A Water Quality Improvement Plan

A plan to reduce bacteria in

Darden Mill Run, Mill Swamp, and Three Creek

March 21, 2013

Prepared by

The Virginia Department of Environmental Quality

In Cooperation with

Local Stakeholders

Department of Biological Systems Engineering,
Virginia Tech Center for Watershed Studies

The Virginia Department of Conservation and Recreation

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Introduction

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

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

Water Quality Problems in Darden Mill Run, Mill Swamp, and Three Creek

TMDLs were completed for these streams in February 2012 after water quality monitoring showed that they were violating the State's water quality standard for bacteria, which is based on the concentration of *E. coli* in the water. The *E. coli* standard states that the *E. coli* bacteria count should not exceed a geometric mean of 126 colony forming units (cfu) per 100 milliliters (mL) of water for two or more samples taken over a 30-day period, and it should not exceed 235 cfu per 100 mL at any time. When a stream continues to violate this standard, it becomes a human health concern since elevated concentrations of bacteria are a signal of an increased risk of illness or an infection after coming into direct contact with the water. The TMDL study identified the sources of bacteria in the watersheds and specified the maximum amount of bacteria that the streams can handle and still meet the water quality standard.

Creating a TMDL Implementation Plan

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

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

Mill Swamp

Review of TMDL Studies

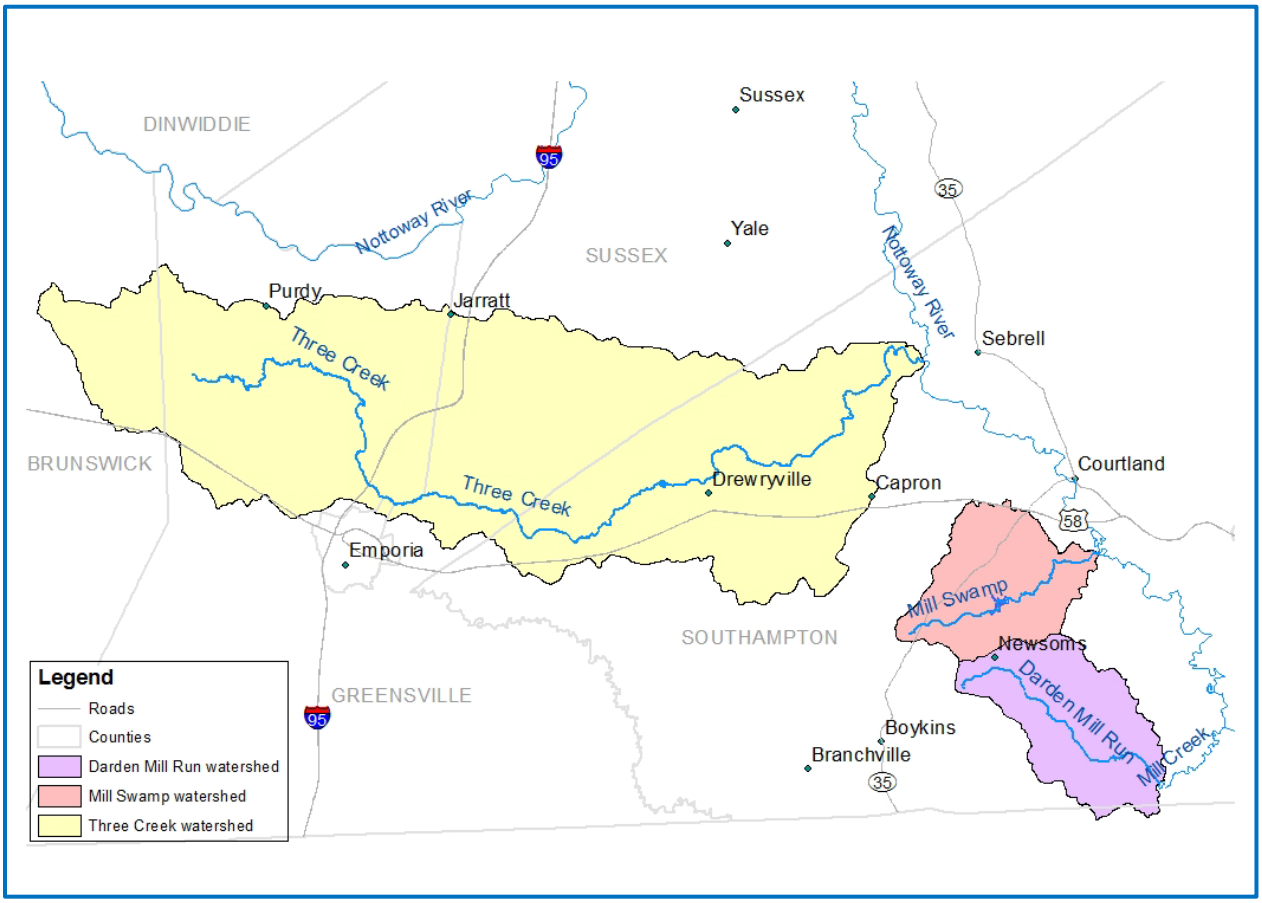


Figure 1. Locations of the Darden Mill Run, Mill Swamp, and Three Creek watersheds.

Watershed Characteristics

The Darden Mill Run and Mill Swamp watersheds are located in Southampton County. The Three Creek watershed is located in Brunswick, Greensville, Sussex, and Southampton Counties and the City of Emporia. Darden Mill Run flows into Mill Creek; Mill Creek, Three Creek, and Mill Swamp flow into the Nottoway River. The Darden Mill Run and Mill Swamp watersheds cover approximately 18,000 acres and 16,000 acres, respectively. The Three Creek watershed covers approximately 140,000 acres. The land use distribution in the TMDL watersheds consist mainly of forested area but with a significant portion of cropland.

The impaired segment of Darden Mill Run begins in the headwaters near Newsoms and extends downstream to Windbourne Millpond, near the VA/NC state line (10.37 miles). The impaired segment of Mill Swamp stretches from the headwaters downstream to the confluence with the Nottoway River (10.19 miles). Three segments of Three Creek have bacteria impairments: an upper segment from Cattail Creek downstream to Slagles Dam (4.34 miles), a middle segment from Otterdam Swamp downstream to Browns Branch (6.51 miles), and a lower segment from the confluence of Chatman Branch downstream to the confluence with Nottoway River (19.23 miles).

Sources of Bacteria in the Watersheds

Agricultural runoff and wildlife have been identified as the primary sources of bacteria in these streams. Non-point sources of bacteria in the watersheds include failing septic systems, livestock (including manure application loads), wildlife, and domestic pets. Point sources including individual residences can contribute bacteria to streams through their permitted discharges. There are currently five point sources permitted to discharge bacteria in the Three Creek watershed.

