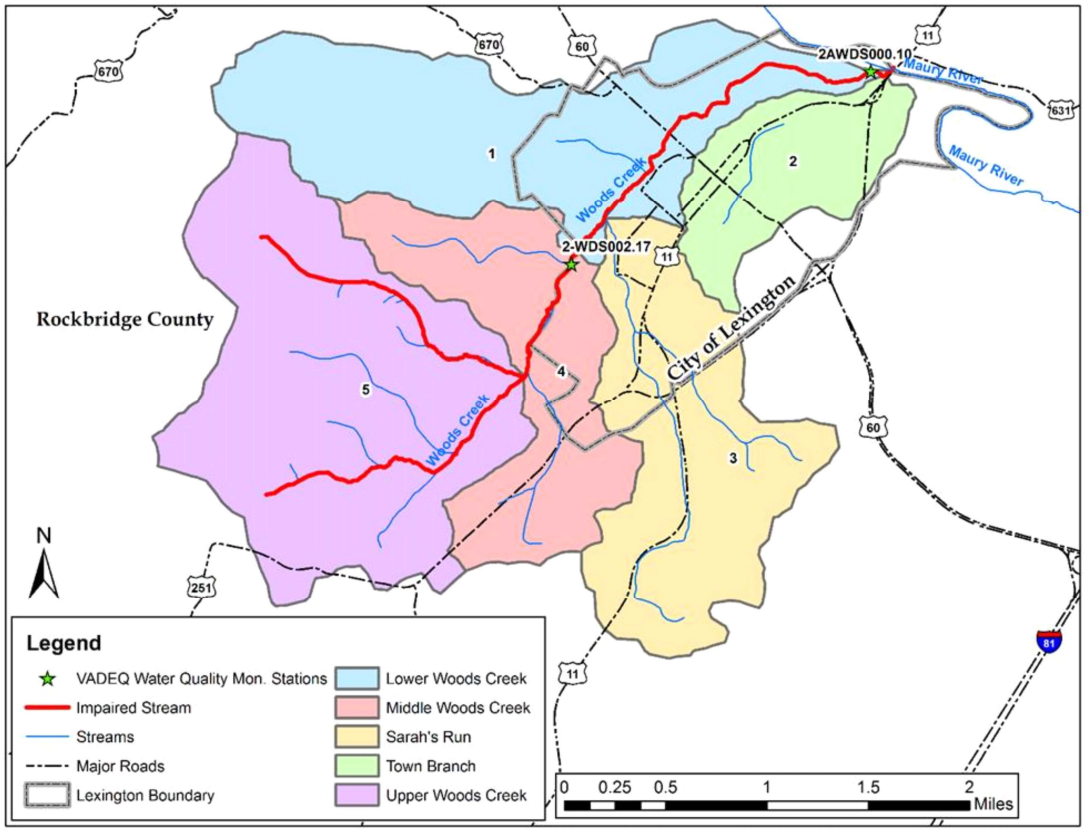

Figure 7-1. VADEQ water quality monitoring stations in the Woods Creek watershed.

7.2.2 Citizen Monitoring

Citizen monitoring is another valuable tool for assessing water quality. A group of volunteer monitors began a Coliscan monitoring program to detect *E. coli* in the watershed in July 2017. Samples are collected on a monthly basis at approximately twelve sites in the watershed. This monitoring initiative is supported by VADEQ and is useful for identifying areas of the watershed with higher concentrations of *E. coli*, which can help focus implementation efforts. Citizen monitoring can also detect improvements in water quality following implementation.

8. STAKEHOLDERS AND THEIR ROLE IN IMPLEMENTATION

Achieving the goals of this plan is dependent on stakeholder participation and strong leadership on the part of both community members and conservation organizations. The Natural Bridge Soil & Water Conservation District covers all of the project area with respect to administration of the VA Agricultural BMP Cost-Share Program. Additional partners will be necessary in order to address residential implementation needs. The following sections in this chapter describe the responsibilities and expectations for the various components of implementation.

8.1 Partner Roles and Responsibilities

8.1.1 Watershed Landowners

The majority of practices recommended in this plan are related to agriculture since it is a predominant bacteria source in the watershed. Participation from local farmers is thus a key factor to the success of this plan. Consequently, it is important to consider characteristics of farms and farmers in the watersheds that will affect the decisions farmers make when it comes to implementing conservation practices on their farms. For example, the average size of farms is an important factor to consider, since it affects how much land a farmer can give up for a riparian buffer. The average age of a farmer, which was 58 in Virginia in 2012, may also influence their decision to implement best management practices, particularly if they are close to retirement and will be relying on the sale of their land for income during retirement. In such cases, it may be less likely that a farmer would be willing to invest a portion of their income in best management practices. Table 8-1 provides a summary of relevant characteristics of farmers and producers in Rockbridge County from the 2012 Agricultural Census (USDA-NASS, 2012). These characteristics were considered when developing implementation scenarios, and should be utilized to develop suitable education and outreach strategies.

Table 8-1. Characteristics of farms and farmers in Rockbridge County (USDA-NASS, 2012).

Characteristic	Extent
Number of farms	833
Land in farms (acres)	168,376
Full owners of farms	545
Part owners of farms	252
Tenants	36
Operators identifying farming as their primary occupation	353
Operators identifying something other than farming as their primary occupation	480
Average years present on the farm	23.9
Average age of primary operator	61.0
Average size of farm (acres)	202
Average value of farmland and buildings ($/acre)	$4,296
Average net cash farm income of operation ($)	$2,239
Farms with internet access	601
Farm typology (farms)	
Family or individual	728
Partnership	54
Family-held corporation	39
Corporation other than family held	6
Other (cooperative, estate or trust, institutional etc.)	6

In addition to local farmers, participation from homeowners, local government staff and elected officials is critical to the success of this plan. Elected officials 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. 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 coming from failing septic systems is minimal compared to livestock, human waste carries with it pathogens that can cause considerable health problems

8.1.2 Natural Bridge Soil & Water Conservation District (SWCD) and Natural Resource Conservation Service (NRCS)

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 Woods Creek watershed, meaning that agricultural BMP implementation goals cannot be met without additional resources. SWCD and NRCS staff responsibilities include promoting available funding for 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 targeted outreach is limited due to existing workloads. Should funding for additional staff become available for outreach in these watersheds, the Natural Bridge SWCD would be well suited to administer an agricultural BMP program. During implementation planning, representatives from the Natural Bridge SWCD noted that they would be interested in pursuing funds for implementation efforts in 2-3 years after staff has worked through a significant backlog of livestock exclusion practices in their service area.

A residential septic system maintenance cost-share program could be administered by a number of different entities including the Natural Bridge SWCD, the VA Department of Health, or one of the localities in the watershed.

