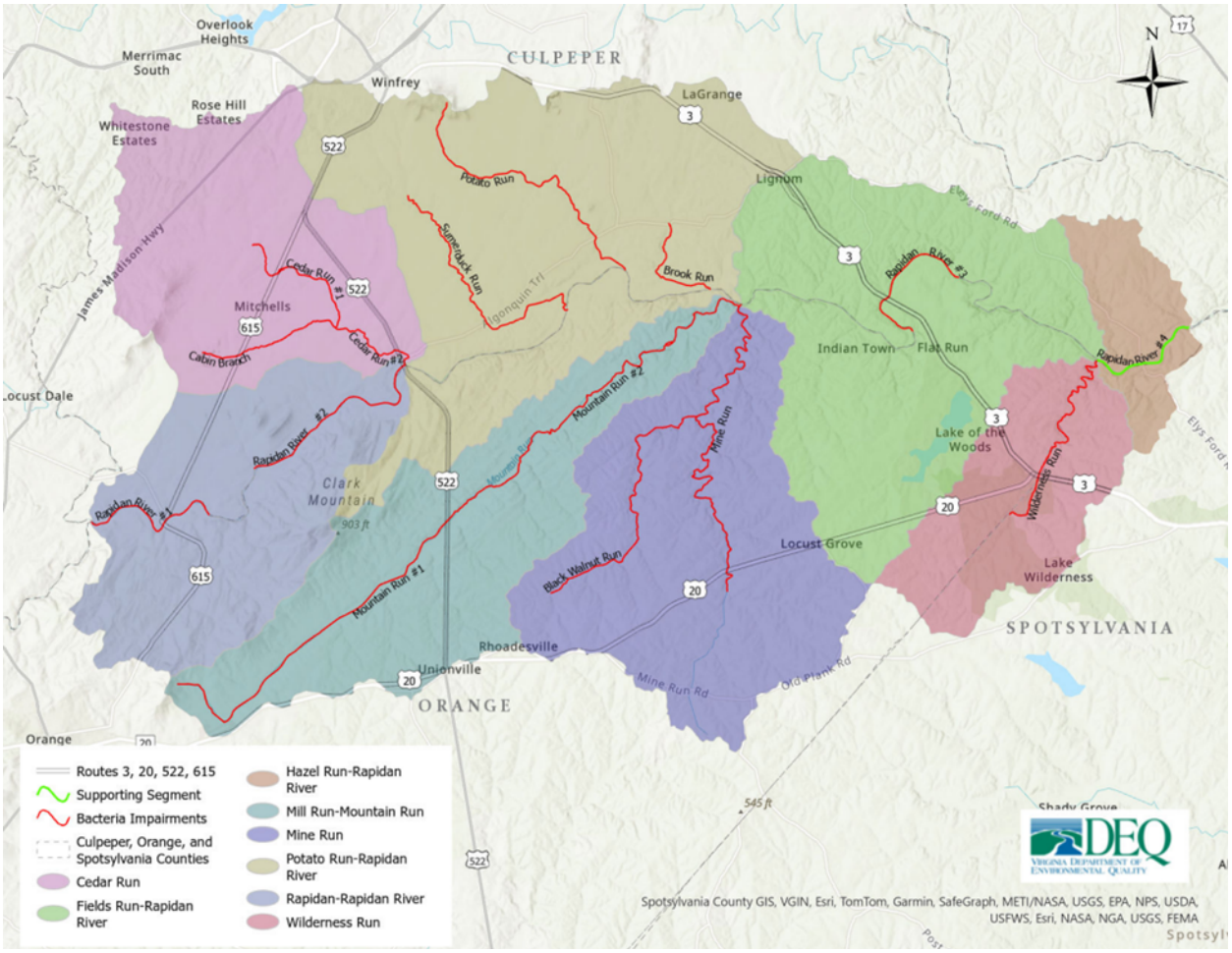
Mine Run, Mountain Run, Cedar Run and the Lower Rapidan River Watershed Implementation Plan



A plan to reduce *E. coli* in the watershed

Technical Document

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Prepared by
Virginia Department of Environmental Quality (DEQ)

In Cooperation with
Local Stakeholders

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TABLE OF CONTENTS

LIST OF ABBREVIATIONS IN THE IMPLEMENTATION PLAN

BMP - Best Management Practice
BDA – Beaver Dam Analogs
CDBG – Community Development Block Grant
CREP - USDA Conservation Reserve Enhancement Program
CRP - USDA Conservation Reserve Program
CSWCD – Culpeper Soil and Water Conservation District
CWA - Clean Water Act
CWSRF - Clean Water State Revolving Fund
DCR - Virginia Department of Conservation and Recreation
DEQ - Virginia Department of Environmental Quality
DD – Direct Deposition
DOF - Virginia Department of Forestry
EPA - United States Environmental Protection Agency
EQIP - USDA Environmental Quality Incentives Program
FTE - Full Time Equivalent
FOR – Friends of the Rappahannock
FSA – Farm Service Agency
GIS - Geographic Information System
GWRC – George Washington Regional Commission
HUC - Hydrologic Unit Code
HSPF – Hydrologic Simulation Program - Fortran
IP - Implementation Plan
LA - Load Allocation
NFWF – National Fish and Wildlife Foundation
NLCD – National Land Cover Database
NPS - Nonpoint Source
NRCS - Natural Resources Conservation Service
PDC - Planning District Commission
PEC – Piedmont Environmental Council
RRRC – Rappahannock-Rapidan Regional Commission
SERCAP – Southeast Rural Community Assistance Project
SWCD - Soil and Water Conservation District
TCC-SWCD – Tri-County City Soil and Water Conservation District
TMDL - Total Maximum Daily Load
UAA – Use Attainability Analysis
USDA - United States Department of Agriculture
USGS - United States Geological Survey
VCAP - Virginia Conservation Assistance Program
VCE - Virginia Cooperative Extension
VDACS – Virginia Department of Agriculture and Consumer Services
VDH – Virginia Department of Health
VLCD Virginia Land Cover Dataset
VPDES - Virginia Pollutant Discharge Elimination System
WBP – Watershed Based Plans
WIP - Watershed Implementation Plan
WLA - Waste Load Allocation
WQIF - Water Quality Improvement Fund
WQMIRA - Virginia Water Quality Monitoring, Information, and Restoration Act

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1 Background

The 1972 Federal Clean Water Act (CWA) requires that streams, rivers, and lakes meet their state's water quality standards. The CWA also requires that states conduct monitoring to identify those waters that do not meet standards. Under the CWA, Virginia has determined that many streams do not meet state water quality standards for the protection of the six designated uses: fish consumption, swimming, shellfishing, aquatic life, wildlife and public water supply.

When streams fail to meet water quality 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" that sets limits on the amount of pollution that a waterbody can tolerate and still maintain water quality standards. In order to develop a TMDL, background concentrations, point source loadings, and non-point source loadings are considered. A TMDL accounts for seasonal variations and must include a margin of safety. Through the TMDL process, states establish water-quality based controls to reduce pollution and meet water quality standards.

Once a TMDL is developed, Virginia's 1997 Water Quality Monitoring, Information and Restoration Act (WQMIRA) requires development of a plan, commonly known as an 'Implementation Plan' (IP), that provides expeditious implantation of TMDLs in order to achieve fully supporting status for impaired waters. An implementation plan describes the pollutant control measures, which can include the use of better treatment technology and the installation of best management practices (BMPs), which need to be implemented in order to meet the water quality goals established in the TMDL.

1.2 Designated Uses and Applicable Water Quality Standards

Water quality standards are designed to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law (§62.1-44.2 et seq. of the Code of Virginia) and the federal Clean Water Act (33 USC §1251 et seq.). Virginia Water Quality Standard 9 VAC 25-260-10 (Designation of uses.) states:

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

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

In order to protect human health during primary contact recreation (e.g., swimming), the Commonwealth of Virginia has set limits on the amount of specific fecal bacteria in all state waters. For example, the bacteria criterion for freshwater in place when the Lower Rapidan River

was listed as impaired in 2002 was based on *Escherichia coli (E. coli)*. For a non-shellfish supporting water body to meet the Virginia *E. coli* bacteria standard for contact recreational use, the following criteria (Virginia Water Quality Standard 9 VAC 25-260-170) applied:

The bacteria criteria for freshwater was that *E. coli* bacteria shall not exceed a geometric mean of 126 colony forming units (cfu)/100 mL, and no single sample value shall exceed 235 cfu/100mL. In both TMDLs, modeling was conducted with a translator developed by DEQ to convert fecal coliform values to *E. coli* values.

In 2019, during the time between the TMDL report and development of this Implementation Plan, the Virginia State Water Control Board adopted EPA's new nationally recommended bacteria criteria. In freshwater, *E. coli* bacteria shall not exceed a geometric mean of 126 counts/100ml and shall not have greater than a 10% excursion frequency of a statistical threshold value (STV) of 410 counts/100 ml, both in an assessment period of up to 90 days. Reductions needed to meet the TMDL will also meet the new standard. During the 2022 integrated report cycle, one additional segment within the Lower Rapidan River watershed was listed as impaired on Virginia's 2022 305(b)/303(d) Water Quality Assessment Integrated Report due to exceedances of the *E. coli* standard: VAN-E16R_CAB01A22, and in Virginia's 2024 Draft 305(b)/303(d) Water Quality Assessment Integrated Report one impairment was delisted, VAN-E18R_RAP03A02. Overall, this Implementation Plan is addressing fourteen impaired segments in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed.

Table 1-1 shows river segments listed as impaired from Virginia's 2002 303(d) Report through Virginia's 2024 Draft 303(d) Report in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watersheds.

Table 1-1. River Segment Impairments between 2002 - 2024 within the IP project area

TMDL Watershed	305(b) Segment ID	Listing Year
Mine Run	VAN-E17R_MIR01A00	2002
Mountain Run	VAN-E17R_MTR01A00	2002
Mountain Run	VAN-E17R_MTR02A02	2006
Cedar Run	VAN-E16R_CED02A04	2006
Black Walnut Run	VAN-E17R_BWR01A06	2006
Rapidan River	VAN-E16R_RAP01A04	2006
Rapidan River[1]	VAN-E18R_RAP03A02	2002

[1] VAN-E18R_RAP03A02 was first listed in the 303(d) list in 2002 for fecal coliform. In 2006, the impairment was translated from fecal coliform to *E.coli* and listed as an E.coli impairment. In 2016, the *E.coli* bacteria parameter was submitted for delist. In 2018, the *E.coli* bacteria parameter was listed in the 303(d) list again. In 2024, the *E.coli* bacteria parameter was submitted for delist.

TMDL Watershed	305(b) Segment ID	Listing Year
Rapidan River	VAN-E16R_RAP03A08	2008
Rapidan River	VAN-E18R_RAP05A08	2008
Wilderness Run	VAN-E18R_WIL01A08	2008
Potato Run	VAN-E17R_POT01A14	2014
Sumerduck Run	VAN-E17R_SUM01A04	2014
Cedar Run[2]	VAN-E16R_CED01A00	2018
Brook Run	VAN-E17R_BRK01A04	2018
Cabin Branch	VAN-E16R_CAB01A22	2022

1.3 Attainability of Designated Uses

All waters in the Commonwealth have been designated as "primary contact" for the swimming use regardless of size, depth, location, water quality or actual use. The 2019 bacteria standard described in Section 1.2 above in this report is to be met during all stream flow levels and was established to protect swimmers from ingestion of potentially harmful bacteria. However, many headwater streams are small and shallow during base flow conditions when surface runoff has minimal influence on stream flow. Even in pools, these shallow streams do not allow full body immersion during periods of base flow. In larger streams, lack of public access often precludes the swimming use.

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

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

In some streams for which TMDLs have been developed, water quality modeling indicates that even after removal of all of the sources of *E. coli* (other than wildlife), the stream will not attain the applicable water quality standards. In such cases, after demonstrating that the source of *E. coli*

[2] In the 2004 and 2006 cycles of the integrated report, this impairment was listed as fecal coliform. In the 2008 cycle, this impairment was translated from fecal coliform to *E.coli* and was listed as *E.coli*.

contamination is natural and uncontrollable by reasonable control measures, Virginia may decide to re-designate the stream's use for secondary contact recreation or to adopt site specific criteria based on natural background levels of *E. coli*. All site-specific criteria or designated use changes must be adopted as amendments to the water quality standards regulations. Watershed stakeholders and EPA will be able to provide comment during this process.

2. REQUIREMENTS FOR IMPLEMENTATION PLANS

There are several requirements and recommendations for IPs. The goal of this chapter is to clearly define what they are and explicitly states if the "elements" are a required component of an acceptable IP or are merely a recommended topic that should be covered in a thorough IP. This chapter discusses a) the requirements outlined by WQMIRA that must be met in order to produce an IP that is approvable by the Commonwealth, b) IP elements recommended by the EPA, and c) components of an IP required under Section 319(h) of the CWA.

2.1 State Requirements

The 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 State Water Control Board 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 outlined in WQMIRA (DEQ, 2017), including:

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

2.2 Federal Recommendations

Section 303(d) of the CWA and current EPA regulations do not require the development of IPs. The EPA does, however, outline the minimum elements needed when implementing a TMDL in its *Guidance for Water Quality-Based Decisions: The TMDL Process* (EPA, 1999):

- 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.

Further recommendations are outlined in the *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* (EPA, 2008). The handbook describes the steps used in the watershed planning and implementation process and integrates EPA's nine elements as described in the following section.

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

2.3 Requirements for CWA Section 319(h) Fund Eligibility

The EPA develops guidelines that describe the process and criteria used to award CWA Section 319(h) nonpoint source grants to States. The guidance is subject to revision and the most recent version should be considered for IP development. The "Nonpoint Source Program and Grant Guidelines for States and Territories" (EPA, 2024) identifies the following nine elements that must be included in the IP in order to qualify for CWA Section 319(h) funds:

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.

While IPs that include EPA's nine elements are not guaranteed CWA Section 319(h) funds, incorporating these elements opens the door to the possibility of receiving CWA Section 319(h) funds which are awarded annually to the State.

3. REVIEW OF TMDL DEVELOPMENT

3.1 Background

This Implementation Plan is based on two TMDLs: 1) *Bacteria TMDLs for Mountain Run and Mine Run Orange County, Virginia* approved by EPA in November 2005 (Virginia DEQ, 2005) and the State Water Control Board (SWCB) in September 2006 and 2) *Bacteria Total Maximum Daily Load Development for the Rapidan River Basin* approved by EPA December 2007 (Virginia DEQ, 2007) and the SWCB in July 2008. Table 3-1 describes the assessment unit and monitoring station details for the impaired segments originally listed in the TMDLs in 2005 and 2007 for *E.coli* impairments in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed.

In the Mountain Run and Mine Run TMDL (Figure 3-1) watershed Mountain Run and Mine Run were first listed as impaired streams in 2002 based on Virginia Department of Environmental Quality monitoring at stations indicating that the swimmable use goal was not being met. Mountain Run flows northeast before emptying into Mine Run. Mine Run drains into the Rapidan River. The Rapidan River joins the Rappahannock River before emptying into the Chesapeake Bay.

In the Rapidan River TMDL (Figure 3-2) watershed the impaired portion of Cedar Run, delineated by DEQ beginning at the confluence of Buck Run and continuing downstream approximately 5.40 miles to the confluence with the Rapidan River, was listed as impaired by fecal coliform on Virginia's 2006 303(d) list due to water quality exceedances of the bacteria standard at water quality monitoring stations 3-CED000.59 and 3-CED003.52. The second impairment, the Rapidan River, was first listed as impaired by *E. coli* bacteria on Virginia's 2002 303(d) list due to water quality exceedances of the bacteria standard at station 3- RAP006.53 at Route 610.

Table 3-1. Impaired *E.coli* Segments Listed in the original TMDLs.

Waterbody Name	County	VAHU6	HUC12	Impaired Assessment Units/ATTAINS ID	Listing Year	Size (miles) [3]	Monitoring Station
Mountain Run	Orange County	RA40	020801031101	VAN-E17R_MTR01A00	2002	10.11	3-MTR003.51
Mine Run	Orange County	RA41	020801031102	VAN-E17R_MIR01A00	2002	10.50	3-MIR004.05
Cedar Run	Culpeper County	RA36	020801031002	VAN-E16R_CED01A00[4]	2006	3.54	3-CED000.59
				VAN-E16R_CED02A04		2.59	3-CED003.52

[3] Mileage listed is the current mileage as of the 2024 Integrated Report draft cycle and may be different than those cited in the original TMDL reports.
[4] Referred to as VAN-E16R-01 in the *Bacteria Total Maximum Daily Load Development for the Rapidan River Basin* TMDL.

Rapidan River	Spotsylvania County	RA44	020801031105	VAN-E18R_RAP03A02[5]	2002	2.59	3-RAP006.53

[5] Referred to as VAN-E18R-01 in the *Bacteria Total Maximum Daily Load Development for the Rapidan River Basin* TMDL

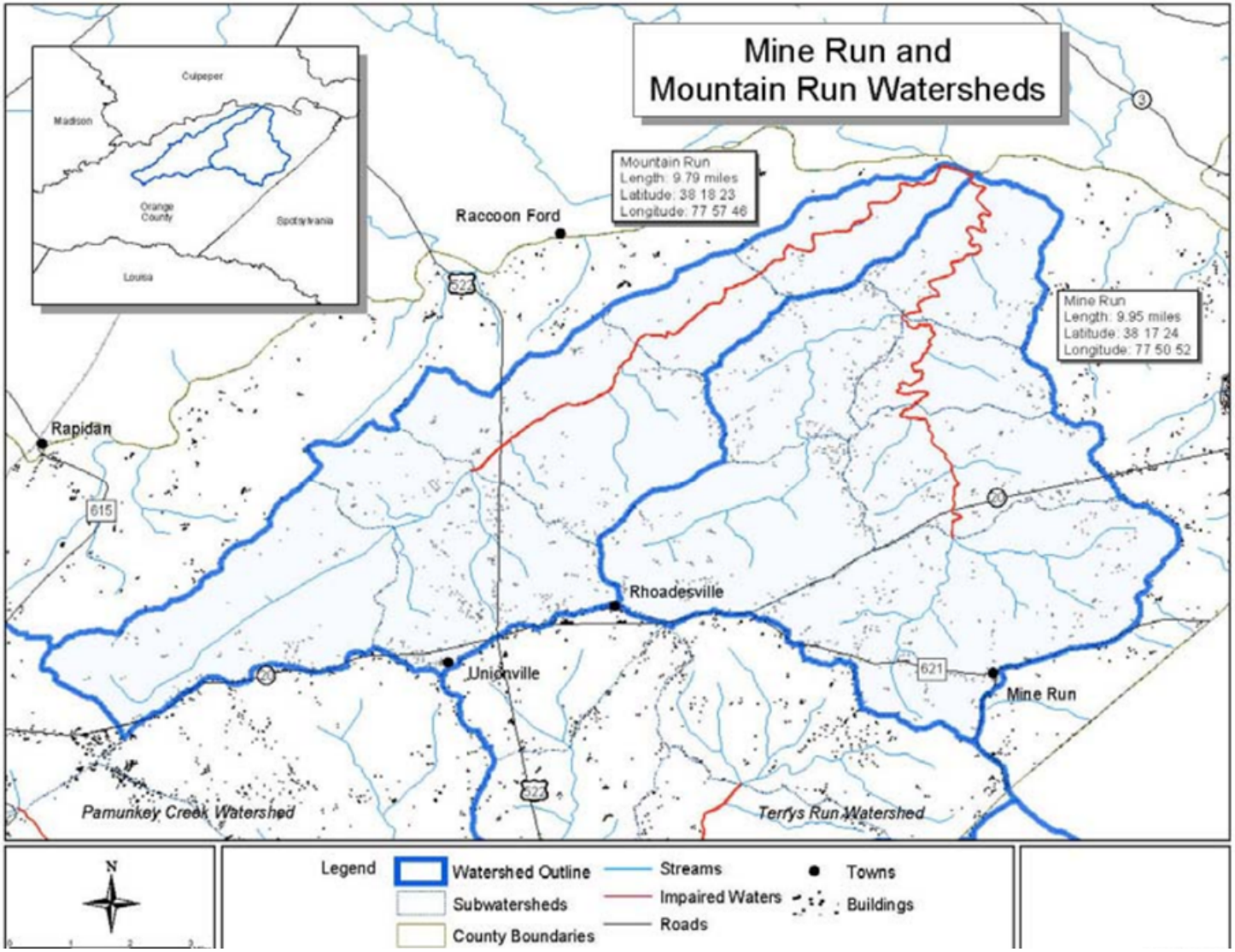

Figure 3-1. Original map with the bacteria impairments from the Bacteria TMDLs for Mountain Run and Mine Run Orange County, Virginia.

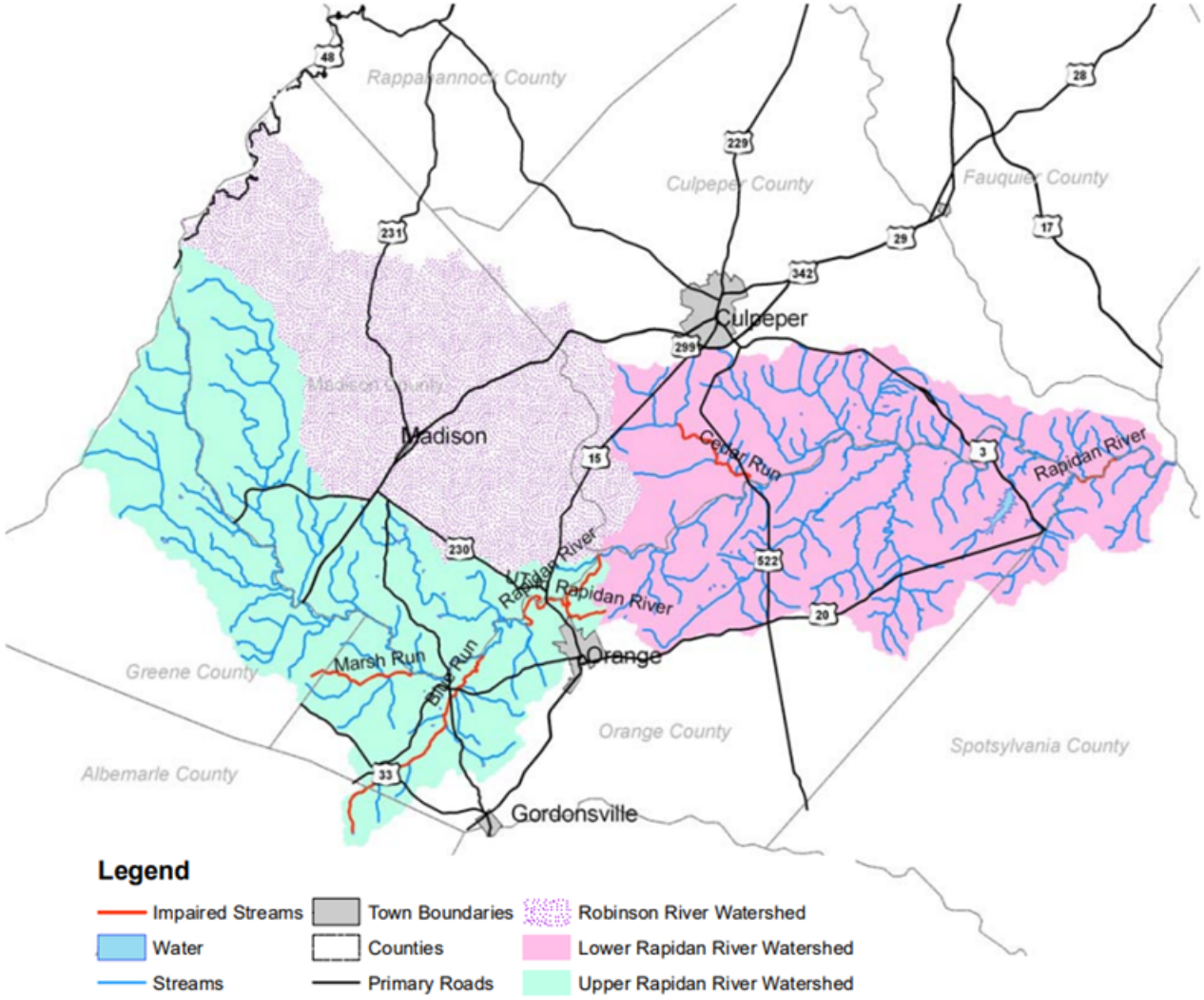

Figure 3-2. Original map with the bacteria impairments from the Bacteria Total Maximum Daily Load Development for the Rapidan River Basin.

