MOORES & MILL CREEKS

IMPLEMENTATION PLAN



A plan to reduce sediment in the water

*Technical Document*

**October 2023**

**Prepared by**

VA Department of Environmental Quality

**In Cooperation with**

Local Stakeholders

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TABLE OF CONTENTS

[1. Introduction 1](#_Toc143577806)

[1.1 Background 1](#_Toc143577807)

[1.2 Designated Uses and Applicable Water Quality Standards 1](#_Toc143577808)

[1.2.1 Aquatic Life Water Quality Criterion (9VAC 25-260-20) 2](#_Toc143577809)

[1.3 Attainability of Designated Uses 3](#_Toc143577810)

[2 REQUIREMENTS FOR IMPLEMENTATION PLANS 4](#_Toc143577811)

[2.1 State Requirements 4](#_Toc143577812)

[2.2 Federal Recommendations 4](#_Toc143577813)

[2.3 Requirements for Section 319 Fund Eligibility 5](#_Toc143577814)

[3 REVIEW OF TMDL DEVELOPMENT 6](#_Toc143577815)

[3.1 Background 6](#_Toc143577816)

[3.2 Water Quality Monitoring Data 10](#_Toc143577817)

[3.3 Water Quality Modeling 12](#_Toc143577818)

[3.4 Sediment Source Assessment 12](#_Toc143577819)

[3.4.1 Point Sources 12](#_Toc143577820)

[3.4.2 Nonpoint sources 13](#_Toc143577821)

[3.5 TMDL Allocation Scenarios 15](#_Toc143577822)

[3.5.1 Setting Target Sediment Loads 15](#_Toc143577823)

[3.5.2 Sediment TMDL Equation 16](#_Toc143577824)

[3.5.3 Sediment Allocation Scenario 16](#_Toc143577825)

[4 PUBLIC PARTICIPATION 18](#_Toc143577826)

[4.1 Public Meetings 18](#_Toc143577827)

[4.2 Community Engagement Meetings 18](#_Toc143577828)

[5 IMPLEMENTATION ACTIONS 20](#_Toc143577829)

[5.1 Identification of Best Management Practices 20](#_Toc143577830)

[5.2 Quantification of Control Measures 20](#_Toc143577831)

[5.2.1 Agricultural Control Measures 22](#_Toc143577832)

[5.2.1 Residential and Urban Control Measures 29](#_Toc143577833)

[5.2.2 Streambank Stabilization 30](#_Toc143577834)

[5.3 Technical Assistance and Education 31](#_Toc143577835)

[6 COSTS AND BENEFITS 34](#_Toc143577836)

[6.1 Agricultural BMPs 34](#_Toc143577837)

[6.2 Urban Stormwater BMPs 35](#_Toc143577838)

[6.3 Streambank Restoration BMPs 35](#_Toc143577839)

[6.4 Technical Assistance 39](#_Toc143577840)

[6.5 Benefit Analysis 39](#_Toc143577841)

[6.5.1 Agricultural Practices 40](#_Toc143577842)

[6.5.2 Urban Stormwater 42](#_Toc143577843)

[6.5.3 Watershed Health and Associated Benefits 43](#_Toc143577844)

[7 MEASUREABLE GOALS AND MILESTONES 44](#_Toc143577845)

[7.1 Milestone Identification 44](#_Toc143577846)

[7.2 Water Quality Monitoring 48](#_Toc143577847)

[7.2.1 DEQ Monitoring 48](#_Toc143577848)

[7.2.2 Citizen Monitoring 48](#_Toc143577849)

[7.3 Prioritizing Implementation Actions 49](#_Toc143577850)

[7.3.1 Prioritizing Agricultural Implementation Actions 50](#_Toc143577851)

[7.3.2 Prioritizing Urban/Residential Implementation Actions 50](#_Toc143577852)

[7.4 Adaptive Management Strategy 51](#_Toc143577853)

[8 STAKEHOLDERS AND THEIR ROLE IN IMPLEMENTATION 52](#_Toc143577854)

[8.1 Partner Roles and Responsibilities 52](#_Toc143577855)

[8.1.1 Watershed Landowners 52](#_Toc143577856)

[8.1.2 Natural Bridge Soil and Water Conservation District (SWCD) and Natural Resource Conservation Service (NRCS) 53](#_Toc143577857)

[8.1.3 Rockbridge County 54](#_Toc143577858)

[8.1.4 Virginia Department of Environmental Quality 54](#_Toc143577859)

[8.1.5 Virginia Department of Conservation and Recreation 55](#_Toc143577860)

[8.1.6 Other Potential Local Partners 55](#_Toc143577861)

[8.2 Integration with Other Watershed Plans 56](#_Toc143577862)

[8.2.1 Rockbridge County Comprehensive Plan 56](#_Toc143577863)

[8.2.2 Virginia’s Phase III Chesapeake Bay Watershed Implementation Plan 57](#_Toc143577864)

[8.2.3 Rockbridge County Conservation Easement and Ag Forestal District Programs 57](#_Toc143577865)

[8.2.4 Additional Natural Resource Management and Conservation Planning 58](#_Toc143577866)

[8.3 Legal Authority 59](#_Toc143577867)

[8.4 Legal Action 61](#_Toc143577868)

[9 FUNDING 62](#_Toc143577869)

[9.1 Virginia Nonpoint Source Implementation Program 62](#_Toc143577870)

[9.2 Virginia Agricultural Best Management Practices Cost-Share Program (VACS) 62](#_Toc143577871)

[9.3 Virginia Agricultural Best Management Practices Tax Credit Program 63](#_Toc143577872)

[9.4 Virginia Conservation Assistance Program (VCAP) 63](#_Toc143577873)

[9.5 Virginia Water Quality Improvement Fund (WQIF) 63](#_Toc143577874)

[9.6 Conservation Reserve Program (CRP) 64](#_Toc143577875)

[9.7 Conservation Reserve Enhancement Program (CREP) 64](#_Toc143577876)

[9.8 Environmental Quality Incentives Program (EQIP) 65](#_Toc143577877)

[9.9 EPA Water Infrastructure Finance and Innovation Act (WIFIA) Funds 65](#_Toc143577878)

[9.11 National Fish and Wildlife Foundation (NFWF) 65](#_Toc143577879)

[9.12 Clean Water State Revolving Fund 66](#_Toc143577880)

[9.13 Wetland and Stream Mitigation Banking 66](#_Toc143577881)

[9.15 Other Potential Funding Sources 66](#_Toc143577882)

[10 REFERENCES 67](#_Toc143577883)

[**Appendix A.** 70](#_Toc143577884)

[**Community Engagement Meeting Summaries** 70](#_Toc143577885)

[**Moores and Mill Creek Clean-Up Plan Community Engagement Meeting #1** 70](#_Toc143577886)

[**Moores and Mill Creek Clean-Up Plan Community Engagement Meeting #2** 72](#_Toc143577887)

TABLE OF FIGURES

[Figure 3￼‑1. Moores and Mill Creek watershed locations. 7](#_Toc143577888)

[Figure 3‑2. Land cover classes in the Moores Creek watershed (2016 VGIN dataset). 9](#_Toc143577889)

[Figure 3‑3. Land cover classes in the Mill Creek watershed (2016 VGIN Dataset). 10](#_Toc143577890)

[Figure 3‑4. DEQ monitoring stations in the Moores and Mill Creek watersheds. 11](#_Toc143577891)

[Figure 5‑1 Livestock exclusion fencing needed in the Moores Creek (a.) and Mill Creek (b.) watersheds. 23](#_Toc143577892)

[Figure 7‑1 DEQ biological and ambientimplementation monitoring stations. 49](#_Toc143577893)

[Figure 7‑2 Agricultural BMP implementation prioritization by subwatershed 50](#_Toc143577894)

TABLE OF TABLES

[Table 3‑1. Impaired stream segments addressed in the Moores and Mill Creek TMDL implementation plan. 6](#_Toc143577895)

[Table 3‑2 Land use acreages and percent total watershed acreages by land use category. 8](#_Toc143577896)

[Table 3‑3. DEQ water quality monitoring stations in the Moores and Mill Creek watersheds. 11](#_Toc143577897)

[Table 3‑4. Permitted sediment point sources in the Moores and Mill Creek watersheds. 13](#_Toc143577898)

[Table 3‑5. Annual existing sediment load in the Moores and Mill Creek watersheds by source. 14](#_Toc143577899)

[Table 3‑6. Target sediment loading rates and reductions for the Moores and Mill Creeks. Existing loads listed include a margin of safety and future growth set-asides. 15](#_Toc143577900)

[Table 3‑7. Annual average sediment TMDL components for Moores and Mill Creeks. 16](#_Toc143577901)

[Table 3‑8. Sediment allocation scenarios for Moores and Mill Creeks. 17](#_Toc143577902)

[Table 5‑1. Best management practices and associated pollutant reductions 21](#_Toc143577903)

[Table 5‑2 Livestock exclusion systems in the watershed tracked through the VADCR Agricultural BMP database: *December* *1999 – October 2022*. NOTE: Table does not include data from systems that were not installed through government cost share programs. CRP and EQIP data were not available. 24](#_Toc143577904)

[Table 5‑3 Stream fencing needed in the Moores and Mill Creek watersheds. *Note: Total potential fencing includes all unfenced pasture adjacent to streams in the watersheds. Values shown in Table 5-2 have been subtracted from total potential fencing.* 24](#_Toc143577905)

[Table 5‑4 Cost share and buffer payment rates for SL-6W practice in the DCR Agricultural BMP Cost Share Program 25](#_Toc143577906)

[Table 5‑5 Estimate of streamside exclusion fencing systems needed by subwatershed. 26](#_Toc143577907)

[Table 5‑6 Land based agricultural BMPs needed to meet sediment TMDLs. 28](#_Toc143577908)

[Table 5‑7 Urban BMPs needed in the Moores and Mill Creek watersheds. 30](#_Toc143577909)

[Table 5‑8 Streambank stabilization needed in the Moores and Mill Creek watersheds. 31](#_Toc143577910)

[Table 6‑1 Agricultural BMP costs for the Moores and Mill Creek watersheds. 36](#_Toc143577911)

[Table 6‑2 Urban and residential stormwater BMP costs for the Moores and Mill Creek watersheds. 37](#_Toc143577912)

[Table 6‑3 Streambank restoration BMP costs for the Moores and Mill Creek watersheds. 37](#_Toc143577913)

[Table 6‑4 Total BMP costs for the Moores and Mill Creek watersheds. 37](#_Toc143577914)

[Table 6‑5 Staged BMP implementation costs for the Moores and Mill Creek watersheds. 38](#_Toc143577915)

[Table 6‑6 BMP cost effectiveness rankings for Moores and Mill Creeks 40](#_Toc143577916)

[Table 6‑7 Example of increased revenue due to installing off-stream waterers (Surber et al., 2005) 41](#_Toc143577917)

[Table 7‑1 Staged BMP implementation goals for Moores Creek. 44](#_Toc143577918)

[Table 7‑2 Percent of land use receiving BMP by stage in Moores Creek. 45](#_Toc143577919)

[Table 7‑3 Staged implementation goals for Mill Creek. 46](#_Toc143577920)

[Table 7‑4 Percent of land use receiving BMP by stage in Mill Creek. 47](#_Toc143577921)

[Table 7‑5 DEQ station location descriptions 49](#_Toc143577922)

# Introduction

## 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. 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 describes control measures, which can include the use of better treatment technology and the installation of best management practices (BMPs), to be implemented to meet the water quality goals established by the TMDL.

## 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.*

### Aquatic Life Water Quality Criterion (9VAC 25-260-20)

The following general standard protects the aquatic life use:

*“A. State waters, including wetlands, shall be free from substances attributable to sewage, industrial waste, or other waste in concentrations, amounts, or combinations which contravene established standards or interfere directly or indirectly with designated uses of such water or which are inimical or harmful to human, animal, plant, or aquatic life.*

*Specific substances to be controlled include, but are not limited to: floating debris, oil scum, and other floating materials; toxic substances (including those which bioaccumulate); substances that produce color, tastes, turbidity, odors, or settle to form sludge deposits; and substances which nourish undesirable or nuisance aquatic plant life. Effluents which tend to raise the temperature of the receiving water will also be controlled” (SWCB, 2011).*

VADEQ’s biological monitoring program is used to evaluate compliance with the above standard. This program monitors the assemblage of benthic (bottom-dwelling) macro (large enough to see) invertebrates (insects, mollusks, crustaceans, and annelid worms) in streams to determine the biological health of the stream. Benthic macroinvertebrates are sensitive to water quality conditions, important links in aquatic food chains, major contributors to energy and nutrient cycling in aquatic habitats, relatively immobile, and easy to collect. These characteristics make them excellent indicators of aquatic health. Changes in water quality are reflected in changes in the structure and diversity of the benthic macroinvertebrate community. Currently, VADEQ assesses the health of the benthic macroinvertebrate community using the Virginia Stream Condition Index (VSCI). This index was first developed by Tetra Tech (2003) and later validated by VADEQ (2006). The VSCI is a multimetric index based on 8 biomonitoring metrics. The index provides a score from 0-100, and scores from individual streams are compared to a statistically derived cutoff value based on the scores of regional reference sites Moores and Mill Creeks were originally listed as impaired due to water quality exceedance of the general aquatic life (benthic) standard in the 2006 and 2016 Virginia Water Quality Assessment 305(b)/303(d) Integrated Reports, respectively (VDEQ, 2006 and VDEQ, 2016). Moores Creek has been designated as impaired from its headwaters 9.09 miles downstream to its confluence with South River (stream segment VAV-I36R\_MRC01A00). The Mill Creek impaired segment extends from its headwaters 9.12 miles downstream to its confluence with the Maury River (stream segment VAV-I35R\_MIS01A00).

In 2021, a stressor identification analysis study was conducted to determine the pollutants of concern contributing to the benthic impairments in the Moores Creek and Mill Creek watersheds. The stressor analysis study used a formal causal analysis approach developed by USEPA, known as CADDIS (Causal Analysis Diagnosis Decision Information System). The CADDIS approach evaluates 14 lines of evidence that support or refute each candidate stressor as the cause of impairment. In each stream, each candidate stressor was scored from -3 to +3 based on each line of evidence. Total scores across all lines of evidence were then summed to produce a stressor score that reflects the likelihood of that stressor being responsible for the impairment. The study found that sediment (measured as total suspended solids or TSS) was a probable stressor in both of the impaired creeks. As a result, sediment TMDLs were developed for Moores and Mill Creeks to identify necessary pollutant reductions to restore the aquatic community.

## Attainability of Designated Uses

Although the Moores and Mill Creek TMDLs were developed for sediment, attainment of a healthy benthic community will ultimately be based on biological monitoring of the benthic macroinvertebrate community, in accordance with established DEQ protocols. If a future review should find that the reductions called for in these TMDLs based on current modeling are found to be insufficiently protective of local water quality, then revision(s) will be made as necessary to provide reasonable assurance that water quality goals will be achieved.

# 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 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 Section 319 guidance.

## 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 and VADCR, 2003):

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

## 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 timeline 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.

## 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 “Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories in FY 2003” 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.

# REVIEW OF TMDL DEVELOPMENT

## Background

Moores Creek was initially listed as impaired on Virginia’s 2006 303(d) Impaired Waters List due to violations of the general standard for aquatic life. Moores Creek was placed on this list based on data collected at VADEQ monitoring station 2-MRC002.14. The benthic impairment extends from the headwaters of Moores Creek down to its confluence with South River. Mill Creek was first listed as impaired in 2016 due to violations at stations 2-MIS000.04 and 2-MIS000.23 (Table 3‑1). The benthic impairment on Mill Creek extends from its headwaters to its confluence with the Maury River. During the 2022 assessment window (January 1, 2015 to December 31, 2020), VSCI scores averaged 55 in Moores Creek and 59 in Mill Creek, indicating impairment of the benthic macroinvertebrate community.

Table 3‑1. Impaired stream segments addressed in the Moores and Mill Creek TMDL implementation plan.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Impaired Segment** | **HUC12/ VAHU6** | **Size** | **Initial Listing  Year** | **Description** |
| **Moores Creek**  (VAV-I36R\_MRC01A00) | 020802020402/  JU78 | 9.09  miles | 2006 | Extending from the headwaters downstream to its confluence with the South River |
| **Mill Creek**  (VAV-I35R\_MIS01A00) | 020802020303/  JU76 | 9.13  miles | 2016 | Extending from its headwaters downstream to its confluence with the Maury River |

The Moores and Mill Creek watersheds are located in both Rockbridge County and Augusta County, Virginia. Moores Creek drains the Raphine and Willow Lake communities south to South River and has a mostly agricultural watershed. Mill Creek drains a predominantly rural watershed northeast of Lexington southwest to Maury River. South River confluences with the Maury River south of the project area, and the Maury River is a direct tributary to the James River, which flows in an easterly direction until it reaches the Chesapeake Bay (Figure 3‑1).