8.1.3 Rockbridge County and the City of Lexington

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 County and City key partners in long term implementation efforts.

8.1.4 Virginia Department of Environmental Quality

The Virginia Department of Environmental Quality (VADEQ) has a lead role in the development of TMDL-IPs to address non-point source pollutants such as bacteria from straight pipes, failing septic systems, pet waste, agricultural operations, and stormwater that contribute to water quality impairments. VADEQ provides available grant funding and technical support for the implementation of NPS (non-point source) components of TMDL IPs. VADEQ will work closely with project partners including the Natural Bridge Soil & 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 Woods Creek

in order to assess water quality and determine when restoration has been achieved and the stream can be removed from Virginia's impaired waters list.

8.1.5 Virginia Department of Conservation and Recreation

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

8.1.6 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 provides technical assistance to homeowners with septic system maintenance and installation, and respond to complaints regarding failing septic systems.

8.1.7 Boxerwood Educational Association

Boxerwood Educational Association is a nonprofit environmental education organization based in the Woods Creek watershed. The staff of Boxerwood are committed to working with other partners in support of the educational and outreach goals included in this implementation plan.

8.1.8 Other Potential Local Partners

There are numerous opportunities for future partnerships in the implementation of this plan and associated water quality monitoring. A list of additional organizations and entities with which partnership opportunities should be explored is provided below:

- Local Ruritan Clubs
- Rockbridge Area Conservation Council
- Rockbridge Area Master Gardeners Association
- Virginia Cooperative Extension

- Virginia Military Institute
- Washington and Lee University

8.2 Integration with Other Watershed Plans

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

8.2.1 Rockbridge County Comprehensive Plan

Rockbridge County adopted their current Comprehensive Plan in November 2016. The plan is intended to guide development and natural resource management within the jurisdiction. The plan stresses the importance of the preservation of rural areas, and includes an objective of meeting State standards for water quality throughout the County.

8.2.2 City of Lexington Comprehensive Plan

The City of Lexington is in the process of updating their Comprehensive Plan. The plan provides goals and objectives for future development and provides guidance to protect and enhance the local character and quality of life of the City.

8.2.3 Virginia's Phase III Chesapeake Bay Watershed Implementation Plan

Significant portions of Chesapeake Bay and its tidal tributaries within Virginia and other Bay States do not meet water quality standards and are listed as impaired. The main pollutants causing these impairments are nitrogen, phosphorus and sediment. Despite significant and sustained efforts for many years, the water quality goals under the Clean Water Act have yet to be met. On December 29, 2010, EPA finalized the Chesapeake Bay TMDL.

The Chesapeake Bay TMDL addresses all segments of the Bay and its tidal tributaries that are on the impaired waters list. The Bay TMDL divided the maximum aggregate watershed pollutant loadings that can achieve the Chesapeake Bay's water quality standards among the Bay states by major tributary basins and source categories

(wastewater, urban storm water, septic, agriculture, air deposition). EPA also set a phased implementation planning requirement for all Bay jurisdictions to focus attention on the actions needed to implement required pollutant reductions by 2025.

Virginia submitted its Phase I Watershed Implementation Plan (WIP) in November 2010, and a more refined Phase II plan (WIP II), which was built upon local BMP planning targets, in 2012. Virginia's Phase III WIP was finalized and submitted to EPA on August 23, 2019. Development of Virginia's Phase III WIP involved extensive engagement with the full array of Virginia's Chesapeake Bay watershed local jurisdictions, state agencies, and numerous other partners as well as the public. Virginia DEQ and DCR coordinated local engagement in partnership with the Commonwealth's Planning District Commissions (PDCs) and Soil and Water Conservation District areas. Implementation of the agricultural, forestry, septic and urban BMP targets that are identified in Virginia's Phase III WIP, together with ongoing reductions from permitted sources, are sufficient to achieve the Commonwealth's Bay TMDL sediment and nutrient reduction goals.

Woods Creek is located in the James River Basin within Virginia's Chesapeake Bay watershed. The pollutant of concern in the Woods Creek IP is bacteria. Implementing measures within the Woods Creek IP watershed that have been identified in either the local TMDL implementation plan or the Phase III WIP will have the co-benefit of improving local water quality while also supporting efforts to achieve Chesapeake Bay cleanup goals. For bacteria TMDL IPs, such as Woods Creek, implementation of BMPs identified in the Phase III WIP will also provide for protection against excess sediment and nutrients in local waters, even if no local impairment due to these pollutants has been identified. Additionally, stakeholder outreach conducted in the Woods Creek watershed as part of the local TMDL implementation project can be leveraged to emphasize additional BMP implementation needs identified in the Phase III WIP.

Types and numbers of BMPs identified as part of the Woods Creek IP are documented in Section 7 of this document. Types and numbers of BMPs identified as part of the Phase III WIP for the James River Basin are documented in Table 3: James River Basin WIP III Final BMPs, of Chapter 8.3 of Virginia's Phase III WIP document.

8.3 Legal Authority

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

VADEQ has responsibility for monitoring waters to determine compliance with state standards, and for requiring permitted point dischargers to maintain loads within permit limits. It has the regulatory authority to levy fines and take legal action against those in violation of permits. Beginning in 1994, animal waste from confined animal facilities that hold in excess of 300 animal units (cattle and hogs) has been managed through a Virginia general pollution abatement permit. These operations are required to implement a number of practices to prevent surface and groundwater contamination. In response to increasing demand from the public to develop new regulations dealing with animal waste, the Virginia General Assembly passed legislation in 1999 requiring VADEQ to develop regulations for the management of poultry waste in operations having more than 200 animal units of poultry (about 20,000 chickens) (ELI, 1999).

VADCR is responsible for administering the Virginia Agricultural BMP Cost-Share and Nutrient Management Programs. Historically, most VADCR programs have dealt with agricultural NPS pollution through education and voluntary incentives. These cost-share programs were originally developed to meet the needs of voluntary partial participation and not the level of participation required by TMDLs (near 100%). To meet the needs of the TMDL program and achieve the goals set forth in the CWA, the incentive programs are continually reevaluated to account for this level of participation.

Through Virginia's Agricultural Stewardship Act (ASA), the Commissioner of Agriculture has the authority to investigate claims that an agricultural producer is causing a water quality problem on a case-by-case basis (Pugh, 2001). If deemed a problem, the

Commissioner can order the producer to submit an agricultural stewardship plan to the local soil and water conservation district. If a producer fails to implement the plan, corrective action can be taken which can include a civil penalty of up to $5,000 per day. The Commissioner of Agriculture can issue an emergency corrective action if runoff is likely to endanger public health, animals, fish and aquatic life, public water supply, etc. An emergency order can shut down all or part of an agricultural activity and require specific stewardship measures. VDACS has three staff members dedicated to enforcing the Agricultural Stewardship Act, and a small amount of funding is available to support water quality sampling. The Agricultural Stewardship Act is entirely complaint-driven.