The Mountain Run, Mine Run, Cedar Run and the Lower Rapidan River watershed Implementation Plan will only be focusing within the HUCs in the Lower Rapidan River watershed in Figure 3-2 above. The remaining area of the Rappahannock River Basin TMDL, the Robinson River and the Upper Rapidan River watershed in Figure 3-2 were previously addressed under the *Little Dark Run and Robinson River* bacteria IP (EPA accepted in 2011) and the *Upper Rapidan River* bacteria IP (EPA accepted in 2015).

The Mountain Run and Mine Run watershed is located in Orange County, Virginia. Table 3-2 below describes the detailed breakdown of land distribution within the watersheds at the time of TMDL development. The Mine Run watershed is 12,285 acres in size and mainly a forested area with the majority of the remaining watershed comprised of agricultural land.

Mountain Run is mainly an agricultural watershed with less than 45% of the remaining watershed comprised of forested areas with 40% and 15% of the 20,531 acres comprised of pasture and cropland, respectively.

The Mountain Run and Mine Run watersheds at the time of TMDL development contained approximately 1% of land cover as residential and 1% as water/wetland.

Table 3-2. Percentages of land cover per land use type during TMDL development.

Watershed Name	Percentage of land cover per land use type
Mine Run	Forest (64%)
	Pasture/Cropland (35%)
Mountain Run	Forest (43%)
	Pasture/Cropland (55%)

Original bacteria impairments within The Rapidan River TMDL were stream segments: Cedar Run and the Rapidan River shown previously in Table 3-1. Seen in Table 3-3 below, these segments were located in Culpeper County, Virginia and Spotsylvania County, Virginia. During the time of TMDL development land use for Cedar Run consisted of a total of 18,100 acres with the majority of land use categorized as pasture/crop with the remaining land use being forested land. The Rapidan River watershed consisted of a total of 157,000 acres with the majority categorized as forested and the remaining as pasture/cropland. Both watersheds had 1% residential land use and 1% water/wetland.

Table 3-3. Percentages of land cover per land use type during TMDL development.

Watershed Name	Percentage of land cover per land use type
Cedar Run	Forest (43%)
	Pasture/Cropland (55%)

Rapidan River	Forest (62%)
	Pasture/Cropland (36%)

3.2 Water Quality Monitoring Data

Data collected from the monitoring stations in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watersheds were used to list the stream segments as impaired by Fecal Coliform and *E. coli*. Table 3-4 provides a summary of the data collected from these stations during TMDL development. The exceedance rate for stations 3-MTR003.51 and 3-MIR004.05 were determined by the number of samples collected from January 1998 through December 2002. The exceedance rate for stations 3-CED000.59, 3-CED003.52 and 3-RAP006.53 were determined by the number of samples collected from January 2000 through December 2004.

Table 3-4. Water quality monitoring stations in the impaired streams in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed during TMDL development.

Station ID	Stream Name	Number of Samples	Exceedance Rate
3-MTR003.51	Mountain Run	17	36.8% Fecal Coliform Standard
3-MIR004.05	Mine Run	19	23.5% Fecal Coliform Standard
3-CED000.59	Cedar Run	13	15% Fecal Coliform Standard
3-CED003.52	Cedar Run	8	38% Fecal Coliform Standard 100% *E.coli* Standard
3- RAP006.53	Rapidan River	12	58% *E.coli* Standard

3.3 Bacteria Source Assessment

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

3.3.1 Point Sources

A TMDL's waste load allocation accounts for the portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Point sources of *E. coli* bacteria in the watersheds include all municipal and industrial plants that treat human waste, as well as private residences that meet general permits. These point sources are required to maintain an *E. coli* discharge concentration no greater than 126 cfu/100mL. Virginia issues Virginia Pollutant Discharge Elimination System (VPDES) permits for point sources. During TMDL development, there were eight individual permit point sources permitted to discharge bacteria in the watershed and thirty-nine Residential facilities operating under a Domestic Sewage General Permit. Table 3-5 lists the permitted sources, along with the permitted discharges and waste load allocations in the TMDLs. The waste load allocations for the point sources were set at the permitted loads.

Table 3-5. Permitted bacteria point sources discharging in the Mountain Run, Mine Run, Cedar Run and the Lower Rapidan River watershed during the time of TMDL development.

Permit Number	Facility Name	Permit Type	Receiving Stream	*E. coli* Load (cfu/year)
VA0087718	DOC - Coffeewood Correctional Center (Municipal)	Individual Permit	Cabin Branch	3.48E+11
VA0087718	DOC - Coffeewood Correctional Center (Industrial)	Individual Permit	Cabin Branch	0.00E+00
VA0092011	Meadowbrook WWTF	Individual Permit	Meadowbrook Run	3.48E+11
VA0091961	Locust Grove Town Center	Individual Permit	Flat Run, Unnamed Tributary	3.48E+10
VA0083411	Wilderness Wastewater Treatment Plant	Individual Permit	Rapidan River	3.48E+12
VA0081621	Lake Wilderness Public Water Systems	Individual Permit	Grant Lake, Unnamed Tributary	0.00E+00
VA0074381	Camp Rappahannock Waste Water Treatment Plant[6]	Individual Permit	Hazel Run, Unnamed Tributary	4.53E+10
VA0051667	Colonial Pipeline	Individual Permit	Mine Run, Unamed Tributary	0.00E+00
VAG406287	Residence	Domestic Sewage General Permit	Dry Run	1.69E+09
VAG406294	Residence	Domestic Sewage General Permit	Potato Run	1.69E+09
VAG406318	Residence	Domestic Sewage General Permit	Brook Run Unnamed Tributary	1.69E+09
VAG406407	Residence	Domestic Sewage General Permit	Sumerduck Run	1.69E+09
VAG406335	Residence	Domestic Sewage General Permit	Rapidan River Unnamed Tributary	1.69E+09
VAG406336	Residence	Domestic Sewage General Permit	Rapidan River Unnamed Tributary	1.69E+09
VAG406349	Residence	Domestic Sewage General Permit	Dry Run	1.69E+09
VAG406290	Residence	Domestic Sewage General Permit	Potato Run Unnamed Tributary	1.69E+09
VAG406286	Residence	Domestic Sewage General Permit	Dry Run	1.69E+09
VAG406309	Residence	Domestic Sewage General Permit	Sumerduck Run Unnamed Tributary	1.69E+09
VAG406268	Residence	Domestic Sewage General Permit	Potato Creek	1.69E+09
VAG406021	Residence	Domestic Sewage General Permit	Potato Run	1.69E+09
VAG406112	Residence	Domestic Sewage General Permit	Potato Run	1.69E+09

[6] Formerly named Camp Happyland.

Permit Number	Facility Name	Permit Type	Receiving Stream	*E. coli* Load (cfu/year)
VAG406127	Residence	Domestic Sewage General Permit	Potato Run	1.69E+09
VAG406140	Residence	Domestic Sewage General Permit	Potato Run	1.69E+09
VAG406182	Residence	Domestic Sewage General Permit	Potato Run	1.69E+09
VAG406200	Residence	Domestic Sewage General Permit	Potato Run	1.69E+09
VAG406167	Residence	Domestic Sewage General Permit	Potato Run Unnamed Tributary	1.69E+09
VAG406070	Residence	Domestic Sewage General Permit	Potato Run Unnamed Tributary	1.69E+09
VAG406117	Residence	Domestic Sewage General Permit	Potato Run Unnamed Tributary	1.69E+09
VAG406261	Residence	Domestic Sewage General Permit	Potato Run Unnamed Tributary	1.69E+09
VAG406081	Residence	Domestic Sewage General Permit	Sumerduck Run	1.69E+09
VAG406163	Residence	Domestic Sewage General Permit	Sumerduck Run	1.69E+09
VAG406219	Residence	Domestic Sewage General Permit	Sumerduck Run Unnamed Tributary	1.69E+09
VAG406044	Residence	Domestic Sewage General Permit	Wilderness Run	1.69E+09
VAG406382	Residence	Domestic Sewage General Permit	Rapidan River Unnamed Tributary	1.69E+09
VAG406306	Residence	Domestic Sewage General Permit	Rapidan River Unnamed Tributary	1.69E+09
VAG406213	Residence	Domestic Sewage General Permit	Rapidan River Unnamed Tributary	1.69E+09
VAG406266	Residence	Domestic Sewage General Permit	Rapidan River Unnamed Tributary	1.69E+09
VAG406337	Residence	Domestic Sewage General Permit	Cedar Run Unnamed Tributary	1.69E+09
VAG406186	Residence	Domestic Sewage General Permit	Cedar Run Unnamed Tributary	1.69E+09
VAG406214	Residence	Domestic Sewage General Permit	Cedar Run Unnamed Tributary	1.69E+09
VAG406414	Residence	Domestic Sewage General Permit	Cedar Run Unnamed Tributary	1.69E+09
VAG406381	Residence	Domestic Sewage General Permit	Cedar Run Unnamed Tributary	1.69E+09
VAG406362	Residence	Domestic Sewage General Permit	Cedar Run Unnamed Tributary	1.69E+09
VAG406154	Residence	Domestic Sewage General Permit	Cedar Run Unnamed Tributary	1.69E+09
VAG406041	Residence	Domestic Sewage General Permit	Cedar Run	1.69E+09

Permit Number	Facility Name	Permit Type	Receiving Stream	*E. coli* Load (cfu/year)
VAG406305	Residence	Domestic Sewage General Permit	Cabin Branch	1.69E+09
VAG406010	Residence	Domestic Sewage General Permit	Cedar Run	1.69E+09

3.3.2 Nonpoint sources

Nonpoint source pollution originates from sources across the landscape (e.g., agriculture and residential land uses) and is delivered to waterbodies by rainfall and snowmelt. In some cases, a precipitation event is not required to deliver nonpoint source pollution to a stream (e.g., pollution from straight pipes or livestock directly defecating in a stream). Nonpoint sources of bacteria in the watershed include failing septic systems, straight pipes, land application of manures, livestock, wildlife, and domestic pets. During TMDL development, bacteria sources and production rates were estimated based on information from U. S. Census Bureau, Virginia Department of Health (VDH), American Veterinary Medical Association Center for Information Management, USDA National Agricultural Statistics Service, Virginia Cooperative Extension (VCE), Culpeper Soil & Water Conservation District, Virginia Department of Wildlife Resources (DWR), U.S. Fish and Wildlife Service (FWS), public participation, additional published information, and professional judgement.

3.4 TMDL Development

This implementation plan is based on two TMDLs: *Bacteria TMDLs for Mountain Run and Mine Run Orange County, Virginia* and *Bacteria Total Maximum Daily Load Development for the Rapidan River Basin.* Bacteria load reduction estimates for the Mountain Run, Mine Run, Cedar Run and the Lower Rapidan River Watershed were calculated using the USGS Hydrologic Simulation Program – Fortran (HSPF). The HSPF water quality model was used to model fecal coliform transport and fate in the watersheds. The HSPF watershed model simulates pollutant accumulation, die-off, and wash off according to the distribution of land uses, soils, and geographic features in a watershed. HSPF then simulates the routing of water and pollutants through the stream channel network, considering instream processes such as die-off. For the bacteria TMDLs, a source assessment of bacteria was performed for the watershed. Fecal coliform was then simulated as a dissolved pollutant using the HSPF model, and concentrations were translated to *E. coli* concentrations using DEQ's translator equation.

3.5 TMDL Allocation Scenarios

The bacteria TMDLs include the reduction scenarios needed to meet the *E. coli* water quality standard for the impaired segments at the time of TMDL development. The standard during TMDL development consisted of two criteria, zero exceedance of a calendar-month geometric mean bacteria criterion (126 cfu/100 mL for *E. coli*) and also zero exceedance of a single sample maximum assessment criterion (235 cfu/100 mL for *E. coli*). The allocation scenarios selected

during TMDL development are shown in Table 3-6. Table 3-7 lists the overall TMDLs expressed as instream *E. coli* loads at each watershed outlet that were derived from these reduction scenarios. It includes the waste load allocation (WLA) from permitted sources and future growth, the load allocation (LA) which represents the allowable nonpoint sources, and a margin of safety (MOS). The MOS was implicitly incorporated into the TMDL by using conservative analytical assumptions.

Table 3-6. Bacteria reduction scenarios needed to meet the *E. coli* standard at the time of TMDL development.

Watershed	*E. coli* Loading Reductions (%)						
	Straight Pipes	Residential	Livestock DD	Cropland	Pasture	Wildlife DD	Forest
Mountain Run (VAN-E17R-MTR01A00)	100	100	100	99	100	99	0
Mine Run (VAN-E17R-MIR01A00)	100	100	100	99	100	99	0
Cedar Run (VAN-E16R-01)	100	98	100	98	98	0	0
Rapidan River (VAN-E18R-01)	100	96	96	96	96	0	0

Table 3-7. TMDL equation expressed as an average annual load.

Watershed	WLA (cfu/yr)	LA (cfu/yr)	MOS	TMDL (cfu/yr)
Mountain Run (VAN-E17R-MTR01A00)	2.26×10^{11}	2.26×10^{13}	N/A	2.28×10^{13}
Mine Run (VAN-E17R-MIR01A00)	8.97×10^{09}	8.97×10^{11}	N/A	9.06×10^{11}
Cedar Run (VAN-E16R-01)	1.82×10^{12}	8.13×10^{12}	N/A	9.95×10^{12}
Rapidan River (VAN-E18R-01)	1.93×10^{13}	2.18×10^{14}	N/A	2.38×10^{14}

4. CHANGES SINCE TMDL DEVELOPMENT

4.1 Background

The Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed includes portions of Culpeper County, Orange County and Spotsylvania County (Figure 4-1). USGS Hydrologic Unit Codes and National Watershed Boundary Dataset information is discussed in Table 4-2.

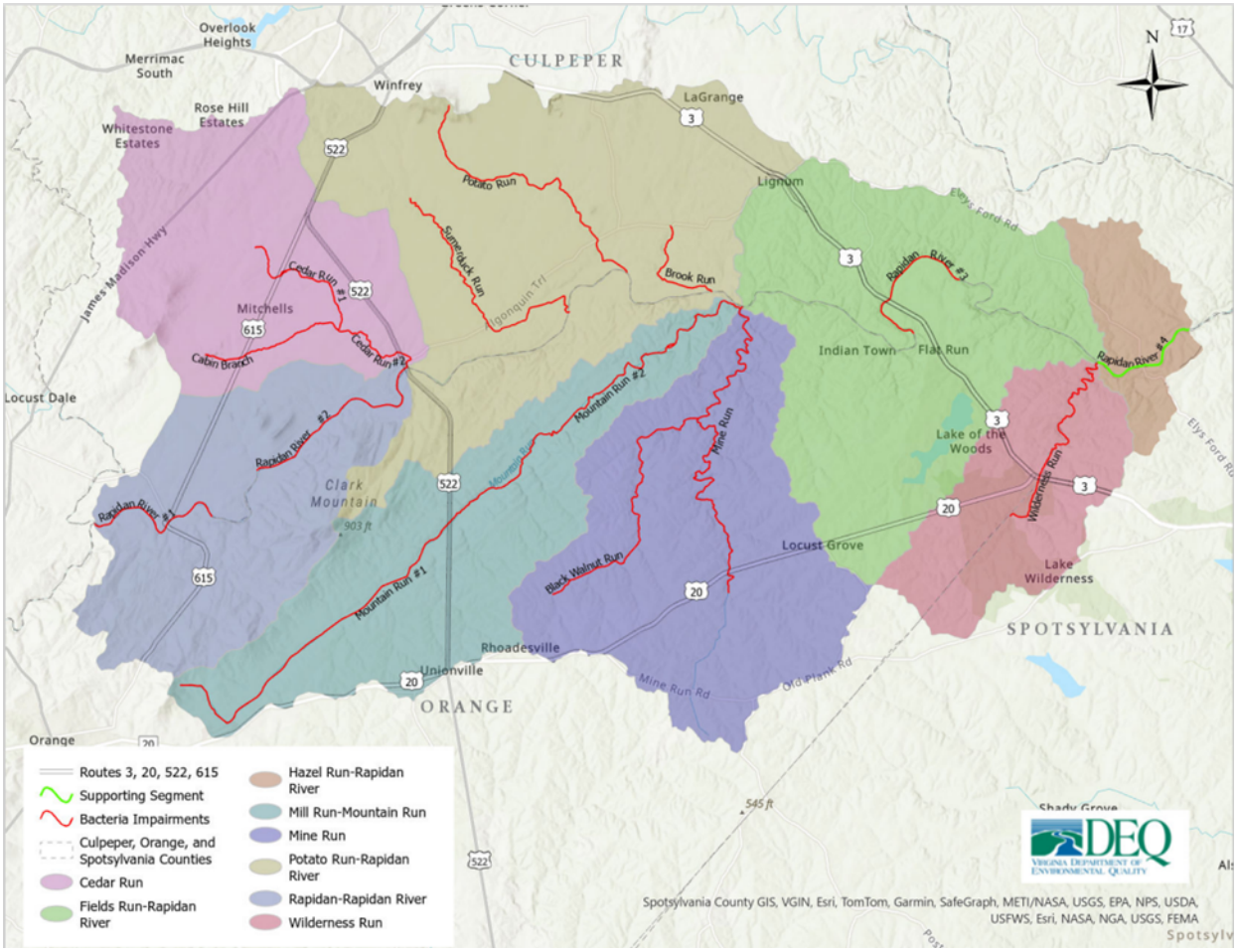

Figure 4-1. The Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed implementation plan boundaries and associated HUC12s and 2024 Integrated Report segments.

The Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed is approximately 153,800 acres in size. As of the National Land Cover Dataset Land Use 2019 data, the watershed is predominantly forested, with the remaining 50% consisting of: open water, developed land, barren land, shrub/scrub, herbaceous, hay/pasture, cultivated crops, woody wetlands, and emergency herbaceous wetlands (Table 4-1, Figure 4-2). The change in land use since the TMDLs were developed has been accounted for during implementation planning.

Table 4-1. Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed IP project area land use data.

Land Use Category	Percentage of Coverage
Open Water	0.8%
Developed Land	8.1%
Barren Land	0.2%
Forest	50.6%
Shrub/Scrub	2.1%
Herbaceous	0.6%
Hay/Pasture	22.8%
Cultivated Crops	9.9%
Woody Wetlands	3.1%
Emergent Herbaceous Wetlands	0.6%

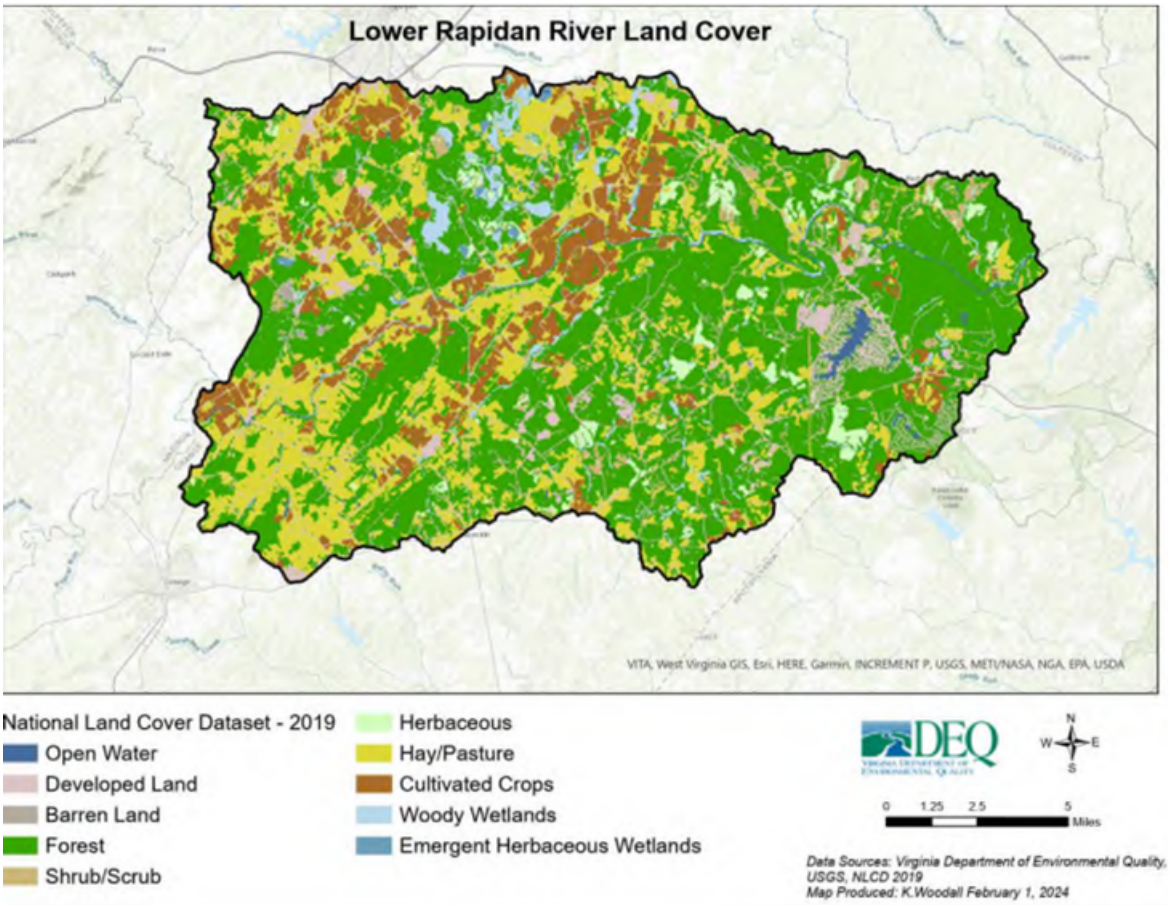

Figure 4-2. National Land Cover Database (NLCD) 2019 land cover data for the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed implementation plan.