According to the 2017 Census of Agriculture, the average farm in Rockbridge County is 179 acres, an 11% reduction since the 2012 Census was completed. The average age of a farmer in Rockbridge County is 62.5. Seventy two percent (72%) of farms in the county are operated by a single owner, 25% are operated by partial owners, and 3% by tenants. Approximately 62% of farmers in the county identify their primary occupation as something other than farming. The average net cash income for a farm in Rockbridge County was estimated at $7,487 (USDA, 2017).

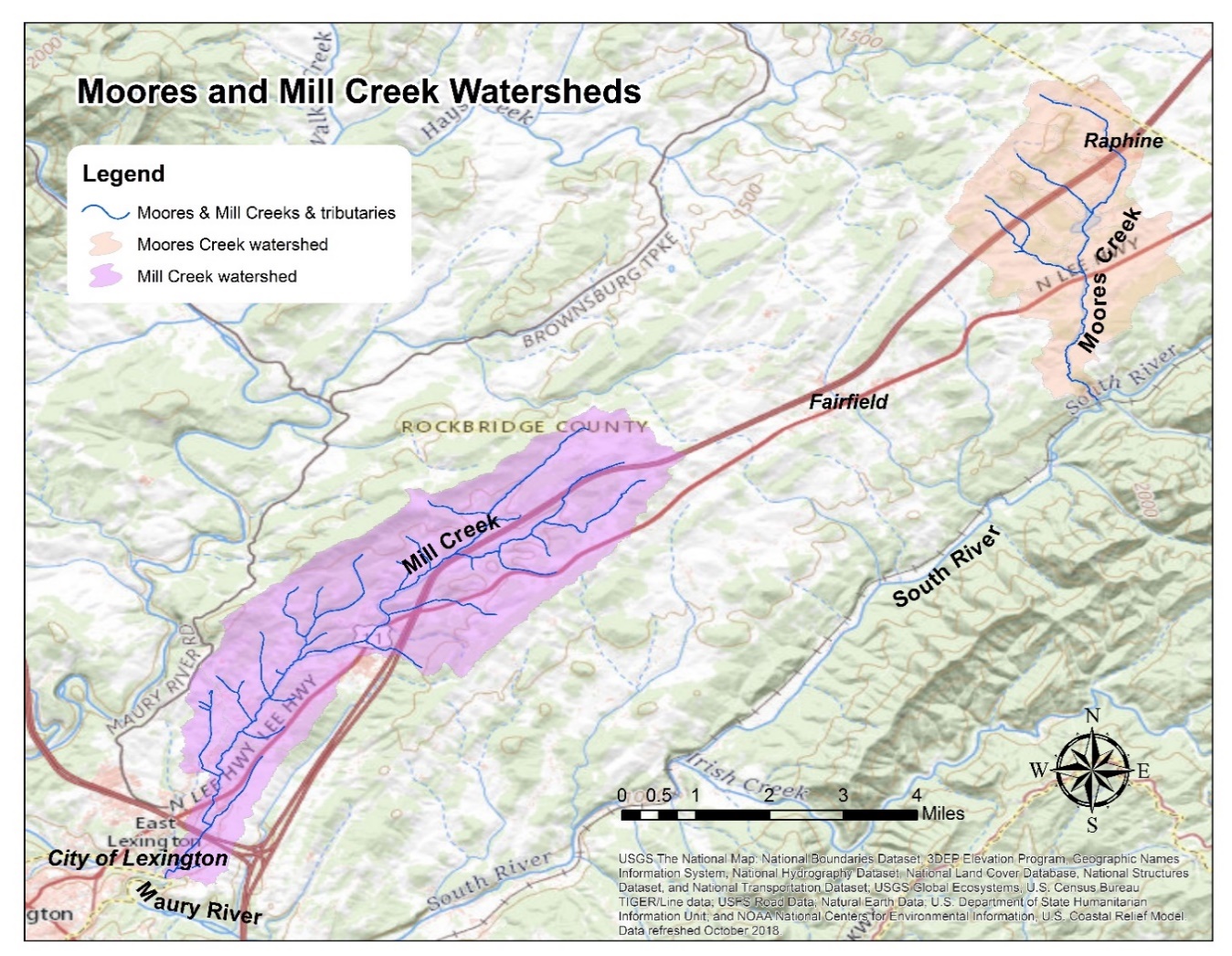


Figure 3￼‑1. Moores and Mill Creek watershed locations.

The 2016 VGIN Virginia Land Cover Dataset (VLCD) land cover dataset was used to determine the land cover distribution throughout the watersheds. Table 3‑2, Figure 3‑2 and Figure 3‑3 summarize land cover distribution in the Moores and Mill Creek watersheds. In Moores Creek, hay and pasture cover a greater extent than urban areas, and as such the majority of the sediment loads are derived from hay and pasture lands. In Mill Creek, the greater urban land cover is reflected in a higher urban sediment load. Both watersheds have a significant portion of their overall sediment load resulting from stream bank and bed erosion.

Table 3‑2 Land use acreages and percent total watershed acreages by land use category.

|  |  |  |
| --- | --- | --- |
| **Land use** | **Watershed: Acres (% total acreage)** | |
| ***Moores Creek*** | ***Mill Creek*** |
| Cropland | 242 (6.5%) | 106 (1.5%) |
| Hay | 852 (22.7%) | 1,032 (14.5%) |
| Pasture | 922 (24.6%) | 1,159 (16.3%) |
| Forest | 568 (15.1%) | 2,654 (37.3%) |
| Trees | 376 (10.0%) | 968 (13.6%) |
| Shrub | 0 (0%) | 31 (0.4%) |
| Harvested/Disturbed | 15 (0.4%) | 0 (0%) |
| Water | 26 (0.7%) | 6 (0.1%) |
| Wetland | 4 (0.1%) | 1 (0.0%) |
| Barren | 15 (0.4%) | 9 (0.1%) |
| Turfgrass | 536 (14.3%) | 702 (9.9%) |
| Developed, pervious | 20 (0.5%) | 47 (0.7%) |
| Developed, impervious | 176 (4.7%) | 405 (5.7%) |
| **TOTAL** | **3,753 (100%)** | **7,121 (100%)** |

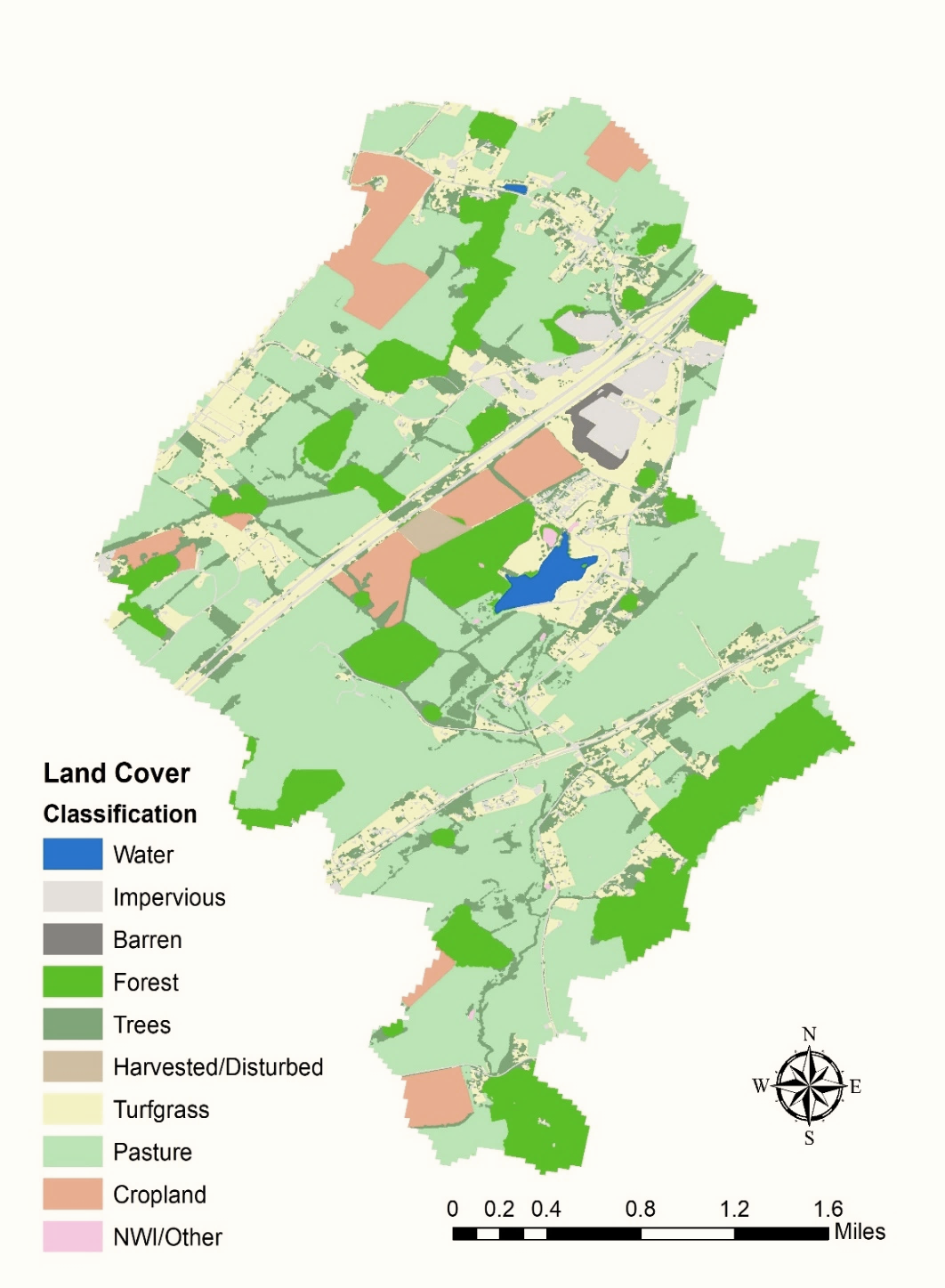


Figure 3‑2. Land cover classes in the Moores Creek watershed (2016 VGIN dataset).

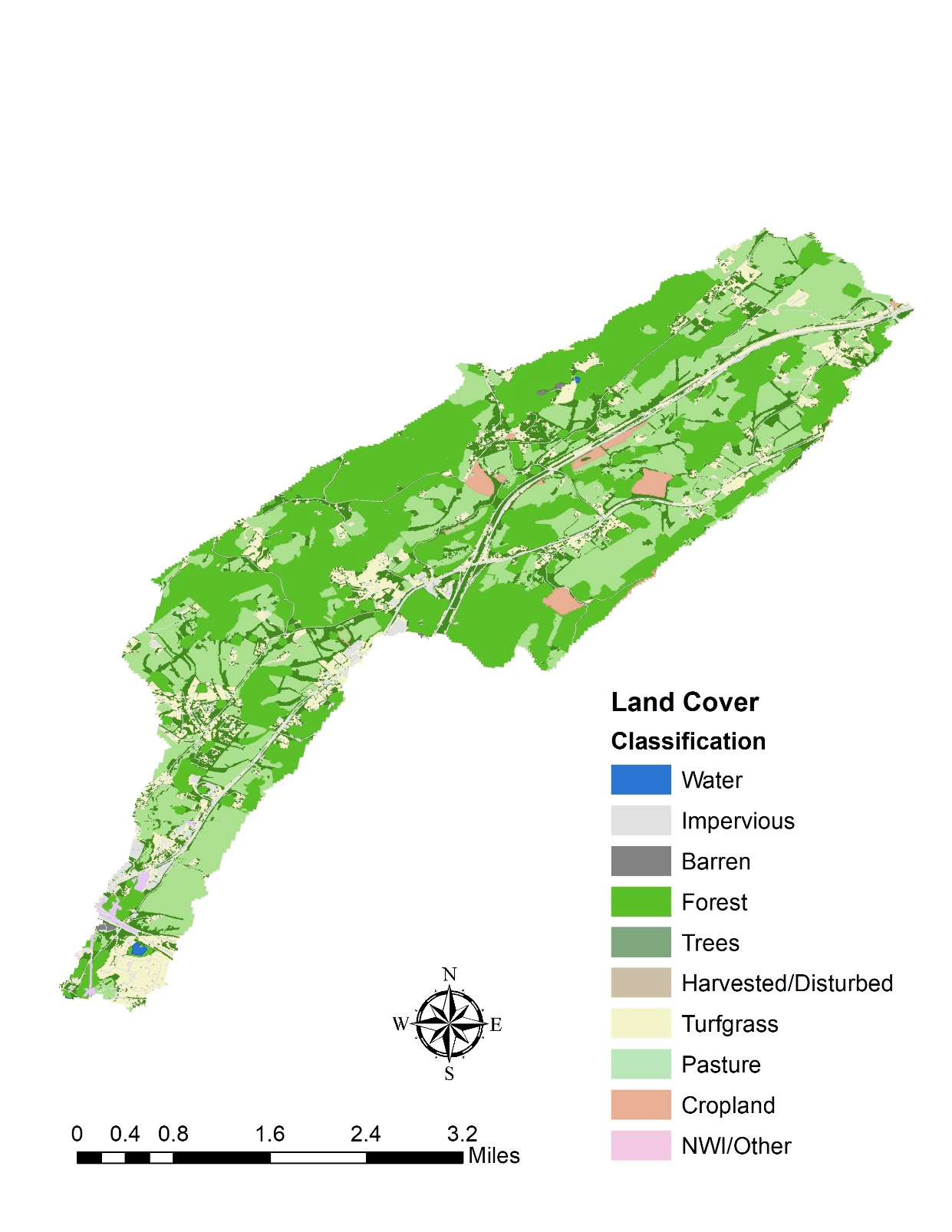


Figure 3‑3. Land cover classes in the Mill Creek watershed (2016 VGIN Dataset).

Wetland Studies and Solutions Inc. (WSSI) was contracted by the Virginia Department of Environmental Quality (DEQ) to develop the Moores and Mill Creek TMDL in 2021, and the TMDL study was completed in December 2022 (VADEQ, 2022).

## Water Quality Monitoring Data

Data collected from ten water quality monitoring stations in Moores and Mill Creeks were used to list these streams with a benthic impairmentand to develop the sediment TMDLs for the streams. Table 3‑3 provides a summary of the data collected from these stations and Figure 3‑4 shows the locations of the stations.

