James River and Tributaries TMDL Implementation Plan:

A Plan to Reduce Bacteria in the James River and its Tributary Watersheds

Prepared for:

Virginia's Region 2000 Local Government Council

Submitted February 17th, 2010

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Executive Summary

A Total Maximum Daily Load (TMDL) study was developed for the James River and its Tributaries when water quality monitoring showed that the streams were violating the State's water quality standard for bacteria. Once the TMDL was developed, the next step is to create a plan to achieve the needed bacteria reductions. An Implementation Plan describes actions that can be taken by the stakeholders that will reduce bacteria loads and improve water quality in the streams.

Sources of bacteria in the watershed include: agricultural-land runoff, direct deposition of manure in streams by livestock, failing septic systems and straight pipes, municipal combined sewer overflows (CSOs), and pets. Best management practices (BMPs) are systems, practices, or methods which are employed for their specific benefits, in this case the reduction of bacteria entering streams.

Agricultural Best Management Practices (BMPs)

Streamside fencing is one of the best ways to reduce bacteria levels in the stream. This will remove direct livestock defecation in the stream and prevent the trampling of the stream banks.

The length of fencing required on perennial streams in the James River and Tributaries watershed is approximately 61 miles. Table E.1 shows the fencing systems needed to meet the livestock exclusion goal. Both the livestock exclusion and streambank protection practices include a 35-ft buffer component. Therefore, these practices will provide some of the best water quality benefits in terms of reducing both direct (cows defacating in the stream) and land- based (runoff of manure into the stream during rain events) contributions of fecal bacteria to the stream.

Table E.1 Livestock Exclusion and Streambank Protection systems required for the James River and Tributaries.

Watershed	Livestock Exclusion systems[1]	Streambank Protection systems
James River	91	13
Blackwater (Inclusive)	57	6
Beaver Creek	38	2
Judith Creek	9	1
Fishing Creek	0	0

[1] The average system length installed within the area is 1,900 ft.

Due to the significant reductions needed on land-based loads of *E. coli* bacteria, additional Best Management Practices (BMPs) for pasture and cropland are also needed. Estimates of all agricultural BMPs needed for Stage I, the first ten years in the watershed are provided in Table E.2.

Table E.2 Agricultural land-based reduction BMPs required.

Control Measure	Unit	James River	Blackwater Inclusive*	Beaver Creek
Improved Pasture Management	Acres	10,173	18,980	6,666
Conservation Tillage	Acres	150	366	188
Manure Incorporation	Acres	22	82	79
Retention Ponds – Pasture	Acre - Treated	3,000	7,700	0
Dairy Waste Storage	System	0	1	0
Livestock Feeding Area	System	2	0	2

Fishing Creek and Judith Creek do not require land-based BMPs.
*Blackwater Inclusive includes its tributary watersheds: Ivy Creek, Tomahawk Creek, and Burton Creek

Although the TMDL resulted in an allocated 67% reduction to agricultural sources within the Fishing Creek impairment, no agricultural BMPS are needed within the impairment. The reason is; it has subsequently been determined, through stakeholder input, that there is a drastically reduced population of livestock within the Fishing Creek impairment watershed, therefore no agricultural BMPs are required.

Residential Best Management Practices (BMPs)

All failing septic systems and straight pipes must be identified and replaced during implementation since a 100% load reduction from direct and nonpoint source (NPS) human waste is required to meet the TMDL goals. In addition, straight pipes are illegal in the Commonwealth of Virginia. The estimated numbers of straight pipes and failing septic systems were reported in the TMDL study and are shown in Table E.3.

Table E.3 Estimated number of straight pipes and failing septic systems.

Watershed	Houses with Standard Septic Systems	Potential Failing Septic Systems	Potential Straight Pipes
James River	5,245	727	106
Blackwater (Inclusive)*	16,116	1,018	51
Beaver Creek	2,158	295	27
Judith Creek	729	73	14
Fishing Creek	4,211	13	0

*Blackwater Inclusive includes its tributary watersheds: Ivy Creek, Tomahawk Creek, and Burton Creek

The James River and Tributaries TMDL allocations call for significant reductions to land-based residential loads. In order to achieve these reductions, the BMPs in Table E.4 must be implemented. The Pet Waste Program shown in the table includes distributing information on how pet waste should be disposed. An additional Pet Waste Composter program is also proposed within the Blackwater impairment, to help eliminate pet waste in homeowner's yards, instead of just in public places. The program includes the distribution of pet waste composters to households and dog kennels in this watershed. This could be accomplished through partnerships with local pet supply stores, the Amherst, Bedford, and Campbell County Animal Shelters, the Society for the Prevention of Cruelty to Animals (SPCA), and the City and County governments.

Table E.4 All residential BMPs recommended for implementation.

		James River	Blackwater Inclusive*	Beaver Creek
Residential Control Measure	**Unit**	**Units Needed**	**Units Needed**	**Units Needed**
Septic Systems Pump-outs (RB-1)	System	5,245	16,116	2,158
Connection to Public Sewer (RB-2)	System	36	50	14
Septic System Repair (RB-3)	System	182	255	74
Septic System Installation/Replacement (RB-4)	System	123	155	47
Alternative Waste Treatment System Installation (RB-5)	System	492	609	187
Community Pet Waste Education Program	Program	1	1	1
Residential Pet Waste Composters	System	0	1,600	0
Vegetated Buffers – Residential Land	Acre	0	12	0
Rain Gardens	Acres – Treated	0	100	0
Bioretention Basins	Acres – Treated	0	350	0

*Blackwater Inclusive includes its tributary watersheds: Ivy Creek, Tomahawk Creek, and Burton Creek

Table E.4 All residential BMPs recommended for implementation (cont.).