4.1.1 Water Quality Standard

In 2019, the Virginia State Water Control Board adopted a new water quality standard for bacteria to protect primary contact recreational uses in surface waters. The criteria outlined in Section 9 VAC 25-260-170 reads as follows:

> *In freshwater, E. coli bacteria shall not exceed a geometric mean of 126 counts/100ml and shall not have greater than a 10% excursion frequency of a statistical threshold value (STV) of 410 counts/100ml, both in an assessment period of up to 90 days.*

4.1.2 Additional Impairments

Since TMDL development, there have been 10 additional segments listed and 1 segment delisted for bacteria impairments as of the assessment in Virginia's 2024 Draft 305(b)/303(d) Water Quality Assessment Integrated Report (DEQ, 2024). A summary on the impaired segments, their size, initial listing year, location description, and HUC information is provided below in Table 4-2.

Table 4-2. Impaired stream segments from the Mountain Run and Mine Run TMDL, Rapidan River TMDL and nested segments[7] since TMDL development as of the 2024 Draft Integrated Report.

Impaired Segment	Size (miles)	Initial Listing Year	Impairment Location Description	HUC12	VAHU6
Cabin Branch VAN-E16R_CAB01A22	3.19	2022	Segment begins at the perennial headwaters of Cabin Branch and continues downstream to the confluence with Cedar Run	020801031002	RA36
Cedar Run #1 VAN-E16R_CED02A04	3.54	2006	Segment begins at the confluence with Buck Run and continues downstream until the confluence with Cabin Branch.	020801031002	RA38
Cedar Run #2 VAN-E16R_CED01A00	2.26	2018	Segment begins at the confluence with Cabin Branch and continues downstream until the confluence with the Rapidan River.	020801031002	RA38
Rapidan River #1 VAN-E16R_RAP03A08	3.40	2008	Segment begins at the confluence with the Robinson River and continues downstream until the confluence with an unnamed tributary to the Rapidan River, at rivermile 36.6.	020801031001	RA37
Rapidan River #2 VAN-E16R_RAP01A04	4.66	2006	Segment begins at the confluence with an unnamed tributary to the Rapidan River, at rivermile 34.5, approximately 0.6 rivermile downstream from Route 689, and continues downstream until the confluence with Cedar Run.	020801031001	RA37
Mountain Run #1 VAN-E17R_MTR02A02	7.46	2006	Segment begins at the headwaters of Mountain Run and continues downstream until the confluence with Mill Run.	020801031101	RA40
Mountain Run #2 VAN-E17R_MTR01A00[1]	10.11	2002	Segment begins at the confluence with Mill Run, approximately 0.25 rivermile downstream of Route 617, and continues downstream until the confluence with Mine Run.	020801031101	RA40
Sumerduck Run VAN-E17R_SUM01A04	6.21	2014	Segment begins at the confluence with Dry Run and continues downstream until the confluence with the Rapidan River.	020801031003	RA39
Potato Run VAN-E17R_POT01A14	6.84	2014	Segment begins at the headwaters of Potato Run and continues downstream until the confluence with the Rapidan River.	020801031003	RA39

[7] In the case of a nested water, a new TMDL is not necessary to address the newly impaired water if the nesting procedure is followed (see Part VII, Rule 3 of the 2024 Integrated Report draft in the References section of this implementation plan).

Impaired Segment	Size (miles)	Initial Listing Year	Impairment Location Description	HUC12	VAHU6
Brook Run VAN-E17R_BRK01A04	2.51	2018	Segment begins at the confluence with an unnamed tributary to Brook Run at Route 647, and continues downstream until the confluence with the Rapidan River.	020801031003	RA39
Black Walnut Run VAN-E17R_BWR01A06	6.48	2006	Segment begins at the Route 621 crossing and continues downstream until the confluence with Mine Run	020801031102	RA41
Mine Run VAN-E17R_MIR01A00	10.50	2002	Segment begins at the confluence with Cormack Run, approximately 0.6 rivermile upstream of Route 20, and continues downstream until the confluence with the Rapidan River.	020801031102	RA41
Rapidan River #3 VAN-E18R_RAP05A08	3.41	2008	Segment begins at the boundary of the public water supply area, approximately 1.17 rivermiles upstream from the Route 3 crossing, and continues downstream to the confluence with Lick Branch.	020801031103	RA42
Rapidan River #4 VAN-E18R_RAP03A02[8]	2.59	2002	Segment begins at the confluence with Wilderness Run, rivermile 7.78, and continues downstream until the confluence with Middle Run.	020801031105	RA44
Wilderness Run VAN-E18R_WIL01A08	5.56	2008	Segment begins at the confluence of North Wilderness Run and South Wilderness Run and continues downstream until the confluence with the Rapidan River.	020801031104	RA43

[8] Segment delisted in the 2024 Integrated Report

The delisted segment in Table 4-2 above is Rapidan River #4, VAN-E18R_RAP03A02 that begins at the confluence with Wilderness Run, river mile 7.78, and continues downstream until the confluence with Middle Run. In 2002, this segment was first added to the 303(d) List for fecal coliform. In 2016, the segment was submitted for delisting. In 2018, the segment was listed again as an *E. coli* impairment then submitted again for delist in 2024. During the 2022 cycle, this segment was assessed as not supporting the recreation use because there were two or more STV exceedances in at least one 90-day period with <10 samples at DEQ station 3-RAP006.53 at Route 610. Data at this location for the 2024 Integrated Report cycle were assessed as supporting; the STV exceedance rate was less than 10% and there were no geomean exceedances in any 90-day period with 10+ samples. Ultimately, it was determined that this segment should be delisted for *E. coli* based on the 2024 data assessment.

4.1.3 Allocation Scenarios to Meet Water Quality Standards during Implementation Plan Development

During implementation planning, the recommended percent reductions from bacteria sources in the allocation scenarios were changed from the TMDL study in order to meet the current water quality standard (Table 4-3). These scenarios were developed by adapting the model used in TMDL development to current conditions. Since the TMDLs associated with this implementation plan were developed 20 years ago, changes in land use, livestock and housing numbers, and BMPs installed since TMDL development were included in the updated model. Also, allocation scenarios were developed for the additional impairments. Performing these changes/updates allows the IP to build upon information gained from prior TMDL development, while also meeting current standards and incorporating flexibility into the plan for future implementation. The stakeholders recommended that approximately half of the BMPs be installed in the first 10 years of implementation (Stage 1) and the remaining during the next 10 years (Stage 2). These stages, the associated timeline, and the adaptive approach used are explained in greater detail in Chapter 8.

Note that the water quality goals cannot be met in some of the watersheds without bacteria reductions from wildlife sources. This implementation plan focuses on reducing the anthropogenic bacteria sources. Although, wildlife bacteria loads will not be explicitly addressed by this implementation plan, the proposed BMPs that reduce bacteria from stormwater runoff are expected to indirectly reduce bacteria pollution from wildlife. While no BMPs are proposed for forested lands, any treatment BMPs on other land uses (i.e., pasture and cropland) will also reduce bacteria loads from wildlife.

Based on the bacteria allocation scenarios, significant reductions will be needed to meet the water quality standard for bacteria, particularly with respect to agriculture, both direct deposition and pasture runoff. In addition, bacteria load attributed to failing septic systems and straight pipes and pets must be reduced.

There are subtler implications as well. Implicit in the requirement for 100% correction of straight pipes (a state mandate) is the need to maintain all functional septic systems.

Table 4-3. Bacteria reduction scenarios used for implementation.

Watershed	*E. coli* Loading Reductions (%)						
	Straight Pipes	Residential	Livestock DD	Cropland	Pasture	Wildlife DD	Forest
Cabin Branch VAN-E16R_CAB01A22	100	96	96	5	96	0	0
Cedar Run #2 VAN-E16R_CED01A00	100	85	60	5	60	0	0
Rapidan River #2 VAN-E16R_RAP01A04	100	80	5	5	5	0	0
Mountain Run #2 VAN-E17R_MTR01A00	100	85	99	5	99	85	0
Sumerduck Run VAN-E17R_SUM01A04	100	80	99	5	99	85	0
Potato Run VAN-E17R_POT01A14	100	80	99	5	99	85	0
Brook Run VAN-E17R_BRK01A04	100	80	99	5	99	85	0
Black Walnut Run VAN-E17R_BWR01A06	100	85	99	5	99	85	0
Mine Run VAN-E17R_MIR01A00	100	85	99	5	99	85	0
Rapidan River #3 VAN-E18R_RAP05A08	100	50	15	5	15	0	0
Wilderness Run VAN-E18R_WIL01A08	100	65	99	5	99	35	0

4.2 Water Quality Monitoring Data

Below in Table 4-4 is the data collected from the monitoring stations since TMDL development in the impaired segments in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watersheds. This data was used to assess the streams as supporting or not supporting for the 2024 Draft Integrated Report. In some cases, data below were carried over from previous assessment cycles determining the stream segment as still impaired for *E. coli.*

Table 4-4. Water quality monitoring stations in the impaired streams in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watersheds.

Station ID	Stream Name	Number of Samples	Exceedance Rate*	Period of Record
3-WIL004.00	Wilderness Run	35	60%	2005-2014
3-SUM002.40	Sumerduck Run	10	70%	2011-2012
3-RUL000.39	Russell Run	10	10%	2011-2012
3-RAP037.90	Rapidan River	44	22%	2005-2022
3-RAP030.21	Rapidan River	210	41%	2003-2023
3-RAP014.45	Rapidan River	36	28%	2005-2016
3-RAP006.53	Rapidan River	118	22%	2003-2023

Station ID	Stream Name	Number of Samples	Exceedance Rate*	Period of Record
3-POT001.06	Potato Run	8	50%	2011-2012
3-MTR010.60	Mountain Run	27	56%	2003-2015
3-MTR008.31	Mountain Run	12	92%	2016
3-MTR003.51	Mountain Run	105	29%	2003-2023
3-MIR004.05	Mine Run	28	21%	2004-2017
3-CED003.52	Cedar Run	50	46%	2004-2020
3-CED000.59	Cedar Run	22	32%	2015-2020
3-CAB002.23	Cabin Branch	11	45%	2020
3-CAB000.22	Cabin Branch	11	45%	2020
3-BWR004.13	Black Walnut Run	30	40%	2003-2015
3-BRK002.64	Brook Run	24	63%	2009-2018

* Proportion of samples exceeding E. coli single sample maximum assessment criterion of 235 cfu/100 mL.

4.3 Bacteria Source Assessment

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

4.3.1 Point Sources

There are currently five individual VPDES permits within the project area (Table 4-5 below). Additionally, there are currently 81 discharges covered under the domestic sewage general permit. Since TMDL development, the following changes have been incorporated:

- The Mountain Run and Mine Run TMDL was modified in 2008 (EPA approval 4/28/2008) to update the WLA to add VPDES permit VA0078131 (which was inadvertently excluded from the original TMDL report) and two discharges covered under the domestic sewage general permit. The modification also incorporated a growth factor of five times the WLA for permit VA0078131.
- The WLA for VPDES permit VA0074381 was updated based on an expansion flow tier.
- Individual permits VA0092011, VA0081621, and VA0051667, which were active at the time of TMDL development, were terminated.
- WLAs for discharges covered under the domestic sewage general permit were updated as applicable.
- Individual and general permit information related to the TMDL WLAs was updated as needed in accordance with the assumptions and requirements of the applicable TMDLs.

Table 4-5. Current Individual VPDES Permits within the Mountain Run, Mine Run, Cedar Run and the Lower Rapidan River watersheds.

Permit Number	Facility Name	Permit Type	Receiving Stream	*E. coli* Load (cfu/year)
VA0074381	Camp Rappahannock Wastewater Treatment Plant[9]	Individual Permit	Hazel Run, Unnamed Tributary	6.27E+10
VA0078131	Locust Grove Elementary School	Individual Permit	Cormack Run, Unnamed Tributary	2.44E+10
VA0083411	Wilderness Wastewater Treatment Plant	Individual Permit	Rapidan River	3.48E+12
VA0087718	DOC - Coffeewood Correctional Center	Individual Permit	Cabin Branch	3.48E+11
VA0091961	Locust Grove Town Center	Individual Permit	Flat Run, Unnamed Tributary	3.48E+10

[9] Formerly named Camp Happyland.

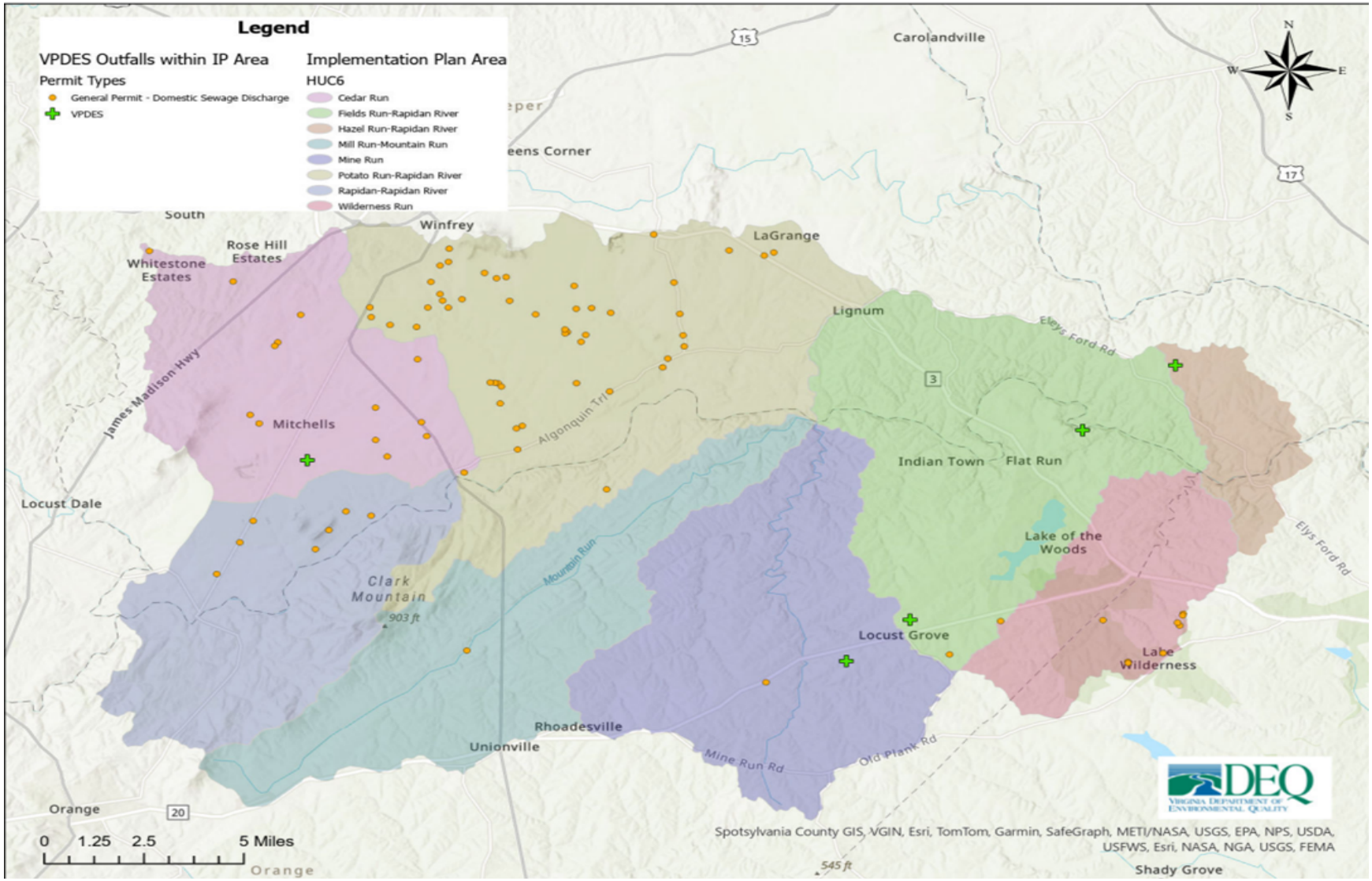

Figure 4-3. Current Individual VPDES Permits within the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watersheds.

5. PUBLIC PARTICIPATION

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

5.1 Public Meetings

The first public meeting was held on the evening of February 21st, 2024, at the George Washington Carver Agricultural Research Center 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 Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watersheds and become familiar with but not limited to:

- the project area,
- environmental concerns,
- the value of an IP for environmental restoration,
- the process and schedule,
- and how to participate throughout the process to come up with ideas to protect and restore water quality in the project area.

This meeting was publicized through a public notice, flyers, direct e-mail communication from DEQ, as well as distributed in the Rappahannock Roundtable newsletter. Twenty individuals attended the meeting representing: DEQ, Culpeper Soil and Water Conservation District, Virginia Cooperative Extension, Friends of the Rappahannock, Culpeper Planning and Zoning, Stevensburg Board of Supervisors, Virginia Department of Health, American Climate Partners, Rappahannock Rapidan Regional Commission, and local county residents. The 1st Public Meeting minutes are provided in Appendix A.

The meeting included a presentation by DEQ on the process to be used to complete an IP for Mountain Run, Mine Run, Cedar Run and the Lower Rapidan River watershed. The presentation also included a discussion on existing water quality conditions in the watersheds and what types of actions and information could be included in the Implementation Plan to improve water quality.

The final public meeting will be held on November 18th, 2024, at the George Washington Carver Agricultural Research Center to present this draft of the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River Watershed Implementation Plan and the strategy to address the bacteria impairments. After the meeting, a 30-day public comment period is initiated which will conclude on December 18th, 2024.

5.2 Community Engagement Meetings

The purpose of the community engagement meetings are to discuss with interested community partners, such as SWCDs, Nonprofits, residents etc., methods needed to reduce the nonpoint sources contributing to bacteria impairments within the watershed. These methods typically are identifying best management practices that can be implemented to reduce human, pet, and livestock bacteria nonpoint source contributions from entering the surface waters within the watershed.

During the first community engagement meeting on April 12th, 2024, there were 23 attendees representing a variety of groups: DEQ, Culpeper Soil and Water Conservation District, Culpeper Planning and Zoning, Stevensburg Board of Supervisors, Piedmont Environmental Council, Virginia Department of Health, American Climate Partners, Rappahannock Rapidan Regional Commission, Culpeper Virginia Cooperative Extension, Cedar Mountain Stone, Small Farm Outreach Program, and local community residents. Throughout the discussion on suggestions to reduce bacteria sources, the group discussed residential septic systems and agricultural recommendations for best management practices. Meeting minutes can be found in Appendix A.

A second community engagement meeting was held on June 27th, 2024, with the goal to understand what the proposed BMPs were for this IP and the costs and timelines associated with them, and to gather input and feedback from the attendees on any remaining adjustments recommended for the plan. The group discussed how to prioritize improving residential septic systems in the areas of the watershed. Soil type in Potato Run and Mountain Run poses challenges because portions of soil coverage in the watershed is comprised of clay or non-percolating soils. Non-percolating soil may cause traditional septic systems to not distribute properly in the drain field overtime causing a higher risk to be malfunctioning and failing systems. Malfunctioning and failing systems have a higher chance of contributing non-processed sewage into surface water.

Agricultural BMP priorities were discussed to prioritize the higher priority areas in Cedar Run, Sumerduck Run, Potato Run and Brook Run using Virginia Department of Conservation and Recreation (DCR) data. Historically, these areas have not had as many agricultural BMPs installed compared to the neighboring watersheds. However, these areas in the NLCD data show agricultural land present which has the opportunity to implement BMPs.

DEQ recommended completing 33% of BMPs in Stage 1, 33% of BMPs in Stage 2 and 33% of BMPs in Stage 3 to the community group. The group agreed that this timeline seems reasonable based on the data that was discussed. Each stage planned to be complete in approximately 5 years if the BMPs proposed were implemented at the rate proposed. Meeting minutes can be found in Appendix A.

6. IMPLEMENTATION ACTIONS

An important part of the Implementation Plan is the identification of specific BMPs, and the associated technical assistance needed to improve water quality. Since this IP is designed to be implemented by landowners on a voluntary basis, it is necessary to identify BMPs that are both financially and technically realistic and suitable for the community. As part of this process, the costs and benefits of the proposed BMPs must be evaluated. Once the types of suitable BMPs have been identified, the number of each BMP necessary to meet the interim measurable milestone laid out in this plan are determined.

6.1 Identification of Best Management Practices

Potential pollutant control measures or BMPs, their associated costs and efficiencies, and potential funding sources were identified through review of the TMDL, input from the stakeholder group, and literature reviews. BMPs that can be promoted through existing state and federal cost-share programs were identified, as well as those that are not currently supported by existing programs. Practices were selected through a process of stakeholder review and analysis of their effectiveness in these watersheds. Various scenarios were developed by adapting the model used in TMDL development to current conditions, and presented to the stakeholders, who considered both their economic costs and the water quality benefits that they produced. Since the main source of NPS pollution in the watershed comes from agricultural lands, most of the recommended practices in this IP are already included in state and federal agricultural cost share programs that promote conservation. The final set of BMPs identified, and the efficiencies used in this study to estimate needs are listed in Table 6-1.

While Continuing Conservation Initiative (CCI) practices are not eligible for CWA Section 319(h) funding at the time of completion of this plan, the stakeholder group is interested in including practices in the implementation plan to protect water quality as initial practice lifespans end. CCI practices offer an incentive for producers to continue to maintain the original practice in order to extend the life of a practice. This becomes especially important in watersheds that are a part of the larger Chesapeake Bay watershed where CCI practices allow for up to five more years of reduction ‘credits’ in the bay model. Some of the CCI practices that would be applicable in the IP subwatersheds are:

- CCI-SE-1, Stream Exclusion – Maintenance Practice
- CCI-SL-6N, Stream Exclusion with Narrow Width Buffer – Maintenance Practice
- CCI-SL-6W, Stream Exclusion with Wide Width Buffer – Maintenance Practice
- CCI-FRB-1, Forested Riparian Buffer – Maintenance Practice
- CCI-HRB-1, Herbaceous Riparian Buffer – Maintenance Practice
- CCI-CNT, Long Term Continuous No-Till Planting Systems

Table 6-1. Proposed BMPs and associated bacteria reductions.