Table 3‑3. DEQ water quality monitoring stations in the Moores and Mill Creek watersheds.

| **Stream** | **Station** | **Station Type** | **Benthic Sampling** | | | **Water Quality Sampling** | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample Period** | **Samples Collected** | **Sample Period** | | **Samples Collected** | |
| Moores Creek | 2-MRC002.14 | Water Quality |  | | | 2018-2019 | | 35 |
| Benthic | 2003-2020 | 10 |  | | | |
| 2-MRC003.82 | Benthic | 2003-2014 | 8 |
| 2-MRC004.21 | Benthic | 2003-2005 | 4 |
| Mill Creek | 2-MIS000.04 | Water Quality |  | | | 1991-2020 | | 96 |
| Benthic | 2008-2019 | 8 |  | | | |
| 2-MIS000.09 | Water Quality |  | | | 2005 | | 2 |
| 2-MIS000.30 | Benthic | 2020 | 2 |  | | | |
| 2-MIS002.21\* | Benthic | 2018 | 1 |
| 2-MIS002.23\* | Benthic | 2018 | 1 |
| 2-MIS003.90 | Water Quality |  | | | 2005 | | 2 |
| 2-MIS005.00 | Water Quality | 2005 | | 2 |
| 2-MIS005.94 | Water Quality | 2005 | | 2 |
| 2-MIS006.76 | Water Quality | 2005 | | 2 |
| 2-MIS006.88 | Water Quality | 2005 | | 2 |
| \* Pollution complaint response sites | | | | | | | | | |

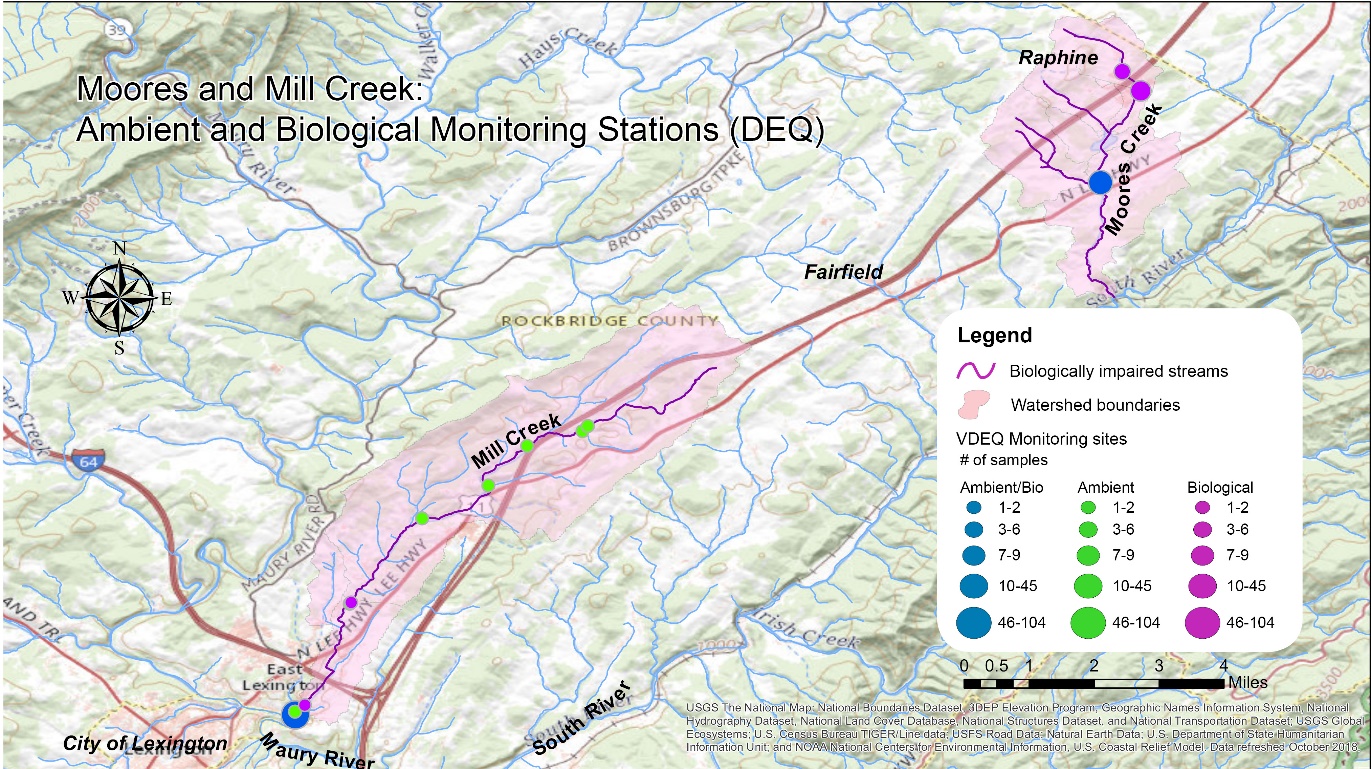


Figure 3‑4. DEQ monitoring stations in the Moores and Mill Creek watersheds.

## Water Quality Modeling

The model selected for development of the sediment TMDLs in the Moores and Mill Creek watersheds was the Generalized Watershed Loading Functions (GWLF) model, developed by Haith et al. (1992), with modifications by Evans et al. (2001), Yagow et al. (2002), and Yagow and Hession (2007). GWLF is a continuous simulation model that operates on a daily timestep for water balance calculations and outputs a monthly sediment yield for the watershed. The model allows for multiple different land cover categories to be incorporated, but spatially it is lumped, in the fact that it does not account for the spatial distribution of sources and has no method of spatially routing sources within the watershed. Observed daily precipitation and temperature data is input, along with land cover distribution and a range of land cover parameters, which the model uses to estimate runoff and sediment loads in addition to dissolved and attached nitrogen and phosphorus loads. To clearly identify sources of sediment, each watershed was divided up into three smaller subwatersheds. The sources and their respective sediment contributions were identified for each smaller subwatershed based on land use and climate data. The GWLF model was then used to simulate the transport of these pollutant loads to the streams.

## Sediment Source Assessment

### 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. Various point sources of sediment exist within the Moores and Mill Creek watersheds. These point sources are permitted under the Virginia Pollutant Discharge Elimination System (VPDES) program and include industrial stormwater general permits and construction general stormwater permits. The point sources of sediment in the watersheds are listed in Table 3‑4, along with their load allocations in the TMDLs. The waste load allocation for each point source was set using established methodology for each permit type as described in the TMDL report.

Table 3‑4. Permitted sediment point sources in the Moores and Mill Creek watersheds.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Permit type** | **Permit No.** | **Facility Name** | **Watershed** | **WLA (lbs/yr)** |
| Industrial Stormwater General Permit | VAR052529 | Devils Backbone Brewing Co. | Mill Creek | 5,984 |
| Construction Stormwater General Permit | Aggregated | NA | Mill Creek | 6,409 |
| Moores Creek | 34,970 |

### Nonpoint sources

#### Surface runoff

Sediment can be transported from both pervious and impervious surfaces during runoff events. Between rainfall events, sediment accumulates on impervious surfaces and can then be washed off these impervious surfaces during runoff events. On pervious surfaces, soil particles are detached by rainfall impact and shear stress from overland flow and then transported with the runoff water to nearby streams. Various factors including rainfall intensity, storm duration, surface cover, topography, tillage practices, soil erosivity, soil permeability, and other factors all impact these processes.

VGIN 2016 land cover data was used to determine the distribution of different land cover types in the watersheds (Figure 3‑2, Figure 3‑3). Values for various parameters affecting sediment loads were gleaned from literature guidance (CBP, 1998; Haith et al., 1992; Hession et al., 1997).

#### Streambank erosion

Increases in impervious areas and impacts to riparian (streambank) vegetation from livestock access and other management practices can cause streambank erosion. As impervious surface increases in a watershed, so does the amount and rate of flow in streams following rainfall events. This is often the cause of the entrenchment, or downcutting, of urban streams – disconnecting higher flow events from the surrounding floodplain.

Additionally, impacts to riparian (streambank) vegetation from livestock access and other management practices weaken the stability of the streambanks themselves as root system matrices break down. Weakened streambanks are more easily eroded by storm flows and can lead to excessive channel migration and eventual channel over-widening. Increasing channel width decreases stream depth which can lead to increased sediment deposition and increased water temperatures, which both negatively impact aquatic life.

GWLF was used to calculate streambank and channel erosion in the Moores and Mill Creek TMDLs. This model uses and algorithm that estimates average annual streambank erosion as a function of cumulative stream flow, fraction of impervious cover in the watershed, and livestock density in the watershed with the area-weighted curve number and soil erodibility factors and the mean slope of the watershed (Evans et al., 2001).

Table 3‑5. Annual existing sediment load in the Moores and Mill Creek watersheds by source.

|  |  |  |
| --- | --- | --- |
| **Land Cover Category** | **Existing TSS load (lbs/yr)** | |
| **Moores Creek** | **Mill Creek** |
| Cropland | 268,500 | 112,100 |
| Hay | 45,880 | 71,060 |
| Pasture | 703,400 | 891,500 |
| Forest | 9,573 | 76,920 |
| Trees | 15,220 | 55,670 |
| Harvested | 3,424 | 11,340 |
| Wetland | 174 | 174 |
| Barren | 103,200 | 109,200 |
| Turfgrass | 30,750 | 49,830 |
| Developed Pervious | 1,946 | 8,277 |
| Developed Impervious | 121,900 | 267,600 |
| Streambank Erosion | 28,400 | 90,520 |
| Permitted | 34,970 | 19,750 |
| ***Total*** | ***1,370,000*** | ***1,760,000*** |

## TMDL Allocation Scenarios

### Setting Target Sediment Loads

The TMDL includes sediment reduction scenarios needed to meet the aquatic life usestandard. Since sediment does not have a numeric criterion, the “all-forest load multiplier” (AllForX) approach was used to establish endpoints in the Moores and Mill Creek TMDLs (Table 3‑6). AllForX is the ratio of the simulated pollutant load under existing conditions to the pollutant load from an all-forest simulated condition for the same watershed. In other words, AllForX is an indication of how much higher current sediment loads are above an undeveloped condition. These multipliers were calculated for three TMDL study subwatersheds and nine comparison subwatersheds of similar size and within the same ecoregion as the TMDL study watersheds. A regression was then developed between the Virginia Stream Condition Index (VSCI) scores at monitoring stations and the corresponding AllForX ratio calculated for each watershed.

In Moores Creek, average VSCI scores were used to calculate the regression. In Mill Creek, the 33rd percentile of scores was used. The results of the benthic stressor analysis for Mill Creek indicate a borderline impairment, with VSCI scores repeatedly falling above and below the threshold of 60. As a result, using average VSCI scores from other streams to develop the regression indicated that no reduction in sediment was necessary in Mill Creek. Given the findings of the benthic stressor analysis, it is clear that this is not the case. Relative Bed Stability (RBS) monitoring results for Mill Creek revealed that bedrock is the predominant substrate in the stream, comprising over 40% of the stream bottom. Although analyses showed relatively limited evidence of sediment deposition, with limited gravel and cobble available for colonization by macroinvertebrates the effects of excess sediment deposition are magnified in the stream. This means that even a small amount of sediment can significantly reduce the availability of suitable habitat in Mill Creek, making a more conservative approach to TMDL development necessary.

Table 3‑6. Target sediment loading rates and reductions for the Moores and Mill Creeks. Existing loads listed include a margin of safety and future growth set-asides.

| **Impaired Stream** | **TSS** **Existing (lb/yr)** | **TSS** **All-Forested (lb/yr)** | **TSS** **Target (lb/yr)** | **Estimated % Reduction** |
| --- | --- | --- | --- | --- |
| Moores Creek | 1,340,665 | 101,541 | 1,255,542 | 6.3% |
| Mill Creek | 1,847,989 | 187,667 | 1,598,165 | 13.5% |

### Sediment TMDL Equation

Total maximum daily loads are determined as the maximum allowable load of a pollutant among the various sources. Each TMDL is comprised of three components, as summed up in this equation:

TMDL= ∑WLA+ ∑LA+MOS

Where :

ΣWLA is the sum of the wasteload allocations (permitted sources),

ΣLA is the sum of the load allocations (non-point sources), and

MOS is a margin of safety.

To account for uncertainties inherent in model outputs, a margin of safety (MOS) is incorporated into the TMDL development process. The MOS can be implicit, explicit, or a combination of the two. This TMDL includes both implicit and explicit MOSs. An allocation of 2% of the total load is specifically set aside for future growth within this TMDL (Table 3‑7).

Table 3‑7. Annual average sediment TMDL components for Moores and Mill Creeks.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Impairment** | **WLA (lb/yr)** | **LA (lb/yr)** | **MOS (lb/yr)** | **TMDL (lb/yr)** | **Existing Load (lb/yr)** | **Reduction (%)** | |
| **Moores Creek** | **60,080** | **1,070,000** | **125,600** | **1,260,000** | ***1,520,000*** | | ***17.3%*** |
| *Construction Stormwater General Permits* | *34,970* |  | | | | | |
| *Future Growth (2% of TMDL)* | *25,110* |
| **Mill Creek** | **44,360** | **1,394,000** | **159,800** | **1,600,000** | **1,960,000** | **18.3%** | |
| *Construction Stormwater General Permits* | *6,409* |  | | | | | |
| *Industrial Stormwater Permits* | *5,984* |
| *Future Growth (2% of TMDL)* | *31,960* |

### Sediment Allocation Scenario

Different scenarios were evaluated by a Technical Advisory Committee (TAC) to identify a fair and equitable approach to implementation that meets the sediment endpoints identified in the TMDL. The total sediment load available for allocation was distributed between point and non point sources, and reductions were identified based on existing and allocated loads. The TAC evaluated these reductions and selected a scenario in which the greatest sediment sources received the largest reduction goals, while smaller sources will need to make smaller reductions. The selected sediment allocation scenario is shown in Table 3‑8.

Table 3‑8. Sediment allocation scenarios for Moores and Mill Creeks.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Source** | **Moores Creek** | | | **Mill Creek** | | |
| **Existing (lb/yr)** | **Red. %** | **Allocation (lb/yr)** | **Existing (lb/yr)** | **Red. %** | **Allocation (lb/yr)** |
| Cropland | 268,500 | 23.0 | 206,700 | 112,100 | 25.0 | 84,070 |
| Hay | 45,880 | 23.0 | 35,330 | 71,060 | 25.0 | 53,300 |
| Pasture | 703,400 | 23.0 | 541,600 | 891,500 | 25.0 | 668,700 |
| Forest | 9,573 | - | 9,573 | 76,920 | - | 76,920 |
| Trees | 15,220 | - | 15,220 | 55,670 | - | 55,670 |
| Harvested | 3,424 | - | 3,424 | 11,340 | - | 11,340 |
| Wetland | 174 | - | 174 | 174 | - | 174 |
| Barren | 103,200 | 8.5 | 94,400 | 109,200 | 13.5 | 94,490 |
| Turfgrass | 30,750 | 8.4 | 28,170 | 49,830 | 13.5 | 43,110 |
| Developed Pervious | 1,946 | 8.5 | 1,781 | 8,277 | 13.5 | 7,151 |
| Developed Impervious | 121,900 | 8.5 | 111,500 | 267,600 | 13.5 | 231,200 |
| Streambank Erosion | 28,400 | 23.0 | 21,870 21,871 | 90,520 | 25.0 | 67,890 |
| Construction Permits | 34,970 | - | 34,970 | 6,409 | - | 6,409 |
| ISW Permits | - | - | - | 13,340 | - | 5,984 |
| Future Growth (2%) | 25,110 | - | 25,110 | 31,960 | - | 31,960 |
| MOS (10%) | 125,600 | - | 125,600 | 159,800 | - | 159,800 |
| **TOTAL** | **1,520,000** | **17.3%** | **1,260,000** | **1,960,000** | **18.3%** | **1,600,000** |

# 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.

## Public Meetings

A public meeting was held on October 26, 2022 at the Rockbridge County Administration Building in Lexington VA to conclude development of sediment TMDLs for Moores and Mill Creeks, and to kick off the development of the implementation plan. This meeting served as an opportunity for local residents to learn more about the problems facing the creeks and work together to come up with new ideas to protect and restore water quality in their community. This meeting was publicized through a press release published in local papers, email announcements, and invitations mailed to riparian landowners. Approximately 15 people attended the meeting.

The meeting began with a brief presentation on existing water quality conditions in the streams and what types of actions and information could be included in the implementation plan to improve water quality. Following the presentation, attendees split up into two working groups: a residential group and an agricultural group. The working groups discussed how residential and agricultural land use practices are affecting the quality of these streams and then reviewed different land use management practices that could be included in the cleanup plan. TMDL staff from Virginia’s Department of Environmental Quality facilitated these discussions.

The final public meeting was held on October 30, 2023 at the Rockbridge County Administration Building in Lexington, VA. Approximately XX people attended.

## Community Engagement Meetings

A Community Engagement Meeting was held on November 17, 2022 at the Rockbridge County Administration Building in Lexington VA to review potential BMPs to include in the implementation plan and associated implementation costs. Participants met again on May 31, 2023 at Rockbridge County Administration Building to review a series of potential implementation scenarios and determine an appropriate timeline for implementation efforts. An electronic copy of the draft plan was shared with participants in the community engagement meetings one month prior to the final public meeting to solicit feedback and revisions. Summaries of these meetings are included in Appendix A on page 70 of this document.

# 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 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 that would be needed to meet the water quality goals established during the TMDL study.

## 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 stakeholder advisory committee, 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. Various scenarios were developed and presented to the stakeholder advisory group, 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 agricultural cost share programs that promote conservation. In addition, innovative and site-specific practices suggested by local producers 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.

## 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 stakeholder advisory group. 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 each watershed, and within smaller subwatersheds. Data from the VADCR Agricultural BMP Database and the Natural Bridge SWCD showing where best management practices are already in place in the watersheds were considered when developing these estimates. Estimates of the amount 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 sediment loads.