VDH is responsible for maintaining safe drinking water measured by standards set by the EPA. Their duties also include septic system regulation and, historically, regulation of biosolids land application on permitted farmland sites. Like VDACS, VDH's actions are complaint-driven. Complaints can range from a vent pipe odor that is not an actual sewage violation and takes very little time to investigate, to a large discharge violation that may take many weeks or longer to effect compliance. In relation to these TMDLs, VDH has the responsibility of enforcing actions to correct or eliminate failed septic systems and straight pipes.

State government has the authority to establish state laws that control delivery of pollutants to local waters. Local governments, in conjunction with the state, can develop ordinances involving pollution prevention measures. In addition, citizens have the right to bring litigation against persons or groups of people shown to be causing some harm to the claimant. The judicial branch of government also plays a significant role in the regulation of activities that impact water quality through hearing the claims of citizens in civil court and the claims of government representatives in criminal court.

8.4 Legal Action

The Clean Water Act Section 303(d) calls for the identification of impaired waters. It also requires that the streams be ranked by the severity of the impairment and that TMDLs be calculated for streams to meet water quality standards. TMDL implementation plans are not required in the Federal Code; however, Virginia State Code does include the development of implementation plans for impaired streams. EPA largely ignored the

nonpoint source section of the Clean Water Act until citizens began to realize that regulating only point sources was no longer maintaining water quality standards. Lawsuits from citizens and environmental groups citing EPA for not carrying out the statutes of the CWA began as far back as the 1970s and have continued until the present. In Virginia in 1998, the American Canoe Association and the American Littoral Society filed a complaint against EPA for failure to comply with provisions of §303(d). The suit was settled by Consent Decree, which contained a TMDL development schedule through 2010. It is becoming more common for concerned citizens and environmental groups to turn to the courts for the enforcement of water quality issues.

Successful implementation depends on stakeholders taking responsibility for their role in the process. The primary role, of course, falls on the landowner. However, local, state and federal agencies also have a stake in ensuring that Virginia's waters are clean and provide a healthy environment for its citizens. An important first step in correcting the existing water quality problem is recognizing that there is a problem and that the health of citizens is at stake. Virginia's approach to correcting NPS pollution problems has been, and continues to be, encouragement of participation through education and financial incentives.

9. FUNDING

A list of potential funding sources available for implementation has been developed. A brief description of the programs and their requirements is provided in this chapter. Detailed descriptions can be obtained from the SWCD, VADEQ, VADCR, NRCS, and VCE.

9.1 Virginia Nonpoint Source Implementation Program

Virginia's nonpoint source (NPS) implementation program is administered by VADEQ through local Soil and Water Conservation Districts (SWCD), local governments, nonprofits, planning district commissions (PDC), and local health departments to improve water quality in the Commonwealth's streams and rivers and in the Chesapeake Bay. DEQ, through its partners, provides cost-share assistance to landowners, homeowners, and agricultural operators as an incentive to voluntarily install nonpoint source best management practices (BMPs) in designated watersheds. The program uses funds from a variety of sources, including EPA Clean Water Act Section 319(h) and the state-funded Water Quality Improvement Fund (WQIF) to install BMPs with the goal of ultimately meeting Virginia's NPS pollution water quality objectives. Although resource-based problems affecting water quality can occur on all land uses, this program addresses cost-share assistance on agricultural, residential, and urban lands. The geographic extent of eligible lands is identified in grant agreements and in watershed based plans (WBPs), including TMDL IPs approved by DEQ and EPA.

Specifically, CWA Section 319(h) funding provides for implementation of BMPs in IP watersheds with approved local IPs. Types and numbers of BMPs identified as part of the Woods Creek IP are documented in Section 7 above. Because Woods Creek is located in the Chesapeake Bay watershed, BMPs that are identified in Table 3 of Chapter 8.3 in Virginia's Phase III WIP III document and will result in nutrient and associated sediment reductions both within the local watershed and within Virginia's James River Basin will also be considered for funding under this program.

9.2 Virginia Agricultural Best Management Practices Cost-Share Program (VACS)

The cost-share program is funded with state and federal monies through local SWCDs. SWCDs administer the program to encourage farmers and 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 the local maximum.

9.3 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 an amount equaling 25% of the first $70,000 expended for agricultural best management practices by the individual. Any practice approved by the local SWCD Board must be completed within the taxable year in which the credit is claimed. The credit is only allowed for expenditures made by the taxpayer from funds of his/her own sources. 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. If the amount of the credit exceeds the taxpayer's state tax obligation, the excess will be refunded to the taxpayer by the Virginia Department of Taxation. This program can be used independently or in conjunction with other cost-share programs on the stakeholder's portion of BMP costs. It is also approved for use in supplementing the cost of repairs to streamside fencing.

Tax credits are also available for the purchase of precision agricultural equipment and conservation tillage equipment. This includes manure applicators, sprayers, variable rate application equipment, and equipment used to reduce soil compaction. Individuals may claim a state tax credit of 25% of all expenditures made for purchasing and installing the equipment, up to a set maximum amount. A Nutrient Management Plan approved by the local SWCD is required to claim these credits.

9.4 Virginia Conservation Assistance Program (VCAP)

This is a relatively new program that provides financial incentives and technical and educational assistance to residential/urban landowners who install stormwater BMPs in Virginia's Chesapeake Bay watershed. Cost-share is typically 75% and some practices provide a flat incentive payment. SWCDs administer the program to encourage residential and urban property owners to install BMPs on their land to reduce erosion, poor drainage, and poor vegetation that contribute to water quality problems.

9.5 Virginia Water Quality Improvement Fund (WQIF)

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 both point and nonpoint source pollution remediation are administered through VADEQ.

9.6 Conservation Reserve Program (CRP)

Through this program, cost-share assistance is available to remove environmentally sensitive land from agricultural production and plant species that will improve environmental health and quality. Applications for the program are ranked, accepted and processed during signup periods that are announced by the Farm Service Agency (FSA). If accepted, contracts are developed for a minimum of 10 and not more than 15 years. To be eligible for consideration, land and applicants must meet certain criteria set by FSA. Payments may include cost share for practice establishment, incentive payments, and rental payments on enrolled acres.

9.7 Conservation Reserve Enhancement Program (CREP)

This program is an "enhancement" of the existing USDA Conservation Reserve Program. It has been enhanced by combining federal funds with state funds in a partnership to address high priority conservation concerns. In exchange for removing environmentally sensitive land from production and establishing permanent resource conserving plant species, farmers are paid an annual rental rate along with state and federal incentives. Contracts are typically established for 10 or 15 years in support of CREP goals, which include reducing sediment, nutrients, nitrogen and other pollutants entering waterbodies, reducing soil erosion, wetland restoration, and enhancement of wildlife habitat.