BMP (Cost-share code in parenthesis)	Units	% Effectiveness	Reference
Livestock Exclusion Practices			
CREP Stream Exclusion with Grazing Land Management (CRSL-6)	System	100% + 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, SL-6F)			
Stream Protection Fencing with Narrow Width Buffer (WP-6N)			
Stream Protection Fencing with Wide Width Buffer (WP-6W)			
Exclusion Fence Maintenance (CCI-SE-1, CCI-SL-6N, CCI-SL-6W)	Lin. ft.	-	-
Pasture/Hayland Practices			
Extension of Watering System (SL-7)	Acres	50%	2
Precision Intensive Rotational/Prescribed Grazing (NRCS-CSP, SL-10)			
Woodland Buffer Filter (FR-3)	Acres treated	50% + Land use change	3
Permanent Vegetative Cover on Critical Areas (SL-11)	Acres	75%	2
Afforestation of Erodible Pasture (FR-1)		Land use change	4
Animal Waste Control Facility: beef (WP-4, WP-4B, WP-4FP, WP-4LL, WP-4SF)	System	75%	5
Roof Runoff Management (WQ-12)		40%	6
Sediment Retention, Erosion or Water Control Structure (WP-1)	Acres treated	60%	6
Stormwater Retention Pond / Surface Water Runoff Impoundment (WP-5, WP-7)			
Cropland Practices			
Long Term Vegetative Cover on Cropland (SL-1)	Acres	75%	2
Cover Crop (SL-8B, SL-8H, SL-8M)		4%	6

BMP (Cost-share code in parenthesis)	Units	% Effectiveness	Reference
Residential Wastewater Practices			
Septic Tank Pump-out (RB-1)	System	-	-
Connection to Public Sewer (RB-2)		100%	1
Connection to Public Sewer w/Pump (RB-2P)			
Septic System Repair (RB-3, RB-3M)			
Septic System Replacement (RB-4, RB-4P)			
Alternative Waste Treatment System (RB-5)			
Pet Waste Practices			
Pet Waste Disposal Station (PW-1)	Station	75%	2
Wastewater Treatment System for Confined Canine Facilities (PW-3)	System	100%	1
Pet Waste Education Program	Program	50%	2

References:
1. Removal efficiency is defined by practice.
2. DEQ Guidance Manual for TMDL Implementation Plans, June 2017.
3. Chesapeake Assessment Scenario Tool - BMP effectiveness values by land use and pollutant, May 2024. Bacteria efficiency assumed to be equal to sediment efficiency.
4. Modeled land use change.
5. DEQ NPS BMP Program, May 2024. Bacteria efficiency assumed to be equal to phosphorus efficiency.
6. DEQ NPS BMP Program, May 2024. Bacteria efficiency assumed to be equal to sediment efficiency.

6.2 Quantification of Control Measures

The quantity of control measures, also called best management practices, recommended during Implementation Plan development was determined through spatial analyses, modeling implementation scenarios based on the current water quality standard, and using input from the stakeholder groups. Data on land use, stream networks, and elevation were used in spatial analyses to develop estimates of the number of control measures recommended overall in the watershed and within smaller subwatersheds. Data from DCR's Agricultural BMP Database, showing where BMPs are already installed, were considered when developing these estimates. In addition, census data were used to quantify septic system repairs and replacements needed to meet the reductions specified. Estimates of the number of residential on-site waste treatment systems, streamside fencing, and number of full livestock exclusion systems were made through these analyses. The number of additional BMPs were determined through modeling scenarios and applying the related pollutant reduction efficiencies to the associated bacteria loads.

6.2.1 Agricultural Control Measures

Livestock Exclusion BMPs

To reduce bacteria in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River Watershed and its tributaries, livestock must be excluded from the stream. To estimate fencing needs, the stream network was overlaid with land use using GIS mapping software. Stream segments that flowed through or were adjacent to land use areas that had a potential for supporting cattle (e.g., pasture) were identified using 2021 Virginia Land Cover Dataset (VLCD), which is derived from aerial imagery, and the 2022 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 DCR Agricultural BMP Database was queried to identify the number of livestock exclusion systems already in place in the watershed. Approximately 380,000 linear feet of livestock exclusion fencing has been installed in the study area since the TMDL study. This fencing was subtracted from the length of fencing needed to accomplish the reduction of the bacteria load from livestock to meet the implementation goal (Table 6-2).

It is expected that the majority of livestock exclusion fencing will be accomplished through Virginia Agricultural BMP Cost-Share Program (VACS), Virginia Nonpoint Source Implementation BMP Cost-Share Program, and federal Natural Resource Conservation Service (NRCS) cost-share programs. Landowners have a number of options when it comes to installing livestock exclusion fencing through these programs. Some applicable cost-shared BMPs for livestock exclusion in the programs are the SL-6N (Stream Exclusion with Narrow Width Buffer and Grazing Land Management), the SL-6W (Stream Exclusion with Wide Width Buffer and Grazing Land Management), the SL-6F (Stream Exclusion in Floodplains),the SL-7 (Extension of Watering Systems), the WP-2N (Stream Protection with Narrow Width Buffer), the WP-2W (Stream Protection with Wide Width Buffer), the WP-2P (Portable Fencing for Stream Protection) and CREP practice CRSL-6 (CREP Stream Exclusion with Grazing Land Management.

Table 6-2. Stream fencing needs summary.
Note: % of total shown in parenthesis.

Sub-watershed	Estimated total length of streambank in pasture/hay (feet)	Approximate fencing installed to date (feet)	Fencing still needed	
			Stage 1 (feet)	Stage 2 (feet)
Rapidan – Rapidan River	207,007	106,087	1,760	0
Cedar Run	191,924	54,275	40,327	39,638
Potato Run – Rapidan River	262,932	69,294	87,735	86,402
Mill Run – Mountain Run	175,278	75,863	50,337	47,325
Mine Run	104,342	48,236	27,934	27,129
Fields Run – Rapidan River	66,290	28,610	0	0
Wilderness Run	40,552	0	20,276	19,871
Total	1,048,325	382,365 (36%)	228,370 (22%)	220,365 (21%)

To develop an estimate of the number of fencing systems needed in the watershed, aerial imagery was utilized in conjunction with local data from the DCR 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 stakeholders and the Culpeper 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 (**Error! Reference source not found.**).

Table 6-3. Livestock exclusion needed to achieve reduction of bacteria load from livestock direct deposition.
Assumes one exclusion system averages 3,000 linear feet of stream fencing.

Sub-watershed	Fencing needed	SL-6N or WP-2N (10 – 25 ft buffer): 15%		SL-6W, SL-6F, WP-2W or CRSL-6 (35 – 50 ft buffer): 85%	
	feet	feet	systems	feet	systems
Stage 1					
Rapidan – Rapidan River	1,760	0	0	1,760	1
Cedar Run	40,327	6,049	2	34,278	11
Potato Run – Rapidan River	87,735	13,160	4	74,575	25
Mill Run – Mountain Run	50,338	7,551	3	42,787	14
Mine Run	27,934	4,190	1	23,744	8
Fields Run – Rapidan River	0	0	0	0	0
Wilderness Run	20,276	3,041	1	17,235	6

Sub-watershed	Fencing needed	SL-6N or WP-2N (10 – 25 ft buffer): 15%		SL-6W, SL-6F, WP-2W or CRSL-6 (35 – 50 ft buffer): 85%	
	feet	feet	systems	feet	systems
Total Stage 1	228,370	33,911	11	194,379	65
Stage 2					
Rapidan – Rapidan River	0	0	0	0	0
Cedar Run	39,638	5,946	2	33,692	11
Potato Run – Rapidan River	86,402	12,960	4	73,442	24
Mill Run – Mountain Run	47,325	7,099	3	40,226	13
Mine Run	27,129	4,069	1	23,060	8
Fields Run – Rapidan River	0	0	0	0	0
Wilderness Run	19,871	2,981	1	16,890	6
Total Stage 2	220,365	33,055	11	187,310	62
Total	448,735	67,046	22	381,689	127

The VACS Program includes a series of livestock exclusion practices that may be used to meet control measure goals in priority implementation watersheds. For areas where greater setbacks are possible, the Stream Exclusion with Wide Width Buffer and Grazing Land Management (SL-6W) offers between 85% to 100% cost-share rate for off stream watering, establishment of a rotational grazing system, stream crossings, and stream exclusion fencing with a 35 to 50-foot setback and a lifespan of 10 to 15 years. The Stream Exclusion in Floodplains (SL-6F) provides the same cost-share benefits as the SL-6W and is intended for areas prone to flooding.

Stream Protection Fencing with Wide Width Buffer (WP-2W) offers between 75% to 80% cost-share rate over a lifespan of 5 to 10 years. It is similar to the SL-6W practice except it does not include an alternative watering system. The WP-2W practice can be combined with the Extension of Watering Systems (SL-7) to provide watering facilities. Landowners may receive up to 75% cost share for the SL-7 practice and must maintain the practice for a period of ten years.

Another option for areas where greater setbacks are possible is the CREP Stream Exclusion with Grazing Land Management (CRSL-6). The CRSL-6 practice is implemented under CREP and offers up to 50% cost-share rate. It is similar to the SL-6W practice with a minimum 35-foot riparian buffer. CREP does not provide funding for cross fencing to establish rotational grazing systems, however, this practice is commonly combined with the SL-7 practice for rotational grazing.

Based on discussions with the stakeholders, it was determined that these practices would be the most appealing to producers in the watershed due to the financial incentives. It was estimated that approximately 85% of fencing in the watershed would be installed using the SL-6W, SL-6F, WP-2W/SL-7 and CRSL-6/SL-7 practices.

Stream Exclusion with Narrow Width Buffer and Grazing Land Management (SL-6N) offers between 60% to 75% cost-share rate for off stream watering, establishment of a rotational grazing system, stream crossings, and stream exclusion fencing with a 10 to 25-foot setback and a lifespan of 10 to 15 years. Another option is Stream Protection Fencing with Narrow Width Buffer (WP-2N). The WP-2N practice offers between 55% to 70% cost-share rate over a lifespan of 5 to 10 years. The WP-2N practice is suitable to provide livestock access to water using a controlled hardened access when no other water source is feasible. It was estimated that approximately 15% of fencing in the watershed would be installed using the SL-6N and WP-2N practices.

Another alternative for livestock exclusion is the Portable Fencing for Stream Protection (WP-2P). This practice provides portable fencing for all live streams in a field to prevent direct deposition of livestock waste and offers a single payment of $0.30 per linear foot of fence and a flat payment of $250.00 per fencing charger. There is no minimum buffer width, and the practice components must be maintained for a minimum of five years.

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

Land Based Agricultural BMPs

In order to meet the necessary bacteria reductions, BMPs to treat land-based sources of bacteria must also be included in implementation efforts. **Error! Reference source not found.** provides a summary of land based agricultural BMPs for each stage needed to achieve water quality goals. Staged implementation will be described in detail in Chapter 8. It is expected that funding assistance for the majority of agricultural practices will be provided by the Virginia Agricultural BMP Cost-Share Program (VACS), DEQ Nonpoint Source BMP Implementation Program, and federal Natural Resource Conservation Service cost-share programs.

Table 6-4. Land based agricultural BMPs needed to achieve reduction of pasture and cropland bacteria load.

BMP (Cost-share codes in parentheses)	Stage 1	Stage 2	Total
	Acres (unless otherwise noted)		
Extension of watering system (SL-7)	487	163	650
Improved pasture management (SL-10)	15,730	5,243	20,973
Woodland buffer filter – acres treated (FR-3)	2,013	4,718	6,731
Afforestation of crop, hay and pasture land (FR-1)	1,667	4,998	6,665
Permanent vegetative cover on critical areas (SL-11)	18	52	70
Cover crop (SL-8B, SL-8H)	72	66	138
Animal waste control facility - system (WP-4, WP-4B, WP-4FP, WP-4LL, WP-4SF)	23	27	50

BMP (Cost-share codes in parentheses)	Stage 1	Stage 2	Total
	Acres (unless otherwise noted)		
Roof runoff management - system (WQ-12)	10	9	19
Water Control Structure – acres treated (WP-1)	377	757	1,134
Stormwater Retention Pond – acres treated (WP-5, WP-7)	757	1,512	2,269

Grazing Systems and Improved Pasture Management (SL-7, SL-10)

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

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

Woodland Buffer Filter (FR-3)

This practice supports the creation of a woodland buffer filter area to protect waterways by reducing erosion, sedimentation, and pollution from agricultural non-point sources. Landowners may receive up to 95% cost share for this practice through VACS.

Afforestation of Crop, Hay and Pasture Land (FR-1)

A small portion of agricultural land is designated for tree planting. This practice will be performed on pasture that is not well suited for agriculture due to slope and other characteristics. The intent of including this practice is not to reduce the presence of agriculture in the watershed, but rather

to optimize the use of suitable pastureland in the watershed and prevent runoff and soil loss from marginal agricultural lands. Cost-share funding is available for tree planting, and a flat rate payment per acre is also made through this practice depending on the length of the BMP contract.

Permanent Vegetation on Critical Areas (SL-11)

This practice supports land shaping and planting permanent vegetative cover on critically eroding areas. This may include measures such as grading, shaping, and filling, the establishment of grasses, and trees or shrubs. Landowners may receive up to 75% cost share for this practice and must maintain the practice for a period of five years. This practice is particularly applicable in highly denuded areas where concentrated runoff of manure is occurring.

Cover Crop (SL-8B, SL-8H)

Farmers are implementing the use of cover crops because of the benefits associated with improved soil quality, reduction of nutrient losses, decreased field maintenance, and erosion control. Cost-share funding and/or tax credit are available for cover crop practices. Cost share for cover crop practices are also offered as part of DCR's Whole Farm Approach – Cover Crop Bundle (WFA-CC). Implementation of DCR's Whole Farm Approach – Nutrient Management Bundle (WFA-NM) is required to be eligible for the WFA-CC practice.

Animal Waste Control Facilities (WP-4)

Establishing structural practices such as animal waste control facilities that temporarily store liquid and/or solid waste from livestock and poultry operations gives producers greater control of when and where animal waste is spread and reduces the chance for waste to contaminate water sources. Manure from feeding operations can be scraped up and temporarily stockpiled before application to cropland or pastureland.

Feeding Pad (WP-4FP)

This practice provides a stable area to feed livestock using a hardened feeding pad of gravel or concrete. Manure from the feeding pad can be captured and temporarily stored before application to cropland or pastureland. Landowners may receive up to 75% cost share for this practice and must maintain the practice for a period of fifteen years.

Loafing Lot Management System with Manure Management (WP-4LL)

This practice provides a sacrifice lot or covered facility with a feeding area and a bedded or manure pack area for livestock, except bovine dairy. A manure storage area is also included if needed. The practice requires a minimum of three associated grassed lots and stream exclusion. Landowners may receive up to 75% cost share for this practice and must maintain the practice for a period of fifteen years.

Seasonal Feeding Facility with Attached Manure Storage (WP-4SF)

This practice provides a covered concrete facility with a feeding area and a manure storage area that can be used during inclement weather. The practice requires an approved rotational grazing

plan and stream exclusion. Landowners may receive up to 75% cost share for this practice and must maintain the practice for a period of fifteen years.

Roof Runoff Management (WQ-12)

Animal feeding operations tend to concentrate manure generation and to produce runoff-driven manure from impervious and bare areas surrounding these operations. Barnyard runoff controls are the primary measures used to control manure in these areas. This practice supports the conveyance of precipitation from a roof to an appropriate discharge area to avoid manure runoff from entering nearby water corridors and streams. Landowners may receive up to 75% cost share for this practice and must maintain the practice for a period of ten years.

Sediment Retention, Erosion, or Water Control Structure (WP-1)

This practice supports the installation of structures that collect and store debris to reduce the movement of sediment and materials from agricultural land to a receiving stream. Types of structures include erosion sediment control dams, desilting reservoirs, sediment basins, or similar structures.

Stormwater Retention Pond (WP-5) / Surface Water Runoff Impoundment (WP-7)

The Stormwater Retention Pond practice creates a structure that will retain stormwater and release the water at a reduced rate. The Surface Water Runoff Impoundment practice impounds surface water runoff and allows settling of sediment and nutrients. Landowners may receive a tax credit for either of these practices.

6.2.2 Residential Control Measures

Failing Septic Systems and Straight Pipes

By Virginia law, all failing septic systems and straight pipes must be identified and corrected. During TMDL development, the number of straight pipes in the study area was estimated based on 1990 U.S. Census Bureau data. The 2000 U.S. Census block maps were used to estimate the spatial distribution of the failing septic systems and straight pipes. Participants at the first stakeholder meeting noted that the estimated number of houses on public sewer or general permit were too high in the Cedar Run watershed, and the estimated number of straight pipes was too low in the Potato Run – Rapidan River watershed. After review of public sewer information provided by Culpeper County, and with consensus from the stakeholders, the distribution of houses in the Cedar Run watershed was readjusted by decreasing the number of houses on public sewer and increasing the number of houses on septic systems and those with failing septic systems. The estimated straight pipes in the Potato Run – Rapidan River watershed was increased based on stakeholder input. Table 6-5 shows the estimated number of failing septic systems and straight pipes in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watersheds.

Table 6-5. Estimated failing septic systems and straight pipes in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed.

Sub-watershed	Unsewered houses	Estimated failing septic systems	Estimated straight pipes
Rapidan – Rapidan River	335	131	9
Cedar Run	425	129	6
Potato Run – Rapidan River	584	181	20
Mill Run – Mountain Run	474	169	6
Mine Run	612	196	6
Fields Run – Rapidan River	661	167	9
Wilderness Run	805	170	0
Total	3,896	1,143	56

Based on input at the first stakeholder meeting, more of the failing septic systems will need to be replaced than repaired. It is estimated that 30% of failing septic systems could be corrected with a repair, and that the remaining 70% will need to be replaced. DEQ administers a septic BMP cost-share program for targeted watersheds with accepted Implementation Plans. This program provides cost-share for two kinds of septic system repairs, those requiring a permit, and those consisting of an inspection and repair that does not require a permit. It is estimated that half of the repairs would be minor in nature and thus not require a permit, while the remainder would be significant enough that one would be required. Of the systems that need to be replaced, VDH estimated that 40% will require alternative waste treatment systems due to the geology present at the site, or a lack of space necessary for a conventional septic drainfield. However, for the portions of the watershed with non-percolating soils (e.g., Potato Run, upper Mountain Run), it was estimated that 90% of septic system replacements will require alternative waste treatment systems. There is also an opportunity for a couple of failing septic systems to be connected to public sewer in the Coffeewood – Mitchells Sewer Service Area.

Error! Reference source not found. shows a breakdown of the estimated septic system repairs and replacements. Residential cost share funds (from a variety of funding sources) are available for these septic BMPs and these possible funding opportunities are listed in Chapter 10 Funding. The residential cost-share program will be most effective in cooperation with local government's enforcement of laws to correct failing septic systems and eliminate straight pipes.

The IP stakeholder group supports a septic tank pump-out program as a good way to heighten local awareness of septic system maintenance needs and to locate failing septic systems. The estimates shown in **Error! Reference source not found.** are based on stakeholder input that one-third of households in the watershed would participate in a septic tank pump-out program.

Table 6-6. Repairs and replacements of failing septic systems in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed.

BMP (Cost-share codes in parentheses)	Units	Extent
Connection to public sewer (RB-2)	Connection	2
Connection to public sewer w/pump (RB-2P)	Connection	1
Onsite sewage system repair w/ permit (RB-3)	Repair	161
Full inspection and non-permitted onsite sewage system repair (RB-3M)	Repair	161
Onsite sewage system installation/replacement (RB-4)	System	209
Onsite sewage system installation/replacement w/ pump (RB-4P)	System	209
Alternative sewage system (RB-5)	System	448
Septic tank pump-out (RB-1)	Pump-out	1,277

Pet Waste

Based on an analysis of the sources estimated during TMDL development, the primary source of *E. coli* in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed is runoff from pasture and livestock in the stream; however, at the first stakeholders meeting the group agreed that bacteria from pets should also be addressed. This presents a more comprehensive approach to management of the watershed and assigns some degree of responsibility to all pollutant source sectors within the watershed. Implementation of a targeted pet waste education program would encourage pet owners to pick up after their pets and facilitate proper disposal of pet waste. Such a program would include the development and distribution of educational materials, installation of pet waste disposal stations with collection bags, and the promotion of pet waste BMPs such as confined canine facilities management (Table 6-7).

Table 6-7. Pet waste BMPs for the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed.

BMP (Cost-share codes in parentheses)	Units	Extent
Pet waste disposal station (PW-1)	Station	6
Wastewater treatment system for confined canine facilities (PW-3)	System	1
Pet waste education program	Program	1

The stakeholders agreed that a potential site for the pet waste stations could be the Lake of the Woods community. The Virginia Conservation Assistance Program (VCAP) provides cost-share and technical assistance for a wastewater treatment system for confined canine facilities if they meet certain design specifications. A pet waste education program could be combined with septic waste education. This program could include newspaper articles, radio ads, postcard mailings and brochures to be distributed at local events and businesses.

6.3 Technical Assistance and Education

In order to get landowners involved in implementation, it will be necessary to initiate education and outreach strategies and provide technical assistance with the design and installation of various

BMPs. There must be a proactive approach to contact farmers and residents to articulate exactly what the IP means to them and what practices will help meet the goal of improved water quality. The stakeholder groups recommended several education/outreach techniques, which will be utilized during implementation.

The following general tasks associated with agricultural, residential and pet waste programs were identified:

Agricultural Programs

- Contact landowners in the watersheds to make them aware of cost-share assistance (targeting new, less experienced farmers), and voluntary options that are available to agricultural producers interested in conservation.
- Provide technical assistance for agricultural programs (e.g., survey, design, layout).
- Organize educational programs for farmers including farm tours and small-scale demonstrations to show practice application in partnership with Culpeper SWCD, VA Cooperative Extension and Farm Bureau.
- Utilize social media and local newspaper to promote agricultural practices and cost-share programs.
- Assess and track progress toward BMP implementation goals.
- Evaluate use of existing agricultural programs and suggest modifications, i.e. adaptive management.

Residential Programs

- Identify failing septic systems (*e.g.*, contact landowners in older homes, septic pump-out program).
- Develop and distribute educational materials (e.g., septic system maintenance guide). Emphasize how the residential septic cost-share program can help reduce costs to the homeowner.
- Encourage a social media partnership between the Virginia Department of Health, Soil and Water Conservation Districts and Virginia Cooperative Extension, 4-H to promote the residential septic and/or pet waste programs and share information (one-pagers) on how to get assistance.
- Provide educational materials to residents, including kennel owners, on proper disposal of pet waste in order to eliminate all *E. coli* bacteria.
- Launch a campaign about septic system maintenance and how to get assistance using yard signs, mailers and door hangers. Emphasize the connection between proper maintenance and groundwater science and highlight available financial assistance.
- Utilize educational programs already established within the local schools.

A critical component in the successful implementation of this plan is the availability of knowledgeable staff to work with landowners on implementing BMPs. 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, local conservation professionals is a key component to successful BMP implementation. Technical assistance includes helping landowners identify suitable BMPs for their property, designing BMPs and locating funding to finance implementation.