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

| **BMP** | **Units** | **Sediment reduction (%)** | **Reference** |
| --- | --- | --- | --- |
| ***Livestock Exclusion Practices*** | | | |
| CREP Stream Exclusion with Grazing Land Management (CRSL-6) | System | 40% + Land use change | 1 |
| Stream Exclusion with Narrow Width Buffer and Grazing Land Management (SL-6N) |
| Stream Exclusion with Wide Width Buffer and Grazing Land Management (SL-6W) |
| Stream Protection (WP-2N, WP-2W, WP-2T) |
| ***Pasture Practices*** | | | |
| Precision Intensive Rotational/Prescribed Grazing | Acres | 30% | 2 |
| Streamside Buffer (35-100 feet): forested | Acres treated | Land use change + 70% | 1 |
| Streamside Buffer (35-100 feet): grass and shrub | Land use change + 40% | 1 |
| Permanent Vegetative Cover on Critical Areas (SL-11) | Acres | 75% | 1 |
| Afforestation of Erodible Pasture (FR-1) | Land use change |  |
| ***Cropland Practices*** | | | |
| Long Term Vegetative Cover on Cropland (SL-1) | Acres | 75% | 1 |
| Continuous No-Till (SL-15B) | 70% |
| Cover Crop (SL-8B) | 20% |
| Conversion of High Till to Low Till (NA) | 90% | 5 |
| ***Residential/Urban Practices*** | | | |
| Bioretention Filters | Ac.treated | 65% - 80%\* | 4 |
| Bioswale | 80% | 4 |
| Grassed channels | 60% - 70%\* | 4 |
| Storm drain inserts | Ac treated | 83% | 6 |
| Turf to trees | Acres | Land use change |  |
| ***Streambank Stabilization (agricultural and urban/residential)*** | Lin. ft. | 50% | 2 |
| ***Riparian Buffers: grass and shrub (agricultural and urban/residential)*** | Ac. Treated | 50% | 1 |
| ***Riparian Buffers: forested (agricultural and urban/residential)*** | Ac. Treated | 70% | 1 |

1. DEQ Guidance Manual for TMDL Implementation Plans, June 2017.
2. A Unified Guide for Crediting Stream and Floodplain Restoration Projects in the Chesapeake Bay Watershed, September 17, 2021.
3. Chesapeake Bay Program. 2018. Chesapeake Bay Program Quick Reference Guide for Best Management Practices (BMPs): Nonpoint Source BMPs to Reduce Nitrogen, Phosphorus and Sediment Loads to the Chesapeake Bay and its Local Waters. CBP DOC ID.
4. Recommendations of the Expert Panel to Define Removal Rates for New State Stormwater Performance Standards, Revised January 20, 2015
5. Modeled land use change (90.6% in Mill Creek, 89.5% in Moores Creek)
6. Manufacturer specifications, Flex Storm Pure Inlet Filters. 2023. Advanced Drainage Systems Inc.

\* Efficiency rates based on class B/C soils in Mill Creek and class B soils in Moores Creek, respectively

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 increased impervious surfaces and land disturbance associated with new development.

5.2.1 Agricultural Control Measures  **Livestock Exclusion BMPs**

Excluding livestock from streams and establishing vegetated streamside buffers helps prevent streambank erosion and traps sediment from eroding pastures before it enters the stream. Consequently, this plan includes recommendations for livestock exclusion/riparian buffer practices implemented in conjunction with improved pasture management. To estimate fencing needs, the perennial stream network was overlaid with land use using GIS mapping software (ArcView v.10.1). 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 VBMP Orthophotography and the 2014 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 watersheds (Table 5‑2). Any fencing installed was subtracted from the length of potential fencing in the watershed (Table 5‑3). A map of potential streamside fencing required for streams in the watersheds is shown in Figure 5‑1.

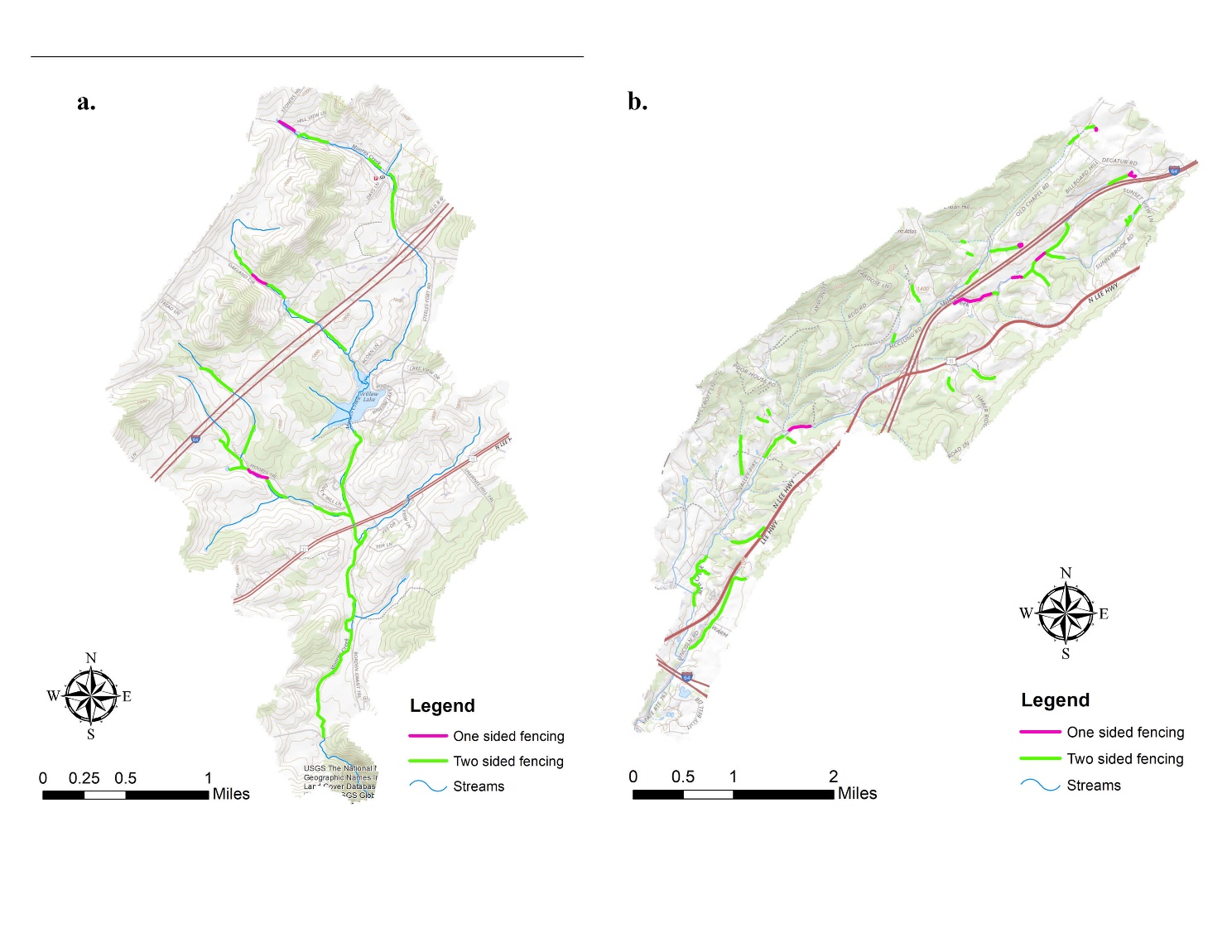


Figure 5‑1 Livestock exclusion fencing needed in the Moores Creek (a.) and Mill Creek (b.) watersheds.

Table 5‑2 Livestock exclusion systems in the watershed tracked through the VADCR Agricultural BMP database: *December* *1999 – October 2022*. NOTE: Table does not include data from systems that were not installed through government cost share programs. CRP and EQIP data were not available.

|  |  |  |  |
| --- | --- | --- | --- |
| **Watershed** | **Practice** | **Number of practices** | **Extent of fence (lin. ft)** |
| Moores Creek | Stream Exclusion With Grazing Land Management (SL-6) | 1 | 5,300 |
| Mill Creek | 3 | 14,426 |

Table 5‑3 Stream fencing needed in the Moores and Mill Creek watersheds. *Note: Total potential fencing includes all unfenced pasture adjacent to streams in the watersheds. Values shown in Table 5-2 have been subtracted from total potential fencing.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Sub-  watershed** | **Total**  **potential**  **fencing (ft)** | **Fencing  still needed to  meet goal (ft)** | **Fencing still**  **needed to meet**  **goal (miles)** |
| **Mill Creek: 40% Exclusion** | | | |
| 1 | 17,980 | 7,192 | 1.36 |
| 2 | 18,152 | 7,261 | 1.38 |
| 3 | 17,909 | 7,164 | 1.36 |
| ***Subtotal*** | ***54,042*** | ***21,617*** | ***4.09*** |
| **Moores Creek: 40% Exclusion** | | | |
| 4 | 30,796 | 12,318 | 2.33 |
| 5 | 13,713 | 3,365 | 0.64 |
| 20 | 6,951 | 2,780 | 0.53 |
| ***Subtotal*** | ***46,160*** | ***18,464*** | ***3.50*** |

It is expected that the majority of livestock exclusion fencing will be accomplished through the VA Agricultural BMP Cost Share Program and federal NRCS cost-share programs. Some applicable cost-shared BMPs for livestock exclusion in the programs are the SL-6W (Stream Exclusion with Wide Buffer Width and Grazing Land Management Practice), the SL-6N (Livestock Exclusion with Narrow Buffer Width and Grazing Land Management), the WP-2 (Livestock Exclusion with Reduced Setback for TMDL Implementation), and CREP (the Conservation Reserve Enhancement Program). To determine the appropriate mix of these practices to include in the implementation plan, 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 local stakeholders, NRCS 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 5.4).

The Stream Exclusion with Wide Buffer Width and Grazing Land Management Practice (SL-6W) offers cost share for off stream watering, establishment of a rotational grazing system, stream crossings, and stream exclusion fencing with a minimum 35-foot setback. Cost share rates for this practice vary depending on the contract term. Landowners may also receive a buffer payment for the land within the fencing setback. Cost share and payment rates are shown in Table 5‑4. This practice is most commonly selected by farmers in the area, so it was estimated that 83% of fencing would be installed using the SL-6W practice.

Table 5‑4 Cost share and buffer payment rates for SL-6W practice in the DCR Agricultural BMP Cost Share Program

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Minimum fence setback** | **Lifespan** | **Cost-share rate** | **Buffer payment rate** | **Buffer payment cap** |
| 35’ | 10 years | 85% | $80/ac/yr | $12,000/contract |
| 15 years | 90% | $18,000/contract |
| 50’ | 10 years | 95% | $12,000/contract |
| 15 years | 100% | $18,000/contract |

The SL-6N practice (Livestock Exclusion with Narrow Buffer Width and Grazing Land Management) is very similar to the SL-6W except that the practice allows for a reduced fencing setback. Landowners may choose a 10’ setback with a 10- or 15-year contract to receive 60% or 65% cost share, respectively. In order to increase their cost share rate, they may elect to set the fence back 25’ with a 10-to-15-year contract, making them eligible for 70% or 75% cost share, respectively. Due to the lower cost share rate, this practice is used far less frequently than the SL-6W practice. Consequently, it was estimated that approximately 7% of fencing in the watershed would be installed using this practice.

The WP-2 system includes streamside fencing, hardened crossings, and a 35-ft buffer from the stream. In cases where a watering system already exists, a WP-2 system is a more appropriate choice. This practice is seldom used because it does not provide cost share for the installation of a well, this was reflected in the number of systems noted in the Ag BMP Database in Rockbridge County. Consequently, it was estimated that only 3% of fencing in the watersheds would be accomplished using the WP-2 practice.

Fencing through the Conservation Reserve Enhancement Program (CREP) was also included in implementation scenarios. For those who are willing to install a 35-foot buffer or larger and plant trees in the buffer, USDA-NRCS’s CREP is an excellent option. State and federal cost BMP programs each offer 50% cost share for this practice, bringing the total cost share rate to 100%. Additional rental payments and sign-up incentive payments bring financial assistance to over 100% of the project cost. It is estimated that 7% of fencing in the watersheds will be installed through CREP.

Table 5‑5 Estimate of streamside exclusion fencing systems needed by subwatershed.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Watershed** | **Subshed** | **Fencing needed** | **SL-6W** | **SL-6N** | **WP-2** | **CRSL-6** |
| **Feet** | | | | |
| Mill Creek | 1 | 17,980 | 5,969 | 503 | 216 | 503 |
| 2 | 18,152 | 6,027 | 508 | 218 | 508 |
| 3 | 17,909 | 5,946 | 502 | 215 | 502 |
| **TOTAL** | **54,042** | **17,942** | **1,513** | **649** | **1,513** |
| Moores Creek | 4 | 30,796 | 10,224 | 862 | 370 | 862 |
| 5 | 8,414 | 2,793 | 236 | 101 | 236 |
| 20 | 6,951 | 2,308 | 197 | 83 | 195 |
| **TOTAL** | **46,160** | **15,325** | **1,292** | **554** | **1,293** |

**Land Based Agricultural BMPs**

In order to meet the sediment reductions outlined in the TMDL, best management practices to treat land-based sources of sediment must also be included in implementation efforts. Table 5.5 provides a summary of land based agricultural BMPs by watershed needed to achieve water quality goals.

**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. Once you move beyond 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 Land 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 to establish these systems. In cases where livestock exclusion is not necessary, grazing land management was prescribed. Grazing land management allows a farmer to better utilize grazing land and associated forage production. This practice includes:

* Implement a current nutrient management plan
* Maintain adequate soil nutrient and pH levels
* Manage livestock rotation to paddock subdivisions to maintain minimum grazing height recommendations and sufficient rest periods for plant recovery
* Maintain adequate and uniform plant cover (≥ 60%) and pasture stand density
* Locate feeding and watering facilities away from sensitive areas
* Manage distribution of nutrients and minimize soil disturbance at hay feeding sites by unrolling hay across the upland landscape in varied locations
* Designate 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.
* Mow pasture as needed to control woody vegetation

An incentive payment of $25 per acre per year is available to producers over the three-year lifespan of this practice and is limited to a maximum of 200 acres per participant per year.

**Cropland Management Practices**

A series of cropland management practices are included to control cropland runoff contributing sediment to the streams. Continuous no-till is a practice that is becoming widely adopted in the region. By reducing tillage of the soil, farmers can conserve valuable soil and fertilizer and increase organic matter, which is an important factor in determining soil quality. Alternatively, should a producer not have the resources to commit to continuous no-till, simply converting high till cropland to low till cropland will result in considerable reductions in soil loss. Cover crops are planted on an annual basis to prevent soil erosion following harvest of crops like corn and soybeans when the soil would typically be left exposed. Establishing permanent vegetative cover on highly erodible or less productive cropland is also highly effective in reducing sediment runoff.

**Hayland Management Practices**

While sediment runoff from hayland is relatively low, BMPs may be targeted to further reduce runoff in less productive fields more susceptible to erosion. Producers wishing to take hayland out of production and plant trees may receive an incentive payment of $100/acre in addition to 75% cost share for planting costs. While the extent of hayland adjacent to streams is minimal in the area, riparian buffers can be planted in these areas to filter runoff and trap sediment. Producers may receive 95% cost share for planting costs in addition to an incentive payment ranging from $100-$250/acre depending on the length of the contract signed and the type of trees planted.

Table 5‑6 Land based agricultural BMPs needed to meet sediment TMDLs.

| **Land use** | **BMP Name** | **BMP Cost Share Code** | **Extent (acres)** | |
| --- | --- | --- | --- | --- |
| **Moores** | **Mill** |
| **Pasture** | Grazing land management | SL-10 | 364 | 709 |
| Permanent vegetation on critical areas | SL-11 | 4 | 2 |
| Aforestation of erodible pasture | FR-1 | 14 | 16 |
| **Cropland** | Continuous no till | SL-15A | 12 | 5 |
| Cover crops | SL-8B | 29 | 12 |
| Convert high till to low till | NA | 13 | 5 |
| Long-term vegetative cover on cropland | SL-1 | 12 | 5 |
| **Hayland** | Forest buffer | FR-3 | 4 | 10 |
| Aforestation of hayland | FR-1 | 128 | 155 |

### Residential and Urban Control Measures

In order to treat sediment running off developed land, BMPs to reduce and filter residential and urban runoff are necessary. According to the TMDL, an 8.5% reduction in residential and developed sediment sources in Moores Creek and a 13.5% reduction in Mill Creek is needed to remove the streams from the impaired waters list.

**Urban and Turfgrass BMPs**

A series of residential and urban stormwater BMPs were identified to treat runoff from developed areas, turfgrass and barren areas in the watersheds. Opportunities for tree plantings on developed pervious areas and turfgrass were also identified. Rain gardens are small landscape features designed to catch runoff from paved surfaces and rooftops and filter out pollutants as the runoff moves down through a special soil mix. These practices are suitable for implementation in residential areas. Bioretention filters are similar in function, but generally require more complex design work due to their capacity to handle a greater drainage area. These practices are typically used more often in commercial developments. Bioswales are similar in function to bioretention filters, capturing and treating runoff in vegetative, shallow, landscaped depressions. These features were identified as another effective practice to treat runoff from impervious surfaces. Grass channels are a less expensive stormwater management practice that provides a modest amount of runoff filtering and volume attenuation. These practices were identified as a suitable option for barren areas, gravel lots and impervious areas. Storm drain inserts were identified as a beneficial practice at the Pilot Travel Center. These inserts may be placed in existing storm drains where they filter stormwater runoff and trap contaminants. While bioretention filters and bioswales are highly effective in filtering stormwater runoff, the soil media can lose its filtering capacity over time if the practice is receiving considerable loads of sediment. Storm drain inserts can be changed out regularly, making them a suitable practice for the Pilot Travel Center where a considerable amount of sediment is deposited in large parking areas. Riparian buffer plantings are a low cost, highly effective way to trap and filter runoff from urban and residential areas. While opportunities for plantings in the watersheds are relatively limited, the Willow Lake subdivision was identified as a high visibility site for a large riparian buffer planting. Homeowners could be engaged in this effort, which could serve as an opportunity to educate residential property owners on the benefits of riparian buffers.