The landowner can obtain and complete CREP application forms at the FSA center. The forms are forwarded to local NRCS and SWCD offices while FSA determines land eligibility. If the land is deemed eligible, NRCS and the local SWCD determine and design appropriate conservation practices. A conservation plan is written, and fieldwork is begun, which completes the conservation practice design phase.

FSA then measures CREP acreage, conservation practice contracts are written, and practices are installed. The landowner submits bills for cost-share reimbursement to FSA. Once the landowner completes BMP installation and the practice is approved, FSA and the SWCD make the cost-share payments. The SWCD also pays out the state's one-time, lump sum rental payment. FSA conducts random spot checks throughout the life of the contract, and the agency continues to pay annual rent throughout the contract period.

9.8 Environmental Quality Incentives Program (EQIP)

This program was established in the 1996 Farm Bill to provide a single voluntary conservation program for farmers and landowners to address significant natural resource needs and objectives. EQIP is administered by NRCS and offers landowners and farmers cost-share assistance to implement a wide range of conservation practices on agricultural and forest land. Applications are ranked and priority is given to conservation practices that will result in greater environmental benefits.

9.9 Southeast Rural Community Assistance Project (SERCAP)

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 SERCAP 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 loans and small grants toward repair/replacement/installation of a septic system or an alternative waste treatment system. Funding is available for low-income homeowners.

9.10 National Fish and Wildlife Foundation (NFWF)

Grant proposals for this funding are accepted throughout the year and processed during fixed signup periods. There are two decision cycles per year. Each cycle consists of a pre-proposal evaluation, a full proposal evaluation, and a Board of Directors' decision. Grants are awarded for the purpose of conserving fish, wildlife, plants, and their habitats. Special grant programs are listed and described on the NFWF website. If the project does not fall into the criteria of any special grant programs, a proposal may be submitted as a general grant if it falls under the following guidelines: 1) it promotes fish, wildlife and habitat conservation, 2) it involves other conservation and community interests, 3) it leverages available funding, and 4) project outcomes are evaluated.

9.11 Clean Water State Revolving Fund

EPA awards grants to states to capitalize their Clean Water State Revolving Funds (CWSRFs). The states, through the CWSRF, make loans for high-priority water quality activities. As loan recipients make payments back into the fund, 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.

9.12 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 expressly for the purpose of providing compensatory mitigation in advance of authorized impacts to similar resources. Mitigation banking is a commercial venture that provides compensation for aquatic resources in financially and environmentally preferable ways. Not every site or property is suitable for mitigation banking. Mitigation banks are required to be protected in perpetuity, to provide financial assurances and long term stewardship. The mitigation banking process is overseen by an Inter-Agency

Review Team made up of state and federal agencies and chaired by VADEQ and the Army Corps of Engineers.

9.13 Other Potential Funding Sources

Additional potential funding sources that have been identified by the working groups or in previous TMDL IPs include:

- Chesapeake Bay Foundation's Mountain-to-Bay Grazing Alliance.
- Virginia Outdoors Foundation.
- U. S. Fish and Wildlife Service (FWS) Conservation Grant Program.
- USDA Agricultural Conservation Easement Program.
- Virginia Environmental Endowment.
- Trout Unlimited.
- Ducks Unlimited.

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APPENDICES

APPENDIX A: Working Group Meeting Minutes

Woods Creek TMDL Implementation Plan: Agricultural Working Group Meeting #1
Natural Bridge Soil & Water Conservation District Office
November 7, 2018

Participants

Sandra Stuart (NBSWCD, RACC)
Chris Wise (RACC)
Lee Cummings (NBSWCD)
Karen Kline (VT-BSE)
Sara Bottenfield (DEQ)
Nesha McRae (DEQ)

Meeting Summary

Sara Bottenfield reviewed the goals and purpose of the working group and this meeting and asked Karen Kline to explain in more detail how the information provided by the group will be used. Karen noted that the Woods Creek TMDL calls for a 70% reduction in bacteria from agricultural sources (direct deposit and pasture runoff). The bacteria reduction BMPs that will be discussed by the group each have an effectiveness rating, which will be applied to the bacteria load to meet the reduction goals.

A representative from NBSWCD mentioned that some of the smaller streams are intermittent in the upper reaches of the watershed, which makes them ineligible for VACS livestock exclusion funding. There has been a CREP practice installed recently above the golf course. Karen confirmed that the NHD Flowline data is used to identify stream fencing needs in the watershed, which includes both perennial and intermittent streams.

The group shared their observations about the general state of agriculture in the watershed. One participant commented that there is some development pressure due to good roads and proximity to Lexington, but it is limited by available sewer capacity/connections. Another participant has heard from VCE that working with leased land has made installation of livestock exclusion practices challenging. NBSWCD staff estimated that 65% of agricultural land in the watershed is leased. Participants have noticed an increasing number of horses in the watershed. Sara noted that horse operations sometimes struggle to meet the eligibility requirements of the VACS program, although some equine-specific BMPs have been developed and might be something to consider for inclusion in the Implementation Plan. Sara referred the group to the table of estimated livestock numbers in each subwatershed on the provided handout. Participants thought the estimate of 11 horses in the Upper Woods Creek subwatershed was too low. The group also agreed that the total number of cow/calf pairs was closer to 400 and that the additional livestock are in the Upper and Lower Woods Creek and Sarah's Run watersheds. Participants knew of a

recent livestock exclusion project in the southwest corner of the watershed that addressed sheet and goat access. A participant offered to follow up with VCE on livestock estimates.

Sara observed that it sounded like there are a few large landowners in the watershed who own the majority of agricultural land, and participants agreed. A participant asked about the golf course and whether they have a Nutrient Management Plan. The group agreed that they do and recalled that their staff participated in TMDL development. Participants discussed some other BMPs that they were aware of in the watershed: at least one livestock exclusion practice has been installed voluntarily (without cost share), and an older CREP practices that wasn't confirmed to still be in place. One participant noted that the results of volunteer E. coli monitoring in Sunnyside and Barbeque Creeks have been consistently high, but there is no known livestock access in those watersheds. Karen asked what buffer widths would be most appealing to landowners who might install livestock exclusion practices. A representative from NBSWCD pointed out that some farms have small paddocks where a 35' buffer is too much land to give up, but the 10' option receives less cost share. The group agreed that a 60/40 split between 35' and 10' would be a good start. The group agreed that the amount of cropland in the watershed is not significant enough to be addressed specifically in the IP.