The staffing level needed to implement the agricultural and residential components of the plan was estimated based on discussions with stakeholders and the staffing levels used in similar projects. Staffing needs were quantified using full time equivalents (FTE), with one FTE being equal to one full-time staff member. Based on the size of the watershed, the extent of implementation needed, and the overall project timeline, an estimate of two FTEs was used for technical assistance. This estimate was based on similar implementation projects in other watersheds where one staff member is administering the septic and pet waste programs and another staff member is administering the agricultural programs. It is expected that staff from the Virginia Department of Health, Rappahannock-Rapidan Health District would be directly involved in any septic system repair or replacement BMPs, coordinating efforts in their locality with the Culpeper SWCD.

7. COSTS AND BENEFITS

7.1 BMP Cost Analysis

The costs of agricultural BMPs included in the Implementation Plan were estimated based on data for Culpeper and Orange Counties from the DCR Agricultural BMP Database, the EQIP General Cost List 2024, the Culpeper SWCD and stakeholder group.

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 7-1 shows total agricultural BMP costs by subwatershed.

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-6N and SL-6W. The cost of fence maintenance can often be a deterrent to participation. In developing the cost estimates for fence maintenance shown in Table 7-1, 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 20-year timeline of this project.

Residential areas and pet waste contribute a small percentage (less than 5%) of overall bacteria to the lower Rapidan River watershed. However, 100% of failing septic systems and straight pipes must be repaired or replaced. The estimated costs of recommended residential and pet waste BMPs were approximated based on input from the stakeholder group, other Implementation Plans in the vicinity, and Virginia's NPS Implementation BMP Guidelines for Fiscal Year 2024. Table 7-2 shows total residential BMP costs for the implementation period.

Total estimated costs for implementation practices needed to meet the bacteria delisting goal are summarized in Table 7-3 for two planned stages of implementation. These stages, the associated timeline, prioritization, and the adaptive approach used are explained in greater detail in Chapter 8.

Table 7-1. Agricultural BMP implementation costs for the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed.

Assumes one exclusion system averages 3,000 linear feet of stream fencing.

Practice	Cost-share code	Units	Unit cost	Number of Units	Total
Stream exclusion with narrow width buffer and grazing land management	SL-6N	system	$60,000	21	$1,260,000
Stream exclusion with wide width buffer and grazing land management	SL-6W, SL-6F, CRSL-6	system	$95,000	121	$11,495,000
Stream protection fencing with narrow width buffer	WP-2N	system	$10,000	1	$10,000
Stream protection fencing with wide width buffer	WP-2W	system	$20,000	6	$120,000
Exclusion fence maintenance (10 yrs)	CCI	feet	$5.00	44,874	$224,370
Extension of watering system	SL-7	acres	$325	650	$211,250
Improved pasture management	SL-10	acres	$150	20,973	$3,145,950
Woodland buffer filter	FR-3	acres-treated	$400	6,731	$2,692,400
Afforestation of crop, hay and pasture land	FR-1	acres	$3,000	6,665	$19,995,000
Critical area stabilization	SL-11	acres	$1,000	70	$70,000
Cover crop	SL-8B, SL-8H	system	$100	138	$13,800
Animal waste control facility	WP-4, WP-4B, WP-4FP, WP-4LL, WP-4SF	system	$100,000	50	$5,000,000
Roof runoff management	WQ-12	acres-treated	$2,300	19	$43,700
Water control structure	WP-1	acres-treated	$1,200	1,134	$1,360,800
Farm pond	WP-5	acres-treated	$100	2,269	$226,900
TOTAL ESTIMATED COST					**$45,869,170**

Table 7-2. Residential BMP implementation costs for the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed.

Practice	Cost-share code	Units	Unit cost	Number of Units	Total
Septic tank pump-out	RB-1	system	$450	1,277	$574,650
Connection to public sewer	RB-2	system	$12,500	2	$25,000
Connection to public sewer w/ pump	RB-2P	system	$20,500	1	$20,500
Septic tank system repair	RB-3	repair	$7,500	161	$1,207,500
Septic system inspection and non-permitted repairs	RB-3M	repair	$4,875	161	$784,875
Septic tank system installation or replacement	RB-4	system	$12,500	209	$2,612,500
Septic tank system installation/replacement w/ pump	RB-4P	system	$16,500	209	$3,448,500
Alternative waste treatment system	RB-5	system	$31,500	448	$14,112,000
Pet waste disposal station	PW-1	station	$2,000	6	$12,000
Large scale pet waste treatment system	PW-3	system	$10,000	1	$10,000
Pet waste education program	N/A	program	$4,000	1	$4,000
TOTAL ESTIMATED COST					**$22,811,525**

Table 7-3. Total BMP implementation costs by stage for the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed.

BMP Application	Cost by Stage		Total
	Stage 1 (Years 1–10)	Stage 2 (Years 11–20)	
Agricultural	$17,837,460	$28,031,710	$45,869,170
Residential	$11,443,925	$11,367,600	$22,811,525
TOTAL ESTIMATED COST	$29,281,385	$39,399,310	**$68,680,695**

7.2 Technical Assistance

Technical assistance costs were estimated for two full time positions using a cost of $65,000/position per year. This figure is based on the existing staffing costs included in the Virginia Department of Environmental Quality's grant agreements with the Soil & Water Conservation Districts across the state to provide technical assistance to landowners in TMDL implementation watersheds. Based on the 20-year timeline of this plan (described in the Implementation Timeline section of this plan), this would make the total cost of technical assistance approximately $2,600,000. When factored into the cost estimate for BMP implementation shown in Table 7-3, this would make the total cost of implementation approximately $71,280,695.

7.3 Benefit Analysis

The primary benefit of implementing this plan will be cleaner water in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed. Specifically, *E. coli* contamination in the watershed will be reduced to meet current water quality standards. It is hard to gauge the impact that reducing *E. coli* contamination will have on public health, as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, because of the reductions required, the incidence of infection from *E. coli* sources through contact with surface waters should be reduced considerably.

An important objective of the Implementation Plan is to foster continued economic vitality. This objective is based on the recognition that healthy waters improve economic opportunities for Virginians and a healthy economic base provides the resources and funding necessary to pursue restoration and enhancement activities. The agricultural and residential practices recommended in this document will provide economic benefits to the community, as well as the expected environmental benefits. Specifically, alternative (clean) water sources, exclusion of livestock from streams, improved pasture management, and private sewage system maintenance will each provide economic benefits to individual landowners. Additionally, money spent by landowners and state agencies in the process of implementing this plan will stimulate the local economy.

7.3.1 Agricultural Practices

It is recognized that every farmer faces unique management challenges that may make implementation of some BMPs more cost effective than others. Consequently, costs and benefits of the BMPs recommended in this plan must be weighed on an individual basis. The benefits highlighted in this section are based on general research findings.

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, 2005). Additionally, keeping cattle in clean, dry areas has been shown to reduce the occurrence of mastitis and foot rot. Horses drinking from marshy areas or areas accessed by wildlife or cattle carrying Leptospirosis tend to have an increased incidence of moonblindness associated with

Leptospirosis infections (VCE, 1998a; VCE, 1998b). A clean water source can prevent illnesses that reduce production and incur the added expense of avoidable veterinary bills.

Taking the opportunity to implement an improved pasture management system in conjunction with installing clean water supplies will also provide economic benefits for the producer. Improved pasture management can allow a producer to feed less hay in winter months, increase stocking rates by 30 to 40% and, consequently, improve the profitability of the operation. With feed costs typically responsible for 70 to 80% of the cost of growing or maintaining an animal, and pastures providing feed at a cost of 0.01 to 0.02 cents/lb of total digestible nutrients (TDN) compared to 0.04 to 0.06 cents/lb TDN for hay, increasing the amount of time that cattle are fed on pasture is clearly a financial benefit to producers (VCE, 2009). 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 producer.

7.3.2 Residential Septic Practices

The residential programs will play an important role in improving water quality, since human waste can carry human viruses in addition to the bacterial and protozoan pathogens that all fecal matter can potentially carry. In terms of economic benefits to homeowners, an improved understanding of on-site sewage treatment systems, including knowledge of what steps can be taken to keep them functioning properly and the need for regular maintenance, will give homeowners the tools needed for extending the life of their systems and reducing the overall cost of ownership. The average septic system will last 20 to 25 years if properly maintained. Proper maintenance includes: knowing the location of the system components and protecting them (*e.g.,* not driving or parking on top of them), not planting trees where roots could damage the system, keeping hazardous chemicals out of the system, and pumping out the septic tank every 3 to 5 years. The cost of proper maintenance, as outlined here, is relatively inexpensive ($450) in comparison to repairing or replacing an entire system ($4,875 to $31,500). Additionally, the repair/replacement and pump-out programs will benefit owners of private sewage (*e.g.,* septic) systems, particularly low-income homeowners, by sharing the cost of required maintenance.

7.3.3 Watershed Health and Associated Benefits

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

Riparian buffers can also improve habitat for wildlife such as ground-nesting quail and other sensitive species. Data collected from Breeding Bird Surveys in Virginia indicate that the quail

population declined 4.2% annually between 1966 and 2007. Habitat loss has been cited as the primary cause of this decline. As a result, Virginia has experienced significant reductions in economic input to rural communities from quail hunting. The direct economic contribution of quail hunters to the Virginia economy was estimated at nearly $26 million in 1991, with the total economic impact approaching $50 million. Between 1991 and 2004, the total loss to the Virginia economy was more than $23 million from declining quail hunter expenditures (VDWR, 2009). Funding is available to assist landowners in quail habitat restoration (see Chapter 9).

In addition to the benefits to individual landowners, the economy of the local community will be stimulated through expenditures made during implementation, and the infusion of dollars from funding sources outside the impaired areas. Building contractors and material suppliers who deal with septic system pump-outs, private sewage system repair and installation, fencing, and other BMP components can expect to see an increase in business during implementation. Income from maintenance of these systems should continue long after implementation is complete. As will be discussed in greater detail in Chapter 9, a portion of the funding for implementation can be expected to come from state and federal sources. This portion of funding represents money that is new to the area and will stimulate the local economy. In general, implementation will provide not only environmental benefits to the community, but economic benefits as well, which in turn will allow for individual landowners to participate in implementation.

8. MEASUREABLE GOALS AND MILESTONES

Based upon the scope of work involved with implementing this IP, full implementation could be expected within 20 years provided that full funding for technical assistance and BMP cost-share are available. Delisting from the Virginia Section 305(b)/303(d) list can be expected after full implementation for the Cabin Branch, Cedar Run and Rapidan River impaired segments, when BMPs attain their maximum reduction efficiencies. Full implementation for the Black Walnut Run, Mountain Run, Mine Run, Sumerduck Run, Potato Run, and Brook Run impaired segments will reduce bacteria loads from all sources except wildlife (addressed indirectly). A timeline for implementation, water quality and implementation goals and milestones, and strategies for targeting of BMPs are described in this section.

8.1 Milestone Identification

The end goals of implementation are restored water quality of the impaired water and subsequent delisting of the water from the Commonwealth of Virginia's Section 305(b)/303(d) list within 20 years. Progress toward end goals will be assessed during implementation through tracking of BMPs through the Virginia Agricultural BMP Cost-Share Program, BMP Warehouse (DEQ-hosted statewide BMP database) 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 within 20 years.

8.1.1 Implementation Milestones

Normally, following the idea of a staged implementation approach, resources and finances will be concentrated on the most cost-efficient control measures and areas of highest interest first. For instance, concentrating on implementing improved pasture management practices and installing half of the livestock exclusion fencing within the first several years may provide the highest return on water quality improvement with less cost to landowners. However, the availability of technical and financial assistance also must be considered. Implementation has been divided into two stages: Stage 1 includes years 1 through 10 and Stage 2 includes years 11 through 20. The stakeholder group recommended that approximately 50% of the agricultural and residential practices be implemented in Stage 1 and the remaining implemented in Stage 2. The exception being a higher amount of rotational grazing and improved pasture management during Stage 1, as this is a popular practice in tandem with livestock exclusion from waterway. The length and number of practices for each stage were selected to provide adequate technical and financial assistance to property owners throughout implementation. Tables 8-1 through 8-7 show implementation goals by stage for each subwatershed.

Table 8-1. Staged implementation goals in the Rapidan – Rapidan River watershed for each stage.

BMP Type	Description	BMP Code	Units	Extent		
				Stage 1	Stage 2	Total
Direct deposit (livestock)	Stream Exclusion with Wide Width Buffer and Grazing Land Management	SL-6W, SL-6F, CRSL-6	feet/ (system)	1,760 (1)	0	1,760 (1)
	Exclusion fence maintenance	CCI		88	88	176
Pasture/ Cropland (livestock)	Extension of watering system	SL-7	acres	9	3	12
	Improved pasture management	SL-10		285	95	380
	Cover crop	SL-8B, SL-8H		9	8	17
Residential septic (human)	Onsite sewage system repair w/ permit	RB-3	repair	10	9	19
	Full inspection and non-permitted onsite sewage system repair	RB-3M		10	9	19
	Onsite sewage system installation/replacement	RB-4	system	14	13	27
	Onsite sewage system installation/replacement w/ pump	RB-4P		14	13	27
	Alternative sewage system	RB-5		23	23	46
	Septic tank pump-out	RB-1	pump-out	56	55	111
Pet waste (pet)	Pet waste education program	N/A	program	1	1	1

Table 8-2. Staged implementation goals in the Cedar Run watershed for each stage.

BMP Type	Description	BMP Code	Units	Extent		
				Stage 1	Stage 2	Total
Direct deposit (livestock)	Stream Exclusion with Narrow Width Buffer and Grazing Land Management	SL-6N	feet/ (system)	6,049 (2)	5,946 (2)	11,995 (4)
	Stream Exclusion with Wide Width Buffer and Grazing Land Management	SL-6W, SL-6F, CRSL-6		30,850 (10)	30,323 (10)	61,173 (20)
	Stream protection fencing with wide width buffer	WP-2W		3,428 (1)	3,369 (1)	6,797 (2)
	Exclusion fence maintenance	CCI		3,998	3,998	7,996
Pasture/ Cropland (livestock)	Extension of watering system	SL-7	acres	121	40	161
	Improved pasture management	SL-10		3,920	1,307	5,227
	Woodland buffer filter	FR-3	acres-treated	355	1,065	1,420
	Afforestation of crop, hay and pasture land	FR-1	acres	352	1,054	1,406
	Critical area stabilization	SL-11		4	11	15
	Cover crop	SL-8B, SL-8H		13	12	25
	Animal waste control facility (beef)	WP-4, WP-4B, WP-4FP, WP-4LL, WP-4SF	system	3	6	9
	Roof runoff management	WQ-12		1	2	3
	Water control structure	WP-1	acres-treated	201	402	603
	Farm pond	WP-5		402	804	1,206
Residential septic (human)	Onsite sewage system repair w/ permit	RB-3	repair	9	9	18
	Full inspection and non-permitted onsite sewage system repair	RB-3M		9	9	18
	Onsite sewage system installation/replacement	RB-4	system	13	12	25
	Onsite sewage system installation/replacement w/ pump	RB-4P		13	12	25
	Alternative sewage system	RB-5		19	19	38
	Connection to public sewer	RB-2, RB-2P		2	1	3
	Septic tank pump-out	RB-1	pump-out	66	65	131
Pet waste (pet)	Pet waste education program	N/A	program	1	1	1

Table 8-3. Staged implementation goals in the Potato Run – Rapidan River watershed for each stage.

BMP Type	Description	BMP Code	Units	Extent		
				Stage 1	Stage 2	Total
Direct deposit (livestock)	Stream Exclusion with Narrow Width Buffer and Grazing Land Management	SL-6N	feet/ (system)	13,160 (4)	12,960 (4)	26,120 (8)
	Stream Exclusion with Wide Width Buffer and Grazing Land Management	SL-6W, SL-6F, CRSL-6		67,118 (22)	66,098 (22)	133,216 (44)
	Stream protection fencing with wide width buffer	WP-2W		7,457 (3)	7,344 (2)	14,801 (5)
	Exclusion fence maintenance	CCI		8,556	8,556	17,112
Pasture/ Cropland (livestock)	Extension of watering system	SL-7	acres	150	50	200
	Improved pasture management	SL-10		4,858	1,619	6,477
	Woodland buffer filter	FR-3	acres-treated	689	2,067	2,756
	Afforestation of crop, hay and pasture land	FR-1	acres	682	2,046	2,728
	Critical area stabilization	SL-11		7	21	28
	Cover crop	SL-8B, SL-8H		26	25	51
	Animal waste control facility (beef)	WP-4, WP-4B, WP-4FP, WP-4LL, WP-4SF	system	8	8	16
	Roof runoff management	WQ-12		3	2	5
	Water control structure	WP-1	acres-treated	37	75	112
	Farm pond	WP-5		75	150	225
Residential septic (human)	Onsite sewage system repair w/ permit	RB-3	repair	9	8	17
	Full inspection and non-permitted onsite sewage system repair	RB-3M		9	8	17
	Onsite sewage system installation/replacement	RB-4	system	4	3	7
	Onsite sewage system installation/replacement w/ pump	RB-4P		4	3	7
	Alternative sewage system	RB-5		70	70	140
	Septic tank pump-out	RB-1	pump-out	89	89	178
Pet waste (pet)	Pet waste education program	N/A	program	1	1	1

Table 8-4. Staged implementation goals in the Mill Run – Mountain watershed for each stage.

BMP Type	Description	BMP Code	Units	Extent		
				Stage 1	Stage 2	Total
Direct deposit (livestock)	Stream Exclusion with Narrow Width Buffer and Grazing Land Management	SL-6N	feet/ (system)	6,796 (2)	6,389 (2)	13,185 (4)
	Stream Exclusion with Wide Width Buffer and Grazing Land Management	SL-6W, SL-6F, CRSL-6		38,508 (13)	36,204 (12)	74,712 (25)
	Stream protection fencing with narrow width buffer	WP-2N		755 (1)	710 (1)	1,465 (2)
	Stream protection fencing with wide width buffer	WP-2W		4,279 (1)	4,022 (1)	8,301 (2)
	Exclusion fence maintenance	CCI		4,883	4,883	9,766
Pasture/ Cropland (livestock)	Extension of watering system	SL-7	acres	100	34	134
	Improved pasture management	SL-10		3,238	1,079	4,317
	Woodland buffer filter	FR-3	acres-treated	388	1,166	1,554
	Afforestation of crop, hay and pasture land	FR-1	acres	385	1,154	1,539
	Critical area stabilization	SL-11		4	12	16
	Cover crop	SL-8B, SL-8H		10	9	19
	Animal waste control facility (beef)	WP-4, WP-4B, WP-4FP, WP-4LL, WP-4SF	system	7	7	14
	Roof runoff management	WQ-12		3	2	5
	Water control structure	WP-1	acres-treated	75	151	226
	Farm pond	WP-5		151	302	453
Residential septic (human)	Onsite sewage system repair w/ permit	RB-3	repair	13	12	25
	Full inspection and non-permitted onsite sewage system repair	RB-3M		13	12	25
	Onsite sewage system installation/replacement	RB-4	system	18	17	35
	Onsite sewage system installation/replacement w/ pump	RB-4P		18	17	35
	Alternative sewage system	RB-5		27	26	53
	Septic tank pump-out	RB-1	pump-out	78	78	156
Pet waste (pet)	Pet waste education program	N/A	program	1	1	1

Table 8-5. Staged implementation goals in the Mine Run watershed for each stage.

BMP Type	Description	BMP Code	Units	Extent		
				Stage 1	Stage 2	Total
Direct deposit (livestock)	Stream Exclusion with Narrow Width Buffer and Grazing Land Management	SL-6N	feet/ (system)	4,190 (1)	4,069 (1)	8,259 (2)
	Stream Exclusion with Wide Width Buffer and Grazing Land Management	SL-6W, SL-6F, CRSL-6		21,370 (7)	20,754 (7)	42,124 (14)
	Stream protection fencing with wide width buffer	WP-2W		2,374 (1)	2,306 (1)	4,680 (2)
	Exclusion fence maintenance	CCI		2,753	2,753	5,506
Pasture/ Cropland (livestock)	Extension of watering system	SL-7	acres	72	24	96
	Improved pasture management	SL-10		2,326	775	3,101
	Woodland buffer filter	FR-3	acres-treated	496	165	661
	Afforestation of crop, hay and pasture land	FR-1	acres	164	491	655
	Critical area stabilization	SL-11		2	5	7
	Cover crop	SL-8B, SL-8H		4	3	7
	Animal waste control facility (beef)	WP-4, WP-4B, WP-4FP, WP-4LL, WP-4SF	system	5	5	10
	Roof runoff management	WQ-12		2	2	4
	Water control structure	WP-1	acres-treated	54	108	162
	Farm pond	WP-5		108	215	323
Residential septic (human)	Onsite sewage system repair w/ permit	RB-3	repair	15	14	29
	Full inspection and non-permitted onsite sewage system repair	RB-3M		15	14	29
	Onsite sewage system installation/replacement	RB-4	system	21	20	41
	Onsite sewage system installation/replacement w/ pump	RB-4P		21	20	41
	Alternative sewage system	RB-5		31	30	61
	Septic tank pump-out	RB-1	pump-out	101	101	202
Pet waste (pet)	Pet waste education program	N/A	program	1	1	1

Table 8-6. Staged implementation goals in the Fields Run – Rapidan River watershed for each stage.

BMP Type	Description	BMP Code	Units	Extent		
				Stage 1	Stage 2	Total
Direct deposit (livestock)	Exclusion fence maintenance	CCI	feet	152	151	303
Pasture/ Cropland (livestock)	Extension of watering system	SL-7	acres	14	5	19
	Improved pasture management	SL-10		440	147	587
	Cover crop	SL-8B, SL-8H		7	7	14
Residential septic (human)	Onsite sewage system repair w/ permit	RB-3	repair	14	13	27
	Full inspection and non-permitted onsite sewage system repair	RB-3M		14	13	27
	Onsite sewage system installation/replacement	RB-4	system	19	19	38
	Onsite sewage system installation/replacement w/ pump	RB-4P		19	19	38
	Alternative sewage system	RB-5		31	31	62
	Septic tank pump-out	RB-1	pump-out	117	116	233
Pet waste (pet)	Large scale pet waste treatment system	PW-3	system	0	1	1
	Pet waste education program	N/A	program	1	1	1

Table 8-7. Staged implementation goals in the Wilderness Run watershed for each stage.