A summary of residential/urban stormwater and BMPs needed in the Moores and Mill Creek watersheds is provided in Table 5‑7

Table 5‑7 Urban BMPs needed in the Moores and Mill Creek watersheds.

| **Land use** | **BMP Name** | **BMP Cost Share Code** | **Units** | **Extent** | |
| --- | --- | --- | --- | --- | --- |
| **Moores** | **Mill** |
| **Urban** | Tree planting | NA | Acres | 2 | 6 |
| Bioretention filter | BR | Acres treated | 9 | 32 |
| Bioswales | IF | Acres treated | 4 | 20 |
| Storm drain insert | NA | Number | 4 | 0 |
| Grass channels | VSC | Acres treated | 7 | 36 |
| **Barren** | Grass channels | VSC | Acres treated | 2 | 2 |
| **Turfgrass** | Forested buffer | NA | Acres | 6 | 4 |
| Tree planting | NA | Acres | 35 | 58 |
| Rain gardens | RG | Acres treated | 11 | 14 |
| Bioretention filters | BR | Acres treated | 5 | 7 |

### Streambank Stabilization

The sediment TMDLs for Moores and Mill Creeks call for 23% and 25% reductions in streambank erosion, respectively. There are 12.8 miles of streambank in the Mill Creek watershed and 7.1 miles in the Moores Creek watershed. The TMDLs do not identify the extent of streambank that is actively eroding, making it difficult to estimate the amount of stabilization that is needed in the watersheds to meet the TMDL target. Estimates of eroding streambank were based on Rapid Bioassessment Protocol habitat measurements collected as part of routine biological monitoring by DEQ in Moores and Mill Creeks. Bank stability is a visual observation of the streambanks, assigning a score to the overall stability of the banks and visible areas of erosion. Mill Creek scores averaged a value of 14 on a scale of 1-20, falling within the middle of the range of “moderately stable,” with an estimated 17.5% of banks eroding. Moores Creek scores averaged 13, with an estimated 19.5% of banks visibly eroding. At an estimated cost of $250/foot, reducing sediment from all streambanks in the watersheds by 23-25% would be cost prohibitive. Therefore, it was estimated that 40% of eroding streambanks in Mill Creek and 30% of eroding banks in Moores Creek could be treated with streambank stabilization practices. The shortfall in sediment reductions resulting from the 30%-40% implementation goal was made up for using more cost-effective pasture management practices as shown in Table 5‑6. The extent of streambank restoration called for in the two watersheds is shown in Table 5‑8.

Table 5‑8 Streambank stabilization (WP-2A) needed in the Moores and Mill Creek watersheds.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Watershed** | **Streambank extent (feet)** | **Estimated % streambank eroding** | **Streambank stabilization goal (% eroding banks)** | **Streambank stabilization goal (feet)** |
| Moores Creek | 37,460 | 19.5% | 30% | 2,192 |
| Mill Creek | 67,388 | 17.5% | 40% | 4,718 |

## 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 urban/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 local Farm Bureau events including annual membership meetings. Provide information for distribution with semiannual 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 outreach regarding agricultural BMPs.
* Conduct targeted outreach to farmers with overgrazed pasture. Encourage incremental improvements including more frequent rotation of livestock, and lower stocking densities with a long-term goal of increased annual vegetative cover in poor pasture throughout the watersheds.
* Work with VA Cooperative Extension to hold rotational grazing workshops, partner with Extension on events at the McCormick Farm.
* Work with county Boards of Supervisors representatives to contact vast agricultural landowners in the watersheds 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, i.e.adaptive management.

**Residential Programs**

* Pursue opportunities for Turf to Trees plantings in residential areas.
* Work with homeowners in the Willow Lake subdivision to complete a pilot riparian buffer planting around the lake.
* Conduct a conservation landscaping workshop for residential property owners.
* 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 urban/residential components of the plan was estimated based on 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 watersheds, the extent of implementation needed, and the overall project timeline, an estimate of 1/2 FTE was used for technical assistance. This estimate was based on similar implementation projects in other watersheds where on staff member is administering both the residential/urban and agricultural programs. It is expected that locality staff would be directly involved in any urban stormwater BMPs, serving as the project lead on any of these efforts with support from the Natural Bridge SWCD.

# COSTS AND BENEFITS

## Agricultural BMPs

The costs of agricultural best management practices included in the implementation plan were estimated based on data for Rockbridge County from the VADCR Agricultural BMP Database, and the Natural Bridge SWCD cost lists for BMP components.

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-6W, SL-6N, and CREP (CRSL-6). The cost of streamside fence and riparian buffer maintenance were identified as deterrents to participation. Producers may be eligible to receive an annual 25% tax credit for fence maintenance through the VA State Cost Share Program, though associated costs frequently exceed the value of this credit. The James River Buffer Program was launched by the Chesapeake Bay Foundation in 2019 for landowners in the Middle James region. The program was extended to the Upper James region the following year. The program directly pays for all riparian buffer project costs, including design, site preparation, materials, installation, and three years of establishment support. There is no out-of-pocket cost to the landowner. This program could be helpful for producers with concerns about riparian buffer maintenance. Participants in the program to date have reported far lower mortality rates in their buffers as a result of the maintenance assistance. In developing the cost estimates for fence maintenance shown in Table 6.1, a figure of $5.50/linear foot of fence was used. It was estimated that approximately 10% 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.

## Urban Stormwater BMPs

The costs of recommended stormwater BMPs were estimated using input from Rockbridge County and average cost data from regional studies and data provided by Hirschman Water & Environment, LLC (Table 6.2).

## Streambank Restoration BMPs

The cost of streambank restoration practices is shown in Table 6‑3. These estimates are based on natural stream channel restoration practices, to be implemented across residential, urban, and agricultural land.

Total BMP implementation costs are shown in Table 6‑4. In Table 6.5, implementation costs are shown for two stages of implementation. These stages and the associated timeline are explained in greater detail in Chapter 7, Section 7.1.

Table 6‑1 Agricultural BMP costs for the Moores and Mill Creek watersheds.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Land use** | **BMP Name (BMP Cost Share Code)** | **Units** | **Unit cost** | **Moores Creek** | | **Mill Creek** | | **Total** | |
| **Extent** | **Cost** | **Extent** | **Cost** | **Extent** | **Cost** |
| Livestock stream access | Livestock exclusion with tree planting (CRSL-6) | System | $69,800 | 0.6 | $42,997 | 0.8 | $54,724 | 1.4 | $97,722 |
| Livestock exclusion with 35-50 ft buffer (SL-6W) | $69,520 | 7.3 | $507,769 | 9.3 | $646,252 | 16.6 | $1,154,021 |
| Livestock exclusion with 10-25 ft buffer (SL-6N) | $57,560 | 0.6 | $35,459 | 0.8 | $45,130 | 1.4 | $80,589 |
| Livestock exclusion with 10-35 ft buffer (WP-2W, WP-2N) | $20,000 | 0.3 | $5,280 | 0.3 | $6,720 | 0.6 | $12,000 |
| Exclusion fence maintenance (10 yrs ) | Feet | $5.50 | 1,846 | $10,155 | 2,162 | $11,889 | 4,008 | $22,044 |
| Pasture | Grazing land management (SL-10) | Acres | $300 | 364 | $109,212 | 709 | $212,820 | 1,073 | $322,032 |
| Permanent vegetation on critical areas (SL-11) | $2,000 | 4 | $8,845 | 2 | $3,670 | 6 | $12,514 |
| Aforestation of Erodible Pasture (FR-1) | $3,050 | 14 | $42,944 | 16 | $48,025 | 30 | $90,969 |
| Hayland | Forested buffers (FR-3) | Acres | $1,750 | 4 | $7,062 | 155 | $18,337 | 159 | $25,399 |
| Aforestation of hayland (FR-1) | $1,750 | 128 | $223,598 | 165 | $271,008 | 293 | $494,605 |
| Cropland | Continuous no till (SL-15A) | Acres | $100 | 12 | $1,212 | 5 | $529 | 17 | $1,741 |
| Cover crops (SL-8B) | $65 | 29 | $1,899 | 12 | $805 | 42 | $2,705 |
| Convert high till to low till | $75 | 13 | $936 | 5 | $339 | 17 | $1,275 |
| Long-term vegetative cover on cropland (SL-1) | $350 | 12 | $4,240 | 5 | $1,852 | 17 | $6,092 |
| **Total estimated cost** | | | | **$1,001,608** | | **$1,322,098** | | **$2,323,706** | |

Table 6‑2 Urban and residential stormwater BMP costs for the Moores and Mill Creek watersheds.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Land use** | **BMP Name (BMP Cost Share Code)** | **Units** | **Unit cost** | **Moores Creek** | | | | **Mill Creek** | | **Total** | |
| **Extent** | | **Cost** | **Extent** | | **Cost** | **Extent** | **Cost** |
| Urban | Tree planting | Acres | $1,750 | 2 | | $2,845 | 6 | | $10,329 | 8 | $13,174 |
| Bioretention filters (BR) | Ac. treated | $36,000 | 9 | | $316,476 | 32 | | $1,166,717 | 41 | $1,483,193 |
| Bioswales (IF) | $40,000 | 4 | | $140,656 | 20 | | $810,220 | 24 | $950,876 |
| Storm drain insert | Number | $300 | 4 | | $1,200 | 0 | | $0 | 4 | $1,200 |
| Grass channels (VCS) | Ac. treated | $24,380 | 7 | | $171,329 | 36 | | $867,378 | 43 | $1,038,708 |
| Barren | Grass channels (VCS) | Ac. treated | $24,380 | 2 | | $45,225 | 2 | | $49,345 | 4 | $94,570 |
| Turfgrass | Forested buffer | Acres | $1,750 | 6 | | $9,804 | 4 | | $7,642 | 10 | $17,446 |
| Tree planting | $1,750 | 35 | | $60,938 | 58 | | $100,799 | 92 | $161,737 |
| Rain gardens (RG) | Acres | $25,000 | 11 | | $267,860 | 14 | | $351,215 | 25 | $619,075 |
| Bioretention filters (BR) | $30,000 | 5 | | $160,716 | 7 | | $210,729 | 12 | $371,445 |
| **Total estimated cost** | | | | | **$1,177,049** | | | **$3,574,374** | | **$4,751,424** | |

Table 6‑3 Streambank restoration BMP costs for the Moores and Mill Creek watersheds.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **BMP Name (BMP Cost Share Code)** | **Units** | **Unit cost** | **Moores Creek** | | **Mill Creek** | | **Total** | |
| **Extent** | **Cost** | **Extent** | **Cost** | **Extent** | **Cost** |
| Streambank restoration (WP-2A) | linear ft | $250 | 2,191 | $547,702 | 4,716 | $1,178,967 | 6,907 | $1,726,670 |

Table 6‑4 Total BMP costs for the Moores and Mill Creek watersheds.

|  |  |  |  |
| --- | --- | --- | --- |
| **BMP type** | **Moores Creek** | **Mill Creek** | **Total** |
| Agricultural | $1,001,608 | $1,322,098 | $2,323,706 |
| Urban Stormwater | $1,177,049 | $3,574,374 | $4,751,424 |
| Streambank restoration | $547,702 | $1,178,967 | $1,726,670 |
| **TOTAL** | **$2,726,360** | **$6,075,440** | **$8,801,799** |

Table 6‑5 Staged BMP implementation costs for the Moores and Mill Creek watersheds.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **BMP Type** | Stage 1 Cost | | | Stage 2 Cost | | | **Total by BMP type** |
| Moores | Mill | Stage 1 Total | Moores | Mill | Stage 2 Total |
| Agricultural | $300,482 | $396,629 | $697,112 | $701,126 | $925,469 | $1,626,594 | $2,323,706 |
| Urban | $313,776 | $1,072,312 | $1,386,088 | $823,095 | $2,502,062 | $3,325,157 | $4,711,245 |
| Streambank restoration | $164,311 | $353,690 | $518,001 | $383,392 | $825,277 | $1,208,669 | $1,726,670 |
| Total by watershed | $778,569 | $1,822,632 | $2,601,201 | $1,907,612 | $4,252,808 | $6,160,420 | $8,761,620 |

## Technical Assistance

Technical assistance costs were estimated for one half time position for Stages 1 and 2 (years 1­10) of the project using a cost of $35,000/position per year. These figures are based on the existing staffing costs included in the Virginia Department of Environmental Quality’s grant agreements for similar implementation projects in the region. 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 $350,000. When factored into the cost estimate for BMP implementation shown in Table 6‑4, this would make the total cost of implementation approximately $9.15M.

## Benefit Analysis

The primary benefit of implementing this plan will be restoration of aquatic life in Moores and Mill Creeks. Specifically, sediment pollution in the creeks will be reduced to a level at which the creeks can support a healthy and diverse pollution of aquatic life. The cost effectiveness of all best management practices included in the plan was reviewed in order to estimate the relative water quality benefit per dollar invested in each practice. The overall sediment reduction associated with implementation of each BMP was divided by the total estimated cost of that practice. BMPs were then ranked based on their overall cost effectiveness and overall benefit (Table 6‑6). This information will prove helpful during the early stages of implementation when partners will be focusing on implementation of the most cost-effective practices first.

An important objective of the implementation plan is to foster continued economic vitality. This objective is based on the recognition that healthy waters improve economic opportunities for Virginians and a healthy economic base provides the resources and funding necessary to pursue restoration and enhancement activities. The agricultural and residential practices recommended in this document will provide economic benefits to the community, as well as the expected environmental benefits. Specifically, alternative (clean) water sources, exclusion of cattle from streams, improved pasture management, and improved residential and urban stormwater management 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.

Table 6‑6 BMP cost effectiveness rankings for Moores and Mill Creeks

| **Land use** | **BMP Name (BMP Cost Share Code)** | **Units** | **Unit cost** | **Average cost/lb sediment** | **Efficiency ranking** |
| --- | --- | --- | --- | --- | --- |
| Livestock stream access | Livestock exclusion with tree planting (CRSL-6) | System | $69,801 | $8.75 | 11 |
| Livestock exclusion with 35-50 ft buffer (SL-6W) | $69,519 | $8.66 | 12 |
| Livestock exclusion with 10-25 ft buffer (SL-6N) | $57,563 | $27.26 | 9 |
| Livestock exclusion with 10-35 ft buffer (WP-2W, WP-2N) | $20,000 | $4.06 | 16 |
| Pasture | Grazing land management (SL-10) | Acres | $300 | $1.30 | 20 |
| Permanent vegetation on critical areas (SL-11) | $2,000 | $1.37 | 19 |
| Aforestation of Erodible Pasture (FR-1) | $3,050 | $7.52 | 13 |
| Hayland | Forested buffers (FR-3) | Acres | $1,750 | $7.42 | 14 |
| Aforestation of hayland (FR-1) | $1,750 | $32.41 | 8 |
| Cropland | Continuous no till (SL-15A) | Acres | $100 | $0.13 | 23 |
| Cover crops (SL-8B) | Acres | $65 | $0.27 | 22 |
| Convert high till to low till | Acres | $75 | $0.02 | 24 |
| Long-term vegetative cover on cropland (SL-1) | Acres | $350 | $0.41 | 21 |
| Urban & Residential stormwater | Rain gardens (RG) | Ac treated | $25,000 | $960.26 | 1 |
| Bioretention filters (BR) | Ac treated | $30,000 | $576.15 | 2 |
| Bioretention filters (BR) | Ac treated | $36,000 | $107.71 | 4 |
| Riparian Buffers | Acres | $1,750 | $5.49 | 15 |
| Turf to trees (residential) | Acres | $1,750 | $43.25 | 7 |
| Turf to trees (urban) | Acres | $1,750 | $18.66 | 10 |
| Bioswales (IF) | Ac treated | $40,000 | $77.78 | 5 |
| Storm drain insert | Ac treated | $300 | $1.69 | 18 |
| Grass channels (VSC) | Ac treated | $24,380 | $3.92 | 17 |
| Grass channels (VSC) | Ac treated | $24,380 | $66.48 | 6 |
| Streambank erosion | Streambank restoration (WP-2A) | Linear ft | $250 | $284.37 | 3 |

### Agricultural Practices

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

Restricting livestock access to streams and providing them with clean water source has been shown to improve weight gain and milk production in cattle (Zeckoski et al., 2007). Studies have shown that increasing livestock consumption of clean water can lead to increased milk and butterfat production and increased weight gain (Landefeld et al, 2002). Table 6‑6shows 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. 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). In addition, horses drinking from marshy areas or areas where wildlife or cattle carrying Leptospirosis have access tend to have an increased incidence of moonblindness associated with Leptospirosis infections (VCE, 1998b). A clean water source can prevent illnesses that reduce production and incur the added expense of avoidable veterinary bills.