Sara asked about the barriers or obstacles to implementing BMPs (in addition to the issue of leased land that was already discussed). NBSWCD staff reported that most folks are not opposed to working with the government and that flooding and other fence maintenance concerns have not been a major factor for most landowners. Well depth has become an issue with wells needing to go deeper for good yield. Most buffer establishment has been through fencing with natural regeneration (not planting trees, grasses, etc.). A NBSWCD representative shared that the James River Association hopes to expand their grant program paying 100% for riparian buffer plantings, but this is still in the works. Participants didn't know of any farms in the watershed implementing rotational grazing, but agreed that overstocking is not a significant concern. They didn't know of any existing manure management systems/structures (non-poultry) but agreed that there are not any feeding areas near streams that would represent a concentrated source of manure runoff.

Participants had a number of ideas for outreach. Flyers or brochures could be placed in many public locations. There is an ongoing farming column in the News Gazette as well as a series of articles on farms and farmers by Lisa Tracy. The group agreed that highlighting farmers who have implemented BMPs would be the best approach. The goal of the IP is not to single anyone out or point fingers, and Sara noted that in a small watershed like Woods Creek this is particularly a concern.

Sara proposed the next meeting for the week of December 10 and asked about preferred meeting times and locations. Participants suggested that a later meeting time might allow more folks to attend and agreed that the NBSWCD office was a convenient location. Sara thanked the group for their input and the meeting was adjourned.

Woods Creek TMDL Implementation Plan: Residential & Urban Working Group Meeting #1
Natural Bridge Soil & Water Conservation District Office
November 7, 2018

Participants

Sandra Stuart (NBSWCD, RACC)
Jeff Martone (City of Lexington)
Kip Brooks (NBSWCD)
Karen Kline (VT-BSE)
Lee Cummings (NBSWCD)
Arne Glaeser (City of Lexington)
Sara Bottenfield (DEQ)
Nesha McRae (DEQ)

Meeting Summary

Sara Bottenfield reviewed the goals and purpose of the working group and this meeting and asked Karen Kline to explain in more detail how the information provided by the group will be used. Karen noted that the Woods Creek TMDL calls for a 100% reduction from human sources of bacteria (septic and sewer) and a 25% reduction from other residential sources, primarily pet waste. The BMPs that will be discussed by the group each have an effectiveness rate that will be applied to the bacteria load to meet the reduction goals.

Sara referred the group to the provided handout, including a watershed map showing the location of sewer lines and a table of estimated quantities of urban and residential bacteria sources. During TMDL development, it was agreed that there are most likely no straight pipes in the watershed. A participant noted that there have been sewer overflows near Woods Creek from at least two locations. City of Lexington representatives stated that they have bolted manhole lids in those locations and installed vents, and that a capital improvement project (Woods Creek Interceptor Study) is in the works to upsize sewer lines which should provide a more permanent solution. The planning phase of the project is nearly complete and work is expected to begin in Spring 2019. The city is also working on the Phase 2 Infield Sewer Shed project, lining pipes and making repairs to offset pipe joints along Lime Kiln Road. A participant noted that volunteer monitoring of Sunnyside and Barbeque Creeks has found consistently high levels of E. coli, and asked whether any of the concerns identified by the city could be a contributing factor. City representatives replied that there is always a chance, but based on their video inspections in that area it is unlikely.

The estimated number of septic systems in the Woods Creek watershed is fairly low. Sara asked NBSWCD representatives about the response to their septic cost share program in an adjacent watershed (Buffalo Creek). They have had very little interest despite significant outreach efforts. The group agreed that there are some alternative systems in the watershed but most are conventional. The city has found that the highest rate of I&I was from the Infield sewer shed, with a peak factor of 10. Within the city limits there are no opportunities for connection to public

sewer – only one septic system exists in the city and it is at a house that has been abandoned for years. There may be opportunities for sewer connection in the County, but those lines are overseen by the Rockbridge PSA. Sara reached out to the PSA prior to this meeting but hadn't yet received a response. Sara asked the group if they thought there would be interest in a septic pumpout program in Woods Creek. Participants asked whether septic programs in other watersheds have resulted in significant water quality improvements. DEQ staff responded that E. coli contributions from septic systems are typically much smaller than contributions from livestock, but that E. coli from human sources presents a greater health risk. A participant asked about sending a mailing to owners of septic systems in the watershed, since the health department should have a list of permitted systems and contact information. Another participant responded that the local health department does not have electronic records, which makes it more difficult to gather that kind of information. Sara noted that septic programs in other watersheds have reached out to the septic contractors to spread the word about cost share. The group briefly discussed some areas where a pumpout program might be most effective. There are a number of septic systems in the Country Club area and near the Mormon Church, but most of those homes are fairly new. Some of the houses in the Cedar Grove development have been there a while. DEQ staff suggested that the county GIS could be a way to identify properties likely to have septic systems, if the information isn't available from the health department. However, it would still be very helpful to have information from the health department, particularly on the percentage of system repairs/replacements expected to need alternative systems, due to the much higher cost. A participant offered to follow up with health department staff.

The group moved on to discuss management of pet waste in the watershed. Previous discussions have indicated that pet waste stations are installed at several locations in the watershed, and the possibility of a dog park had been mentioned. A city representative reported that the dog park is likely to become a reality, as a petition in favor of the park recently received over 900 signatures. The dog park was originally proposed to be close to Woods Creek near Waddell Elementary but that location was not pursued and the other locations under consideration are farther away from streams. Currently there are pet waste stations near Waddell, near the BBQ restaurant, and at Jordan's Point park. A participant wondered whether Lexington has a pet waste ordinance and if not, whether it would be worthwhile. Enforcement would probably be lax, but it might have some educational value. Several participants knew of apartment complexes and residential developments where residents must submit their dogs' DNA samples so that if waste isn't picked up, the culprit can be identified. DEQ staff noted that if bacteria from pet waste can't be eliminated by encouraging/requiring owners to clean up after their pets, the group may want to consider retention structures that would address bacteria in runoff. Other ideas for outreach included temporary/step-in signs in park areas, perhaps with student involvement, and a pamphlet or flyer that could be distributed with dog licenses. Public Works maintains the existing pet waste stations, so feasibility of additional stations would need to take their budget and work plan into consideration. The group felt it was unlikely that maintenance of the stations could be accomplished with volunteers. A participant observed that pet waste concerns might tie in with the sustainability program at W&L and/or the Rockbridge Area Outdoor Plan signage component, and will look into those possibilities.

DEQ staff pointed out that Lexington does not have an MS4 permit, so grant funding could be used towards stormwater retrofit practices to address existing sources of bacteria. Past

experience with septic programs suggests that septic efforts will not be enough to fully meet reductions, so stormwater practices that could be implemented by the city could be a way to achieve additional reductions. It is possible that Lexington could initiate a major stormwater project in 5-10 years, which would create an issue with the lifespan of any BMPs installed in the near future. Perhaps smaller BMPs to address specific concerns would be more practical. DEQ staff noted that these BMPs could have an educational component as well. A NBSWCD representative mentioned that many of those types of BMPs would be eligible under the VCAP program. A participant asked about urban riparian buffers and streambank restoration. Buffers could be included in the IP, but streambank restoration does not have a bacteria reduction efficiency and therefore would not be eligible.