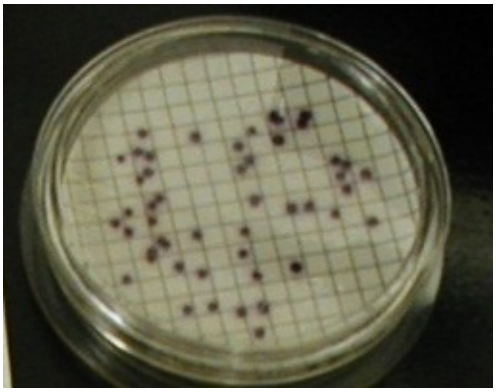


Photo shows a coliscan plate, which reveals the presence and abundance of coliform bacteria colonies from a water sample.

Goals for Reducing Bacteria

The TMDL studies completed for the streams identified goals for reducing bacteria from the different sources in the watersheds. These goals are based on what it would take to reach the point where the creeks would meet the geometric mean standard for E. coli (126 cfu/100mL) and would not violate the instantaneous standard for E. coli (235 cfu/100mL) more that 10.5% of the time (Table 1).

Table 1. Goals for bacteria reductions.

Impaired Watershed	E. Coli Reduction from Source Category (%)						
	Livestock Direct Deposit	Loads from Pasture	Loads from Cropland	Straight Pipes and Failing Septic Systems	Loads from Residential Areas*	Kennel Wash-off	Wildlife Direct Deposit
Darden Mill Run	95	0	0	100	0	75	65
Mill Swamp	0	0	0	100	0	0	0
Three Creek (upper)	75	75	75	100	75	55	50
Three Creek (middle)	90	0	0	100	0	45	85
Three Creek (lower)	0	0	0	100	0	0	0

*in addition to failing septic systems

Public Participation

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

A public meeting was held on the evening of February 15, 2012 at the Southampton Board of Supervisors Meeting Room to review the TMDL water quality study and 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 streams and work together to come up with new ideas to protect and restore water quality in their community. A final public meeting was held on March 21, 2013 at the same location to present the completed draft plan to the public and collect local input.

A working group was formed in order to discuss implementation and outreach strategies suitable for different land uses in the watersheds. The working group was made up of stakeholders who were familiar with land use management issues and have an interest in improving the water quality in these streams. The group met on March 30, 2012, September 14, 2012, and January 11, 2013. The group focused on both residential and agricultural practices that would be utilized by homeowners and local producers to reduce bacteria.

Implementation Actions

USDA, NRCS (2010)

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

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

Management Actions Selected through Stakeholder Review

While management actions such as livestock exclusion and correction of failing septic systems were directly prescribed by the TMDL, a number of additional measures were needed to control bacteria coming from land-based sources. Various scenarios were developed and presented to the working group, who reviewed both economic costs and the water quality benefits. The majority of these best management practices (BMPs) are included in state and federal agricultural cost share programs that promote conservation. In addition, innovative management practices suggested by local stakeholders and technical conservation staff were considered. The final set of practices identified and the efficiencies used in this study are listed in Table 2. It should be noted that an adaptive management strategy will be utilized in the implementation of this plan. BMPs that are easiest to implement, provide the greatest water quality benefits, and offer the greatest economic return to landowners will be implemented first. The effectiveness of these practices will be continually evaluated, and adjustments of actions will be made as appropriate. As new technologies and innovative BMPs to address bacteria become available, these practices should also be evaluated for implementation in the watersheds.

Table 2. Bacteria reduction efficiencies for best management practices.

BMP Type	Bacterial Reduction	Reference
Agricultural Control Measures		
Streamside buffers	60%	1
Livestock exclusion from waterway	100%	2
Improved pasture management	30%	1
Reforestation of erodible pasture	Land use change	3
Permanent vegetative cover on critical areas	Land use change	3
Water control structure/surface water runoff impoundment	33%	4
Continuous no-till	70%	1
Cover crop	10%	1
Cropland buffers/field borders	56%	1
Residential Control Measures		
Septic tank pump-out	5%	4
Septic system repair	100%	2
Septic system replacement	100%	2
Alternative on-site waste treatment system	100%	2
Pet waste education program	25%	5
Kennel wash-off diversions	100%	2

1 - EPA-CBP sediment effectiveness, 2010. (Bacteria efficiency assumed equal to sediment efficiency.)
2 - By definition.
3 - Based on unit bacteria load from wildlife.
4 - EPA-CBP nutrient effectiveness, 2010. (Bacteria efficiency assumed equal to nutrient efficiency.)
5 – Modified from Swann, 1999.

Straight Pipes and Failing Septic Systems

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

Estimates of the percentages of households served by failing septic systems and straight pipes (pipes directly discharging untreated sewage into the stream) in the watersheds are shown in Table 3. These estimates were developed as part of the TMDL studies. They are based on the age of homes in the watershed, and in the case of straight pipes, the proximity of homes to the stream. Estimates of needed repairs and replacements of failing systems with conventional and alternative systems were based on input from the Virginia Department of Health and the working group. It was assumed that 75% of failing septic systems could be repaired without installing a new system. Of those failing systems needing to be replaced, most of those are assumed to be on soils that do not meet current siting requirements for septic systems, therefore it was estimated that 75% would need to be replaced with alternative waste treatment systems and the remainder replaced with a conventional septic system. It is assumed that 50% of straight pipe corrections will be conventional septic systems and 50% will be alternative waste treatment systems. A septic tank pump-out program could be utilized to help educate homeowners in the watersheds about septic system maintenance and to locate and correct failing septic systems. This program could be implemented on a limited basis, targeting homes closest to streams. The estimates shown in Table 3 are based on pumping out septic tanks for 10% of households in each watershed.

Table 3. Residential wastewater treatment BMPs.

Watershed	Failing septic systems	Straight pipes	Septic system repair	Alternative waste treatment system	Septic system replacement	Septic tank pump-out
Darden Mill Run	18	0	14	3	1	24
Mill Swamp	10	2	7	3	2	24
Three Creek	76	0	58	15	5	175

Livestock Direct Deposition

The TMDL studies specify a 75-95% reduction in the direct deposit of waste in the stream by livestock, making some form of stream fencing is necessary.

To estimate fencing needs, information on the stream network was compared with land use data. Stream segments that flowed through or were adjacent to pasture were identified. If the stream segment flowed through a pasture, it was assumed that fencing was needed on both sides of the stream. If a stream segment flowed adjacent to a pasture, it was assumed that fencing was required on only one side of the stream. Not every pasture has livestock on it at any given point in time. However, it is assumed that all pasture areas have the potential for livestock access, meaning that livestock exclusion fencing should be installed. The VADCR Agricultural BMP Database was utilized in conjunction with input from SWCD and NRCS staff to determine typical characteristics (e.g., average length of fencing installed per fencing project) of the different livestock exclusion systems offered through the state and federal agricultural cost share programs so that the number of different systems needed could be accurately estimated. In addition, data on stream fencing already in place was collected for each watershed and subtracted from the total fencing needed.

Farmers who wish to exclude their livestock from the stream have several options through state and federal cost share programs. A summary of cost share programs is provided on pages 30-33. Incentive payments vary based on the width of the streamside buffer that is installed between the fence and the stream, and the type of fencing that is installed. The portion of fencing that will be accomplished using a series of available fencing practices was based on historical data and input from agricultural conservation professionals.