Table 6‑7 Example of increased revenue due to installing off-stream waterers (Surber et al., 2005)

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

In addition to reducing the likelihood of animals contracting waterborne illnesses by providing a clean water supply, streamside fencing excludes livestock from wet, swampy environments as are often found next to streams where cattle have regular access. Keeping cattle in clean, dry areas has been shown to reduce the occurrence of mastitis and foot rot. The VCE (1998a) reports that mastitis costs producers $100 per cow in reduced quantity and quality of milk produced. On a larger scale, mastitis costs the U.S. dairy industry about $1.7 billion to 2 billion annually or 11% of total U.S. milk production. While the spread of mastitis through a dairy herd can be reduced through proper sanitation of milking equipment, mastitis-causing bacteria can be harbored and spread in the environment where cattle have access to wet and dirty areas. Installation of streamside fencing, and well managed loafing areas will reduce the amount of time that cattle have access to these areas.

Taking the opportunity to implement a rotational grazing 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.

### Urban Stormwater

The primary benefits of 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 0-5% of the market value of a home (Braden and Johnston, 2004). In addition, urban BMPs have a number of economic benefits to localities. Increased retention of stormwater on site can lower peak discharges, thereby reducing the drainage infrastructure needed to prevent flooding. This can result in cost savings to local governments through reduced engineering and land acquisition costs, and reduced materials and installation costs for stormwater culverts and streambank armoring to prevent scour. Lastly, implementation of urban BMPs greatly reduces soil erosion and sediment transport to our rivers, streams, and lakes. A 1993 study of the economic cost of erosion-related pollution showed that national off-site damages from urban sediment sources cost between $192 million and $2.2 billion per year in 1990-dollar values (Paterson et al, 1993). This cost range would be far greater today if adjusted for inflation.

### Watershed Health and Associated Benefits

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

# MEASUREABLE GOALS AND MILESTONES

Given the scope of work involved with implementing this TMDL, full implementation and de-listing from the Virginia Section 305(b)/303(d) list could be expected within 10 years provided that full funding for technical assistance and BMP cost share were available. Described in this section are a timeline for implementation, water quality and implementation goals and milestones, and strategies for targeting of best management practices.

## Milestone Identification

The end goals of implementation are restored water quality of the impaired waters and subsequent de-listing of the waters from the Commonwealth of Virginia's Section 305(b)/303(d) list within 10 years. Progress toward end goals will be assessed during implementation through tracking of best management practices through the Virginia Agricultural 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 TMDLs 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. Implementation has been divided up into two stages: 2024-2028 and 2029-2033. Table 7‑1 - Table 7‑4 show implementation and water quality improvement goals for sediment loads for each watershed in each implementation stage.

Table 7‑1 Staged BMP implementation goals for Moores Creek.

| **Land use** | **BMP Name (BMP Cost Share Code)** | **Units** | **Extent** | |
| --- | --- | --- | --- | --- |
| **Stage 1** | **Stage 2** |
| Pasture | Livestock exclusion with tree planting (CRSL-6) | Feet | 388 | 905 |
| Livestock exclusion with 35-50 ft buffer (SL-6W) | 4,598 | 10,728 |
| Livestock exclusion with 10-25 ft buffer (SL-6N) | 388 | 905 |
| Livestock exclusion with 35 ft buffer (WP-2) | 166 | 388 |
| Exclusion fence maintenance (10 yrs ) | 554 | 1,292 |
| Grazing land management (SL-10) | Acres | 109 | 255 |
| Permanent vegetation on critical areas (SL-11) | 1.3 | 3.1 |
| Aforestation of erodible pasture (FR-1) | 4.2 | 9.9 |
| Cropland | Continuous no till (SL-15A) |  | 3.6 | 8.5 |
| Cover crops (SL-8B) | 8.8 | 20.5 |
| Convert high till to low till | 3.7 | 8.7 |
| Long-term vegetative cover on cropland (SL-1) | 3.6 | 8.5 |
| Hayland | Forest buffer (FR-3) | Acres | 1 | 3 |
| Aforestation of hayland (FR-1) | 38 | 89 |
| Urban/Residential stormwater | Rain gardens (RG) | Ac treated | 1.6 | 4.9 |
| Bioretention filters (BR) | 1.6 | 4.9 |
| Bioretention filters (BR) | 0.5 | 1.2 |
| Riparian Buffers | Acres | 1.7 | 3.9 |
| Turf to trees (residential) | 10.5 | 24.4 |
| Turf to trees (urban) | 0.5 | 1.1 |
| Bioswales (IF) | Ac treated | 0.5 | 1.2 |
| Storm drain insert | 4.0 | 0.0 |
| Grass channels (barren) | 0.6 | 1.3 |
| Grass channels (urban) | 1.8 | 4.1 |
| Streambank erosion | Streambank restoration (WP-2A)\* | Linear ft | 657 | 1,534 |
| ***Estimated annual sediment load (lb/yr) upon completion*** | | | ***1,437,437*** | ***1,255,474*** |
| ***Total sediment reduction (%)*** | | | ***5.3%*** | ***17.3%*** |

Table 7‑2 Percent of land use receiving BMP by stage in Moores Creek.

| **Land use** | **BMP Name (BMP Cost Share Code)** | **Units** | **% Land Use** | |
| --- | --- | --- | --- | --- |
| **Stage 1** | **Stage 2** |
| Pasture | Livestock exclusion with tree planting (CRSL-6) | Feet | 0.8% | 2.0% |
| Livestock exclusion with 35-50 ft buffer (SL-6W) | 10.0% | 23.2% |
| Livestock exclusion with 10-25 ft buffer (SL-6N) | 0.8% | 2.0% |
| Livestock exclusion with 35 ft buffer (WP-2) | 0.4% | 0.8% |
| Exclusion fence maintenance (10 yrs ) | 10.0% | 10.0% |
| Grazing land management (SL-10) | Acres | 11.9% | 27.7% |
| Permanent vegetation on critical areas (SL-11) | 0.1% | 0.3% |
| Aforestation of erodible pasture (FR-1) | 0.5% | 1.1% |
| Cropland | Continuous no till (SL-15A) |  | 1.5% | 3.5% |
| Cover crops (SL-8B) | 3.6% | 8.5% |
| Convert high till to low till | 1.5% | 3.6% |
| Long-term vegetative cover on cropland (SL-1) | 1.5% | 3.5% |
| Hayland | Forest buffer (FR-3) | Acres | 0.1% | 0.3% |
| Aforestation of hayland (FR-1) | 4.5% | 10.5% |
| Urban/Residential stormwater | Rain gardens (RG) | Ac treated | 0.3% | 0.7% |
| Bioretention filters (BR) | 0.3% | 0.7% |
| Bioretention filters (BR) | 0.3% | 0.7% |
| Riparian Buffers | Acres | 0.3% | 0.7% |
| Turf to trees (residential) | 2.0% | 4.6% |
| Turf to trees (urban) | 0.2% | 0.6% |
| Bioswales (IF) | Ac treated | 0.3% | 0.7% |
| Storm drain insert | 2.0% | 0.0% |
| Grass channels (barren) | 3.8% | 8.8% |
| Grass channels (urban) | 0.9% | 2.1% |
| Streambank erosion | Streambank restoration (WP-2A)\* | Linear ft | 9.0% | 21.0% |

*\* % land use treated only includes the length of eroding streambank, total excludes stable banks*

Table 7‑3 Staged implementation goals for Mill Creek.

| **Land use** | **BMP Name (BMP Cost Share Code)** | **Units** | **Extent** | |
| --- | --- | --- | --- | --- |
| **Stage 1** | **Stage 2** |
| Pasture | Livestock exclusion with tree planting (CRSL-6) | Feet | 454 | 1,059 |
| Livestock exclusion with 35-50 ft buffer (SL-6W) | 5,383 | 12,559 |
| Livestock exclusion with 10-25 ft buffer (SL-6N) | 454 | 1,059 |
| Livestock exclusion with 35 ft buffer (WP-2) | 195 | 454 |
| Exclusion fence maintenance (10 yrs ) | 649 | 1,513 |
| Grazing land management (SL-10) | Acres | 213 | 497 |
| Permanent vegetation on critical areas (SL-11) | 0.6 | 1.3 |
| Aforestation of erodible pasture (FR-1) | 4.7 | 11.0 |
| Cropland | Continuous no till (SL-15A) |  | 1.6 | 3.7 |
| Cover crops (SL-8B) | 3.7 | 8.7 |
| Convert high till to low till | 1.4 | 3.2 |
| Long-term vegetative cover on cropland (SL-1) | 1.6 | 3.7 |
| Hayland | Forest buffer (FR-3) | Acres | 3 | 7 |
| Aforestation of hayland (FR-1) | 46 | 108 |
| Urban/Residential stormwater | Rain gardens (RG) | Ac treated | 2.1 | 4.9 |
| Bioretention filters (BR) | 2.1 | 4.9 |
| Bioretention filters (BR) | 8.5 | 19.9 |
| Riparian Buffers | Acres | 1.3 | 3.1 |
| Turf to trees (residential) | 17.3 | 40.3 |
| Turf to trees (urban) | 1.8 | 4.1 |
| Bioswales (IF) | Ac treated | 6.1 | 14.2 |
| Storm drain insert | 0.0 | 0.0 |
| Grass channels (barren) | 0.6 | 1.4 |
| Grass channels (urban) | 10.7 | 24.9 |
| Streambank erosion | Streambank restoration (WP-2A)\* | Linear ft | 1,415 | 3,301 |
| ***Estimated annual sediment load (lb/yr) upon completion*** | | | ***1,847,406*** | ***1,597,976*** |
| ***Total sediment reduction (%)*** | | | ***5.5%*** | ***18.3%*** |

Table 7‑4 Percent of land use receiving BMP by stage in Mill Creek.

| **Land use** | **BMP Name (BMP Cost Share Code)** | **Units** | **% Land Use** | |
| --- | --- | --- | --- | --- |
| **Stage 1** | **Stage 2** |
| Pasture | Livestock exclusion with tree planting (CRSL-6) | Feet | 0.8% | 2.0% |
| Livestock exclusion with 35-50 ft buffer (SL-6W) | 10.0% | 23.2% |
| Livestock exclusion with 10-25 ft buffer (SL-6N) | 0.8% | 2.0% |
| Livestock exclusion with 35 ft buffer (WP-2) | 0.4% | 0.8% |
| Exclusion fence maintenance (10 yrs ) | 10.0% | 10.0% |
| Grazing land management (SL-10) | Acres | 18.4% | 42.8% |
| Permanent vegetation on critical areas (SL-11) | 0.0% | 0.1% |
| Aforestation of erodible pasture (FR-1) | 0.4% | 1.0% |
| Cropland | Continuous no till (SL-15A) |  | 1.5% | 3.5% |
| Cover crops (SL-8B) | 3.5% | 8.2% |
| Convert high till to low till | 1.3% | 3.0% |
| Long-term vegetative cover on cropland (SL-1) | 1.5% | 3.5% |
| Hayland | Forest buffer (FR-3) | Acres | 0.3% | 0.7% |
| Aforestation of hayland (FR-1) | 4.5% | 10.5% |
| Urban/Residential stormwater | Rain gardens (RG) | Ac treated | 0.3% | 0.7% |
| Bioretention filters (BR) | 0.3% | 0.7% |
| Bioretention filters (BR) | 1.9% | 4.4% |
| Riparian Buffers | Acres | 0.2% | 0.4% |
| Turf to trees (residential) | 2.5% | 5.7% |
| Turf to trees (urban) | 0.4% | 0.9% |
| Bioswales (IF) | Ac treated | 1.3% | 3.1% |
| Storm drain insert | 0.0% | 0.0% |
| Grass channels (barren) | 6.9% | 16.1% |
| Grass channels (urban) | 2.4% | 5.5% |
| Streambank erosion | Streambank restoration (WP-2A)\* | Linear ft | 9.0% | 21.0% |

*\* % land use treated only includes the length of eroding streambank, total excludes stable banks*

## Water Quality Monitoring

### DEQ Monitoring

Improvements in water quality will be evaluated through biological monitoring conducted at DEQ monitoring stations located in the watersheds as shown below in Figure 7‑1. Descriptions of these stations are provided in Table 7‑5. The map shows stations that are part of DEQ’s Biological Monitoring Program and are co-located with ambient monitoring stations as well. Biological monitoring is conducted in the spring and fall and takes place on a rotating basis within a six-year assessment cycle. Monitoring will begin no sooner than the second odd numbered calendar year following the initiation of implementation. Beginning monitoring after 2 to 3 years of BMP 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 spring and fall for two years. After two years of bi-annual 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 do not show signs of improvement within this two-year period, monitoring will be discontinued for two years. Bi­-annual 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.

### Citizen Monitoring

Citizen monitoring is another valuable tool for assessing water quality. Citizen monitoring can supplement DEQ monitoring, identify priority areas for implementation, and detect improvements in water quality following implementation. Maury River Monitors is an active citizen monitoring group that conducts biological monitoring throughout the Maury River watershed. This group could work collaboratively with DEQ to supplement existing monitoring efforts and determine whether improvements to stream health are underway. DEQ offers information on Citizen Water Quality Monitoring at:

<https://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityMonitoring/CitizenMonitoring.aspx>.

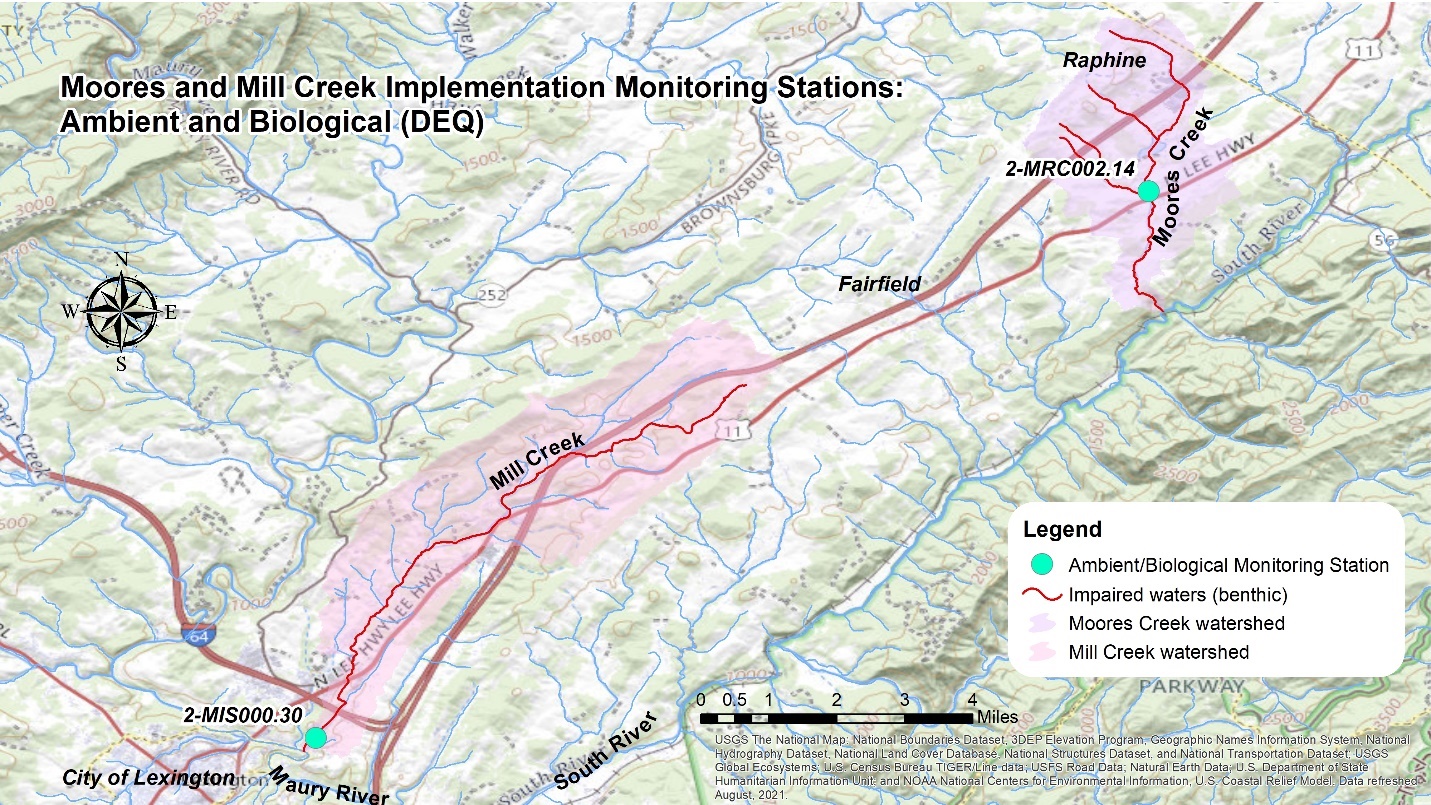


Figure 7‑1 DEQ biological and ambientimplementation monitoring stations.