Sara proposed the next meeting for the week of December 10 and asked about preferred meeting times. Participants agreed that afternoons worked well. Sara thanked the group for their input and the meeting was adjourned.

Woods Creek TMDL Implementation Plan: Agricultural Working Group Meeting #2
Natural Bridge Soil & Water Conservation District Office
December 11, 2018

Participants

Sandra Stuart (NBSWCD, RACC)
Chris Wise (RACC)
Robert Hickman (NBSWCD)
Karen Kline (VT-BSE)
Sara Bottenfield (DEQ)
Tara Wyrick (DEQ)

Meeting Summary

Sara Bottenfield briefly summarized the group's first meeting for the participants who were not able to attend. Karen Kline provided a handout with information on potential BMP implementation scenarios to meet bacteria reductions needed for both Stage 1 (Delisting) and Stage 2 (TMDL) goals. She explained that the reduction goals for Stage 1 would be sufficient to remove Woods Creek from the impaired waters list, while the Stage 2 goals would meet a more stringent water quality standard.

Karen reviewed the list of potential BMPs and explained that the associated costs are estimated using data from other projects and tools such as CAST. Staff from NBSWCD questioned the difference in cost between the SL-6 and LE-2 practices. The LE-2 allows for a narrower buffer, but typically this does not significantly change the total amount of fence needed and they recommended the same cost be used for both practices. The group felt that most of the other costs seemed reasonable. The participants agreed that due to the small size of the watershed, one staff person would probably be sufficient to implement the proposed BMPs.

Karen referred the group to the map of potential fencing areas. Many of the streams identified for potential exclusion are designated as intermittent. There was some discussion of how intermittent vs. perennial designations are determined, and NBSWCD staff shared their observation that what they find in the field often doesn't match what is indicated on the map. Because of this uncertainty, participants agreed that it would be a good idea to consider all of the identified streambanks in the plan for potential fencing. Karen noted that during the Working Group's first meeting NBSWCD staff mentioned projects that are already underway in the watershed. Any exclusion fencing installed as part of those projects will be subtracted from the available footages.

As discussed during the Working Group's first meeting, the needed exclusion (70%) is split between 35-foot and 10-foot buffer widths at a 60/40 ratio. NBSWCD staff suggested using the same average fence footage (2,500') for both SL-6 and LE-2 projects. NBSWCD staff also observed that the area designated as pasture and included in available fencing likely has the potential to be grazed, but it is unlikely that livestock are currently present on all of the available acres. Since the Woods Creek watershed is small, Karen suggested that land use could be looked

at more closely along streams. The group felt that the total number of proposed livestock exclusion practices was reasonable. There was some discussion of the limitations of the state cost share program in dealing with equine operations since they often do not meet eligibility requirements. Sara suggested that this may be an opportunity to look beyond the state cost share program for alternative funding sources.

The group moved on to discuss pasture management BMPs. Karen explained that due to the effectiveness factor of these BMPs, achieving the needed 70% reduction requires treatment of almost all pasture acres. Since some of these acres will be horse pasture, the same limitations with state cost share programs will apply. NBSWCD staff observed that BMPs for pasture management are limited in the state cost share program, but technical assistance can always be provided and NRCS offers cost share on clover overseeding. This may be another opportunity to look for other funding sources, both for equine operations and others.

Pasture BMPs also include Permanent Vegetative Cover on Critical Areas (SL-11) and Afforestation of Erodible Pasture (FR-1). NBSWCD staff stated that there is likely to be limited demand for these practices, but felt they should be included as potential BMPs because they are very effective.

Karen reviewed the changes she plans to make in response to the group's input. She noted that the costs associated with the proposed agricultural BMPs are much higher than the costs for urban BMPs, because the bacteria load from agricultural land is much higher. NBSWCD staff requested that it be made clear in the plan that state cost share is generally not available to equine operations. There was some discussion of potential changes to the state cost share program as a result of the Phase III WIP that would expand cost share opportunities for equine operations.

Karen asked for the group's input on a time frame for implementation. Five years for each stage has been a common timeline for past plans, with an assessment after the first five years. The group felt this was realistic for Woods Creek as well.

Sara thanked the group for their time and attendance, and explained that the Working Groups will no longer meet separately but will transition to a combined Steering Committee. The Steering Committee will likely meet in late January or early February to provide input on a draft of the Implementation Plan.

Woods Creek TMDL Implementation Plan: Residential & Urban Working Group Meeting #2
Natural Bridge Soil & Water Conservation District Office
December 11, 2018

Participants

Sandra Stuart (NBSWCD, RACC)
Melissa Alexander (Rockbridge Co. PSA)
Kip Brooks (NBSWCD)
Chuck Smith (Lexington City Council)
Karen Kline (VT-BSE)
Sara Bottenfield (DEQ)
Nesha McRae (DEQ)

Meeting Summary

Sara Bottenfield briefly summarized the group's first meeting for the participants who were not able to attend. A representative from the Rockbridge County PSA shared some information related to the discussion about potential sewer connections in the County. Currently, the agreement between the PSA and City of Lexington allows sewer connections only for new construction in certain subdivisions. Connection to public water is required when connecting to sewer, but water lines are more widespread than sewer; of the PSA's approximately 2,400 customers, about 1,000 have sewer connections and the remainder have water only.

Karen Kline provided a handout with information on potential BMP implementation scenarios to meet bacteria reductions needed for both Stage 1 (Delisting) and Stage 2 (TMDL) goals. She explained that the reduction goals for Stage 1 would be sufficient to remove Woods Creek from the impaired waters list, while the Stage 2 goals would meet a more stringent water quality standard. The Stage 1 reduction from Residential Land sources has been reduced to 10% due to a correction of the model. Karen reviewed the list of potential BMPs and explained that the associated costs are estimated using data from other projects and tools such as CAST. The group felt that most costs appeared reasonable. The estimate includes two full-time staff but participants felt that due to the small size of the watershed, one staff person would probably be a more reasonable assumption.

The group moved on to discuss potential septic BMPs. Woods Creek has a relatively low number of septic systems, with an estimate of eight failing systems and zero straight pipes. Participants felt that a septic pumpout program would probably be successful. Karen noted that the estimate of 57 pumpouts represents one third of the total systems in the watershed. The group thought that was a reasonable expectation for participation. Most homeowners get a pumpout when they are selling the property or have a noticeable problem, but offering cost share for pumpouts provides an opportunity to detect problems earlier and also to educate residents on water quality concerns and septic maintenance needs. State programs for septic cost share typically offer 50% cost share for pumpouts, with eligibility for a greater percentage depending on income. Participants felt that there would likely be a demand for income-based higher cost

share rates in the watershed. For the estimated eight failing systems, Karen assumed that half would require a repair and half would need replacement. A more accurate estimate of likely repairs vs. replacement can hopefully be obtained from VDH.