Farmers who cannot afford to give up a significant amount of land for a streamside buffer can receive 50% cost share for the installation of exclusion fencing with a ten foot setback, cross fencing, and to provide an alternative water source for their livestock. It is estimated that 15% of total fencing in the watersheds will be installed using this particular practice (code LE-2T). If a landowner can afford to give up 35 feet for a buffer along the stream, then they are eligible to receive cost share at a rate of 85% to cover the costs of the stream fencing, cross fencing and providing alternative water. It is estimated that 60% of the total fencing in the watersheds will be installed using this particular practice (code LE-1T). For those who are willing to install a 35 foot buffer or larger and plant trees in the buffer, the Conservation Reserve Enhancement Program (CREP) is an excellent option. This practice provides cost share at a rate of 75% and additional incentives for fencing, planting materials, and alternative water source development (code CRSL-6). It is estimated that 25% of fencing in the watersheds will be installed through this program. Table 4 shows the fencing required for the impaired watersheds in order to meet the livestock exclusion goal.

Table 4. Livestock exclusion BMPs.

Exclusion System		Linear Feet of Livestock Exclusion		
		Darden Mill Run	**Three Creek (middle)**	**Three Creek (upper)**
LE-1T		7,926	529	1,304
LE-2T		1,981	132	326
CRSL-6		3,302	220	544
TOTAL	Feet	**13,209**	**881**	**2,174**
	Miles	**2.5**	**0.17**	**0.41**

Kennel Wash-off

In order to reduce bacteria from dog waste at hunt club kennels, some type of kennel wash-off diversion is needed.

Hunt club dog populations were estimated from the total number of licensed kennels in Brunswick, Greensville, Sussex, and Southampton Counties. These estimates were developed as part of the TMDL studies. The Working Group discussed different options to reduce the fecal bacteria in wash-off from dog kennels from getting into nearby streams. Suggested Kennel Wash-off Diversion practices include

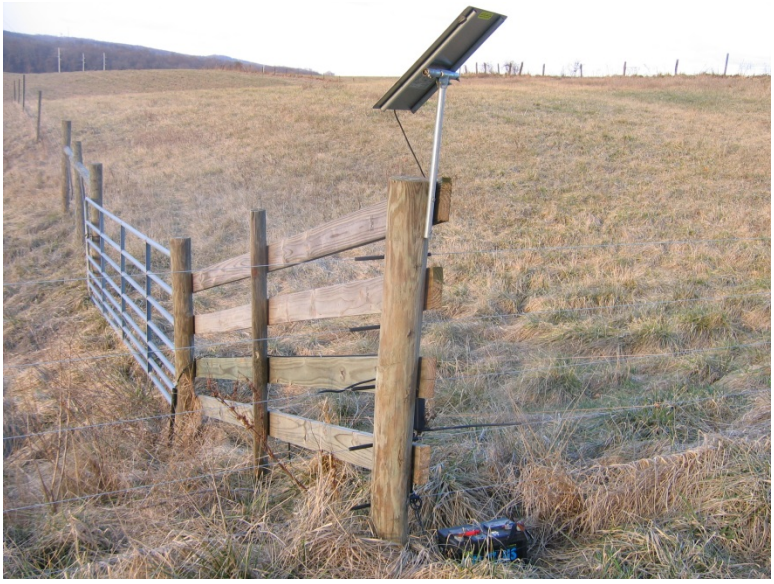
- a trench around the concrete pad to divert wash-off away from a stream or swamp,
- simple composting of dog waste by shoveling the waste to a compost pile surrounded by hay or straw bales to keep the fecal matter from running off into a stream or swamp, and
- commercial pet waste digesters.

A pet waste education program will also help hunt club and pet owners better understand the importance of appropriate pet waste management practices. This program will include the development and distribution of educational materials and the promotion of pet waste BMPs including kennel wash-off diversions. The BMPs needed to meet the TMDL load reductions for bacteria from dog waste are shown in Table 5.

Table 5. Pet waste BMPs.

BMP	Darden Mill Run	Three Creek (middle)	Three Creek (upper)	TOTAL
Pet waste education program	One community-wide program			**1**
Kennel wash-off diversions	7	7	7	**21**

Implementation Actions for Pasture



Runoff from pastures can carry with it bacteria from manure deposited on the pasture on its way to the stream.

Reductions of bacteria load from pasture are only needed in the Three Creek watershed upstream of Slagles Dam (upper Three Creek). Improved pasture management through the implementation of a prescribed grazing system can prevent overgrazing by livestock, thereby reducing runoff, increasing filtration and vegetative uptake of pollutants, and allowing farmers to better utilize their pasture acreage. Vegetated buffers are an excellent way to treat runoff from pasture. These buffers act as filters, trapping bacteria before it runs into the stream. Farmers can utilize state and federal cost share programs to convert highly erodible pasture such as areas with steep slopes and poor vegetative cover to forest. These types of pasture typically produce a lower yield of forage for livestock making them less optimal for grazing or cutting hay. Water control structures (retention ponds) reduce runoff from the land to the receiving stream. Table 6 shows the reductions needed in upper Three Creek.

Table 6. Pasture BMPs in upper Three Creek.

BMP	Units	Extent Required
Improved Pasture Management	acres	2,067
Reforestation of Erodible Pasture	acres	689
Permanent Vegetative Cover on Critical Areas	acres	6
Water Control Structures	acres-treated	930

Implementation Actions for Cropland

Bacteria can run off of cropland when soils fertilized with manure are exposed to rainfall. The bacteria will make its way to the stream unless filtering practices like riparian buffers are in place to trap it.

To meet the water quality standard, reductions of bacteria load from cropland are only needed in the Three Creek watershed upstream of Slagles Dam. Bacteria from the spreading of manure on cropland can end up in a stream unless the appropriate management practices are in place. Bacteria from manure spread on cropland can be reduced either by decreasing the source of the bacteria (spreading less manure or storing it longer so that bacteria will die off) or by the use of filtering practices like streamside buffer plantings. Reducing tillage of the soil, increasing soil organic content and allowing better cover will also reduce the degree of runoff and soil loss from cropland during rain events. The Working Group suggested the use of voluntary cost-share practices associated with the Virginia Quail Recovery Program's wildlife option on cropland.

Table 7. Cropland BMPs in upper Three Creek.

BMP	Units	Extent Required
Field Borders/Wildlife Option	acres	33
Idle Land/Wildlife Option	acres	34
Fescue Conversion/Wildlife Option	acres	33
Continuous No-till	acres	472
Harvestable Cover Crop	acres	378
Small Grain Cover Crop	acres	377
Grass Buffers	acres	2
CREP Grass Buffers	acres	3

Education and Outreach

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

There must be a proactive approach to contact watershed residents to articulate exactly what the TMDL means to them and what practices will help meet the goal of improved water quality. The working group recommended several education/outreach strategies that could be used.