			Judith Creek	Fishing Creek	Totals
Residential Control Measure	**Unit**	**Cost per Unit**	**Units Needed**	**Units Needed**	**Units Needed**
Septic Systems Pump-outs (RB-1)	System	$250	729	4,211	28,459
Connection to Public Sewer (RB-2)	System	$18,000	4	1	105
Septic System Repair (RB-3)	System	$3,500	18	3	532
Septic System Installation/Replacement (RB-4)	System	$10,000	13	2	340
Alternative Waste Treatment System Installation (RB-5)	System	$23,500	52	7	1,347
Community Pet Waste Education Program	Program	$5,000	0	1	4
Residential Pet Waste Composters	System	$50	0	0	1,600
Vegetated Buffers – Residential Land	Acre	$360	0	0	12
Rain Gardens	Acres – Treated	$5,000	0	0	100
Bioretention Basins	Acres – Treated	$10,000	0	0	350

Tables E.5 and E.6 show the estimated cost of installing the recommended agricultural and residential BMPs in Stages I (implementation years 1 - 10) and II (implementation years 10 – 20). The total cost for Stage I is $41.83 million. The total cost for full implementation comes to $63.33 million (Table E.7). All BMPs are expected to be completed by the end of Stage II. The cost of implementing CSO stormwater control measures is not reflected in these totals, as those costs are governed by the City of Lynchburg's Long Term Control Plan (LTCP), which is subject to change as it is currently undergoing a revision. Timelines with expected pollutant reductions are shown in Figures E.1 through E.8. For the purposes of these figures, it is assumed that that CSO program is implemented uniformly throughout the 20 year timeline and there are unlimited funds available to do so.

Table E.5 Costs to implement Stage I (years 1 - 10) for the James River and Tributaries watershed.

Impairment	Agricultural BMPs (million $)	Residential BMPs (million $)	Technical Assistance (million $)	Total Cost (million
James River	3.57	7.60	0.36	11.53
Blackwater (Inclusive)*	4.18	14.76	0.61	19.55
Beaver Creek	1.87	5.57	0.26	7.70
Judith Creek	0.19	1.55	0.05	1.79
Fishing Creek	0.00	1.26	0.01	0.27
Total	**9.81**	**30.74**	**1.28**	**41.83**

Costs related to the CSO Program are not reflected in this table

*Blackwater Inclusive includes its tributary watersheds: Ivy Creek, Tomahawk Creek, and Burton Creek

Table E.6 **Costs to implement Stage II (years 10 - 20) for the James River and Tributaries watershed.**

Impairment	Agricultural BMPs	Residential BMPs	Technical Assistance	Total Cost
	(million $)	(million $)	(million $)	(million
James River	0.44	7.59	0.26	8.29
Blackwater (Inclusive) *	1.09	10.68	0.40	12.17
Beaver Creek	0.58	0.27	0.07	0.92
Judith Creek	0.00	0.09	0.00	0.09
Fishing Creek	0.00	0.00	0.00	0.00
Total	**2.11**	**18.63**	**0.73**	**21.47**

Costs related to the CSO Program are not reflected in this table

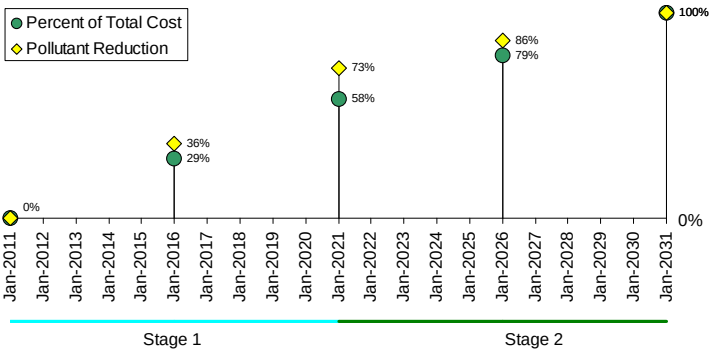
*Blackwater Inclusive includes its tributary watersheds: Ivy Creek, Tomahawk Creek, and Burton Creek

Table E.7 **Total cost for implementation in the James River and Tributaries watershed.**

Impairment	Agricultural BMPs	Residential BMPs	Technical Assistance	Total Cost
	(million $)	(million $)	(million $)	(million
James River	4.01	15.18	0.62	19.81
Blackwater (Inclusive) *	5.27	25.47	1.00	31.74
Beaver Creek	2.45	5.84	3.25	8.62
Judith Creek	0.20	1.65	0.05	1.90
Fishing Creek	0.00	1.26	0.01	1.27
Total	**11.93**	**49.40**	**2.00**	**63.33**

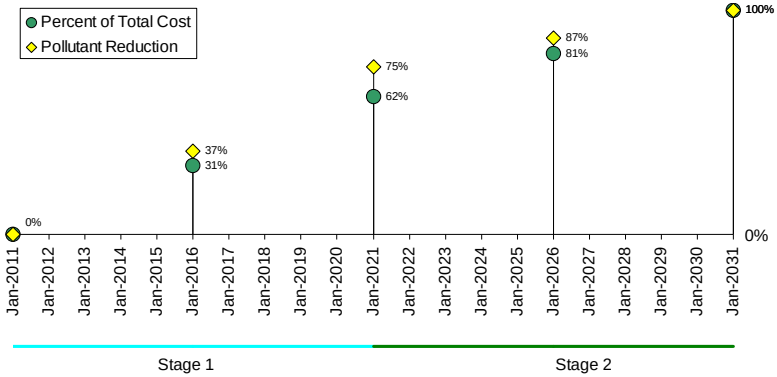
Costs related to the CSO Program are not reflected in this table

*Blackwater Inclusive includes its tributary watersheds: Ivy Creek, Tomahawk Creek, and Burton Creek



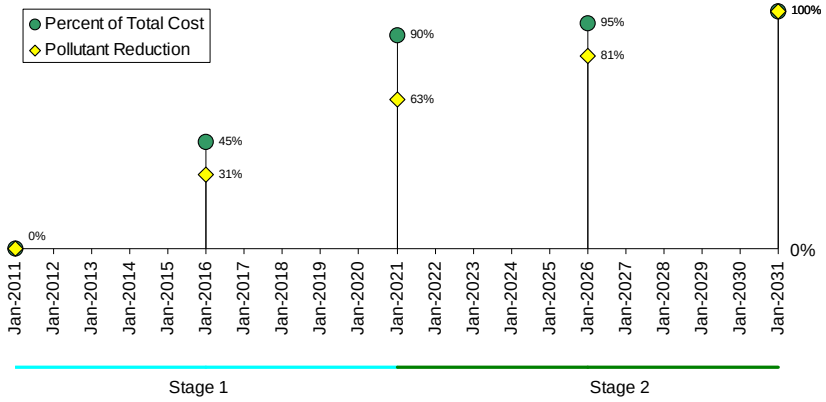
Note: Assumes unlimited funding for, and uniform implementation of, CSO program.

Figure E.1 Timeline for implementation in the James River.