BMP Type	Description	BMP Code	Units	Extent		
				Stage 1	Stage 2	Total
Direct deposit (livestock)	Stream Exclusion with Narrow Width Buffer and Grazing Land Management	SL-6N	feet/ (system)	3,041 (1)	2,981 (1)	6,022 (2)
	Stream Exclusion with Wide Width Buffer and Grazing Land Management	SL-6W, SL-6F, CRSL-6		15,512 (5)	15,201 (5)	30,713 (10)
	Stream protection fencing with wide width buffer	WP-2W		1,723 (1)	1,689 (1)	3,412 (2)
	Exclusion fence maintenance	CCI		2,008	2,007	4,015
Pasture/ Cropland (livestock)	Extension of watering system	SL-7	acres	21	7	28
	Improved pasture management	SL-10		663	221	884
	Woodland buffer filter	FR-3	acres-treated	85	255	340
	Afforestation of crop, hay and pasture land	FR-1	acres	84	253	337
	Critical area stabilization	SL-11		1	3	4
	Cover crop	SL-8B, SL-8H		3	2	5
	Animal waste control facility (beef)	WP-4, WP-4B, WP-4FP, WP-4LL, WP-4SF	system	0	1	1
	Roof runoff management	WQ-12		1	1	2
	Water control structure	WP-1	acres-treated	10	21	31
	Farm pond	WP-5		21	41	62
Residential septic (human)	Onsite sewage system repair w/ permit	RB-3	repair	13	13	26
	Full inspection and non-permitted onsite sewage system repair	RB-3M		13	13	26
	Onsite sewage system installation/replacement	RB-4	system	18	18	36
	Onsite sewage system installation/replacement w/ pump	RB-4P		18	18	36
	Alternative sewage system	RB-5		24	24	48
	Septic tank pump-out	RB-1	pump-out	133	133	266
Pet waste (pet)	Pet waste disposal station	PW-1	station	3	3	6
	Pet waste education program	N/A	program	1	1	1

8.1.2 Water Quality Milestones

Error! Not a valid bookmark self-reference. shows the expected *E. coli* bacteria water quality improvement goals in each implementation stage. There are three expressions of the water quality milestones. The first, a percent exceedance of the previous maximum single sample *E. coli*

criterion (235 cfu/100mL), is provided for an assessment of water quality improvement in years when high frequency monitoring is not conducted. The other two expressions are the percent exceedance of the current 90-day STV and geometric mean E. coli criteria. To better assess the improvement in water quality throughout implementation, each 10-year stage was further divided into 5-year increments with the assumption that half of each stage's implementation practices will be installed in each 5-year period.

Table 8-8. Average annual *E. coli* load, load reductions, and percent exceedance of water quality criteria for each stage.

	Existing	Stage 1		Stage 2		Total
		Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	
Cabin Branch						
Average annual *E. coli* load (cfu/yr)	$6.41x10^{13}$	$4.91x10^{13}$	$3.40x10^{13}$	$1.92x10^{13}$	$4.40x10^{12}$	$4.40x10^{12}$
% Reduction in *E. coli* load from existing	0%	24%	47%	70%	93%	93%
% Exceedance of maximum single sample *E. coli* criterion (235 cfu/100 mL)*	46%	33%	19%	10%	0%	0%
% Exceedance of 90-day STV *E. coli* criterion (410 counts/100 mL)**	100%	78%	55%	28%	0%	0%
% Exceedance of 90-day geometric mean *E. coli* criterion (126 counts/100 mL)**	99%	64%	29%	15%	0%	0%
Cedar Run						
Average annual *E. coli* load (cfu/yr)	$3.49x10^{14}$	$2.90x10^{14}$	$2.30x10^{14}$	$1.72x10^{14}$	$1.13x10^{14}$	$1.13x10^{14}$
% Reduction in *E. coli* load from existing	0%	17%	34%	56%	68%	68%
% Exceedance of maximum single sample *E. coli* criterion (235 cfu/100 mL)*	28%	24%	20%	15%	10%	10%
% Exceedance of 90-day STV *E. coli* criterion (410 counts/100 mL)**	79%	61%	52%	28%	3%	3%
% Exceedance of 90-day geometric mean *E. coli* criterion (126 counts/100 mL)**	27%	18%	8%	4%	0%	0%
Rapidan River #2 (includes reductions attributed to the Upper Rapidan and Robinson Rivers)						
Average annual *E. coli* load (cfu/yr)	$9.02x10^{15}$	$5.49x10^{15}$	$1.96x10^{15}$	$1.93x10^{15}$	$1.90x10^{15}$	$1.90x10^{15}$
% Reduction in *E. coli* load from existing	0%	39%	78%	79%	79%	79%
% Exceedance of maximum single sample *E. coli* criterion (235 cfu/100 mL)*	43%	29%	15%	14%	13%	13%
4%% Exceedance of 90-day STV *E. coli* criterion (410 counts/100 mL)**	100%	56%	11%	8%	5%	5%
% Exceedance of 90-day geometric mean *E. coli* criterion (126 counts/100 mL)**	100%	50%	0%	0%	0%	0%

	Existing	Stage 1		Stage 2		Total
		Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	
Mountain Run #2						
Average annual *E. coli* load (cfu/yr)	$7.36x10^{14}$	$5.70x10^{14}$	$4.03x10^{14}$	$2.22x10^{14}$	$4.16x10^{13}$	$4.16x10^{13}$
% Reduction in *E. coli* load from existing	0%	23%	45%	70%	94%	94%
% Exceedance of maximum single sample *E. coli* criterion (235 cfu/100 mL)*	58%	54%	50%	33%	16%	16%
21%% Exceedance of 90-day STV *E. coli* criterion (410 counts/100 mL)**	100%	100%	100%	61%	21%	21%
% Exceedance of 90-day geometric mean *E. coli* criterion (126 counts/100 mL)**	100%	94%	88%	57%	26%	26%
Sumerduck Run						
Average annual *E. coli* load (cfu/yr)	$2.66x10^{14}$	$2.04x10^{14}$	$1.41x10^{14}$	$7.62x10^{13}$	$1.24x10^{13}$	$1.24x10^{13}$
% Reduction in *E. coli* load from existing	0%	24%	47%	71%	95%	95%
% Exceedance of maximum single sample *E. coli* criterion (235 cfu/100 mL)*	69%	61%	53%	32%	11%	11%
% Exceedance of 90-day STV *E. coli* criterion (410 counts/100 mL)**	100%	97%	94%	52%	9%	9%
% Exceedance of 90-day geometric mean *E. coli* criterion (126 counts/100 mL)**	100%	93%	85%	53%	21%	21%
Potato Run						
Average annual *E. coli* load (cfu/yr)	$2.87x10^{14}$	$2.18x10^{14}$	$1.49x10^{14}$	$8.08x10^{13}$	$1.25x10^{13}$	$1.25x10^{13}$
% Reduction in *E. coli* load from existing	0%	24%	48%	72%	96%	96%
% Exceedance of maximum single sample *E. coli* criterion (235 cfu/100 mL)*	70%	62%	53%	32%	11%	11%
% Exceedance of 90-day STV *E. coli* criterion (410 counts/100 mL)**	100%	97%	94%	52%	9%	9%
% Exceedance of 90-day geometric mean *E. coli* criterion (126 counts/100 mL)**	100%	93%	85%	54%	22%	22%

	Existing	Stage 1		Stage 2		Total
		Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	
Brook Run						
Average annual *E. coli* load (cfu/yr)	$3.21x10^{14}$	$2.44x10^{14}$	$1.67x10^{14}$	$8.91x10^{13}$	$1.12x10^{13}$	$1.12x10^{13}$
% Reduction in *E. coli* load from existing	0%	24%	48%	73%	97%	97%
% Exceedance of maximum single sample *E. coli* criterion (235 cfu/100 mL)*	69%	60%	50%	28%	6%	6%
5%% Exceedance of 90-day STV *E. coli* criterion (410 counts/100 mL)**	100%	96%	92%	49%	5%	5%
% Exceedance of 90-day geometric mean *E. coli* criterion (126 counts/100 mL)**	100%	91%	81%	48%	14%	14%
Black Walnut Run						
Average annual *E. coli* load (cfu/yr)	$2.38x10^{14}$	$1.82x10^{14}$	$1.26x10^{14}$	$6.75x10^{13}$	$9.08x10^{12}$	$9.08x10^{12}$
% Reduction in *E. coli* load from existing	0%	24%	47%	72%	96%	96%
% Exceedance of maximum single sample *E. coli* criterion (235 cfu/100 mL)*	52%	47%	42%	26%	10%	10%
11%% Exceedance of 90-day STV *E. coli* criterion (410 counts/100 mL)**	100%	95%	89%	50%	11%	11%
% Exceedance of 90-day geometric mean *E. coli* criterion (126 counts/100 mL)**	96%	80%	63%	41%	18%	18%
Mine Run						
Average annual *E. coli* load (cfu/yr)	$5.56x10^{14}$	$4.33x10^{14}$	$3.10x10^{14}$	$1.77x10^{14}$	$4.29x10^{13}$	$4.29x10^{13}$
% Reduction in *E. coli* load from existing	0%	22%	44%	68%	92%	92%
% Exceedance of maximum single sample *E. coli* criterion (235 cfu/100 mL)*	54%	51%	47%	32%	17%	17%
% Exceedance of 90-day STV *E. coli* criterion (410 counts/100 mL)**	100%	99%	97%	62%	26%	26%
% Exceedance of 90-day geometric mean *E. coli* criterion (126 counts/100 mL)**	100%	85%	70%	49%	27%	27%

	Existing	Stage 1		Stage 2		Total
		Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	
Rapidan River #3 (includes reductions attributed to the Upper Rapidan and Robinson Rivers)						
Average annual *E. coli* load (cfu/yr)	$9.51x10^{15}$	$6.43x10^{15}$	$3.34x10^{15}$	$2.71x10^{15}$	$2.07x10^{15}$	$2.07x10^{15}$
% Reduction in *E. coli* load from existing	0%	33%	65%	72%	78%	78%
% Exceedance of maximum single sample *E. coli* criterion (235 cfu/100 mL)*	35%	26%	17%	14%	11%	11%
0%% Exceedance of 90-day STV *E. coli* criterion (410 counts/100 mL)**	97%	62%	27%	14%	0%	0%
% Exceedance of 90-day geometric mean *E. coli* criterion (126 counts/100 mL)**	89%	46%	3%	2%	0%	0%
Wilderness Run						
Average annual *E. coli* load (cfu/yr)	$3.05x10^{14}$	$2.28x10^{14}$	$1.50x10^{14}$	$7.99x10^{13}$	$9.82x10^{12}$	$9.82x10^{12}$
% Reduction in *E. coli* load from existing	0%	26%	51%	74%	97%	97%
% Exceedance of maximum single sample *E. coli* criterion (235 cfu/100 mL)*	55%	41%	27%	14%	1%	1%
% Exceedance of 90-day STV *E. coli* criterion (410 counts/100 mL)**	100%	83%	65%	33%	0%	0%
% Exceedance of 90-day geometric mean *E. coli* criterion (126 counts/100 mL)**	100%	74%	47%	26%	4%	4%

*Water quality standard at time TMDL was developed.
** Current water quality standard.

Table 8-9 shows the estimated bacteria reductions from each type of BMP in the study area. These are the estimated reductions that occur at the locations of the implemented practices. These values are different than reductions at the outlets of the impaired streams because of factors such as bacteria die off that occur between the points of implementation and the modeled watershed outlets.

Table 8-9. Estimated bacteria reductions for each BMP type.

Bacteria Source	BMP Description (Cost-share codes in parentheses)	Number of Units	Estimated Bacteria Reduction (cfu/yr)	
			Average Reduction per Unit of BMP	Total Reduction
Livestock in stream	Livestock exclusion from waterway (SL-6N, SL-6W, SL-6F, CRSL-6, WP-2W)	149 systems	$5.20x10^{12}$	$7.75x10^{14}$
Pasture and cropland	Streamside buffer (10 - 100 feet) (SL-6N, SL-6W, SL-6F, CRSL-6, WP-2W, FR-3)		$2.91x10^{12}$	$4.34x10^{14}$
	Rotational grazing and improved pasture management (SL-7, SL-10)	20,973 acres	$1.02 x10^{12}$	$2.13x10^{16}$
	Permanent vegetative cover on critical areas (SL-11)	70 acres	$1.01x10^{12}$	$7.05x10^{13}$
	Afforestation of crop, hay and pasture land (FR-1)	6,665 acres	$1.01x10^{12}$	$6.72x10^{15}$
	Cover crop (SL-8B, SL-8H)	138 acres	$3.57x10^{09}$	$4.93x10^{11}$
	Animal waste control facility (WP-4, WP-4B, WP-4FP, WP-4LL, WP-4SF)	50 systems	$1.78x10^{13}$	$8.89x10^{14}$
	Roof runoff management (WQ-12)	19 systems	$9.49x10^{12}$	$1.80x10^{14}$
	Water control structure (WP-1)	1,134 ac-treated	$3.05x10^{11}$	$3.46x10^{14}$
	Farm pond (WP-5)	2,269 ac-treated	$3.05x10^{11}$	$6.93x10^{14}$
Straight pipes and failing septic systems	Repair or replace (RB-2, RB-2P, RB-3, RB-3M, RB-4, RB-4P, RB-5)	1,191 systems	$2.39x10^{12}$	$2.85x10^{15}$
Residential pet	Pet waste disposal station (PW-1)	6 systems	$4.30x10^{12}$	$2.58x10^{13}$
	Pet waste confined canine unit (PW-3)	1 system	$5.74x10^{12}$	$5.74x10^{12}$
	Pet waste education program	1 program	$8.47x10^{13}$	$8.47x10^{13}$

8.2 Water Quality Monitoring

8.2.1 DEQ Monitoring

Improvements in water quality will be evaluated through water quality monitoring conducted at DEQ monitoring stations located in the watersheds as shown in Figure 8-1 and Table 8-10. At these stations, monitoring will begin no sooner than the second odd numbered calendar year

following the initiation of implementation once the IP has been accepted by EPA and approved by the VA SWCB. While implementation is ongoing through the various state and federal agency programs, initiation of implementation is generally defined as beginning once obtaining a CWA Section 319(h) project through the annual RFA process. Beginning implementation monitoring after 2 to 3 years of implementation will help ensure that time has passed for remedial measures to have stabilized and BMPs to have become fully functional.

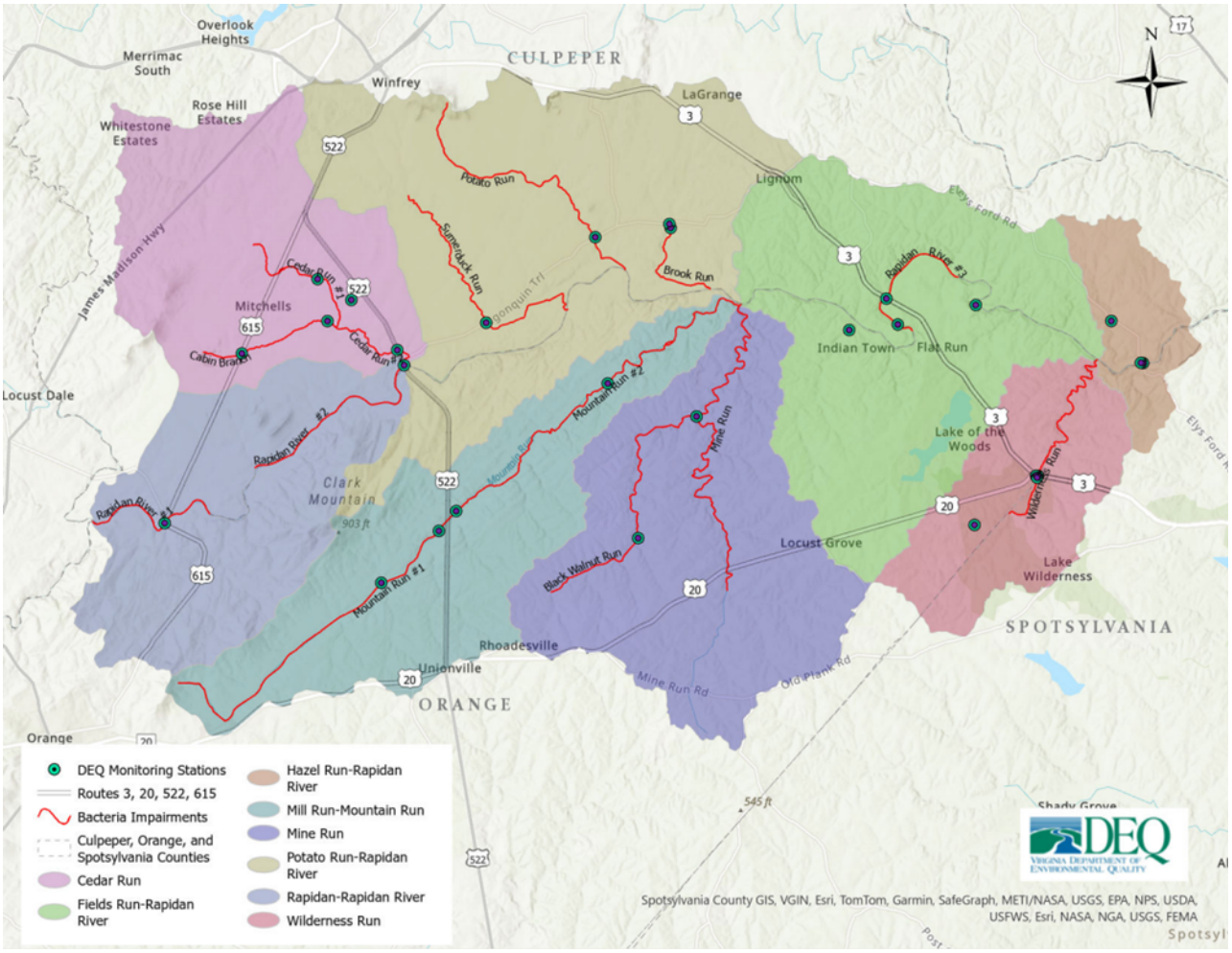

Figure 8-1. Water quality monitoring stations used to evaluate implementation in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed.

Table 8-10. Water quality monitoring stations used to evaluate implementation in the Mountain Run, Mine Run, Cedar Run and the Lower Rapidan River watershed.

Assessment Unit	DEQ Monitoring Station	Stream Name	Station Description
VAN-E16R_CAB01A22	3-CAB000.22 3-CAB002.23	Cabin Branch	Route 655 (Summerville Road) & Route 615 (Rapidan Road)
VAN-E16R_CED02A04	3-CED003.52	Cedar Run	Route 652 (Mitchell Road)
VAN-E16R_CED01A00	3-CED000.59	Cedar Run	Route 522 (Zachary Taylor Hwy)
VAN-E16R_RAP03A08	3-RAP037.90	Rapidan River	Route 615 (Rapidan Road)
VAN-E16R_RAP01A04	3-RAP030.21	Rapidan River	Route 522 (Zachary Taylor Hwy)
VAN-E17R_MTR02A02	3-MTR010.60	Mountain Run	Route 666 (Hawfield Rd)
VAN-E17R_MTR01A00	3-MTR003.51 3-MTR008.31	Mountain Run	Routes 611 (Raccoon Ford Road) & 621 (Pine Stake Road)
VAN-E17R_SUM01A04	3-SUM002.40	Sumerduck Run	Route 647 (Twin Mountains Road)
VAN-E17R_POT01A14	3-POT001.06	Potato Run	Route 647 (Twin Mountains Road)
VAN-E17R_BRK01A04	3-BRK002.64	Brook Run	Route 647 (Batna Road)
VAN-E17R_BWR01A06	3-BWR004.13	Black Walnut Run	Route 602 (Old Office Road)
VAN-E17R_MIR01A00	3-MIR004.05	Mine Run	Route 611 (Raccoon Ford Rd)
VAN-E18R_RAP05A08	3-RAP014.45	Rapidan River	Route 3 (Germanna Highway)
VAN-E18R_WIL01A08	3-WIL004.00	Wilderness Run	Route 3 (Plank Road)

Most of the stations are part of DEQ's Ambient Monitoring Program, wherein bi-monthly watershed monitoring takes place on a rotating basis for two consecutive years of a six-year assessment cycle. Other programs at DEQ such as, but not limited to, the Implementation Monitoring (IM) program also collect data in order to evaluate stream health. At a minimum, the frequency of sample collections will be every other month for two years. After two years of bi-monthly monitoring an evaluation will be made to determine if water quality is improving. If the

water quality is improving and is close to meeting the water quality milestones presented earlier in Chapter 8, high frequency monitoring will then be conducted to assess the segments potential for delisting. 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 (DEQ, 2020). If the an implementation monitoring station associated with this Implementation Plan is not trending to meet the bacteria standard within this two-year period, monitoring will be discontinued for two years. Bi-monthly monitoring will be resumed for another two years on the odd numbered calendar year in the third two-year period of the six-year assessment window. After this, the most recent two years of data will be evaluated, and the same criteria as was used for the first two-year monitoring cycle will apply. Monitoring station locations are evaluated annually in order to address Program and watershed needs and are subject to change from the list shown in Table 8-16.

8.2.2 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. DEQ offers information on Citizen Water Quality Monitoring at:
https://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityMonitoring/CitizenMonitoring.aspx.

8.3 Prioritizing Implementation Actions

Staged implementation implies the process of prioritizing BMPs to achieve the greatest bacteria reduction benefits early in the process. For example, practices that reduce bacteria from residential septic systems and straight pipes are considered 100% effective. Since malfunctioning septic systems contributing sewage to surface water or groundwater pose risks to human health, and straight pipes are illegal it will be essential to focus on these sources. Also, the TMDL study indicated that runoff from pasture contributes the majority of the total bacteria load in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River project area. Prioritizing implementation practices such as livestock exclusion from the stream and improved pasture management will provide the highest return on water quality improvement.

Implementation actions were prioritized spatially based on watershed inventory and optimum utilization of limited technical and financial resources. The Mountain Run, Mine Run, Cedar Run and Lower Rapidan River implementation area was divided into sub-watersheds to identify focus areas for prioritization of agricultural and residential BMPs (Figures 8-2 and 8-3). Table 8-11 lists the order of priorities by BMP type and the top priority areas. To illustrate, addressing the human sources of bacteria along Sumerduck Run, Potato Run, Brook Run, and Mountain Run has a higher priority over other sources in the Residential category, while livestock exclusion on Cabin Branch and Cedar Run has a higher priority in addressing bacteria sources in the Agricultural category. Factors used to develop BMP priorities were human and livestock health risks, effectiveness of

BMPs, stakeholder interest, costs, and ease of installation. The distribution of implementation milestones listed in Tables 8-1 through 8-7 correspond with these priorities.