The following tasks associated with outreach programs were identified:

Agricultural Programs

- Make contact with landowners in the watersheds to make them aware of implementation goals, cost-share assistance, and voluntary options that are available to agricultural producers interested in conservation
- Provide technical assistance for agricultural programs (e.g., survey, design, layout)
- Develop and distribute educational materials through bulk mailings, Franklin-Southampton County Fair, FSA and VCE newsletters, etc.
- Organize educational programs (e.g., farm tours, presentations at VCE events or club events)

Residential Programs

- Identify straight pipes and failing septic systems (e.g., contact landowners in older homes near the streams, septic pump-out program)
- Develop educational materials
- Organize educational programs (e.g., demonstration septic pump-outs, pet waste control)
- Distribute educational materials on the clean-up plan and on-site sewage disposal systems at Farm Day, Heritage Day, etc.
- Distribute educational materials on practices pet owners and hunt club kennels can implement to reduce dog waste

Staffing Needed for Outreach and Technical Assistance

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

The staffing level needed to implement the agricultural and residential components of the plan was estimated based on discussions with stakeholders and the staffing levels used in similar projects. Staffing needs were quantified using full time equivalents (FTE), with one FTE being equal to one full-time staff member. It was determined that 2 FTEs would be needed to provide the technical assistance needed for agricultural and residential implementation. The Chowan Basin Soil and Water Conservation District (SWCD) could house an agricultural technician to manage outreach and technical assistance with design and implementation of agricultural BMPs. The position of a residential coordinator to conduct outreach and work with landowners to address failing septic systems, straight pipes, and pet waste from residences and hunt clubs could be housed at the Chowan Basin SWCD or the local Health Department.

Implementation Costs

North Dakota State Univ. Extension (2012)

Virginia DCR

Costs: Agricultural BMPs

The costs of agricultural best management practices included in the implementation plan were estimated based on data for Brunswick, Greensville, Sussex, and Southampton Counties from the VADCR Agricultural BMP Database and considerable input from SWCD and NRCS staff. When sufficient data were available, the search of the agricultural database for best management practices and their associated costs was limited to 2002 through 2012 so that estimates were as current as possible.

The total cost of livestock exclusion systems includes not only the costs associated with fence installation, but also the cost of developing alternative water sources and installing hardened crossings for LE-1T, LE-2T, CREP practices. 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, when assessing costs it is important to consider both the potential cost to the landowner as well as the cost to state and federal programs. Table 8 shows total agricultural BMP costs by watershed with VADCR cost-share codes in parenthesis.

Costs: Residential BMPs

The costs of recommended residential BMPs for treating failing septic systems and straight pipes were estimated using cost data from other watersheds where residential septic system maintenance programs have been implemented. Costs for a Pet Waste Education Program were estimated from other TMDL Implementation Plans in the state. These costs are shown for each watershed in Table 9 with VADCR cost-share codes in parenthesis.

Table 8. Estimated agricultural BMP costs by watershed.

Practice	Unit	Unit Cost	Cost by watershed	
			Darden Mill Run	Three Creek
Livestock Exclusion – Riparian Buffers (LE-1T)*	system	$15,000	$135,000	$45,000
Livestock Exclusion – Reduced Setback (LE-2T)*	system	$11,000	$11,000	$0
CREP Stream Exclusion (CRSL-6)*	system	$15,000	$60,000	$30,000
Improved Pasture Management (EQIP 512, EQIP 528)	acre	$110	$0	$227,370
Reforestation of Erodible Pasture (FR-1)	acre	$95	$0	$65,455
Permanent Vegetative Cover on Critical Areas (SL-11)	acre	$2,800	$0	$16,800
Water Control Structures (WP-1)	acres-treated	$360	$0	$334,800
Field Borders/Wildlife Option (WL-1)	acre	$260	$0	$8,580
Idle Land/Wildlife Option (WL-2)	acre	$150	$0	$5,100
Fescue Conversion/Wildlife Option (WL-3)	acre	$300	$0	$9,900
Continuous No-till (SL-15A)	acre	$95	$0	$44,840
Harvestable Cover Crop (SL-8H)	acre	$35	$0	$13,230
Small Grain Cover Crop (SL-8B)	acre	$35	$0	$13,195
Grass Buffers (WQ-1)	acre	$180	$0	$360
CREP Grass Buffers (CRWQ-1)	acre	$180	$0	$540
TOTAL ESTIMATED COST			$206,000	$815,170

* estimate includes BMP-defined components and component costs

Table 9. Estimated residential BMP costs by watershed.

Practice	Unit	Unit Cost	Cost by watershed		
			Darden Mill Run	Mill Swamp	Three Creek
Septic Tank Pump-out (RB-1)	pump-out	$250	$6,000	$6,000	$43,750
Replacing Straight Pipes					
Conventional Septic System (RB-4)	system	$8,000	$8,000	$8,000	$40,000
Alternative Waste Treatment System (RB-5)	system	$20,000	$60,000	$40,000	$300,000
Repairing Failing Septic Systems (RB-3)	repair	$3,500	$49,000	$24,500	$203,000
Replacing Failing Septic Systems					
Conventional Septic System (RB-4)	system	$8,000	$0	$8,000	$0
Alternative Waste Treatment System (RB-5)	system	$20,000	$0	$20,000	$0
Pet Waste Education Program	program	$5,000	$1,250	$0	$3,750
Kennel Wash-off Diversions	system	$500	$3,500	$0	$7,000
TOTAL ESTIMATED COST			$127,750	$106,500	$597,500

Costs: Technical Assistance

Technical assistance costs were estimated using a cost of $60,000/position per year for a full time position. This figure is based on the existing staffing costs included in the Virginia Department of Conservation and Recreation's grant agreements with the Soil and Water Conservation Districts across the state to provide technical assistance to landowners in TMDL implementation watersheds. Based on the 15 year timeline of this plan (described in detail in the Implementation Timeline section of this plan), two full time positions are needed for the first five years of implementation, and one full time position for the next five years, making the total cost of technical assistance approximately $900,000. When factored into the cost estimate for BMP implementation shown in Table 10, this would make the total cost of implementation approximately $2.8M.

Table 10. Total estimated costs of full BMP implementation.

BMP Type	Darden Mill Run	Mill Swamp	Three Creek	TOTAL
Agricultural	$206,000	$0	$815,170	$1,021,170
Residential	$127,750	$106,500	$597,500	$831,750
TOTAL ESTIMATED COST	$333,750	$106,500	$1,412,670	$1,852,920

Implementation Benefits

The primary benefit of implementing this plan will be cleaner water in Darden Mill Run, Mill Swamp and Three Creek.

Specifically, *E. coli* contamination in the creeks will be reduced to meet water quality standards. It is hard to gage the impact that reducing *E. coli* contamination will have on public health, as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, the incidence of infection from *E. coli* sources through contact with surface waters should be reduced considerably following the implementation of the measures outlined in this plan.