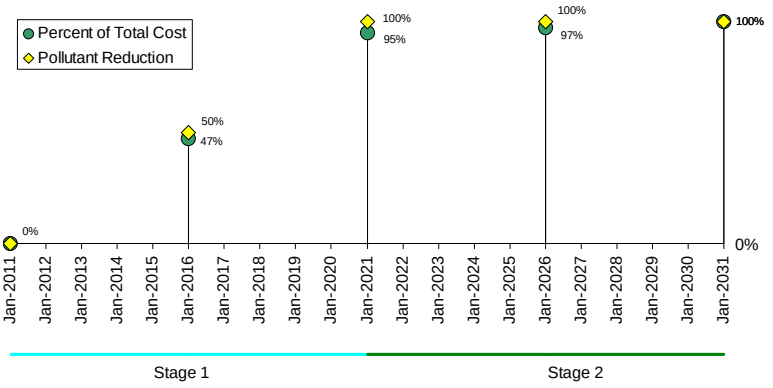
Note: Assumes unlimited funding for, and uniform implementation of, CSO program.

Figure E.2 Timeline for implementation in Blackwater Creek.



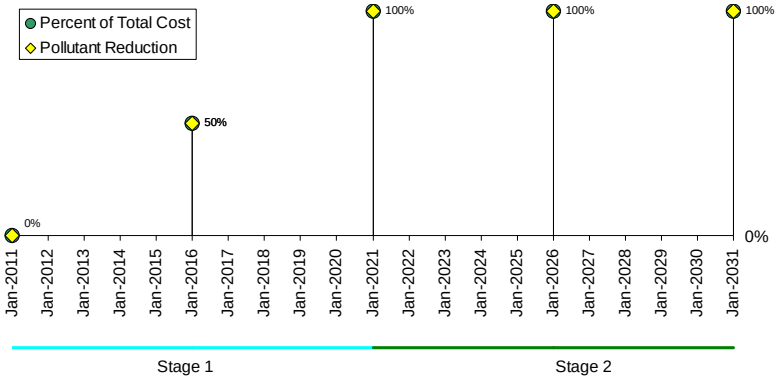
Note: Assumes unlimited funding for, and uniform implementation of, CSO program.

Figure E.3 Timeline for implementation in Beaver Creek.



Note: Assumes unlimited funding for, and uniform implementation of, CSO program.

Figure E.4 Timeline for implementation in Judith Creek.



Note: Assumes unlimited funding for, and uniform implementation of, CSO program.

Figure E.5 Timeline for implementation in Fishing Creek.

Introduction

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

When a stream fails to meet the water quality standards, it is listed as impaired, or dirty, on the CWA's Section 303(d) list. When this occurs, the CWA and the U.S. Environmental Protection Agency (EPA) both require that states develop a Total Maximum Daily Load (TMDL) for each pollutant. A TMDL is a "pollution budget" for a stream. That is, it sets limits on the amount of pollution that a stream can tolerate and still maintain water quality standards. A TMDL accounts for seasonal variations and must include a margin of safety (MOS).

The TMDL process includes three different steps after a stream is listed on the impaired waters or 303(d) list. The first step is to conduct a TMDL study to determine which pollutants are causing the stream to fail at meeting its water quality standards. The second step is development of an implementation plan that contains projects to reduce those pollutants. The third step is implementation of the plan and tracking of the improvements in water quality.

The first step is conducting a TMDL study. This step is complete for the James River and Tributaries Watershed and the results are explained below and in the Review of the TMDL Development Study section of this booklet.

James River and Tributaries watershed is part of the James River Basin and is located within USGS hydrologic unit code 02080203 (James River). The James River and Tributaries watershed is approximately 143,000 acres. See Figure 1 for a map of the James River and Tributaries impaired segments.

The James River (VAC-H03R-04), Ivy Creek (VAC-H03R-03), Fishing Creek (VAC-H03R-02) and Blackwater Creek (VAC-H03R-01) were listed as impaired on Virginia's 1996 303(d) Total Maximum Daily Load Priority List and Report (VADEQ, 1996). Tomahawk Creek (VAC-H03R-07), Burton Creek (VAC-H03R-05), Judith Creek (VAC-H03R-06) and Beaver Creek (VAC-H05R-03) were added to the 2004 305(b)/303(d) Integrated Water Quality Assessment Report.

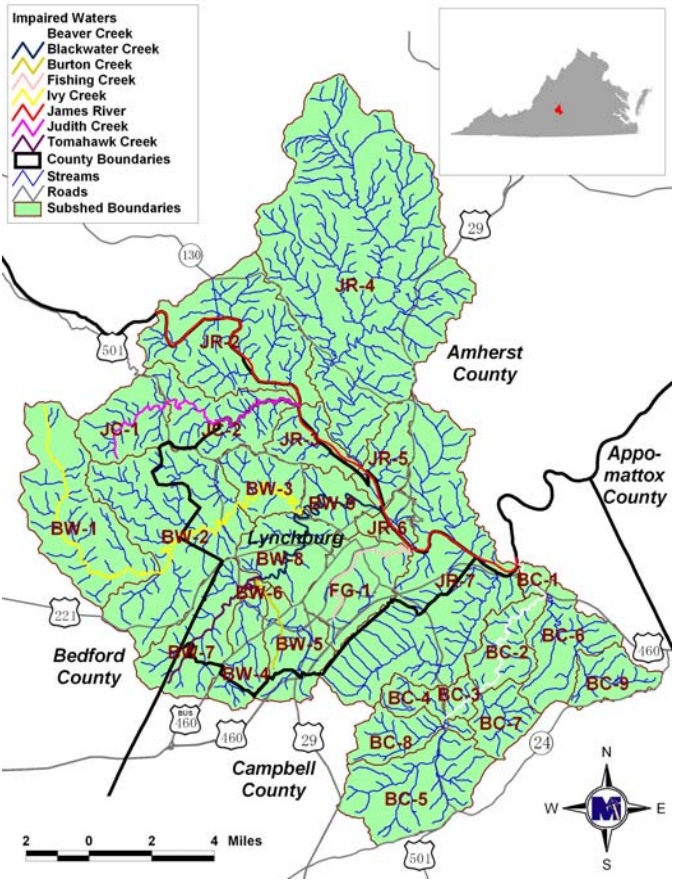


Figure 1 **The James River and Tributaries impaired segments.**

Now that TMDL studies have developed and approved by the EPA and the State Water Control Board (SWCB), measures must be taken to reduce pollution levels in the stream. This second step in the TMDL process is the development of an implementation plan (IP).