Table 7‑5 DEQ station location descriptions

|  |  |  |
| --- | --- | --- |
| **Watershed** | **Station ID** | **Description** |
| Mill Creek | 2-MIS000.30 | Off Route 763 above confluence with Maury River |
| Moores Creek | 2-MRC002.14 | Downstream of Route 794 |

## Prioritizing Implementation Actions

Staged implementation implies the process of prioritizing BMPs to achieve the greatest sediment reduction benefits early in the process. Table 6‑6 shows the cost effectiveness of each practice included in the plan. Focusing on cropland and pasture management practices during the first several years of implementation will result in the greatest reduction in sediment at the lowest cost. Additionally, local stakeholders expressed considerable interest in streambank stabilization practices, recommending that implementation begin in the headwaters of Moores and Mill Creeks. It is expected that streambank stabilization projects would move forward quickly given the interest expressed previously. Prioritizing different BMPs across the stages optimizes the use of limited resources by focusing on the most cost-effective practices and those that present the least obstacles (acceptance by landowners, available cost-share, etc.)

### Prioritizing Agricultural Implementation Actions

Agricultural implementation actions were prioritized spatially based on parcel sizes to ensure optimum utilization of limited technical and financial resources. Subwatersheds with the greatest number of large agricultural parcels were assigned a higher priority for outreach and engagement. Efforts to sign landowners up for conservation programs in these watersheds will have a greater return on the investment of time, resulting in larger projects and greater reductions in sediment (Figure 7‑2).

Map

Description automatically generated

Figure 7‑2 Agricultural BMP implementation prioritization by subwatershed

### Prioritizing Urban/Residential Implementation Actions

Several areas within each watershed were identified as priorities for urban and residential BMP implementation in the watersheds. Priority was given to high visibility properties with the potential for BMP implementation at a larger scale.

#### Moores Creek Urban Implementation Priorities

* ***Pilot Travel Center:*** The travel center was identified as a priority for a series of demonstration projects including storm drain inserts to treat stormwater runoff and stabilization of an outfall and downstream channel below one of the two stormwater basins on the property.
* ***Whites Travel Center:*** This property recently underwent a change in management. Prior to this change, the property was identified as an excellent location for a significant streambank stabilization project on the segment of Moores Creek just below the developed portion of the property. Streambanks are very incised and poorly vegetated on this portion of the stream. Banks should be laid back and revegetated. Additionally, a riparian buffer can be established along this segment of the stream. Outreach should be conducted to the new property owners to gage their interest in restoration efforts.
* ***Willow Lake Subdivision:*** This subdivision was identified as a high visibility property for a riparian buffer demonstration project. A riparian buffer can be established around the lake in cooperation with local groups including the Buffalo Creek Boys School and Rockbridge Conservation. Homeowners could also be encouraged to install rain gardens on their properties for additional stormwater management.

#### Mill Creek UrbanImplementation Priorities

* ***Devils Backbone:*** This property was prioritized for outreach regarding opportunities for stormwater BMP implementation. Stakeholders recommended contacting property owners to discuss opportunities for implementation on the property due to its high level of visibility.
* ***Route 811 Subdivision:*** There are few densely developed areas in the Mill Creek watersheds, which is largely rural. Properties in the subdivision off Route 811 were identified as a potential priority for residential BMP implementation.

## Adaptive Management Strategy

An adaptive management strategy will be utilized in the implementation of this plan to achieve water quality goals. Throughout the course of implementation, the management measures and water quality goals will be assessed, and adjustments of actions will be made as appropriate. The assessment of these measures and goals will be accomplished through monitoring of water quality, as discussed in Section 7.2 of this report, and evaluation of BMP implementation. Both mechanisms are documented in DEQ’s triennial Progress Reports. The Progress Report is developed at the watershed/IP level and includes a summary of the watershed, implementation highlights, and water quality monitoring results. Information in the Progress Report can be used to determine if adaptive management is necessary. If assessments of Stage 1 water quality and implementation milestones show that progress toward achieving the sediment reduction goals is not as expected, the implementation strategy can be adjusted. Stakeholders, such the Natural Bridge SWCD, NRCS, and DEQ will be responsible for making this determination. Stakeholders’ roles are described in Chapter 8.

As new technologies and BMPs become available, these practices will be evaluated for implementation in the watersheds. In addition, as new funding opportunities become available, they will be reviewed and pursued if applicable in the Moores and Mill Creek watersheds.

# 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 and Water Conservation District covers all the project area with respect to administration of the VA Agricultural BMP Cost Share Program. Additional partners will be necessary to address urban/residential implementation needs including Rockbridge County. The following sections in this chapter describe the responsibilities and expectations for the various components of implementation.

## Partner Roles and Responsibilities

### Watershed Landowners

The majority of practices recommended in this plan are related to agriculture since it is a predominant land use in the watersheds. 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 age of a farmer 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. In 2017, 44% of farmers in Rockbridge County were 65 or older. Table 8.1 provides a summary of relevant characteristics of farmers and producers in Rockbridge County in the 2017 Agricultural Census. 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

|  |  |  |
| --- | --- | --- |
| **Characteristic** | **2017** | **% change since 2012** |
| Number of farms | 752 | -10 |
| Land in farms (acres) | 134,789 | -20 |
| Average size of farm (acres) | 179 | -11 |
| **Per farm average**  27,590 | | |
| Farm related income | $10,636 | +79 |
| Total production expenses | $39,409 | +1 |
| Net cash farm income | $7,487 | +234 |
| **Characteristic** | **2017** | |
| % of farms implementing no till | 9 | |
| % of farms with cover crops | 7 | |
| % of farmers identifying farming as their primary occupation | 38 | |
| % of rented land in farms | 55 | |

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.

### Natural Bridge Soil and 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 watersheds that are covered in this plan, meaning that agricultural BMP implementation goals cannot be met without additional resources. SWCD and NRCS staff responsibilities include promoting available funding 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. In addition, the SWCD is prepared to work with landowners to pursue grant opportunities through the VA Conservation Assistance Program (VCAP) to implement stormwater BMPs in the region. Most practices included in this program are eligible for 80% cost share and some practices provide a flat rate incentive payment up to the installation cost. Landowners interested in participating in the program can reach out to the Natural Bridge SWCD to discuss their eligibility for assistance. SWCD staff will conduct a site visit to the property and assist with development of a design plan. The SWCD Board and the VCAP Steering Committee review applications for assistance and make decisions on approval. All practices are required to be maintained for 10 years. Through this program, the SWCD could play an important role in working with Rockbridge County to implement priority stormwater BMPs in the watersheds.

### Rockbridge County

Decisions made by local government staff and elected officials regarding land use and zoning will play an important role in the implementation of this plan. This makes Rockbridge County a key partner in long term implementation efforts. Rockbridge County established the Rockbridge Easement Agreement Program to allow the county to acquire voluntary conservation easements. This program is intended to preserve farm, forestland, and open space, while conserving and protecting water resources and environmentally sensitive lands. Additionally, the county has designated six agricultural forestal districts. This designation protects agricultural and forest land from development. Local government support of land conservation will become increasingly important as greater numbers of conservation measures are implemented across the watersheds. Rockbridge County will also serve as a key partner in urban/residential stormwater BMP outreach and implementation.

### Virginia Department of Environmental Quality

The Virginia Department of Environmental Quality (DEQ) has a lead role in the development of implementation plans to address non-point source pollutants such as sediment from agricultural operations and urban/residential stormwater that contribute to water quality impairments. DEQ provides available grant funding and technical support for the implementation of NPS (non-point source) components of implementation plans. DEQ will work closely with project partners including the Natural Bridge Soil and Water Conservation District to track implementation progress for best management practices. In addition, DEQ will work with interested partners on grant proposals to generate funds for projects included in the implementation plan. When needed, DEQ will facilitate additional meetings of the steering committee to discuss implementation progress and make necessary adjustments to the implementation plan.

DEQ is also responsible for monitoring state waters to determine compliance with water quality standards. DEQ will continue monitoring water quality in Moores and Mill Creeks to assess water quality and determine when restoration has been achieved and the streams can be removed from Virginia’s impaired waters list.

### Virginia Department of Conservation and Recreation

The Virginia Department of Conservation and Recreation (DCR) administers the Virginia Agricultural Cost Share Program, working closely with Soil and Water Conservation Districts to provide cost share and operating grants needed to deliver this program at the local level. DCR works with the SWCDs to track BMP implementation as well. In addition, DCR 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.

### 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:

* VA Cooperative Extension
* Chesapeake Bay Foundation
* James River Association
* Maury River Monitors
* Rockbridge Conservation
* Boxerwood Gardens
* Buffalo Creek Boys School
* Valley Conservation Council
* VA Master Naturalists
* VA Master Gardeners
* Local Ruritan and Rotary Clubs
* Central Shenandoah Planning District Commission
* Rockbridge County Farm Bureau
* Native Plant Society
* VA Rural Water Association

## 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.

### Rockbridge County Comprehensive Plan

Rockbridge County has adopted a Comprehensive Plan intended to guide development and natural resource management within its jurisdiction (Rockbridge County, 2016). The plan stresses the importance of the preservation of rural areas and encourage development in development core areas. The Comprehensive Plan lists a series of natural environment goals with supporting objectives and strategies. The plan identifies meeting federal and state water quality standards as one of the County’s objectives. Supporting strategies include the development of a surface and groundwater monitoring program and careful management of new development. The plan also states that building and agricultural activities should not be conducted in the floodplain. Land stabilization measures designed to deter erosion and downstream sediment transport are recommended including establishment of natural vegetation in the floodplain. The County notes that excess sediment is one of the primary pollutants responsible for water quality impairments in the area. The preservation of open space and the protection of valuable natural resources are key objectives of the Comprehensive Plan. Identification and protection of environmentally sensitive areas and sustainable management of potential natural resources are strategies identified to support these objectives. The plan prioritizes agricultural and forestal areas in the land use planning process, stressing the importance of their preservation.

For more information: <https://www.co.rockbridge.va.us/DocumentCenter/View/1301/Rockbridge-Comp-Plan-2016?bidId=>

### Virginia’s Phase III Chesapeake Bay Watershed Implementation Plan

Virginia’s Watershed Implementation Plan (WIP) outlines a series of BMPs, programs and regulations that will be implemented across the state to meet nitrogen, phosphorous, and sediment loading reductions called for in the Chesapeake Bay TMDL, completed in December 2010. In July 2018, the Environmental Protection Agency issued State-Basin Targets for nitrogen and phosphorus in Virginia’s five Chesapeake Bay River basins including the James River. Nutrient reduction goals established for 2025 are ambitious and will require a significant level of BMP implementation. Sustained funding and increased technical capacity are identified as critical needs to accomplish these goals across all source sectors. Multiple state initiatives designed to engage local communities, identify resource gaps, and encourage continued innovation with respect to BMP implementation will be employed to meet 2025 targets. These efforts will support both Chesapeake Bay and local TMDL implementation. Several of the BMPs included in this implementation plan are also found in Virginia’s Phase III WIP. Consequently, Rockbridge County will be able to track and receive credit for progress in meeting Phase III WIP goals while also working towards implementation goals established in this plan to improve local water quality.

For more information about Virginia’s Phase III WIP, please visit:   
<https://www.deq.virginia.gov/our-programs/water/chesapeake-bay/phase-iii-wip>

### Rockbridge County Conservation Easement and Ag Forestal District Programs

In 2003, Rockbridge County established the Rockbridge Easement Agreement Program (REAP) to protect and preserve farm and forest land, historic sites, and water resources. Establishment of this program allows the County to acquire voluntary conservation easements and serve as a co-holder of the easement to preserve land in perpetuity. The REAP utilizes a series of ranking criteria to determine program eligibility. Natural resources are prioritized for easements, and parcels falling within a series of the County’s impaired watershed including Mill Creek are assigned a greater ranking. Higher rankings are also given to riparian parcels. The County reported a total of 94,181 acres of land under easement in their 2016 Comprehensive Plan. In addition to their easement program, the County allows landowners to establish Agricultural and Forestal Overlay Districts, and restrictive agricultural zoning districts. These rural conservation areas are protected from development for a limited period and in return, landowners can take advantage of property tax incentives. In the 2016 Comprehensive Plan, the County reported a total of 6,466 acres within six designated Agricultural/Forestal Districts (Rockbridge County, 2016). The preservation of agricultural land in the watersheds will help to extend the life span of agricultural BMPs installed by landowners, while protection of forest land will provide numerous water quality benefits including the filtration of pollutants from adjacent developed lands.

### Additional Natural Resource Management and Conservation Planning

There are a number of organizations working to implement natural resource management and land conservation plans in the watersheds. The Chesapeake Bay Foundation, the James River Association and the Virginia Department of Forestry are currently collaborating on the James River Buffer Program, which is a grant funded initiative to restore or create forest buffers in the James River watershed. The program covers the full cost of buffer plantings, allows landowners to select native trees and plants based on their preferences, and maintains the buffers for a period of three years after planting. The program was launched in 2019 after the Chesapeake Bay Foundation was awarded a $1.1 million grant from the Virginia Environmental Endowment’s James River Water Quality Improvement Program. The program was very successful due to the flexibility that it offers landowners with respect to tree species options and maintenance support. The coverage area was expanded into the Middle James River watershed in 2020 through another grant from the Virginia Environmental Endowment providing landowner support for buffer plantings through 2024. Virginia Cooperative Extension is working to encourage implementation of rotational grazing through its Graze 300 initiative. The program’s mission is to “enable Virginia farmers to achieve 300 days of livestock grazing by facilitating better pasture management and environmental stewardship.” This educational initiative is designed to improve both farm profitability and water quality by encouraging farmers to shift from feeding hay in the winter months to extended rotational grazing. Whenever possible, efforts should be made to integrate the implementation of these and other conservation-related plans that will impact water quality with this plan for the Moores and Mill Creek watersheds.

## 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 four state agencies responsible for regulating activities that impact water quality in Virginia. These agencies are DEQ, DCR, VDH, and Virginia Department of Agriculture and Consumer Services (VDACS).

DEQ 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 DEQ to develop regulations for the management of poultry waste in operations having more than 200 animal units of poultry (about 20,000 chickens) (ELI, 1999). On January 1, 2008, DEQ assumed regulatory oversight of all land application of treated sewage sludge, commonly referred to as biosolids as a directed by the Virginia General Assembly in 2007. DEQ’s Office of Land Application Programs within the Water Quality Division to manages the biosolids program. The biosolids program includes having and following nutrient management plans for all fields receiving biosolids, unannounced inspections of the land application sites, certification of persons land applying biosolids, and payment of a $7.50 fee per dry ton of biosolids land applied. DEQ holds the responsibility for addressing nonpoint sources (NPS) of pollution as of July 1, 2013.

DCR is responsible for administering the Virginia Agricultural Cost Share and Nutrient Management Programs. Historically, most DCR 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.

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.

## 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 not protective of water quality. 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 §303d. 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.

# FUNDING

A list of potential funding sources available for implementation has been developed. As part of adaptive management, the state recognizes that other funding opportunities may become available. These opportunities will be utilized if appropriate. A brief description of the programs and their requirements is provided in this chapter. Detailed descriptions can be obtained from the SWCD, DEQ, DCR, NRCS, and VCE.

## 9.1 Virginia Nonpoint Source Implementation Program

Virginia’s nonpoint source (NPS) implementation program is administered by DEQ 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 (NPS) best management practices (BMPs) in designated watersheds. The program uses funds from a variety of sources, including EPA 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.

## 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 state 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 DEQ.

## 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 EPA Water Infrastructure Finance and Innovation Act (WIFIA) Funds

The WIFIA program was established by the Water Infrastructure Finance and Innovation Act of 2014. WIFIA provides long-term, low-cost supplemental loans for regionally and nationally significant projects. The funds can be used for development and implementation activities for eligible projects including, but not limited to, wastewater conveyance and treatment, drinking water treatment and distribution, enhanced energy efficiency projects at drinking water and wastewater facilities, acquisition of property if it is integral to the project or will mitigate the environmental impact of a project, and combinations of eligible projects. Loans can be combined with other funding sources including state Revolving Fund loans.