Karen reviewed the proposed BMPs to address pet waste. The estimated number of pets in the watershed is based on veterinary and pet industry surveys that have found of average of one pet per household. One participant suggested that more pet waste stations on the Woods Creek trail would be helpful, and perhaps a station at Washington & Lee since they have an environmental focus. A participant at the first Urban & Residential Working Group meeting offered to look into this possibility. The attendees were aware of several pet waste stations along the Woods Creek trail and three or four more in the downtown area, and felt that the addition of the five proposed stations would be sufficient coverage. Karen and DEQ staff explained what the pet waste digesters are and how they function. Since they do require maintenance to work properly, the group felt that 13 was a reasonable number to include in the plan. The education efforts proposed for Stage 1 will likely overlap with installation of the other BMPs. A participant at the Working Group's first meeting followed up on a suggestion for educational outreach by checking with the City Treasurer about including a flyer with dog license renewal mailings and was told that would be allowed.

The final category of proposed BMPs are focused on urban stormwater. Bioretention filters/raingardens and buffers can be expensive and hard to site, so they are proposed for Stage 2 while Stage 1 will focus on septic BMPs. One participant has had inquiries from multiple landowners about buffers, which would total more than the one acre proposed. A participant asked whether streambank restoration would be considered a component of buffer practices. Karen and DEQ staff replied that, within the context of the Implementation Plan, it would not be included because it does not provide bacteria reduction. There was some discussion of potential obstacles to buffer installation in an urban setting; the city has a grass height ordinance and depending on the buffer width needed, landowners may not want to give up a significant amount of their yard/property. DEQ staff noted that example ordinances to accommodate buffers and other landscaping for water quality are available online. Participants were aware of existing raingardens in some newer developments, but thought there might be opportunities for additional stormwater management BMPs in other areas. The city is initiating a wastewater study that will include mapping impervious surfaces. The potential raingardens would be residential-scale, likely treating about half an acre. DEQ staff thought that the estimated cost would likely be higher that what is proposed, closer to $10,000/acre. There was some discussion of the cost-effectiveness of stormwater practices compared to some of the other, less expensive, proposed practices. Participants agreed that it was beneficial to include a range of BMPs since there are many factors that determine what will be most effective.

The group discussed how the proposed BMPs could be funded and the restrictions that might affect implementation. DEQ staff explained that for projects funded with DEQ grants, there is typically some flexibility in moving funds between different types of practices.

Sara thanked the group for their time and attendance, and explained that the Working Groups will no longer meet separately but will transition to a combined Steering Committee. The Steering Committee will likely meet in late January or early February to provide input on a draft of the Implementation Plan.

APPENDIX B: Public Outreach

Department of Environmental Quality Community Meeting and Notice of Public Comment Period: Total Maximum Daily Load Implementation Plan (TMDL IP) for Woods Creek:

October 24, 2018 at 6:00 p.m. (student research showcase starting at 5:30 p.m.) at Waddell Elementary School, 100 Pendleton Place, Lexington, VA 24450

PURPOSE OF NOTICE: The Department of Environmental Quality (DEQ) seeks written and oral comments from interested persons on the development of a Total Maximum Daily Load (TMDL) Implementation Plan for the Woods Creek watershed in Rockbridge County and the City of Lexington, Virginia.

MEETING DESCRIPTION: DEQ and its contractor, Virginia Tech's Biological Systems Engineering Department, will discuss the process that will be used to complete a water quality improvement plan, known as a TMDL Implementation Plan, for Woods Creek and its tributaries. Prior to the meeting students from Lexington schools will showcase their recent studies of Woods Creek water quality. This is an opportunity for local residents to learn about the condition of the creek, share information about the area, and become involved in the process of local water quality improvement. Volunteers will be solicited to assist with TMDL Implementation Plan development by serving on Working Groups. A public comment period will follow the meeting (October 25, 2018 through November 30, 2018).

In case of inclement weather, the meeting will be held at the same time and location on October 30, 2018.

DESCRIPTION OF STUDY: A TMDL is the total amount of a pollutant a water body can contain and still meet water quality standards. Section 303(d) of the Clean Water Act and §62.1-44.19:7.C of the Code of Virginia require DEQ to develop TMDLs for pollutants responsible for each impaired water contained in Virginia's 303(d) TMDL Priority List and Report. Woods Creek was listed on the 303(d) TMDL Priority List and Report as impaired due to violations of Virginia's water quality standards for bacteria for Recreational Use. DEQ completed the bacteria TMDL study for Woods Creek in 2017. The Woods Creek TMDL was approved by the Environmental Protection Agency (EPA) in February 2018. Section 62.1-44.19:7.C of the Code of Virginia requires expeditious implementation of TMDLs when appropriate. To restore water quality, bacteria levels need to be reduced to the amount established in the TMDL. The TMDL Implementation Plan should provide measurable goals and the date of expected achievement of water quality objectives. The TMDL Implementation Plan should also include the corrective actions needed and their associated costs, benefits, and environmental impacts. DEQ will collaborate with local stakeholders to develop a TMDL Implementation Plan that meets these criteria.

HOW TO COMMENT AND PARTICIPATE: All meetings in support of TMDL Implementation Plan development are open to the public and all interested parties are welcome. Written comments will be accepted through November 30, 2018 and should

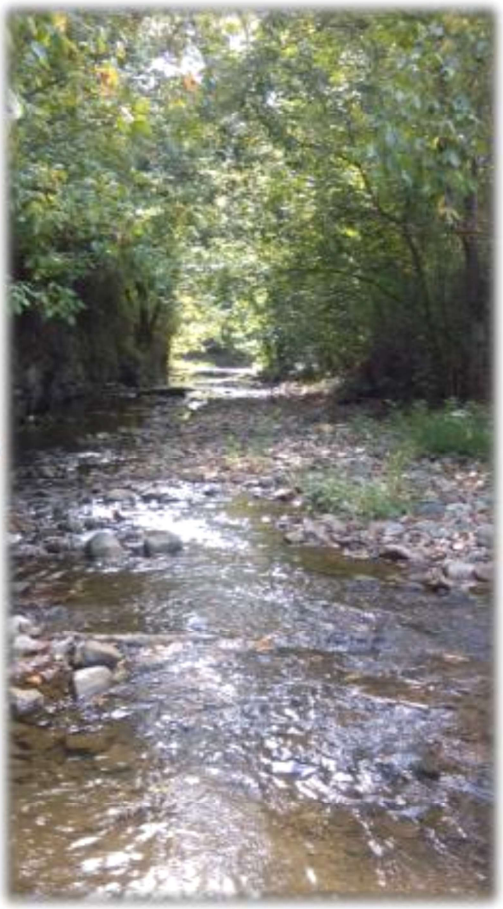
include the name, address, and telephone number of the person submitting the comments. For more information, or to submit written comments, please contact:

Sara Bottenfield
DEQ Valley Regional Office
PO Box 3000
Harrisonburg, VA 22801
Telephone: (540) 574-7872
Fax: (540) 574-7878
E-mail: sara.bottenfield@deq.virginia.gov

Community Meeting

to discuss a plan to **improve water quality** in

Woods Creek



October 24, 2018

5:30 pm - Student Research Showcase

6:00 pm - Meeting

Waddell Elementary School

100 Pendleton Place, Lexington, VA

The Woods Creek watershed includes all of the land that drains to Woods Creek and its tributaries. Currently, Woods Creek does not meet water quality standards for bacteria, which poses a risk to human health when coming in contact with the water. The Virginia Department of Environmental Quality will work with local residents and organizations to develop a plan to reduce bacteria in Woods Creek. Please join us to learn more about the water quality of Woods Creek and how you can help!

Lexington students will showcase their recent Woods Creek water quality studies, starting at 5:30!

For more information, contact:
Sara Bottenfield, DEQ Valley Regional Office
sara.bottenfield@deq.virginia.gov (540)574-7872

DEQ
Virginia Department of Environmental Quality

Department of Environmental Quality Community Meeting and Notice of Public Comment Period: Total Maximum Daily Load Implementation Plan (TMDL IP) for Woods Creek:

May 8, 2019 at 6:00 p.m. at the Rockbridge Regional Library, Piovano Room, 138 South Main Street, Lexington, VA 24450

PURPOSE OF NOTICE: The Department of Environmental Quality (DEQ) seeks written and oral comments from interested persons on the development of a Total Maximum Daily Load (TMDL) Implementation Plan for the Woods Creek watershed in Rockbridge County and the City of Lexington, Virginia.

MEETING DESCRIPTION: DEQ and its contractor, Virginia Tech's Biological Systems Engineering Department, will present a draft water quality improvement plan, known as a TMDL Implementation Plan, for Woods Creek and its tributaries. This is an opportunity for local residents to learn about the condition of the creek and provide input on the draft plan. A public comment period will follow the meeting (May 9, 2019 through June 10, 2019).

In case of inclement weather, the meeting will be held at the same time and location on May 14, 2019 and the public comment period will be extended accordingly.

BACKGROUND INFORMATION: A TMDL is the total amount of a pollutant a water body can contain and still meet water quality standards. Section 303(d) of the Clean Water Act and §62.1-44.19:7.C of the Code of Virginia require DEQ to develop TMDLs for pollutants responsible for each impaired water contained in Virginia's 303(d) TMDL Priority List and Report. Woods Creek was listed on the 303(d) TMDL Priority List and Report as impaired due to violations of Virginia's water quality standards for bacteria for Recreational Use. DEQ completed the bacteria TMDL study for Woods Creek in 2017. The Woods Creek TMDL was approved by the Environmental Protection Agency (EPA) in February 2018. Section 62.1-44.19:7.C of the Code of Virginia requires expeditious implementation of TMDLs when appropriate. To restore water quality, bacteria levels need to be reduced to the amount established in the TMDL. The TMDL Implementation Plan should provide measurable goals and the date of expected achievement of water quality objectives. The TMDL Implementation Plan should also include the corrective actions needed and their associated costs, benefits, and environmental impacts. Over the last eight months, DEQ has collaborated with local stakeholders to develop a draft TMDL Implementation Plan that meets these criteria.

HOW TO COMMENT AND PARTICIPATE: All meetings in support of TMDL Implementation Plan development are open to the public and all interested parties are welcome. Written comments will be accepted through June 10, 2019 and should include the name, address, and telephone number of the person submitting the comments. For more information, or to submit written comments, please contact:

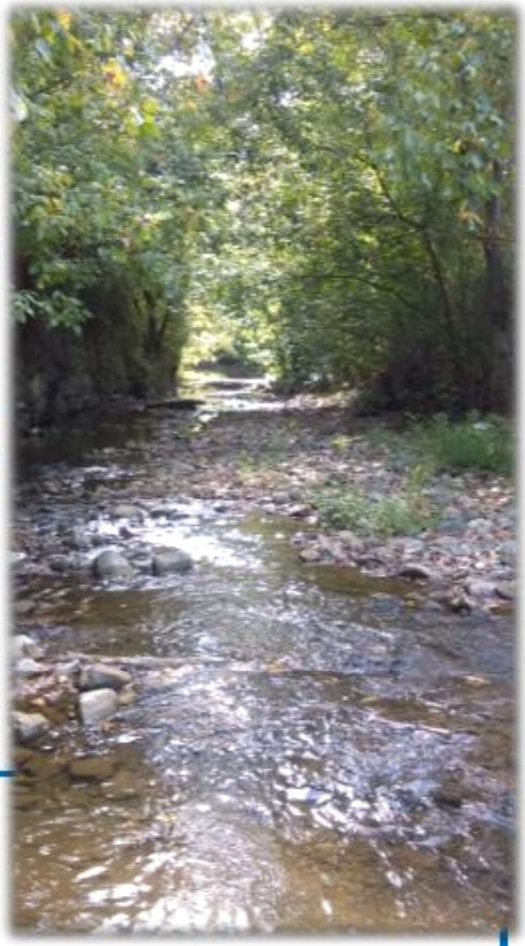
Sara Bottenfield
DEQ Valley Regional Office
PO Box 3000

Harrisonburg, VA 22801
Telephone: (540) 574-7872
Fax: (540) 574-7878
E-mail: sara.bottenfield@deq.virginia.gov

Community Meeting

to present a **water quality improvement plan** for

Woods Creek



May 8, 2019 6:00 pm

Rockbridge Regional Library
Piovano Room
138 South Main Street, Lexington, VA

The Woods Creek watershed includes all of the land that drains to Woods Creek and its tributaries. Currently, Woods Creek does not meet water quality standards for bacteria, which poses a risk to human health when coming in contact with the water. In partnership with local residents and organizations, the Virginia Department of Environmental Quality has developed a plan outlining the best ways to reduce bacteria in Woods Creek. If you would like to learn more about this plan and what you can do to help, please join us!

For more information, contact:
Sara Bottenfield, DEQ Valley Regional Office
sara.bottenfield@deq.virginia.gov (540)574-7872

DEQ
Virginia Department of Environmental Quality

APPENDIX C: Public Comments

Response to Comments Document for Woods Creek
TMDL Implementation Plan Development