In fulfilling the state's requirement for the development of an implementation plan, a framework has been established for reducing *E. coli* levels and achieving the water quality goals for the James River and Tributaries impaired stream segments. This plan is complete for the *E. coli* impairments in the James River and Tributaries watershed and this booklet is a summary of its information. This plan outlines how the TMDL goals can be accomplished in the watershed to improve water quality. The IP describes corrective actions and the installation of BMPs to be implemented in a staged process.

The third step in the TMDL process is to meet these water quality goals through implementation of the plan. This IP will increase the opportunities for funding for implementation, and will provide residents of this watershed with a guide to improve water quality in their community and enhance their natural resources. The implementation of this plan will reduce levels of bacteria in James River and Tributaries watershed. The benefits of the implementation of this plan are described in detail in the Cost/Benefit Analysis chapter of this document. In short, the implementation of this plan may provide benefits to homeowners and farmers, as well as those that use the streams for recreation purposes.

State and Federal Requirements for Implementation Plans

State Requirements

The TMDL IP is a requirement of Virginia's 1997 Water Quality Monitoring, Information, and Restoration Act (§62.1-44.19:4 through 19:8 of the Code of Virginia), or WQMIRA. WQMIRA directs the state's 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

as outlined by WQMIRA. WQMIRA requires that IPs include the following:

- Date of expected achievement of water quality objectives,
- Measurable goals,
- Necessary corrective actions, and
- Associated costs, benefits, and environmental impact of addressing the impairment.

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

The listed elements include:

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

This booklet is an abbreviated version of the full IP technical report which can be obtained by contacting the Virginia Department of Environmental Quality (DEQ).

Key components of the implementation plan are discussed in the following sections:

- Review of the TMDL Development Study
- Process for Public Participation
- Assessment of Needs
- Implementation, and
- Cost/Benefit Analysis

Review of the TMDL Development Study

The James River and Tributaries watershed is located in the City of Lynchburg, as well as Amherst, Bedford, and Campbell Counties in Virginia. The James River is part of the James River Basin and is located within USGS hydrologic unit code 02080203 (James River). The James River and Tributaries watershed is approximately 143,000 acres.

The *E. coli* bacteria TMDL studies for the James River and Tributaries watershed were submitted in August 2007 and March 2010 to the EPA by the DEQ. Copies of the TMDL studies are posted at www.deq.virginia.gov.

These TMDL studies were conducted because James River and Tributaries were not meeting the state water quality standards for recreational use (swimming). In order to meet the water quality goals established by the TMDL study, <10% bacteria water samples from the stream must be equal to or less than 235 colony forming units per 100 milliliters (cfu/100mL) for *E. coli* at all times. If >4 samples are collected within a calendar month, a geometric mean is applied and it must be equal to or less than 126 cfu/100mL.

During the TMDL study, bacteria source tracking (BST), a water quality analysis method, was performed on water samples from the watershed. BST is intended to aid in identifying the sources of fecal contamination in water bodies (i.e., human, pets, livestock, or wildlife). The BST results provided insight into the likely sources of fecal contamination and the distribution of fecal bacteria in the creeks. The major sources of bacteria are human, wildlife, pets and livestock.

Having this information improves the chances for success in implementing solutions by allowing better targeting of the sources of bacteria in this watershed. Figures 2 through 9 show the load weighted average BST results for the James River watershed. These averages were calculated from the 12 monthly samples collected during TMDL development. The weighting process favors the values that are associated with highest *E. coli* concentrations because those concentrations often exceed the water quality standard and it is more important to know what the dominant sources of bacteria are when *E. coli* exceeds the water quality standard. A summary of the final *E. coli*

allocations for the different nonpoint sources in this watershed that resulted from the TMDL study is given in Table 1. No reductions to wildlife sources were required in order to meet the water quality standard.

Information from the TMDL study determined the water quality goals and associated pollutant reductions needed in the implementation plan. The TMDL goals for the implementation plan are to address those sources of bacteria that can be attributed to human activities. The correction of straight pipes and failing septic systems are necessary to meet the TMDL goals. In addition, the majority of livestock in the watershed will need to be excluded from the creeks. Runoff carrying *E. coli* into the creeks after rain events must also be addressed.

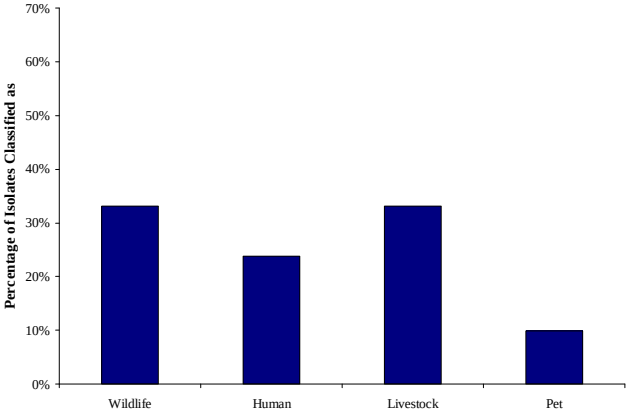


Figure 2 **Load weighted averages for E. coli concentrations and fecal bacteria sources conducted by DEQ during development of the TMDL for the James River at station 2-JMS258.54.**

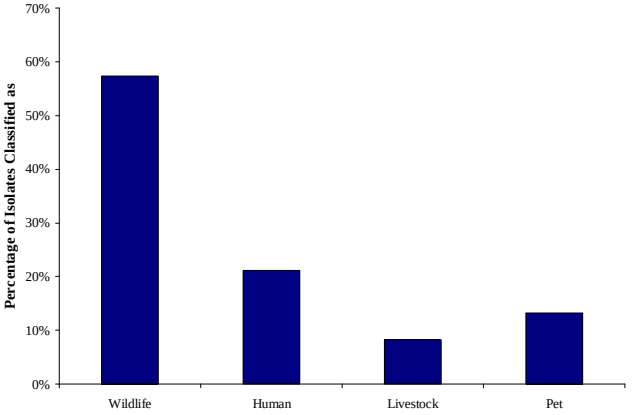


Figure 3 **Load weighted averages for *E. coli* concentrations and fecal bacteria sources conducted by DEQ during development of the TMDL for Blackwater Creek at station 2-BKW000.40.**