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

Benefits: Agricultural Practices

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

Restricting livestock access to streams and providing them with clean water source has been shown to improve weight gain and milk production in cattle (Zeckoski et al., 2007). Studies have shown that increasing livestock consumption of clean water can lead to increased milk and butterfat production and increased weight gain (Landefeld et al, 2002). Table 17 shows an

example of how this can translate into economic gains for producers. In addition, keeping cattle in clean, dry areas has been shown to reduce the occurrence of mastitis and foot rot. Implementing a prescribed grazing management strategy in conjunction with a providing livestock with a clean water source will also provide economic benefits for the producer. Standing forage utilized directly by the grazing animal is less costly and of higher quality than forage harvested with equipment and fed to the animal.

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

Note: Table from Zeckoski et al. (2007)

Benefits: Residential Practices

The residential program will play an important role in improving water quality since human waste can carry human viruses in addition to bacterial and protozoan pathogens. In terms of economic benefits to homeowners, an improved understanding of on-site sewage treatment systems, including knowledge of what steps can be taken to keep them functioning properly, will give homeowners the tools needed for extending the life of their systems and reducing the overall cost of ownership. The average septic system will last 20 to 25 years if properly maintained. Proper maintenance includes: knowing the location of the system components and protecting them (e.g., not driving or parking on top of them), not planting trees where roots could damage the system, keeping hazardous chemicals out of the system, and pumping out the septic tank every 3 to 5 years. The cost of proper maintenance, as outlined here, is relatively inexpensive ($250 per pump-out) in comparison to repairing or replacing a system ($3,500 to $20,000).

Watershed Health and Associated Benefits

Focusing on reducing bacteria loads in the Darden Mill Run, Mill Swamp, and Three Creek watersheds will have associated watershed health benefits as well. Overall herd health in the watershed is a significant associated benefit. Reductions in streambank erosion, excessive nutrient runoff, and water temperature are additional benefits associated with streamside buffer plantings. In turn, reduced nutrient loading and erosion and cooler water temperatures improves habitat for fisheries, which provides associated benefits to anglers and the local economy.

Riparian buffers can also improve habitat for wildlife such as ground-nesting quail and other sensitive species. Data collected from Breeding Bird Surveys in Virginia indicate that the quail population declined 4.2% annually between 1966 and 2007. Habitat loss has been cited as the primary cause of this decline. As a result, Virginia has experienced significant reductions in economic input to rural communities from quail hunting. The direct economic contribution of quail hunters to the Virginia economy was estimated at nearly $26 million in 1991, with the total economic impact approaching $50 million. Between 1991 and 2004, the total loss to the Virginia economy was more than $23 million from declining quail hunter expenditures (VDGIF, 2009). Funding is available to assist landowners in quail habitat restoration (see pages 30-33).

Implementation Timeline

The end goal of implementation is restored water quality in Darden Mill Run, Mill Swamp, and Three Creek.

It is expected that this will occur over a 10-year period of implementation. Two types of milestones will be used to evaluate progress over the 10 year period: *implementation milestones and water quality milestones*. The implementation milestones establish goals for the extent of the different best management practices installed within certain time frames, while the water quality milestones establish the corresponding goals for improvements in water quality.

The timeline for implementation has been divided into two stages with each stage spanning a period of five years. Resources will be concentrated on the most cost-efficient best management practices first in Stage 1. Stage 2 includes the remaining practices needed. Table 11 shows the cost of BMP implementation in each watershed at each stage. Table 12 shows implementation and water quality improvement goals for the upper Three Creek watershed in each implementation stage. BMPs for Darden Mill Run, Mill Swamp and the remainder of Three Creek can be implemented during Stage 1. A summary of these practices and the associated water quality improvement goals is shown in Table 13.

In order to be removed from the impaired waters list, a stream cannot violate the *E. coli* standard more than 10.5% of the time. A goal of this implementation is to achieve a violation rate below this cut-off by the final stage of implementation. This goal should be achievable in Mill Swamp by the end of Stage 1. Achieving this goal in the Darden Mill Run, and Three Creek watersheds will be challenging due to bacteria contributions from wildlife. Without addressing wildlife contributions, it will not be possible to meet the water quality standard 100% of the time in these watersheds.

Table 11. BMP implementation costs by stage.

Stage	Darden Mill Run	Mill Swamp	Three Creek	TOTAL
Stage 1 (Years 1-5)	$333,750	$106,500	$669,000	$1,109,250
Stage 2 (Years 6-10)	-	-	$743,670	$743,670
TOTAL ESTIMATED COST	$333,750	$106,500	$1,412,670	$1,852,920

Table 12. Timeline for implementation in the upper Three Creek watershed.

BMP Type	BMP	Units	Stage 1	Stage 2
Direct Deposition	Livestock Exclusion with Riparian Buffers	system	2	-
	Livestock Exclusion with Reduced Setback	system	-	-
	CREP Stream Exclusion	system	1	-
Pasture	Improved Pasture Management	acres	-	2,067
	Reforestation of Erodible Pasture	acres	-	689
	Permanent Vegetative Cover on Critical Areas	acres	-	6
	Water Control Structures	acres-treated	-	930
Cropland	Field Borders/Wildlife Option	acres	-	33
	Idle Land/Wildlife Option	acres	-	34
	Fescue Conversion/Wildlife Option	acres	-	33
	Continuous No-till	acres	-	472
	Harvestable Cover Crop	acres	-	378
	Small Grain Cover Crop	acres	-	377
	Grass Buffers	acres	-	2
	CREP Grass Buffers	acres	-	3
Residential	Pet Waste Education Program	program	1	-
	Kennel Wash-off Diversion	system	-	7
Septic	Septic Tank Pump-out	system	34	-
	Septic Tank System Repair	system	10	-
	Septic Tank System Installation/Replacement	system	1	-
	Alternative On-site Waste Treatment System	system	3	-
% Violation of Instantaneous E. coli standard			**8**	**0**
% Violation of Geometric mean E. coli standard			**40**	**0**

Table 13. Stage 1 implementation practices in Darden Mill Run, Mill Swamp, middle Three Creek, and lower Three Creek.

BMP Type	BMP	Units	Darden Mill Run	Mill Swamp	Three Creek (middle)	Three Creek (lower)
Direct Deposition	Livestock Exclusion with Riparian Buffers	system	9	-	1	-
	Livestock Exclusion with Reduced Setback	system	1	-	-	-
	CREP Stream Exclusion	system	4	-	1	-
Residential	Pet Waste Education Program	program	1	-	1	-
	Kennel Wash-off Diversion	system	7	-	7	-
Septic	Septic Tank Pump-out	system	24	24	60	81
	Septic Tank System Repair	system	14	7	28	20
	Septic Tank System Installation/Replacement	system	1	2	2	2
	Alternative On-site Waste Treatment System	system	3	3	7	5
% Violation of Instantaneous E. coli standard			**27**	**1**	**27**	**1**
% Violation of Geometric mean E. coli standard			**65**	**0**	**38**	**0**

Targeting Implementation

Implicit in the process of a staged implementation is targeting of best management practices. Targeting ensures optimum utilization of limited technical and financial resources. In order to determine where outreach efforts should be focused in the early stages of implementation, sub-watersheds were ranked with respect to implementation priority for BMPs and associated outreach efforts. Targeting of critical areas for livestock fencing was accomplished through analysis of livestock population and the fencing requirements for each sub-watershed. An effort should be made to prioritize financial and technical resources for livestock exclusion fencing in sub-watersheds 3, 4, 5, and 6 for Darden Mill Run, and sub-watersheds 21 and 33 for Three Creek (Figure 2).