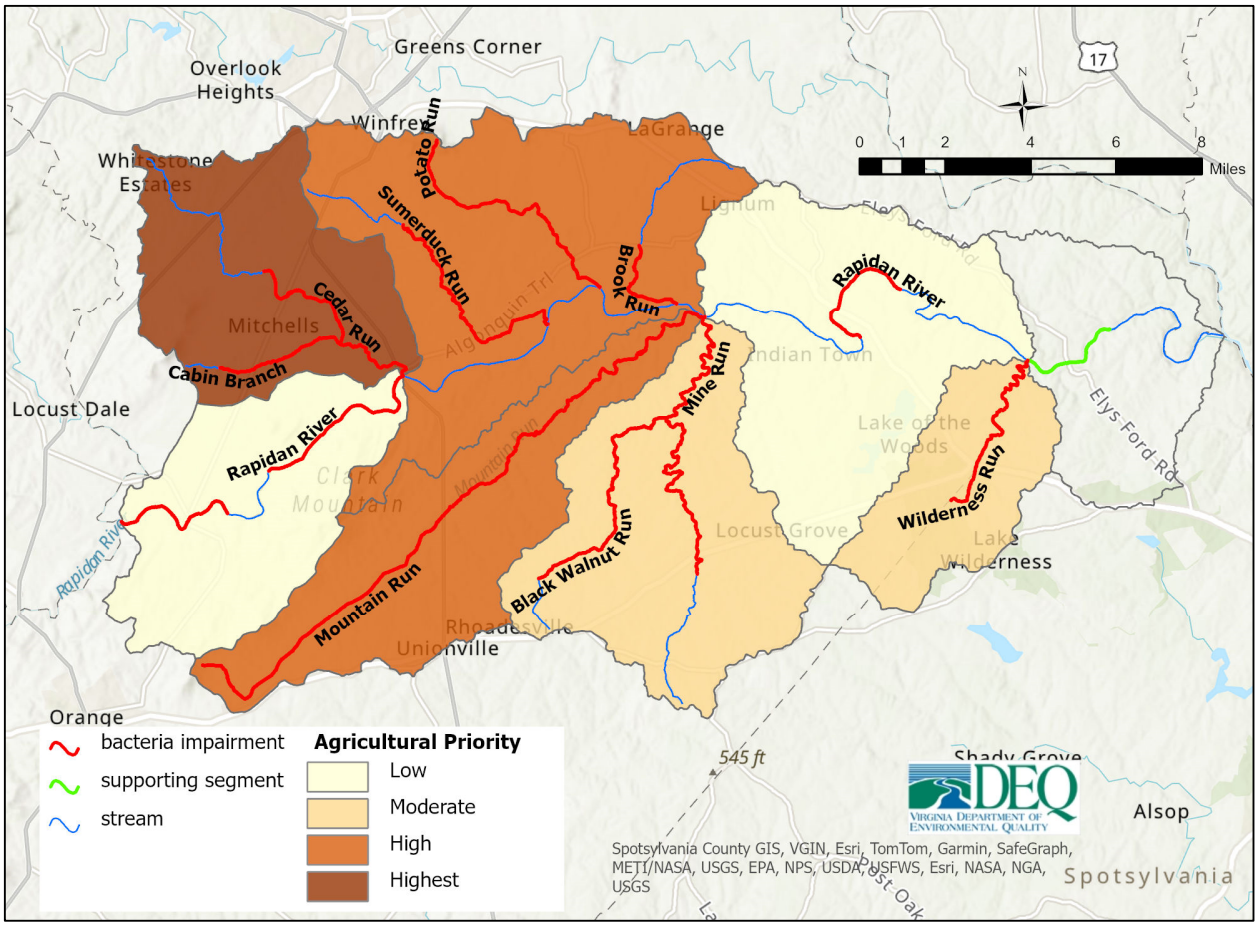

Figure 8-2. Agricultural prioritization by sub-watershed for the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River project area.

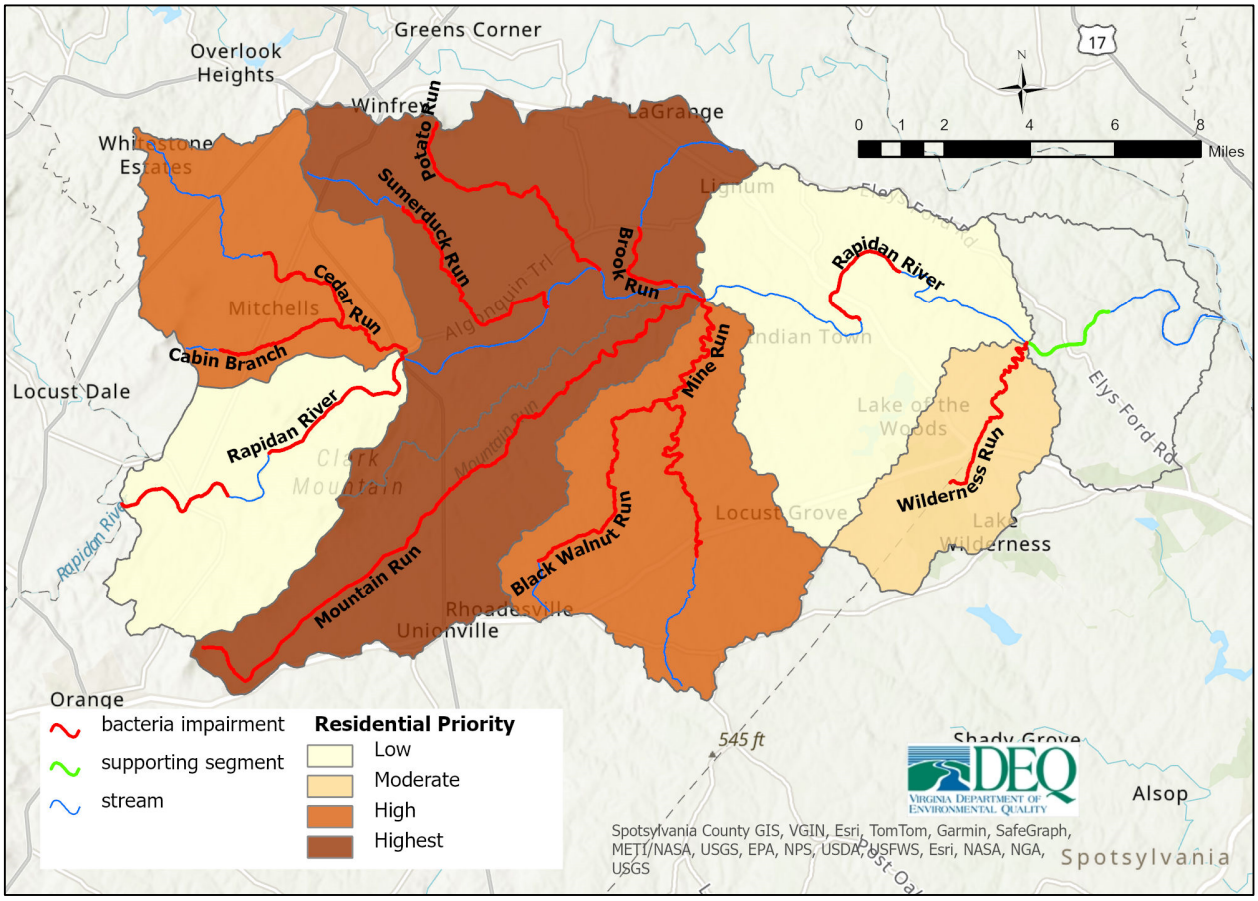

Figure 8-3. Residential prioritization by sub-watershed for the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River project area.

Table 8-11. Implementation priorities for meeting water quality goals in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed.

BMP Type (Cost-share codes in parentheses)	Sub-watershed with 6th order HUC *(unless otherwise noted)*
Agricultural	
- Livestock exclusion systems (SL-6N, SL-6W, SL-6AT)	Cedar Run Mill Run – Mountain Run Potato Run – Rapidan River Mine Run Wilderness Run Rapidan – Rapidan River Fields Run – Rapidan River
- Rotational grazing and improved pasture management (SL-7, SL-10)	
- Animal waste control facility (WP-4, WP-4B, WP-4FP, WP-4LL, WP-4SF)	as needed
- Afforestation of crop, hay and pasture land (FR-1)	
- Critical area stabilization (SL-11)	
- Roof runoff management (WQ-12)	
- Long term vegetative cover on cropland (SL-1)	
- Cover crop (SL-8B, SL-8H)	
Residential	
- Repair/Replacement of straight pipes and failing septic systems (RB-3, RB-3M, RB-4, RB-4P, RB-5)	Potato Run – Rapidan River Mill Run – Mountain Run Cedar Run Mine Run Wilderness Run Rapidan – Rapidan River Fields Run – Rapidan River
- Septic tank pump-outs (RB-1)	entire watershed
- Pet waste education program	entire watershed
- Pet waste disposal station (PW-1)	Lake of the Woods
- Large scale pet waste treatment systems	as needed

8.4 Adaptive Management Strategy

An adaptive management strategy will be utilized in the implementation of this plan in order to achieve the 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 8.2 of this report, and evaluation of BMP implementation. Both of these 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, load reductions achieved through BMP implementation and water quality monitoring results. Information in the Progress Report can be used to determine if adaptive management is necessary. Once the IP is accepted by EPA, it will be placed in the triennial rotation of Progress Reports; therefore, interim milestone achievements at periods less than 10 years (length of each stage in this IP) will be shown. Furthermore, at the end of Stage 1 (Year 10), if assessments of

water quality and implementation milestones find that progress toward achieving the bacteria reduction goals is not as expected, the implement

ation strategy can be adjusted. One aspect of an Implementation Plan is for it to be considered a living document, amenable to changes over time. Stakeholders, such as Culpeper SWCD and DEQ, will be responsible for making the determination if the IP needs to be updated or adjusted. Stakeholders' roles are described in Chapter 9.

As new technologies and innovative BMPs to address bacteria reduction become available, these practices will be evaluated for implementation in the watershed. Other developments, for example, an extension of the county's sewer lines, could also result in an adaptation of the original implementation plan. In addition, as new funding opportunities become available, they will be reviewed and pursued if applicable in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed.

8.4.1 Beaver Dam Analogs (BDA)

Beaver Dam Analogs (BDA) are man-made structures mimicking beaver dams (EWU, 2022). Although it is unknown about the bacteria reductions that may result from BDAs, this BMP can be an example of a future adaptative management strategy once additional research is performed overtime indicating known bacteria reductions from BDAs. Eastern Washington University and Utah State University have ongoing research studies on BDAs and these BMPs becoming an increasingly popular restoration tool (EWU, 2022). The study at Eastern Washington University will be a long-term study assessing BDA success over time, and analyzing whether BDAs play a similar role to beaver dams in increasing ecosystem resilience and climate resiliency. BDAs are a cost-effective solution to help reduce sediment impairments in streams caused by wildfire debris or livestock use by slowing the flow of water and trapping sediment (Methow Beaver Project, 2024). Overtime long-term studies are being performed at universities to provide results on which pollutants and nutrients BDAs may filter out of streams.

9. STAKEHOLDERS AND THEIR ROLE IN IMPLEMENTATION

Achieving the goals of this plan is dependent on community engagement from community members who live, work, and recreate in the project area. Community members involved in the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed implementation plan consisted of local residents, nonprofit organizations, and local county governments. The Culpeper Soil and Water Conservation District covers the Orange County and Culpeper County portions as well as the Rappahannock Rapidan Regional Commission and the Rappahannock-Rapidan Health District. These organizations are necessary in order to address residential, agricultural and pet waste implementation needs.

9.1 Partner Roles and Responsibilities

9.1.1 Watershed Landowners

Participation by homeowners and local farmers are equally important in the success of this implementation plan. Residential property owners will need to repair or replace any malfunctioning septic system and ensure that their septic systems continue to work properly by regularly pumping and having inspections every 3 to 5 years. SWCD and NRCS Conservationist staff will work with farmers to select the most applicable and cost-efficient practices for their farms. To assist with this selection, it is important to consider characteristics of farms and farmers in the watersheds that will affect the decisions farmers make when it comes to implementing conservation practices on their farms. For example, the average size of farms is an important factor to consider, since it affects how much land a farmer can give up for a riparian buffer. The average age of a farmer, which was 58 in Virginia in 2017, may also influence their decision to implement BMPs, 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 BMPs. Table 9-1 provides a summary of relevant characteristics of farmers and producers in Culpeper, Orange and Spotsylvania Counties from the 2022 Agricultural Census (USDA-NASS, 2022). These characteristics were considered when developing implementation scenarios and should be utilized to develop suitable education and outreach strategies.

In addition to local farmers and homeowners, participation from 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.

Table 9-1. Characteristics of farms and farmers in Culpeper, Orange and Spotsylvania Counties (USDA-NASS, 2022).

Characteristic	Extent by County		
	Culpeper	Orange	Spotsylvania
Number of farms	609	430	281
Land in farms (acres)	115,816	103,983	39,666
Full owners of farms	449	324	213
Part owners of farms	126	84	53
Tenants	34	22	15
Operators identifying farming as their primary occupation	503	364	237
Operators identifying something other than farming as their primary occupation	573	413	267
Average years present on the farm	19.2	18.3	21.4
Average age of primary operator	59.2	59.4	62.0
Average size of farm (acres)	190	242	141
Average value of farmland and buildings ($/acre)	7,957	6,611	7,739
Average net cash farm income of operation ($)	17,833	50,683	16,768
Farms with internet access	511	354	237
Farm typology (farms)			
Family or individual	463	340	217
Partnership	51	38	31
Family-held corporation	68	44	23
Corporation other than family held	11	6	2
Other (cooperative, estate or trust, institutional etc.)	16	2	8

9.1.2 Culpeper Soil and Water Conservation District (CSWCD),Tri-County City Soil and Water Conservation District (TCC-SWCD) and Natural Resource Conservation Service (NRCS)

At the local level in Virginia, SWCDs work in partnership with the USDA/NRCS staff to deliver agricultural conservation technical advice and services to area producers. The Culpeper SWCD serves all of Culpeper and four other adjoining counties and has the largest geographic jurisdictions and staff capacity within Virginia. Tri-County/City SWCD serves Spotsylvania County. SWCDs have considerable technical assistance capabilities to offer landowners within the IP watersheds. Together with NRCS, CSWCD and TCC-SWCD continually reach out to farmers within their watersheds to provide conservation practice technical expertise. With dedicated staffing capability for the IP watersheds, the SWCDs can better provide agricultural BMP design and layout assistance to individual producers. SWCD staff will more broadly communicate with landowners in the watersheds to help advance environmental education and encourage participation in conservation programs, both agricultural and residential-focused. Once this IP meets the requirements for funding eligibility under EPA's CWA Section 319(h) program, the SWCDs may apply for grant assistance to enable them to target their expertise to the IP project area landowners.

A residential septic system maintenance cost-share program and/or pet waste program could be administered by a number of different entities including the SWCDs or the Rappahannock-Rapidan Health District of the Virginia Department of Health.

9.1.3 Orange, Culpeper and Spotsylvania Counties

Decisions made by local government staff and elected officials regarding land use and zoning will play an important role in the implementation of this plan. This makes the Counties a key partner in long term implementation efforts.

9.1.4 Virginia Department of Environmental Quality (DEQ)

The Virginia Department of Environmental Quality has a lead role in the development of IPs to address nonpoint source pollutants such as bacteria from straight pipes, failing septic systems, pet waste, agricultural operations, and stormwater that contribute to water quality impairments. DEQ provides available grant funding and technical support for the implementation of NPS (nonpoint source) components of IPs. DEQ will work closely with project partners including the Culpeper Soil and Water Conservation District and Tri-County/City Soil and Water Conservation District to track implementation progress for BMPs. 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 stakeholder group 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 the Mountain Run, Mine Run, Cedar Run and Lower Rapidan River watershed in order to assess water quality and determine when restoration has been achieved and the stream can be removed from Virginia's impaired waters list.

9.1.5 Virginia Department of Conservation and Recreation (DCR)

The Virginia Department of Conservation and Recreation administers the Virginia Agricultural BMP Cost-Share Program, working closely with Soil & Water Conservation Districts to provide cost-share and operating grants needed to deliver this program at the local level. 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.

9.1.6 Virginia Department of Health (VDH)

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

9.1.7 Virginia Cooperative Extension (VCE)

The local office of VCE is located in Culpeper, and connects residents to Virginia's land-grant universities, Virginia Tech and Virginia State University. Through educational programs based on research and developed with input from local stakeholders, VCE offices help to improve local communities with programs in Agriculture and Natural Resources, Family and Consumer Sciences, 4-H Youth Development, and Community Viability.

9.1.8 Friends of the Rappahannock (FOR)

FOR has offered longstanding leadership of efforts to protect and improve the quality of the natural and cultural resources of the Rappahannock River basin. FOR's goals are organized around advocacy, restoration, and education, and they are highly active on each of these fronts. Its education and outreach efforts are supported in part by a Chesapeake Bay "Roundtable" grant designed to foster broadened support for local and regional efforts to restore water quality and engage citizens and stakeholder organizations in collaborative efforts toward that end. FOR has a Rappahannock River basin headwaters office in Culpeper, Virginia.

9.1.9 Rappahannock-Rapidan Regional Commission (RRRC)

RRRC serves Culpeper County and Orange County providing a variety of progressional planning and technical resources to local governments and community members. RRRC encourages and facilitates local government cooperation in addressing regional basis problems of greater than local significance. Among grant writing assistance, program management, land use planning, transportation planning and housing and homeless ness planning, RRRC also has a dedicated program area toward agriculture and environmental planning. RRRC facilitates a land use and environment committee, supports Chesapeake Bay TMDL and local TMDL efforts, and protects land through the promotion of green infrastructure. The mission and involvement of RRRC in this implementation plan process will help carry forward the implementation goals.

9.1.10 George Washington Regional Commission (GWRC)

GWRC serves Spotsylvania County as Planning District 16. GWRC's focus areas to encourage and facilitate local government cooperation on local issues are economic development, environmental services, human services, affordable housing, transportation demand management, and rural and urban transportation planning. GWRC's jurisdiction sits in the Chesapeake Bay watershed which means all water in their region drains into the Chesapeake Bay. GWRC provides staff to support environmental planning by supporting the Chesapeake Bay and local TMDLs/IPs, coastal zone management, education and outreach, green infrastructure, resiliency and has recently created their own septic program partnering with the local health department.

9.1.11 Piedmont Environmental Council (PEC)

PEC was formed in 1972 and works with the citizens of its nine-county region to conserve land, create high-quality communities, strengthen rural economies, celebrate historic resources, protect air and water quality, build smart transportation networks, promote sustainable energy choices, restore wildlife habitat, and improve people's access to nature. PEC works to empower citizens to

protect what makes the Piedmont a wonderful place and encourage them to pursue a positive vision for the region's future. PEC has a long history of working with landowners to conserve their land through easements, is active in water quality monitoring, is jointly pursuing the Headwaters Stream Initiative with FOR to increase riparian tree plantings in the upper Rappahannock basin and manages the "Culpeper Fund" that provides resources to support local environmental quality restoration projects in Culpeper County.

9.1.12 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:

- American Farmland Trust
- Department of Forestry
- Rappahannock River Roundtable
- Culpeper Master Gardeners
- Small Farm Outreach Program

9.2 Integration with Other Watershed Plans

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

9.2.1 Culpeper County Comprehensive Plan

The current Comprehensive Plan was approved in 2023 (Culpeper County, Virginia, 2023). This plan has a dedicated chapter (Chapter 4) toward analyzing current and future environmental and historic preservation concerns and trends in Culpeper County.

9.2.2 Rappahannock-Rapidan Regional Commission

Environmental and natural resource planning is a long-standing project area for the Regional Commission. Recent efforts include coordination of the development and implementation of the Region's Chesapeake Bay Watershed Implementation Plan and a Regional Green Infrastructure Plan. The Commission's Land Use and Environment Committee provides valuable input on these projects. RRRC has noted that it can be helpful to link both local and regional watershed restoration goals in project proposals to funders, such as NFWF's Chesapeake Bay Restoration grant program. More information on RRRC's existing plans and activities may be accessed at: https://www.rrregion.org/program_areas/environmental/index.php.

9.2.3 Virginia's Chesapeake Bay TMDL Watershed Implementation Plan

A Total Maximum Daily Load was prepared by EPA for the Chesapeake Bay in 2010. The overall watershed pollutant loadings are divided among the Bay states and their major tributary basins, as

well as by major source categories (wastewater, urban storm water, septic, agriculture, air deposition). Virginia and other Bay states have been required by the EPA to prepare Watershed Implementation Plans (WIP) to guide their efforts to achieve the pollutant reductions called for in the TMDL. During 2018-19, local government jurisdictions, regional commissions, and soil and water conservation districts were all engaged in a detailed effort to prepare a "bottom-up" plan of specific conservation measures designed to achieve Virginia's Bay TMDL goals by 2025. In 2023, the Chesapeake Bay Program partnership formed a Steering Committee to convene about recommendations focused on providing a scope of work, or next steps for the Chesapeake Bay Program beyond 2025 (Chesapeake Bay Program, 2024).

9.2.4 Orange County Comprehensive Plan

The current Comprehensive Plan was approved in 2023 (Orange County, Virginia, 2023). This plan on pages 15-17 discuss preserving historical and environmental resources and developing plans to protect the quality and supply of surface water.

9.2.5 Spotsylvania County Comprehensive Plan

The current Comprehensive Plan was approved in 2021 and amended July 9, 2024 (Spotsylvania, Virginia, 2024). Chapter 6 Natural Resources is dedicated toward protecting environmental resources, protecting the County's potable water resources, creating partnerships to promote and protect natural resources, and promoting education and outreach.

9.3 Legal Authority

The EPA has the responsibility of overseeing the various programs necessary for the success of the CWA. However, administration and enforcement of such programs falls largely to the states. In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. Currently, there are four state agencies responsible for regulating activities that impact bacteria impaired streams 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 source 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).

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

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

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

9.4 Legal Action

The Clean Water Act Section 303(d) calls for the identification of impaired waters. It also requires that the streams be ranked by the severity of the impairment and that TMDLs be calculated for streams to meet water quality standards. Implementation Plans are not required in the Federal Code; however, Virginia State Code does include the development of Implementation Plans for impaired streams. EPA largely ignored the nonpoint source section of the Clean Water Act until citizens began to realize that regulating only point sources was no longer maintaining water quality standards. Lawsuits from citizens and environmental groups citing EPA for not carrying out the

statutes of the CWA began as far back as the 1970s and have continued until the present. In Virginia in 1998, the American Canoe Association and the American Littoral Society filed a complaint against EPA for failure to comply with provisions of §303(d). The suit was settled by Consent Decree, which contained a TMDL development schedule through 2010. It is becoming more common for concerned citizens and environmental groups to turn to the courts for the enforcement of water quality issues.

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

10. FUNDING

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

10.1 Virginia Nonpoint Source Implementation Program

Virginia's nonpoint source (NPS) implementation best management practice cost-share program is administered by DEQ through local Soil & 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 BMPs in designated watersheds. The program uses funds from a variety of sources, including CWA Section319(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 IPs approved by DEQ and accepted by EPA.

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

The cost-share program is funded with state and federal monies through local SWCDs. SWCDs administer the program to encourage farmers and landowners to use BMPs on their land to better control transportation of pollutants into our waters due to excessive surface flow, erosion, leaching, and inadequate animal waste management. Program participants are recruited by SWCDs based upon those factors, which have a great impact on water quality. Cost-share is typically 75% of the actual cost, not to exceed the local maximum.