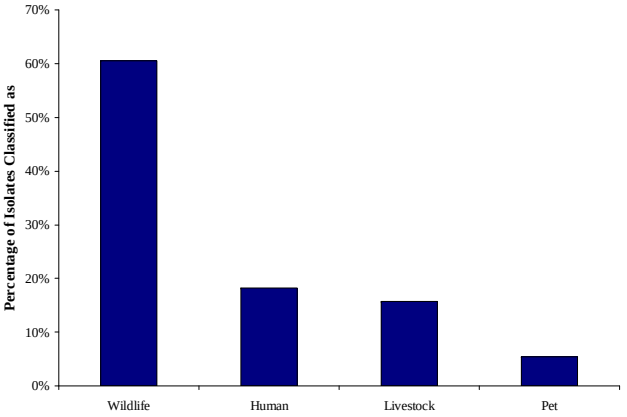


Figure 4 **Load weighted averages for *E. coli* concentrations and fecal bacteria sources conducted by DEQ during development of the TMDL for Blackwater Creek at station 2-BKW007.19.**

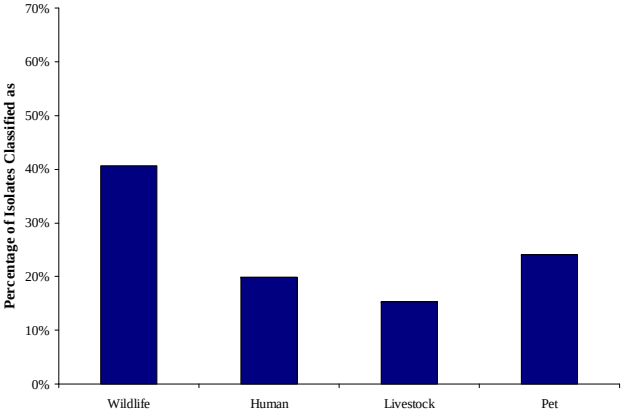


Figure 5 **Load weighted averages for *E. coli* concentrations and fecal bacteria sources conducted by DEQ during development of the TMDL for Burton Creek at station 2-BUN001.64.**

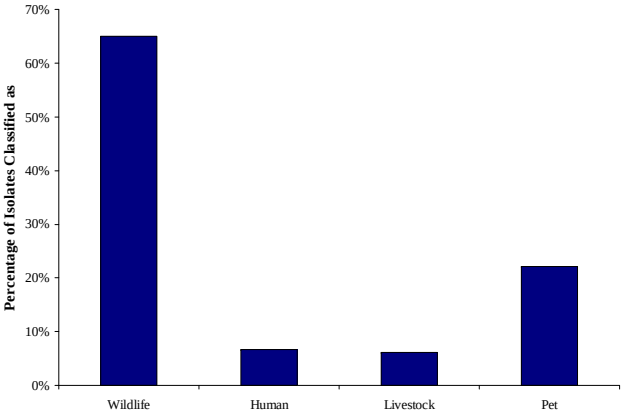


Figure 6 **Load weighted averages for *E. coli* concentrations and fecal bacteria sources conducted by DEQ during development of the TMDL for Dreaming Creek at station 2-DMG000.58.**

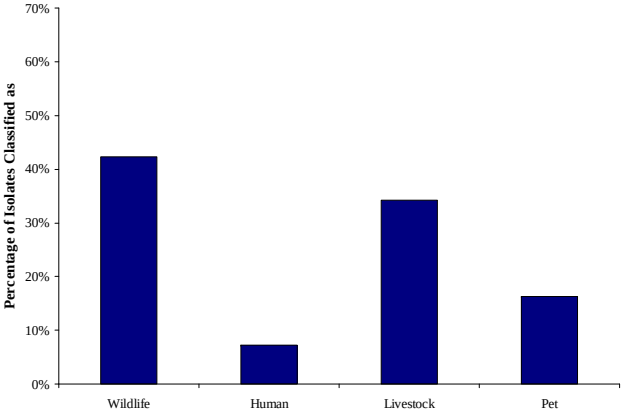


Figure 7 **Load weighted averages for *E. coli* concentrations and fecal bacteria sources conducted by DEQ during development of the TMDL for Fishing Creek at station 2-FSG000.85.**

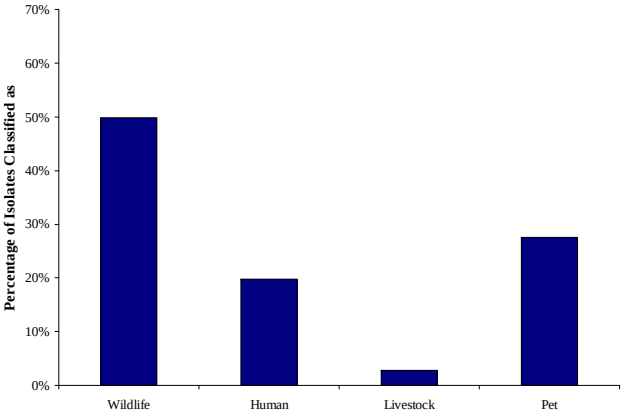


Figure 8 **Load weighted averages for *E. coli* concentrations and fecal bacteria sources conducted by DEQ during development of the TMDL for Ivy Creek at station 2-IVA000.22.**

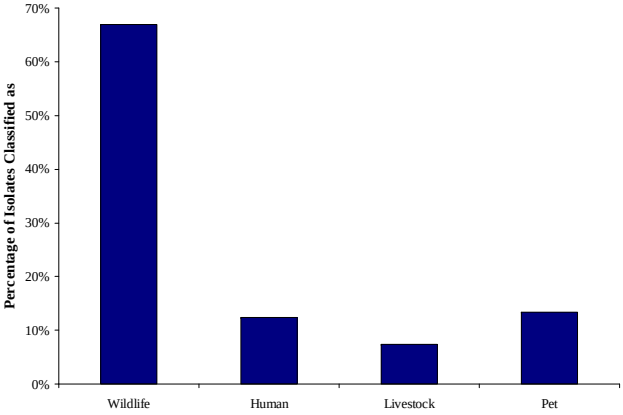


Figure 9 **Load weighted averages for E. coli concentrations and fecal bacteria sources conducted by DEQ during development of the TMDL for Tomahawk Creek at station 2-THK001.31.**

Table 1 Load reductions allocated for the James River and Tributaries TMDLs.