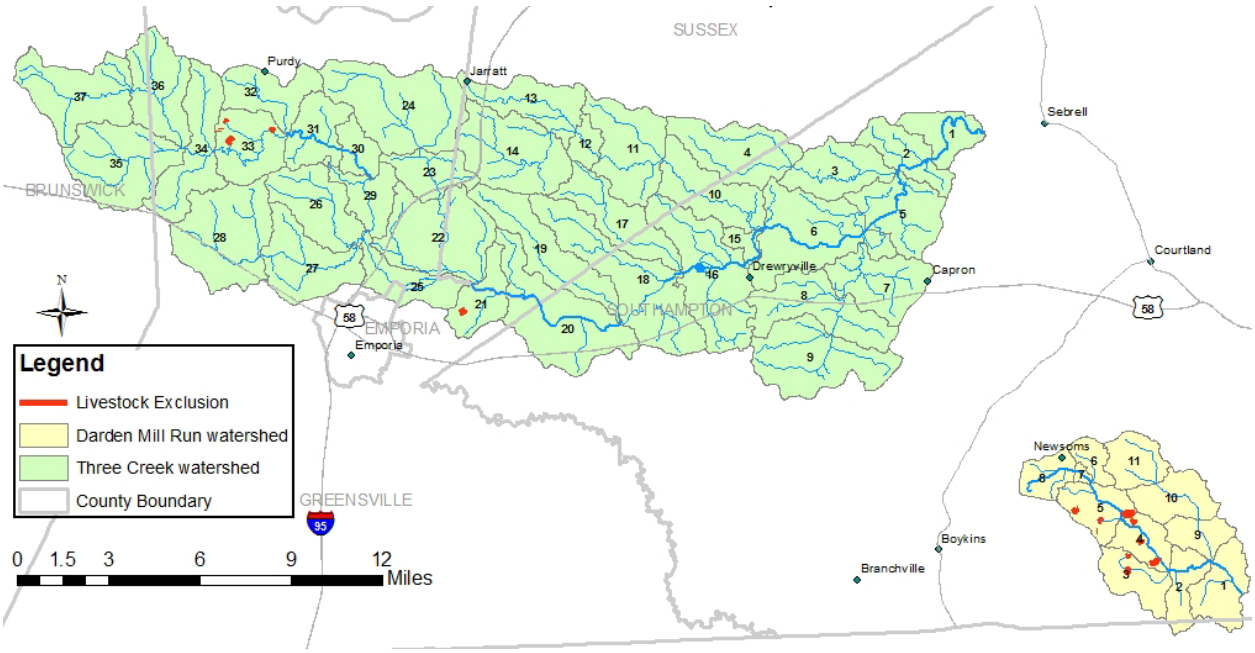


Figure 2. Area available for streamside fencing in the Darden Mill Run and Three Creek watersheds.

The repair and replacement of straight pipes and failing septic systems in Mill Swamp are also a high priority to remove Mill Swamp from the state's impaired waters list. Bacterial loads from sources of human sewage located close to a stream are highest in Darden Mill Run sub-watershed 5; and Three Creek sub-watersheds 6, 20, 24, 28 and 30. Priority analysis for kennel wash-off diversions was based on the sub-watersheds with the highest number of licensed kennels. Darden Mill Run has the highest number of kennels in sub-watersheds 1, 10, and 11. Installation of kennel wash-off diversions should first be prioritized in Three Creek sub-watersheds 20, 22, 24, 27 and 28 to affect the areas with the highest number of kennels in the Three Creek watershed.

Partners and Their Role in Implementation

Agricultural Landowners

SWCD and NRCS conservation staff often consider characteristics of farms and farmers in the watersheds that will affect the decisions farmers make when it comes to implementing conservation practices. For example, the average size of farms is an important factor to consider, since it affects how much cropland or pasture a farmer can give up for a riparian buffer. The age of a farmer may also influence their decision to implement best management practices. Table 14 provides a summary of relevant characteristics of farms and producers in Brunswick, Greensville, Sussex and Southampton Counties from the 2007 Agricultural Census. These characteristics were considered when developing implementation scenarios, and should be utilized to develop suitable education and outreach strategies.

Table 14. Characteristics of farms and farmers in Brunswick, Greensville, Sussex and Southampton Counties.

Characteristic	Brunswick	Greensville	Sussex	Southampton
Number of farms	367	143	151	342
Land in farms (acres)	86,700	48,741	74,224	161,650
Full owners of farms	264	95	89	202
Part owners of farms	91	38	45	96
Tenants	12	10	17	44
Operators identifying farming as their primary occupation	132	53	84	171
Operators identifying something other than farming as their primary occupation	129	49	50	140
Average age of primary operator	61.4	58.9	59.1	55.3
Average size of farm (acres)	236	341	492	473
Average value of farmland ($/acre)	$2,495	$2,770	$3,161	$2,591
Average net cash farm income of operation ($)	$7,795	$10,157	-$9,514	$19,608
Average farm production expenses ($)	$35,290	$63,007	$148,408	$113,210
Farms with internet access	144	76	72	191
Farm typology (acres)				
Small family farms: retirement and residential/lifestyle	54,713	12,851	22,610	45,184
Small family farms: farming occupation	12,061	15,923	22,305	38,589
Large and very large family farms	5,399	11,080	23,429	58,900
Nonfamily farms	4,867	-	2,025	15,235

Residential Landowners

In addition to local farmers, participation from homeowners is also critical to the success of this plan. For Mill Swamp, the elimination of human waste from failing septic systems and straight pipes will restore water quality in that watershed. Though the amount of bacteria that is coming from failing septic systems and straight pipes is minimal compared to livestock in the Darden Mill Run and Three Creek watersheds, human waste needs to be removed since it carries with it pathogens that can cause health problems above and beyond those associated with livestock manure.

Kennel Owners

Dogs housed in kennels, such as those associated with hunt clubs, can contribute fecal bacteria to swamps and streams when the pens are hosed down during cleaning. Hunt clubs have the opportunity to demonstrate that they are good stewards of the waterways by implementing appropriate practices to remove dog waste from the forests, swamps, and streams.

Chowan Basin SWCD and the Natural Resource Conservation Service

During the implementation project, the SWCD and NRCS will continue to reach out to farmers in the watersheds and provide them with technical and financial assistance with conservation practices. Their responsibilities include promoting available funding and the benefits of BMPs and providing assistance in the survey, design, and layout of agricultural BMPs. The SWCD and NRCS staff will conduct outreach activities in the watershed to encourage participation in conservation programs. Such activities include mailing out newsletters and organizing field days. It is recommended that a SWCD conservation technician and a NRCS district conservationist work cooperatively in their efforts to increase local awareness of water quality issues in the creeks and make agricultural landowners aware of financial and technical assistance available for BMP implementation in the watersheds.