## 9.11 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 National Fish and Wildlife Foundation (nfwf.org). 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.

## 9.12 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, land conservation and riparian buffers.

## 9.13 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 DEQ and the Army Corps of Engineers.

## 9.15 Other Potential Funding Sources

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

* Virginia Outdoors Foundation. For more information: Virginia Outdoors Foundation | Protecting Virginia's Open Spaces (vof.org), accessed 10/13/2021.
* U. S. Fish and Wildlife Service (FWS) Conservation Grant Program. For more information: Financial Assistance | U.S. Fish and Wildlife Service (fws.gov), accessed 10/13/2021.
* USDA Agricultural Conservation Easement Program. For more information: Agricultural Conservation Easement Program | NRCS (usda.gov), accessed 10/13/2021.
* Virginia Environmental Endowment. For more information: Virginia Environmental Endowment (vee.org), accessed 10/13/2021.
* Trout Unlimited. For more information: Trout Unlimited | Home, accessed 10/13/2021.
* Ducks Unlimited. For more information: World Leader in Wetlands & Waterfowl Conservation (ducks.org), accessed 10/13/2021.
* As part of adaptive management, the state recognizes that other funding opportunities may become available. These opportunities will be utilized if appropriate.

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<https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Census_by_State/Virginia/index.php> Accessed: June 21, 2023.

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**Community Engagement Meeting Summaries**

### **Moores and Mill Creek Clean-Up Plan Community Engagement Meeting #1**

Rockbridge County Administration Building, Lexington VA

November 17, 2022

**Attendees**

Bill Sweeney (VDOF) Spencer Suter (Rockbridge County)  
Robert Wagner (Apex) Lewis Straub (Landowner)

Evan Everson (Apex) Becky Szarzynski (Landowner)

Reid Mackey (Landowner) John Pancake (RACC)

Marsha Heatwole Charles Robertson (Landowner)

Tom Stanley (VCE) Sandra Stuart (RACC)

Lee Cummings (NBSWCD) Deborah Woocock

Ray Lewis (Rockbridge Co BOS) Leslie Ayers (Rockbridge Co BOS)

**Meeting Summary**

Nesha McRae (DEQ) began the meeting with introductions and a brief recap of the clean-up study (formally known as a Total Maximum Daily Load, TMDL) that was completed for Moores and Mill Creek in November 2022. Nesha explained that sediment was identified as the primary stressor for the two streams, and that the study identified the reductions in sediment from each stream needed to restore aquatic life. One participant asked if the study identified exactly where the sediment was coming from (did it identify sediment originating from upland pasture versus riparian pasture or from particular properties). Nesha explained how a watershed model is used to simulate the transport of sediment from different land use types in the watersheds. She noted that forests contribute very little sediment to the streams, while sediment from pasture comprises the largest amount of sediment in the streams. Pasture and forest are the predominant land uses in both watersheds, which is why pasture is the largest contributor of sediment. Another participant asked how the sediment reductions identified in the study align with Chesapeake Bay TMDL goals. Nesha explained that this is a separate effort and that DEQ has worked with partners to match up local goals with Chesapeake Bay TMDL goals at their request, but that this is not a requirement.

The group moved on to discuss the role of the stakeholder committee, which is to provide local input on implementation actions and strategies that are best suited for the Moores and Mill Creek watershed community. Nesha explained that the plan will be implemented on a voluntary basis, making local buy in critical to its success. The group discussed potential best management practices to include in the plan, beginning with livestock exclusion fencing. Nesha shared information on a variety of fencing practices offered through state and federal cost share programs with varying setback requirements and financial incentives. Nesha asked the group to assign priority rankings to the different fencing practices. One participant asked who is responsible for maintaining the fence when it is installed on rented land. Tom Stanley explained that this can be a challenge. Ultimately the landowner is responsible for contractual requirements, but they often ask the renter to take care of maintenance since they are typically absentee landowners. Many farmers have 1-year leases on rented land, which be a deterrent to installing fencing since there is no long-term commitment to assistance with maintenance for the property owner. One participant suggested increasing tax incentives for agricultural land placed in riparian buffers. Agricultural land in Rockbridge County does receive land use tax benefits, but these benefits to not differentiate between agricultural land and riparian buffers. Several participants expressed concerns about maintenance of fencing and control of invasive species. The wider the buffer is, the less likely the fence is to wash out and the great the financial incentive is however, a wider buffer is also more work to maintain with respect to control of invasive species. One participant noted that it is difficult to get into a buffer area with a bush hog due to the uneven terrain and space constraints caused by the fence and the creek. The need for greater flexibility was expressed. Temporary fencing was suggested as a good way to keep cows out of the stream most of the time but also allow for easier maintenance of buffer areas. The James River Association has a program targeted at removing invasive species from old CREP buffers, and the Chesapeake Bay Foundation has a program to plant trees in riparian buffers, but there is not a great program out there to maintain new buffers for landowners. Participants noted that all of the red tape associated with state and federal cost share programs for livestock fencing is a major deterrent to participating in these programs. Lee Cummings (NBSWCD) explained that these requirements are in place to ensure the durability of these programs and make sure that taxpayer dollars are being spent appropriately. It was noted that farmers can install these practices on their own if they want greater flexibility. One participant noted that Boxerwood has a carbon offset program in place to support tree planting, this could be a good resource for farmers looking for different programs. Bill Sweeny (DOF) noted that some of the maintenance concerns expressed by participants could be addressed if landowners were more involved in planting plans for their buffers. Participants agreed that the clean-up plan should prioritize practices with minimal maintenance requirements. Nesha asked if landowners would prefer grassed buffers or forested buffers. One participant responded that grass would be preferred since it is easier to maintain. Nesha asked the group about local interest in rotational grazing and installation of off stream water. Participants agreed that rotational grazing works well and that off stream water is key to making it work. Wells can be very expensive to install. An electric line is needed, though solar is another, less dependable, option. One participant noted that it is difficult to get funding for gravity fed systems anymore. Cover crops are another popular practice in the area that should be included in the plan.

Participants were reluctant to assign priorities to practices without input from more farmers in the area. Nesha suggested that she review records of practices installed in the watersheds historically and assign similar ratios to practices included in the plan.

The group moved on to discuss stormwater practices to include in the plan. Nesha suggested identifying a series of high priority practices so that it would be easier to pursue funding for these projects. The Pilot Travel Center in the headwaters of Moores Creek was identified as a priority area for stormwater management in addition to White’s Travel Center, also in the headwaters of Moores Creek. Representatives from Apex noted that one of the two basins at the Pilot Travel Center is under a maintenance agreement with Rockbridge County and looks pretty good. The other stormwater basin dates back to the old Wilco Station and is blasted out. This would be a good area to focus on. A check basin and check dams could be installed at the site. In addition, the small tributary below the basin going into Moores Creek could use some bank stabilization work. Catch basins and curb inlets would be good practices to consider at the truck stop properties. The bags that are installed have an estimated 5-year lifespan and cost around $250-$300 each. Pervious pavement will not withstand tractor trailer traffic. Nesha agreed to reach out to representatives from Apex to arrange a site visit before the next meeting. There are additional opportunities for streambanks stabilization in the lower reaches of the White’s Travel Center property. Since the property is now under next ownership, additional discussions will be required in order to gage interest in pursuing restoration practices. Nesha asked participants for potential areas to target with stormwater practices in the Mill Creek watershed. One participant suggested a residential subdivision in the lower watershed. Several residents in this area are active Master Gardeners and might be interested in implementing stormwater management practices. Nesha asked whether Devils Backbone might be interested. Since the property is now under new ownership by a larger corporation, it may be more challenging to work with the owners.

Nesha discussed next steps with the group. A second stakeholder meeting will be held in early 2023, during which participants will review BMP scenarios and discuss associated costs. Nesha thanked participants for attending and the meeting was adjourned.

**Moores and Mill Creek Clean-Up Plan Community Engagement Meeting #2**

Rockbridge County Administration Building, Lexington VA  
May 31, 2023

**Attendees**

Dave Walsh (Perkins and Orrison)

Spencer Suter (Rockbridge County)

Jonathan Griffin (Rockbridge County)

Lee Cummings (NBSWCD)  
Barbara Walsh (Rockbridge Conservation)

Sandra Stuart (Rockbridge Conservation)

Tom Stanley (VA Cooperative Extension)

Billy Grose (Rockbridge County)  
Ashley Wendt (DEQ)  
Kaitlin King (DEQ)  
Madison Whitehurst (DEQ)

**Meeting Summary**

Nesha McRae (DEQ) began the meeting with a welcome and introductions, followed by a brief recap of the implementation planning process currently underway for the Moores and Mill Creek watersheds. The group moved on to discuss the implementation scenario for best management practices (BMPs) in the watersheds shown in Table 2 of the handout. Nesha explained that the table includes cost effectiveness rankings for each practice so that participants could weigh costs and benefits. Nesha noted that the scenario includes a greater extent of agricultural BMPs when compared to urban and residential practices. This is due in part to the predominance of agricultural land in the watersheds. Additionally, cost effectiveness rankings for cropland and pasture BMPs were highest, while urban stormwater practices were lowest.

The group discussed livestock exclusion practices included in the proposed BMP scenario. Lee Cummings noted that fencing project costs have nearly tripled in the past 10 years. The Natural Bridge Soil and Water Conservation District (NBSWCD) is currently looking at raising their fencing cost share rates by $1/foot (woven wire) in the next program year, bringing the average cost up to $7-$7.20/ft. Lee noted that a fencing project complete with a watering system is currently costing between $60K and $80K, though some projects cost even more. During a recent site visit with a landowner in Moores Creek interested in exclusion, Lee noted that the practice cost was a clear deterrent. While state and federal programs cover much of the cost of exclusion practices, farmers still have to cover the upfront costs, for which they are reimbursed. Nesha noted livestock exclusion practices do not give us a significant sediment reduction credit since we do not currently have a good way to credit the reduction in downcutting of banks that occurs when livestock no longer have access to the stream. Sediment reduction credits for exclusion practices are based on riparian buffer installation and rotational grazing. Nesha noted that if costs are an issue, we could focus more on pasture management practices since these reduce a greater amount of sediment runoff for a lower cost. The group discussed the practice listed as “conversion of poor pasture to fair pasture.” This is not a practice included in the state cost share program, but rather a change in overall pasture management that would be achieved through targeted education and outreach efforts focused on the establishment of a greater degree of vegetative cover through more frequent rotation of livestock between fields, and lower stocking rates. The group discussed whether the Continuous Conservation Initiative Practice could be included in the plan to track voluntary fencing installed as an alternative to higher cost woven wire fencing. Participants did not see a need to include this practice in the plan as voluntary fencing is not common in the area. The group agreed to leave the fencing practices in the plan while moving forward with targeted outreach to encourage improved pasture management.

The Chesapeake Bay Foundation (CBF) has a fantastic riparian buffer program that has been very helpful in getting buffers established in the area. The James River Buffer Program was launched in 2019 for landowners in the Middle James region, then extended to the Upper James region the following year. The program directly pays for all project costs, including design, site preparation, materials, installation, and three years of establishment support. There is no out-of-pocket cost to the landowner. Participants thought that this program would be available for several more years given its widespread success. Farmers have experience far lower mortality with buffer plantings and have been receptive to the option to select their own buffer species (as long as they are native trees). This program should be included as a resource in the plan.

The group discussed cropland management practices included in the proposed BMP implementation scenario. Lee noted that there was a big decline in cover crops this past year, as landowners moved to selling for grain.

A participant asked how agricultural BMPs are marketed to farmers. Lee Cummings responded that he tries to focus on the economic benefits of practices and how it will improve the overall productivity of the farm. It was noted that there is a lot of bureaucracy associated with state and federal cost share programs. Having a basic brochure outlining resources available to farmers that is specific to the Moores and Mill Creek watersheds might be helpful in navigating these programs. Lee noted that farmer to farmer communication is also a very helpful tool. Farmers like to see how practices work on other farms when considering whether to adopt them. Nesha asked participants about other outreach possibilities to promote pasture and cropland management practices. The McCormick Farm (VA Tech) hosts a large field day every other year that focuses on new tools for farmers wishing to explore conservation farming. The NBSWCD hosted a field day a few months ago that was very well attended, so it appears that interest in the area is relatively high. Tom Stanley (VCE) offered to partner with the SWCD on development of a brochure for farmers in the watersheds. He also noted that we need to be aware that the landowner and the farmer may be two different people.

The group discussed urban and residential management practices. The Pilot Travel Center is interested in installing storm drain inserts to treat runoff from their parking lots. Truck stops have large amounts of dust and other pollutants deposited on their lots, making other filtering practices like bioretention filters impossible to maintain. These inserts are reusable and fairly effective. A participant asked if there are any regulatory requirements regarding installation and maintenance of storm drain inserts. This would be a voluntary practice with maintenance integrated into existing stormwater management planning. Nesha noted that a site visit would be helpful in better understanding other stormwater management practices that could be implemented at the site including stabilization downstream of the outlet to one of the two stormwater ponds on the property. Jonathan Griffin agreed to visit the site with Nesha in the next several months. Nesha asked participants about the other truck stop in the Moores Creek watershed, formally known as White’s Travel Center. Participants did not think that the new ownership would be interested in pursuing streambank restoration plans previously developed for the site with Bobby Berkstresser. This site had significant streambank erosion issues downstream of the developed portion of the property. The group discussed the high cost and design needs associated with streambank restoration. In order to address bank erosion issues in the watersheds, it will be important to identify the properties with the worst issues. It is likely that the bulk of the sediment is coming from a handful of highly eroded areas. Louise Finger (Department of Wildlife Resources) has been a great resource for streambank restoration design in the region, but is currently not exploring new projects. Due to the high cost of projects, targeting will be very important. A participant asked about the overall contribution of streambank erosion to the sediment impairments. Nesha noted that pasture and cropland contribute more sediment due to their predominance in the watersheds, but that there may be a few reaches of streambank contributing a large amount of sediment. The group discussed other resources to assist with streambank restoration design work. Trout Unlimited has staff who can assist with design work, but they only work in trout waters. Shenandoah Streamworks may be undergoing a change in management and doing less streambank restoration work in the area these days.

The group discussed opportunities for riparian buffer and turf to trees plantings in the watersheds. Nesha noted that Willow Lake would be a great location for a demonstration project, and suggested collaborating with the Buffalo Creek Boys School on this effort. The school recently purchased a property on Moores Creek just downstream of the lake. Participants noted that the school was struggling with enrollment and may not remain in business much longer. There may still be some opportunities for buffer plantings on their Moores Creek property. Nesha asked participants if they knew anyone who owned a property in the subdivision. Spencer Suter offered to ask around to see if there is a homeowners association for the neighborhood. Nesha asked participants if they thought Devil’s Backbone might be interested in implementing any stormwater management practices on their property. They are already treating runoff from their paved parking lot with a filtering BMP, and participants were unsure of other opportunities to treat stormwater from the site. It would still be worth reaching out to them to see if they have any ideas and if they are interested in participating in the project. Boxerwood could be a good partner in tree planting projects. They are currently in the process of applying for an urban forestry grant from USDA, though the Moores and Mill Creek watersheds are not in their project area. Sandra Stuart noted that the Department of Forestry will be issuing a request for proposals for a tree planting program later this summer. This might be another option for the watersheds.

The group moved on to discussed development of a staged timeline for implementation. Nesha shared a proposed implementation scenario that featured a focus on implementation of the most cost effective practices in the first stage, and the less effective practices in the second with a 70%/30% split in each stage. Participants thought that it would be best to set a target of implementation of 30% of all practices in the first stage in order to allow time to build moment and 70% of practices in the second stage. Nesha asked about an appropriate timeline for implementation. Participants agreed on a ten year timeline split equally between the two stages.

The group moved on to discuss next steps for the project. Nesha explained that she will be working on drafting the plan over the next few weeks. Once complete, it will be circulated to meeting participants who will have two weeks to review and document and provide comments. Participants recommended holding the final public meeting in early September, just not on the Thursday or Friday after Labor Day since this is when the Rockbridge County Fair will be held. One participant suggested reaching out to the Timber Ridge Presbyterian Church, though they usually charge a fee to use their meeting room. The McCormick Farm is another option, though it may be a little warm in early September. The Lexington Presbyterian Church has a nice space for meetings, though they are not located near the two project watersheds. Participants suggested engaging the Rockbridge County Farm Bureau along with the Sam Houston Ruritan Club.

Nesha thanked participants for attending and the meeting was adjourned.