Impairment	CSOs[1]	Failed Septic Systems and Straight Pipes	Direct Livestock	Residential/ Urban Nonpoint Sources	Agricultural Nonpoint Sources
James River	75%	100%	83%	75%	75%
Ivy Creek	100%	100%	99%	87%	87%
Fishing Creek	100%	100%	72%[2]	67%	67%[2]
Blackwater Creek	100%	100%	92%	87%	87%
Tomahawk Creek	0%	100%	99%	87%	87%
Burton Creek	0%	100%	100%	87%	87%
Judith Creek	0%	100%	99%	0%	0%
Beaver Creek	0%	100%	99%	64%	99%

[1] The City of Lynchburg is currently updating their Combined Sewer Overflow (CSO) LTCP, one element of which is improving the model used to estimate CSO loads. Improvements to the estimates of CSO loads may impact the resulting TMDL allocations.

[2] Although the original TMDL called for reductions to direct livestock and agricultural sources within Fishing Creek, it has since been determined that this watershed has a drastically reduced livestock population, therefore no BMPS will need to be implemented for such activities within this watershed.

Process for Public Participation

The actions and commitments described in this document are drawn together through input from citizens of the watershed, Amherst County, Bedford County, Campbell County, the City of Lychburg, DEQ, DCR, Virginia Department of Health (VDH), Virginia Cooperative Extension (VCE), Virginia Department of Forestry (DOF), the Natural Resources Conservation Service (NRCS), Region 2000 Local Government Council, Robert E. Lee Soil and Water Conservation District (RELSWCD), Peaks of Otter Soil and Water Conservation District

(POSWCD), and MapTech, Inc. Every citizen in the watershed and interested party is encouraged to become involved in the implementation process and contribute to restoring the health of the streams. Public participation in development of the plan took place on three levels: public meetings, working groups, and a steering committee.

A public meeting was held on 5/06/2010 to inform the public about the water quality impairments in the James River watershed and outline the goals for improving water quality through an implementation plan. A second public meeting took place on 12/9/2010 to request feedback from citizens on the draft implementation plan.

Specialized working groups were assembled to discuss specific implementation strategies for different sources of bacteria in this watershed and recommend actions for the plan. The working groups were divided into two focus areas: residential/agricultural and urban/governmental.

A steering committee was formed with representation from DEQ, DCR, VDH, RELSWCD, POSWCD, County Government representatives, City of Lynchburg representatives and working groups representatives. This committee reviewed recommendations from the working groups and the draft implementation plan before it was made public.

Assessment of Needs: Recommended Actions

Agricultural BMPs

Agricultural Streamside Fencing

Livestock exclusion systems, or streamside fencing, are one of the best ways to reduce bacteria levels in streams in agricultural watersheds. Some form of stream exclusion is needed to achieve the bacteria reductions from pastureland in the watershed. From an environmental perspective, the best scenario would be to establish a vegetated buffer and exclude livestock from the stream and stream banks. This eliminates direct-deposition by livestock and helps reduce bacteria and sediment loads in runoff. It also prevents livestock from eroding the stream bank, provides a filter strip of vegetation which captures

pollutants and improves water quality, and establishes a healthy environment for aquatic life.

Livestock stream exclusion example.

Several different fencing options are available through state, federal, and private cost share programs. *Livestock Exclusion with Riparian Buffers for TMDL Implementation* (**LE-1T**) systems include streamside fencing, cross fencing, an alternative watering system, and a 35-ft buffer from the stream. It offers an 85% cost share and is only available in targeted TMDL watersheds with implementation plans.

Livestock Exclusion with Reduced Setback Practice for TMDL Implementation (**LE-2T**) systems are only available in targeted TMDL areas with implementation plans. This practice requires a 10 foot setback for stream fencing, and is more flexible in fencing materials allowed. Cost share is provided for stream fencing and cross fencing, and off stream waterers at a rate of 50%.

The *Streambank Protection for TMDL Implementation* (**WP-2T**) systems include streamside fencing, hardened crossings, and a 35-ft buffer from the stream. The WP-2T practice is only available in TMDL targeted implementation areas. This practice includes 75% cost-share and an up-front cost share payment of 50 cents per linear foot of fence installed to assist in covering anticipated fencing maintenance costs.

Off stream watering source for cattle.

Financial assistance for streamside fencing is also available through cost-share programs such as the Conservation Reserve and Enhancement Program (CREP). In general, cost-shares of 50% - 100% are available to help pay for fencing which excludes livestock from farmland adjacent to streams, creating a riparian buffer. It is recommended that participants consult the experienced personnel at their local SWCD in order to choose the most applicable exclusion system and the funding sources to match. Several fencing practices are summarized in Table 2.

Table 2. Fencing cost-share practices comparison

DCR Spec. #	Required Buffer Distance	Maximum Cost Share	Components Available for Cost-share				
			Permanent Stream Fencing	Cross Fencing	Alternate Water Supply	Restricted Crossing	Hardened Access or Crossing
LE - 1T	35	85%	√	√	√	√	
LE - 2T	10	50%	√	√	√	√	
WP- 2T	35	75%	√				√

The quantity of streamside fencing needed was determined through spatial analyses of land uses, the stream network, and archived data. Additionally, input from local agency representatives and citizens were used to verify the analyses.

Photo of badly eroded streams banks from direct livestock access in Pulliam Branch (Campbell County) 11/2/2000.

The length of fencing required on perennial, flowing year round, streams in the James River and Tributaries watershed is approximately 61 miles. In order to assess this goal, the state cost-share program for agricultural best management practices (BMPs) was utilized. The total fencing needed was divided up among the different BMPs offered through the state cost-share program that include a fencing component. Table 3 shows the fencing systems required for the impaired watershed in order to meet the livestock exclusion goal.

Table 3 Livestock exclusion systems and stream protection systems required for James River and tributaries watershed.

Watershed	Livestock Exclusion systems[1]	Streambank Protection systems
James River	91	13
Blackwater (Inclusive)	57	6
Beaver Creek	38	2
Judith Creek	9	1
Fishing Creek	0	0

[1] The average system length installed within the area is 1,900 ft.

Agricultural land based reduction BMPs

Due to the large reductions needed on land-based loads of *E. coli* bacteria, additional BMPs for pasture and cropland are also needed.

Estimates of the needed land-based agricultural BMPs are listed in Table 4.