10.3 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 BMPs 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.

10.4 Virginia Conservation Assistance Program (VCAP)

The Virginia Conservation Assistance Program can provide financial incentives and technical and educational assistance to residential/urban landowners who install stormwater BMPs. The program is administered by SWCDs, who accept and review BMP plans submitted by landowners, verify project eligibility, and issue and track reimbursements for completed projects. All non-agricultural property owners (including businesses and public and private lands) in eligible districts may apply for project funding to reduce erosion and address poor drainage and poor vegetation that contribute to water quality problems. A program manual includes standards and specifications for the urban BMPs that are eligible for reimbursement. The local SWCDs may have staff members available to apply for funds through this program in order to work with interested property owners on eligible BMPs.

10.5 Virginia Water Quality Improvement Fund (WQIF)

This is a permanent, non-reverting fund established by the Commonwealth of Virginia 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.

10.6 Virginia Department of Forestry Logging BMP Cost Share Program

When WQIF funding is made available, DOF offers cost-share assistance to timber harvest operators through a unique program that shares the cost of installing forestry BMPs on timber harvest sites by harvest contractors. Contractors may receive up to 50% of direct project costs, not to exceed $2,500 per parcel, for BMP installation practices involving streams. If the project scope involves the purchase of a portable bridge, assistance shall be 50% of direct project costs plus the portable bridge cost, not to exceed $5,000.

10.7 Virginia Riparian Forest Buffer Tax Credit Program

The primary goal of this program is to provide an incentive to landowners through a tax credit for preserving riparian forest buffers along waterways during a timber harvest operation. In 2000, the Virginia General Assembly enacted the Riparian Buffer Tax Credit

to provide a non-refundable credit to: individuals, family partnerships, grantors trusts, and limited liability corporations. Applicants must own land that abuts a waterway on which timber is harvested. Recipients must refrain from timber harvesting on certain portions of the land for 15 consecutive years. The amount of the credit is equal to 25 percent of the value of the timber retained as a buffer up to a specified limit. The buffer must be at least 35 feet wide and no more than 300 feet and remain intact for 15 years. The applicant must have a stewardship plan for the tract to qualify.

10.8 Virginia Trees for Clean Water Program

Grants are awarded through this program to encourage local government and citizen involvement in creating and supporting long-term and sustained canopy cover. Through funds from the U.S. Forest Service's Chesapeake Watershed Forestry Program, DOF has developed the Virginia Trees for Clean Water program. It is designed to improve water quality in the Chesapeake Bay through on-the-ground efforts to plant trees where they are needed most. Projects include tree planting activities of all types: riparian buffer tree planting, community and neighborhood tree plantings etc. Grant funds will be reimbursed at the conclusion of the project and funding is available on a 50/50 match basis, with in-kind match including volunteer time permissible.

10.9 Clean Water Act (CWA) Section 319(h) Grant Project Funds

Through CWA Section 319(h), EPA awards Virginia grant funds to implement NPS programs. DEQ administers the money annually on a competitive grant basis to fund TMDL implementation projects, outreach and educational activities, water quality monitoring, and technical assistance for staff of local sponsor(s) coordinating implementation. CWA Section 3199h) funding provides for implementation of BMPs in IP watersheds with approved local IPs; the types and number of BMPs identified in Section 8 are the specific activities that may be supported through these grants. Because the Mountain Run, Muddy Run and Lower Hazel River watersheds are located in Virginia's Chesapeake Bay drainage, BMPs that are identified in Table 3 of Chapter 8.2 in Virginia's Phase III WIP document and will result in nutrient and associated sediment reductions both within the local watershed and within Virginia's Rappahannock River Basin will also be considered for funding under this program.

10.10 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.

10.11 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.

10.12 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.

10.13 Southeast Rural Community Assistance Project (SERCAP)

The mission of this project is to promote, cultivate, and encourage the development of water and wastewater facilities to serve low-income residents at affordable costs and to support other development activities that will improve the quality of life in rural areas. Staff members of other community organizations complement the SERCAP staff across the region. They can provide (at no cost): on-site technical assistance and consultation, operation and maintenance/management assistance, training, education, facilitation, volunteers, and financial assistance. Financial assistance includes loans and small grants

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

10.14 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's website. If the project does not fall into the criteria of any special grant programs, a proposal may be submitted as a general grant if it falls under the following guidelines: 1) it promotes fish, wildlife and habitat conservation, 2) it involves other conservation and community interests, 3) it leverages available funding, and 4) project outcomes are evaluated.

10.15 Clean Water State Revolving Fund (CWSRF)

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

10.16 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.

10.17 Community Development Block Grant (CDBG) Program

The Virginia Department of Housing and Community Development (DHCD) sponsors this program which provides financial and technical support to improve housing, water, sewer,

road, and drainage conditions in a community. DHCD offers Planning Grants through the CDBG program. A planning grant can fund the research and initial preparation needed to apply for a block grant. DHCD also offers CDBG grants through the Construction-Ready Water and Sewer Fund for construction costs of installation or improvement of public water or sewer service.

10.18 Other Potential Funding Sources

Additional potential funding sources may be available under the following organizations and programs:

- USDA Natural Resource Conservation Service and Forest Service Joint Chiefs' Landscape Restoration Partnership
- Virginia Outdoors Foundation
- U.S. Fish and Wildlife Service (USFWS) Conservation Grant Program
- USDA Agricultural Conservation Easement Program
- Virginia Environmental Endowment
- Trout Unlimited
- Ducks Unlimited

These organizations and programs have either been identified by the community engagement groups during IP development or mentioned in previous IPs.

As part of adaptive management, the state recognizes that other funding opportunities may become available. These opportunities will be utilized if applicable.

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APPENDIX A: PUBLIC MEETING MINUTES

MINUTES
Cedar Run, Mine Run, Mountain Run, and Lower Rapidan River Implementation Plan
1st Public Meeting

WHEN: **February 21st, 2024; 6:30-8:30 pm**
WHERE: **George Washington Carver Agricultural Research Center**

ATTENDEES:

- Department of Environmental Quality (DEQ)
  - Madison Whitehurst – NPS Data Coordinator – Central Office/PRO, VRO
  - Kaitlin King – NPS Coordinator – Central Office/NRO
  - Ashley Wendt – Technical Reviewer
  - Melissa Secor – NPS Projects Coordinator
  - Karen Kline – Watershed Modeler
  - Kayla Stanley
- Greg Wichelns, Culpeper Soil and Water Conservation District
- Luke Bellow VCE Extension Agent
- Bryan Hoffman, Friends of the Rappahannock
- Harrison Premen, Culpeper Planning and Zoning
- Susan Gugino, Board of Supervisors
- Vy Truong, Virginia Dept of Health
- Don McCown, Piedmont Environmental Council
- Emily Bourdon, Virginia Dept of Health
- Dwayne Dixon, Virginia Dept of Health
- Caleb Pellmann, American Climate Partners
- Patricia Reed, Resident
- Jennifer Bierhuzon, Resident
- Sue Platts, Resident
- Michelle Edwards, Rappahannock Rapidan Regional Commission

Meeting purpose: To kick start the development of a cleanup plan for the Cedar Run, Mine Run, Mountain Run and Lower Rapidan River in Orange, Culpeper, and Spotsylvania counties; Engage the public in this process with their participation.

Meeting goal: Answer questions and identify stakeholders to help develop the Implementation Plan (IP) (also known as a Water Quality Improvement Plan or Clean Up Plan).

Kaitlin King (DEQ) gave a brief introduction of the meeting purpose, gave an overview of Virginia's water quality process, both the bacteria Mountain Run and Mine Run TMDL (approved in 2005) and the bacteria Rapidan River Basin (approved in 2007), what a Clean Up Plan is/is not and next steps/timeline to complete the plan.

A 30-day public comment period starts February, and goes until March 22, 2024, to comment on the development of the IP.

There will be at least two Community Engagement meetings starting in April 2024 to go into more detail about the local needs/interests, types of practices, potential partners, and funding sources so that a draft plan can be developed by August/September 2024. The final public meeting (with the draft plan) is tentatively planned for August/September 2024. It is anticipated that the plan will be approved by EPA Winter 2024/Spring 2025 allowing potential applicants to apply to the RFA in Summer 2025 and accepted applicants receiving funds in Fall/Winter 2026.

Meeting Notes:

Slide 2:
Concerns were raised about failing septic systems in the area. The soil in portions of the IP area are non-permeable. Lower income homeowners may need up to 100% assistance to repair or replace their failing septic systems.

Slide 7:
Meeting participants discussed the idea of level 3 water monitoring data points at being a possible option to fill in gaps with water monitoring where there is not enough data to determine an existing impairment. Ashley Wendt, DEQ, explained that the bacteria standard has changed recently and the process of delisting an impairment is intensive for staff because of the high frequency monitoring requirements. It was also discussed that sometimes there is not a need for additional sampling along a waterbody with multiple impairments because it can almost be assumed that in between the upstream and downstream impairments is also an impairment. Once best management practices are put into place near impaired waterbodies then the streams can be monitored and reassessed to determine if there has been any improvement.

Slide 9:
The question was raised if there is a way for a citizen to apply to have a water monitoring station at a specific location? Is there a way for citizen monitoring to take place along the waterbodies? There are citizen monitoring programs in Virginia and if they choose the option to submit and meet the requirements for level 3 data by DEQ this data can be used in the assessment process to determine waterbody impairments. There is also more information about citizen monitoring and nominating water quality stations on DEQ's website. https://www.deq.virginia.gov/our-programs/water/water-quality/monitoring/citizen-monitoring

Slide 11:
The question was raised if DEQ looks at chemicals in the water as a result of fertilizer runoff? DEQ staff explained that those parameters are assessed, however this implementation plan for the Lower Rapidan River Watershed will only be focusing on fecal coliform exceedance levels in the waterbodies since there is not enough sufficient data on other parameters in the area. The only TMDL in the Lower Rapidan River Watershed that exists are for bacteria impairments.

Slide 13:

The question was raised about if DEQ will be providing numbers of failing septics and unprotected streams from livestock etc. The response is yes, throughout this process DEQ will be providing these data points during the community engagement meetings however the data DEQ provides is using what is readily available to them.

MINUTES
Cedar Run, Mine Run, Mountain Run, and Lower Rapidan River Implementation Plan
1st Community Engagement Meeting

WHEN: **April 12th, 2024; 10:00 a.m.**
WHERE: **George Washington Carver Agricultural Research Center**

ATTENDEES:

- Department of Environmental Quality (DEQ)
  - Madison Whitehurst – NPS Data Coordinator – Central Office/PRO, VRO
  - Kaitlin King – NPS Coordinator – Central Office/NRO
  - Ashley Wendt – Technical Reviewer
  - Melissa Secor – NPS Projects Coordinator
  - Karen Kline – Watershed Modeler
  - Gwen McCrea – Environmental Justice Coordinator NRO
  - Justin Williams – Director, Office of Watershed & Local Government Assistance
- Greg Wichelns, Culpeper Soil and Water Conservation District
- Cheyenne Sheridan, Culpeper Soil and Water Conservation District
- Harrison Premen, Culpeper Planning and Zoning
- Susan Gugino, Board of Supervisors
- Don McCown, Piedmont Environmental Council
- Emily Bourdon, Virginia Dept of Health
- Caleb Pellmann, American Climate Partners
- Michelle Edwards, Rappahannock Rapidan Regional Commission
- Clare Mangum, Virginia Dept. of Health – Environmental Health
- Katherine Merten, Virginia Dept. of Health
- Emily Bourdon, Virginia Dept. of Health
- Jennifer Cosby, Resident
- Eugene Triplett, Resident
- Carl Stafford, Virginia Cooperative Extension Culpeper
- Roland Terrell, Small Farm Outreach Program
- Tom Louher, Cedar Mountain Stone

Meeting purpose: To get initial feedback on the status of the bacteria sources in Cedar Run, Mine Run, Mountain Run and Lower Rapidan River in Orange, Culpeper, and Spotsylvania counties. The goal of this is to have discussion with the community on ways to reduce the bacteria sources in the watershed with best management practices, outreach/education and partnerships; and discuss next steps.

Kaitlin King (DEQ) gave a brief introduction of the meeting purpose, gave an overview of Virginia's water quality process, both the bacteria Mountain Run and Mine Run TMDL (approved in 2005) and the bacteria Rapidan River Watershed (approved in 2007), what a Clean Up Plan is/is

not and next steps/timeline to complete the plan. After the project overview the group discussed in detail through the data presented on septic, pet waste, and agricultural best management practices to reduce bacteria loads in the watershed.

There will be at least one more Community Engagement meeting in the Summer 2024 to go into more detail on the updated data, local needs/interests, types of practices, potential partners, and funding sources so that a draft plan can be developed by August/September 2024. The final public meeting (with the draft plan) is tentatively planned for August/September 2024. It is anticipated that the plan will be approved by EPA Winter 2024/Spring 2025 allowing potential applicants to apply to the Request for Applications (RFA) in Summer 2025 and accepted applicants receiving funds in Fall/Winter 2026.

Meeting Notes:

Slide 9 From the TMDL Study: Bacteria Load Reductions:

The bacteria load reductions show that 0% of bacteria reductions is required from wildlife direct deposition into the streams to meet the delisting criteria. There are wildlife sources of bacteria in this watershed but no reductions needed to meet the delisting criteria. The way the reduction percentages were calculated in the Total Maximum Daily Load (TMDL) plan was taking into account on what reductions are needed from anthropogenic sources that we can control and can these sources meet the delisting criteria alone. Wildlife will be mentioned in the development plan and if there are any plans to address wildlife or resources in the area known during development these can be included in the plan as well.

Question: Why is a straight pipe not a point source? Point sources would be considered in the TMDL focusing on permitted point sources which include only the individual municipal or general domestic sewage permits which are classified as a "Virginia Pollutant Discharge Elimination System." The straight pipes within the Implementation Plan Clean Up Study process are referring to nonpoint source related straight pipes that are non-permitted and can be considered a pipe directly depositing non-treated sewage from a home into a stream, or a septic tank that has no drainfield and is located within 200 feet of a stream.

Slide 10 Residential Overview:

The houses estimated to be on failing septic systems is based on an assume failing rate. The base data will be updated for the next community engagement meeting and reapplied with the assumption. Pending DEQ can receive an updated assumption for this report to apply to the model.

Since TMDL development in 2005 there have been two large housing booms in the watershed which may impact this data when it's updated. There was a question on if there is any data on the number of septic systems that are pumped out. This is not recorded anywhere consistently that we know of aside the numbers under active 319 projects for paid pump-outs.

An issue/concern in the area is that there are individuals who have a permit to fix a septic issue but they don't follow through on fixing the issue (for unknown reasons) which leads to a continued failing system.

Slide 11 What Changes Have You Seen in the Watersheds?
A lot of new homes are being built and current housing stock continues to age. The number of straight pipes listed in the previous slide for houses seems low. Houses with straight pipes is including homes with no septic system. The number of straight pipes is low specifically looking at Potato Run. Wilderness Run lists 0 which doesn't seem accurate.

There hasn't been any expansion out of Cedar Run. The number 77 seems high. May want to contact someone else in Culpeper County to get confirmation on this number of provided a more accurate number.

Slide 12 Potential Residential Wastewater Practices to Reduce Bacteria Load
The question was asked if 319 is regulated. The answer is no 319 funding and an implementation plan clean up study are all supporting voluntary cost-share practices that are nonpoint source. Point sources are regulated which were addressed during the TMDL study and reviewed during the implementation plan, but not governed. If a septic system is under a DEQ general permit 319 funding cannot be used on that system. A permit through VDH to perform septic work is different than a general permit for a discharge system provided by DEQ.

Clarification on the RB-5 BMP Alternative On-site Waste Treatment System: Installation of an alternative onsite sewage system to correct a malfunctioning or failing conventional onsite sewage system, malfunctioning or failing alternative onsite sewage system, or to replace an identified non-complying discharging system (e.g., straight pipe) in situations where installation or replacement of a conventional onsite sewage system cannot be permitted. An alternative onsite sewage system means a treatment works that is not a conventional onsite sewage system.

Slide 13 Residential BMPs Installed Since 2005:
There was a question about RB-4s requiring a permit. We require a permitted installer but cannot contribute 319 funding if the system is under a DEQ/EPA general permit.

Slide 14 Potential Pet Waste Practices to Reduce Bacteria Load
A note was made about that digesters that go into the ground. When other organizations have tried implementing this practice they struggled a lot with finding people who needed them. It is likely we would not want to include that practice as the community doesn't seem to have any need or interest for them.

Slide 15 and 16 What Needs to be Done to Address Residential Septic/Pet Waste Sources of Bacteria
When it comes to repairs versus replacements a rough estimate would be saying 3 out of 10 systems in the watershed would be a repair with the remaining 7 being a replacements. This was a

rough estimate brought up during discussions. In Potato Run the soil does not percolate and it is likely 9 out of 10 houses would need an alternative septic system.

For pet waste station placement it would be likely that Lake of the Woods would be using them. In terms of existing funding there is SWAP and SERCAP through VDH. The SWAP funds have all been allocated recently though and there is not much in the way of available funding through these programs at the moment.

Slide 18 Agriculture BMPs Installed Since 2005
It seems that the amounts of systems installed and acres are not up to date. DEQ will follow up on this data and provide an updated table for the next community engagement meeting.

Slide 20 Potential Agriculture Practices to Reduce Bacteria Load
This watershed area would likely have a strong interest in confined feeding facilities which would fall underneath the categorization of a WP-4 Animal Waste Control Facility. It is estimated that the cost for WP-4s should be higher in the table.

During this discussion the question was raised about nutrient loads. Because this implementation plan is only addressing bacteria it will not go into the detail on any nutrient loads in the watershed. However, there are resources on DEQ and EPA's website to look at this watershed on a map and look at the other impairments in the area which could be associated to sediment and nutrient loads. Reach out to a DEQ staff member for more information.

Slide 21 and 22 What Needs to be Done to Address Agricultural Sources of Bacteria
When it comes to community interest with to what extent feet of a buffer landowners will likely install, 25 and 35 feet buffers are the most common. 50 feet buffers do occur just maybe will not occur as often.

This watershed area is seeing an increase in new farmers and these new farmers will likely need stream exclusion practices. Agricultural cost-share is still really popular. People are doing cover crops, however they seem to not be as popular as they used to be but it's still worth including in the plan.

MINUTES
Cedar Run, Mine Run, Mountain Run, and Lower Rapidan River Implementation Plan
2nd Community Engagement Meeting

WHEN: **June 27th, 2024 at 1:00 p.m.**
WHERE: **George Washington Carver Agricultural Research Center**

ATTENDEES:

- Department of Environmental Quality (DEQ)
  - Kaitlin King – NPS Coordinator – Central Office/NRO
  - Ashley Wendt – Technical Reviewer
  - Karen Kline – Watershed Modeler
- Greg Wichelns, Culpeper Soil and Water Conservation District
- Cheyenne Sheridan, Culpeper Soil and Water Conservation District
- Harrison Premen, Culpeper Planning and Zoning
- Emily Bourdon, Virginia Dept of Health
- Caleb Pellmann, American Climate Partners
- Michelle Edwards, Rappahannock Rapidan Regional Commission
- Clare Mangum, Virginia Dept. of Health – Environmental Health
- Eugene Triplett, Resident
- Roland Terrell, Small Farm Outreach Program
- Julie Norris, Virginia Dept of Health
- Vy Truong, Virginia Dept of Health
- April Harper, Friends of the Rappahannock

Meeting purpose: To get feedback on the proposed BMPs and associated timeline to implement to address the bacteria sources in Cedar Run, Mine Run, Mountain Run and Lower Rapidan River in Orange, Culpeper, and Spotsylvania counties. The goal of this is to have discussion with the community on the most reasonable timeline to stage BMP to reduce the bacteria sources in the watershed with best management practices, outreach/education and partnerships; and discuss next steps.

Kaitlin King (DEQ) gave a brief introduction of the meeting purpose, gave an overview of Virginia's water quality process, both the bacteria Mountain Run and Mine Run TMDL (approved in 2005) and the bacteria Rapidan River Basin (approved in 2007), what a Clean Up Plan is/is not and next steps/timeline to complete the plan. After the project overview the group discussed in detail through the data presented on septic, pet waste, and agricultural best management practices to reduce bacteria loads in the watershed.

The final public meeting (with the draft plan) is tentatively planned for September/October 2024. It is anticipated that the plan will be approved by EPA Winter 2024/Spring 2025 allowing potential

applicants to apply to the Request for Applications (RFA) in Summer 2025 and accepted applicants receiving funds in Fall/Winter 2026.

Meeting Notes:

Slide 7

As of the draft 2024 Integrated Report the Rapidan River #4 segment in the project area has been listed as a supporting segment. However, it will still be included in the IP so the sub watershed it's located in will be eligible for 319 funding.

Slide 8

Bacteria source assessment shows agriculture as contributing most of the bacteria load. Wildlife is contributing as well but the IP will only address BMPs that reduce livestock, human, and pet sources. With this being said, wildlife will still be addressed in its own section of the IP to discuss consideration of wildlife BMPs if they become available in the future.

Slide 9

The question was raised about where the waste water treatment plant in Cedar Run is for possible sewer connection. The Mitchells community has a waste water treatment plant that serves the correctional facility and also expands into the community for possible sewer connection. The other is in the Town of Culpeper which serves part of the Potato Run-Rapidan River HUC. The question was raised about how the failing septic systems and straight pipes are estimated. Estimates came from the TMDL report and were updated to current housing numbers and ages.

Slide 10

The estimates for percentages and the breakdown of the numbers was created based on the discussion and feedback from the previous community engagement meeting.RB-4s and RB-5s are high because of the soil that is not percolating in various watersheds.

Slide 12

The project is implemented in stages to allow for water quality monitoring during implementation. We're looking for improvements after Stages 1 & 2. The group suggested that 10 years may be best for Stages 1 and 2, maybe even Stage 3. The costs shown back on slide 11 are total costs, not cost share. Question was raised about what happens if the Stage 1 water quality goals are not met. As long as there are impairments, and the implementation goals haven't been met, then Stage 1 continues. The length of each stage is not set in stone. They're just a means for tracking implementation and water quality milestones. Stage 1 is met when all the Stage 1 BMPs are installed.

Slide 18

It was recommended that the narrow buffer BMPs to be increased to 15-20% of the total fencing BMPs.

Slide 19

It was recommended to include farm ponds as BMPs. Based on the number of BMPs needed, the recommendation is 10 years for each stage.

Slide 21

Suggestion that Wilderness Run be moved to moderate since there will be residential development in that watershed in the future (within next 10 years). Suggestion to move Mountain Run (maybe #1 or both #1 and #2) to high.

Slide 22

If Stages are 10 years, recommended that one FTE for ag BMPs and one for residential septic and pet BMPs is good.

Slide 24

The draft IP will be available for review before the final public meeting. The final public meeting will be in September or October.