Brunswick, Greensville, Sussex and Southampton Counties

County government staff members should work closely with state agencies to implement conservation practices in concert with their comprehensive plans. They may also help to promote education and outreach to citizens, businesses and developers to introduce the importance of good stewardship of natural resources.

Dedicated personnel are currently not available to lead efforts to correct failing septic systems and straight pipes. A partnership between the local governments and the Brunswick, Greensville/Emporia, Sussex and Southampton County Health Departments could be formed to provide technical support to meet the septic BMP goals.

Virginia Department of Environmental Quality

Improvements in water quality and implementation progress will be determined through monitoring conducted by the VA Department of Environmental Quality's ambient monitoring program. DEQ will monitor six locations in the watersheds (Figure 3). Through the DEQ

Ambient Water Quality Monitoring Program, each monitoring station will be visited once per month or every other month depending on the station type. 5ADMR008.42, 5ATRE008.48, and 5ATRE016.02 are trend stations. These stations are long-term stations sited for permanent monitoring for the purpose of detecting water quality trends for various parameters. 5AMSP000.16, 5ATRE022.05, and 5ATRE038.07 are part of a network of watershed stations in which they are sampled every other month for two years. Stations are then rotated within the network for a six year cycle.

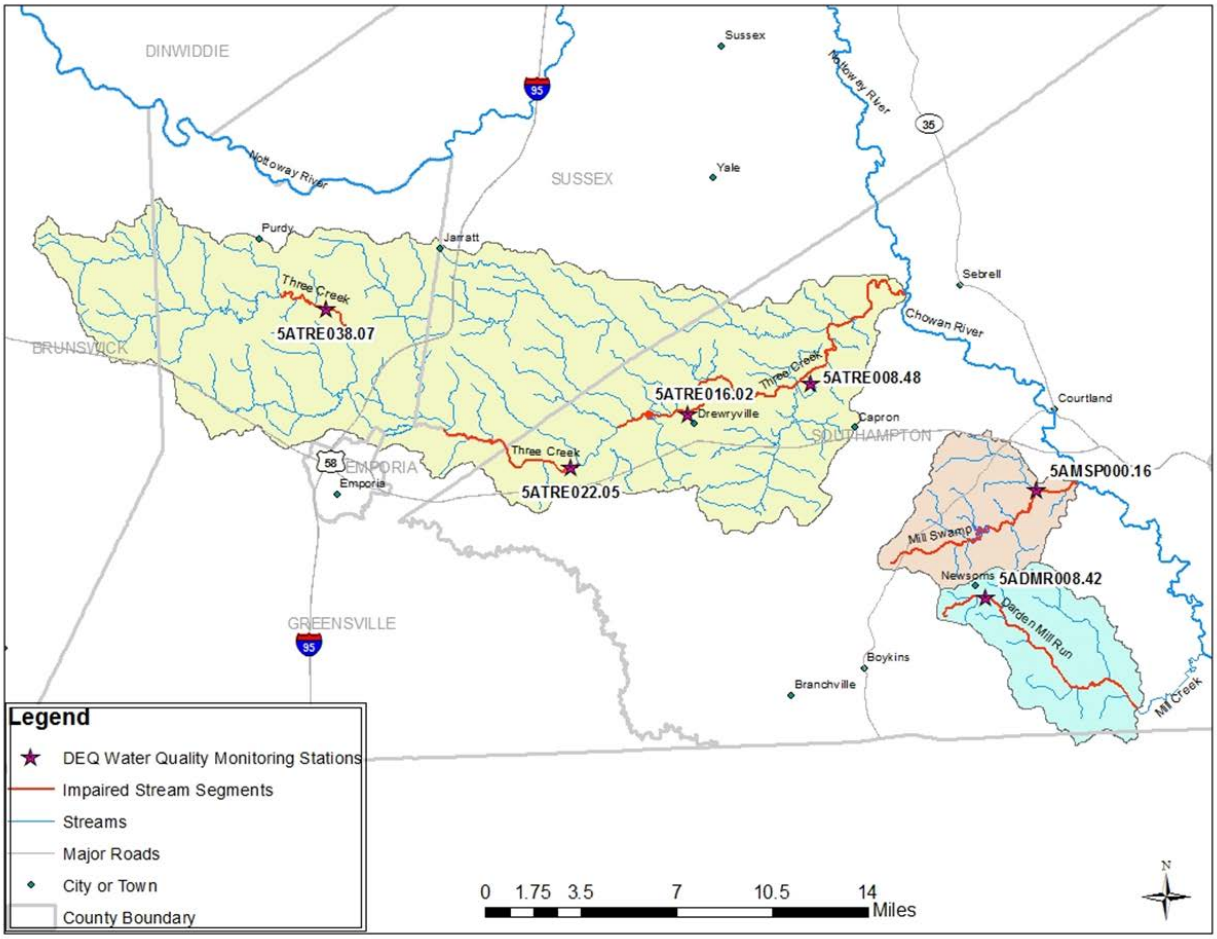


Figure 3. Location of the Darden Mill Run, Mill Swamp and Three Creek Virginia DEQ water quality monitoring stations.

Virginia Department of Conservation and Recreation

The Department of Conservation and Recreation (DCR) will work closely with project partners including the Soil and Water Conservation District to track implementation progress and provide cost share for agricultural best management practices through the Virginia Agricultural Cost Share Program. In addition, DCR will provide support to improve the implementation process through utilization of existing authorities and resources.

Other Potential 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:

- Blackwater Nottoway Riverkeeper Program
- Historic Southside Chapter – Virginia Master Naturalists
- County schools
- Virginia Department of Games and Inland Fisheries
- County Health Departments
- USDA Rural Development
- Virginia Hunting Dog Alliance
- Albemarle-Chowan Watershed Roundtable

Integration with Other Watershed Plans

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

County Comprehensive Plans

Virginia state law requires all local governments have an adopted comprehensive plan. Typical topics addressed in a comprehensive plan include the analysis of population change, land use and trends, natural and environmental features, transportation systems, and community facilities and services.

Additional Natural Resource Management and Conservation Planning

There are a number of organizations working to implement natural resource management and land conservation plans in the watersheds. The Virginia Department of Game and Inland Fisheries is currently working to implement the "Northern Bobwhite Quail Action Plan for Virginia," which includes a series of recommended management practices that will also help to improve water quality by reducing runoff and filtering out pollutants before they reach the stream. The Albemarle-Pamlico National Estuary Partnership's Comprehensive Conservation and Management Plan includes goals, outcomes, objectives, and actions to ensure that the Albemarle-Pamlico estuary natural resources are sustained. When possible, efforts should be made to integrate the shared goals of local comprehensive plans and this water quality improvement plan, thereby saving time and resources while achieving the same end result.