Stormwater runoff from farmland picks up bacteria from manure and causes soil-loss and erosion of valuable land along its path to the stream. There are several BMPs that can be applied to farmland that will help prevent soil and bacteria from ending up in streams.

Along with the infrastructure provided by a streamside fencing system, improved *Pasture Management* includes: maintaining forage height during growing season, application of lime and fertilizer when needed, controlling woody vegetation, distribution of manure through managed rotational grazing, and reseeding if necessary. Employing the pasture management practices listed above can produce significant economic gains to producers at a very low investment cost.

Prescribed grazing and *Pasture and Hayland Planting* are two BMPs, which go hand and hand with pasture management. Prescribed grazing is managing the harvest of vegetation with grazing and/or browsing animals. Among the benefits of prescribed grazing are maintaining a desired vegetation species composition, improved quantity and quality of forage for grazing, and reduced soil erosion. Pasture and Hayland Planting involves establishing stands of cool season perennial grasses to be used for forage, hay, pasture, or wildlife habitat. Pasture and Hayland Planting improves livestock nutrition, extends the grazing season, reduces soil erosion, and improves water quality.

Conservation tillage involves managing the intensity (frequency and aggressiveness) of soil-disturbing activities related to residue management, seedbed preparation, nutrient application, planting, and pest control while planting and growing crops. Employing conservation tillage helps prevent erosion, which also helps keep bacteria found in manure fertilizers from running off the land. Benefits include improved soil quality and reductions in time, fuel, and production costs.

Manure incorporation, or the incorporation of manure fertilizers into the soil as opposed to typical land application methods, has benefits of improving soil properties and crop production, as well as the benefit of helping keep the fertilizer, and its associated bacteria, from running off the land.

Retention Ponds on pasture-land allow time for the sediment and bacteria to settle out from the captured runoff, before it flows into streams. Retention ponds have several potential benefits, including: recreational uses such as fishing, water sources, and aesthetics.

Dairy Waste Storage Facilities allow manure to be properly collected, contained, and stored until the appropriate time when it can be applied.

Livestock Feeding Areas are necessary when heavy-use feeding areas have to be located in close proximity to streams. These hardened surfaces that allow for manure collection and storage, as opposed to being washed off into the stream.

Many agricultural BMPs qualify for financial assistance. It is recommended that participants discuss funding options with experienced personnel at their local SWCD in order to choose the best option.

Environmental Quality Incentives Program (EQIP) is conservation program for farmers and landowners to address significant natural resource needs and objectives offers 5 to 10-year contracts to landowners and farmers to provide 75% cost-share assistance, 25% tax credit, and/or incentive payments to implement conservation. Eligible land includes cropland, pasture, and other agricultural land in priority areas, or land that has an environmental need that matches one of the statewide concerns.

The **Chesapeake Bay Watershed Initiative (CBI)** provides technical and financial assistance to implement a combination of conservation practices to better manage inputs, increase profits, reduce nonpoint source pollution, and improve soil and water quality.

Table 4 Agricultural land based reduction BMPs.

Control Measure	Unit	James River	Blackwater Inclusive*	Beaver Creek
Improved Pasture Management	Acres	10,173	18,980	6,666
Conservation Tillage	Acres	150	366	188
Manure Incorporation	Acres	22	82	79
Retention Ponds – Pasture	Acre - Treated	3,000	7,700	0
Dairy Waste Storage	System	0	1	0
Livestock Feeding Area	System	2	0	2

Fishing Creek and Judith Creek do not require land-based BMPs.
*Blackwater Inclusive includes its tributary watersheds: Ivy Creek, Tomahawk Creek, and Burton Creek

Residential BMPs

The James River and Tributaries TMDL allocations call for a 100 percent reduction in bacteria sources in the watershed from straight pipes and failing septic sytstems. The BMPs include removing straight pipes, replacing failing septic systems, and proper disposal of pet waste by homeowners, kennel owners, hunt clubs, etc.

Septic Systems

All failing septic systems and straight pipes must be identified and replaced during implementation since a 100 percent load reduction from direct and nonpoint source (NPS) human waste is required to meet the TMDL goals. In addition, straight pipes are illegal in the Commonwealth of Virginia. The estimated numbers of straight pipes and failing septic systems, reported in the TMDL study, are shown in Table 5. The number of estimated potential failing septic systems and straight pipes is derived based on census data and data on the age of houses and their respective septic fields within the watershed.

The Residential Working Group, with input from local Virginia Department of Health representatives, estimated that 70% of failing septic systems would need to be replaced and 25% could be corrected with septic system repairs. It was decided that 5% of failing septic systems could potentially be connected to public sewer. It was also estimated that 80% of all newly installed septic systems would require alternative wastewater systems.

Table 5 Estimated residential waste treatment systems.

Watershed	Houses with Standard Septic Systems	Potential Failing Septic Systems	Potential Straight Pipes
James River	5,245	727	106
Blackwater (Inclusive)	16,116	1,018	51
Beaver Creek	2,158	295	27
Judith Creek	729	73	14
Fishing Creek	4,211	13	0

Financial assistance could be provided through grants to provide cost-share for homeowners to pump out their septic tanks. While it is not likely that sufficient grant funds will be available to assist every homeowner in this watershed with a septic system pump-out, it is expected that this type of outreach will raise local awareness and lead homeowners to assume responsibility for maintaining their systems. In turn, this will help to prevent septic system failures in the future.

Pet Waste

There are a significant number of dogs in the watershed. For example, in 2006 Campbell County issued 175 licenses for kennels that held between five to 20 dogs. An additional 25 kennel licenses were issued for facilities that held between 21 to 50 dogs.

The Community Pet Waste Education Program shown in Table 6 includes distribution of information on proper disposal of pet waste to pet owners, kennel operators and hunt clubs; signage regarding proper disposal of pet waste in public areas, along with pet waste disposal stations in public dog walking areas. There are many parks within the City of Lynchburg where signage, receptacles, and disposal bags could be located, including the future Lynchburg Dog Park within the Blackwater Creek Athletic Area, planned to open spring of 2011. Consideration should also be given to distributing pet waste information at campgrounds and picnic areas. A Pet Waste Composter program is also proposed to help eliminate pet waste in homeowners'

yards and at kennels in addition to public places. The program includes the distribution of pet waste composters to households in this watershed with pets. This could be accomplished through partnerships with local pet supply stores, the Amherst, Bedford, and Campbell County Animal Shelters, the Society for the Prevention of Cruelty to Animals (SPCA), and the City and County governments.