Funding for Implementation

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

Virginia Agricultural Best Management Practices Cost-Share Program

The Virginia Agricultural Best Management Practices (BMPs) Cost-Share Program provides funds to help install conservation practices that protect water and make farms more productive. Funding availability varies by SWCD. The state provides SWCDs with funds to target areas with known water quality needs. Areas with the greatest need receive the greatest funding. The cost-share program supports using various practices in conservation planning to treat animal waste, cropland, pastureland and forested land. Some are paid for at a straight per-acre rate. Others are cost-shared on a percentage basis up to 85 percent. In some cases, USDA also pays a percentage. In fact, the cost-share program's practices can often be funded by a combination of state and federal funds, reducing the landowner's expense to less than 30 percent of the total cost. Cost-share funds are also available for approved innovative BMP demonstration projects intended to improve water quality.

Virginia Agricultural Best Management Practices Loan Program

The Virginia Agricultural Best Management Practices Loan Program provides a source of low interest financing which will encourage the use of specific best management practices which reduce or eliminate the impact of Agricultural Nonpoint Source (NPS) pollution to Virginia's waters. VADEQ's Virginia Ag BMP loan program is a subset of the parent Virginia Clean Water Revolving Loan Fund (VCWRLF) loan program and is intended to create a continuing source of low interest financing that will be available to Virginia's agricultural producers to assist them in their efforts to reduce agricultural non-point source pollution. Unlike other assistance programs, the Ag BMP loan program is not dependent on legislative appropriations for its fund availability. All repayments of principle and interest from previous Ag BMP loans are returned to the Fund and used to provide additional loans to other Virginia farmers. In addition to the revenue available from repayments, VADEQ will request that the State Water Control Board (SWCB) consider making additional funding set-asides from the VCWRLF revenue as deemed necessary in order to meet Virginia's agricultural non-point source pollution reduction needs.

Virginia Agricultural Best Management Practices Tax Credit Program

For all taxable years, any individual or corporation, who is engaged in agricultural production for market and who has in place a soil conservation plan approved by the local SWCD, is allowed a credit against the tax imposed by Section 58.1-320 of an amount equaling 25% of the first $70,000 expended for agricultural best management practices by the individual. The amount of the credit cannot exceed $17,500 or the total amount of the tax imposed by this program

(whichever is less) in the year the project was completed. This program can be used 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.

Virginia Small Business Environmental Assistance Fund Loan Program

The Fund, administered through VADEQ, is used to make loans or to guarantee loans to small businesses for the purchase and installation of environmental pollution control equipment, equipment to implement voluntary pollution prevention measures, or equipment and structures to implement agricultural BMPs. The loans are available in amounts up to $50,000 and will carry an interest rate of 3%, with favorable repayment terms based on the borrower's ability to repay and the useful life of the equipment being purchased or the life of the BMP being implemented. To be eligible for assistance, a business must employ 100 or fewer people and be classified as a small business under the federal Small Business Act.

Virginia Water Quality Improvement Fund

The purpose of the Virginia Water Quality Improvement Act of 1997 (WQIA) is to restore and improve the quality of state waters and to protect them from impairment and destruction for the benefit of current and future citizens of the Commonwealth of Virginia (Section 10.1-2118 of the Code of Virginia). The purpose of the fund is to provide water quality improvement grants to local governments, soil and water conservation districts and individuals for point and nonpoint source pollution prevention, reduction and control programs (Section 10.1-2128.B. of the Code of Virginia). Nonpoint source pollution is a significant cause of degradation of state waters. The Virginia Department of Environmental Quality (VADEQ) is responsible for administering point source grants and the Virginia Department of Conservation and Recreation (VADCR) administers nonpoint source grants. WQIF funds are provided, in accordance with the guidelines, to help stimulate nonpoint source pollution reduction through the Virginia Agricultural Best Management Practices Cost-share Program and water quality improvement projects. VADCR staff provides technical assistance, as well as financial assistance. During implementation in the RR watersheds, standards, specifications, cost-share, and tax credits for practices under the Virginia Agricultural BMP Cost-share Program will be followed for funding eligibility.

Conservation Reserve Enhancement Program

The Conservation Reserve Enhancement Program (CREP) is a voluntary land retirement program that helps agricultural producers protect environmentally sensitive land, decrease erosion, restore wildlife habitat, and safeguard ground and surface water. CREP is an offshoot of the country's largest private-lands environmental improvement program -- the Conservation Reserve Program (CRP). Like CRP, CREP is administered by USDA's Farm Service Agency (FSA). CREP addresses high-priority conservation issues of both local and national significance, such as impacts to water supplies, loss of critical habitat for threatened and endangered wildlife species, soil erosion, and reduced habitat for fish populations such as salmon. CREP is a community-based, results-oriented effort centered on local participation and leadership. CREP contracts require a 10- to 15-year commitment to keep lands out of agricultural production. A

federal annual rental rate, including an FSA state committee-determined maintenance incentive payment, is offered, plus cost-share of up to 50 percent of the eligible costs to install the practice.

Environmental Quality Incentives Program

The USDA Natural Resources Conservation Service's Environmental Quality Incentives Program (EQIP) was established to provide a voluntary conservation program for farmers and ranchers to address significant natural resource needs and objectives. EQIP offers financial and technical help to assist eligible participants install or implement structural and management practices on eligible agricultural land.

Wildlife Habitat Incentive Program (WHIP)

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

Wetland Reserve Program (WRP)

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

National Fish and Wildlife Foundation

Grant proposals for this funding are accepted throughout the year and processed during fixed sign up 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 generally range between $10,000 and $150,000. Grants are awarded for the purpose of conserving fish, wildlife, plants, and their habitats. Special grant programs are listed and described on the NFWF website (http://www.nfwf.org). If the project does not fall into the criteria of any special grant programs, a proposal may be submitted as a general grant if it falls under the following guidelines: 1) it promotes fish, wildlife and habitat conservation, 2) it involves other conservation and community interests, 3) it leverages available funding, and 4) project outcomes are evaluated.

Southeast Rural Community Assistance Project (Southeast RCAP)

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 Southeast RCAP central office staff across the region. They can provide (at no cost to a community): on-site technical assistance and consultation, operation and maintenance/management assistance, training, education, facilitation, volunteers, and financial assistance. Southeast RCAP also has a state-funded Indoor Plumbing and Rehabilitation Program to help with interior plumbing upgrades for low-income rural residents.

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 which provides compensation for aquatic resources in financially and environmentally preferable ways. Not every site or property is suitable for mitigation banking. Wetlands and streams are complex systems, and their restoration, creation, enhancement, or preservation often requires specialized ecological and engineering knowledge. Likewise, the mitigation banking process requires experience to efficiently navigate. Mitigation banks are required to be protected in perpetuity, to provide financial assurances, and long term stewardship. The mitigation banking processes is overseen by the Inter-Agency Review Team (IRT) consisting of several state and federal agencies and chaired by DEQ and Army Corps of Engineers. For more information, contact the Army Corps of Engineers or VADEQ's Virginia Water Protection Program.

Clean Water State Revolving Fund

USEPA 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, NPS, 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. NPS projects include agricultural, silviculture, rural, and some urban runoff control; on-site wastewater disposal systems (septic tanks); land conservation and riparian buffers; leaking underground storage tank remediation, etc.

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