In order to achieve the necessary residential reductions, the BMPs in Table 6 are targeted.

Table 6 All residential BMPs recommended for implementation.

		James River	Blackwater Inclusive*	Beaver Creek
Residential Control Measure	**Unit**	**Units Needed**	**Units Needed**	**Units Needed**
Septic Systems Pump-outs (RB-1)	System	5,245	16,116	2,158
Connection to Public Sewer(RB-2)	System	36	50	14
Septic System Repair (RB-3)	System	182	255	74
Septic System Installation/Replacement (RB-4)	System	123	155	47
Alternative Waste Treatment System Installation (RB-5)	System	492	609	187
Community Pet Waste Education Program	Program	1	1	1
Residential Pet Waste Composters	System	0	1,600	0
Vegetated Buffers – Residential Land	Acre	0	12	0
Rain Gardens	Acres – Treated	0	100	0
Bioretention Basins	Acres – Treated	0	350	0

*Blackwater Inclusive includes its tributary watersheds: Ivy Creek, Tomahawk Creek, and Burton Creek

Table 6 All residential BMPs recommended for implementation (cont.).

Residential Control Measure	Unit	Cost per Unit	Judith Creek Units Needed	Fishing Creek Units Needed	Totals Units Needed
Septic Systems Pump-outs (RB-1)	System	$250	729	4,211	28,459
Connection to Public Sewer (RB-2)	System	$18,000	4	1	105
Septic System Repair (RB-3)	System	$3,500	18	3	532
Septic System Installation/Replacement (RB-4)	System	$10,000	13	2	340
Alternative Waste Treatment System Installation (RB-5)	System	$23,500	52	7	1,347
Community Pet Waste Education Program	Program	$5,000	0	1	4
Residential Pet Waste Composters	System	$50	0	0	1,600
Vegetated Buffers – Residential Land	Acre	$360	0	0	12
Rain Gardens	Acres – Treated	$5,000	0	0	100
Bioretention Basins	Acres – Treated	$10,000	0	0	350

Stormwater Control Measures

Bacteria loads from combined sewer overflows (CSO) will need to be addressed to meet the TMDL. The City of Lynchburg's strategy for mitigating stormwater related CSOs is contained within its Long Term Control Plan (LTCP). The City is currently revising its previously approved LTCP, to evaluate the option of storage and treatment, in comparison to the current plan of complete separation. Once approved, the revised LTCP will be the guiding document for City's CSO management.

Low Impact Development (LID) BMPs offer a potential alternative, or supplement, to traditional CSO mitigation measures to reduce stormwater volumes in urban landscapes and the associated CSO occurrences. There are several LID practices, applicable within the City, which may be employed to reduce stormwater peak flows and volumes within urban landscapes, which include green roofs, bioretention basins, permeable pavement, and roof runoff detention systems (such as rain barrels).

Technical Assistance

It is estimated that two full-time staff members are needed throughout implementation. Much of the Technical assistance will be provided through the local Soil and Water Conservation Districts: Robert E. Lee SWCD and the Peaks of Otter SWCD. It is recommended that stakeholders and participants consult the experienced personnel at their local SWCD in order to choose the most applicable BMPs, the programs that best fit their needs, and the funding sources to match.

Cost Estimate

Associated cost estimates of agricultural and residential BMPs were calculated by multiplying the unit cost of each practice by the number of units in each watershed. Tables 7 and 8 show the estimated cost of installing the recommended agricultural and residential BMPs in Stages I and II. The total cost for Stage I for this watershed is $41.83 million.

It was determined that it would require $50,000 to support the salary, benefits, travel, training, and incidentals for education for one technical staff member. With quantification analysis yielding a need for two staff members per year for the duration of implementation, the maximum total cost to provide technical assistance during implementation is expected to be $2,000,000. Factoring in technical assistance costs, the total cost for full implementation in this watershed comes to $63.33 million (Table 9).

Table 7 Costs to implement Stage I (years 1 - 10) for the James River and Tributaries.

Impairment	Agricultural BMPs (million $)	Residential BMPs (million $)	Technical Assistance (million $)	Total Cost (million
James River	3.57	7.60	0.36	11.53
Blackwater (Inclusive)*	4.18	14.76	0.61	19.55
Beaver Creek	1.87	5.57	0.26	7.70
Judith Creek	0.19	1.55	0.05	1.79
Fishing Creek	0.00	1.26	0.01	0.27
Total	**9.81**	**30.74**	**1.28**	**41.83**

Costs related to the CSO Program are not reflected in this table

*Blackwater Inclusive includes its tributary watersheds: Ivy Creek, Tomahawk Creek, and Burton Creek

Table 8 Costs to implement Stage II (years 10 - 20) for the James River and Tributaries.

Impairment	Agricultural BMPs (million $)	Residential BMPs (million $)	Technical Assistance (million $)	Total Cost (million
James River	0.44	7.59	0.26	8.29
Blackwater (Inclusive)*	1.09	10.68	0.40	12.17
Beaver Creek	0.58	0.27	0.07	0.92
Judith Creek	0.00	0.09	0.00	0.09
Fishing Creek	0.00	0.00	0.00	0.00
Total	**2.11**	**18.63**	**0.73**	**21.47**

Costs related to the CSO Program are not reflected in this table

*Blackwater Inclusive includes its tributary watersheds: Ivy Creek, Tomahawk Creek, and Burton Creek

Table 9 Total cost for implementation in the James River and Tributaries watershed.

Impairment	Agricultural BMPs (million $)	Residential BMPs (million $)	Technical Assistance (million $)	Total Cost (million
James River	4.01	15.18	0.62	19.81
Blackwater (Inclusive)*	5.27	25.47	1.00	31.74
Beaver Creek	2.45	5.84	3.25	8.62
Judith Creek	0.20	1.65	0.05	1.90
Fishing Creek	0.00	1.26	0.01	1.27
Total	**11.93**	**49.40**	**2.00**	**63.33**

Costs related to the CSO Program are not reflected in this table

*Blackwater Inclusive includes its tributary watersheds: Ivy Creek, Tomahawk Creek, and Burton Creek

Implementation

Funding

Potential funding sources available during implementation were identified during plan development. Detailed descriptions can be obtained from the RELSWCD, POSWCD, DCR, NRCS, and VCE. Sources include:

Federal

Chesapeake Bay Watershed Initiative (CBWI)
Community Development Block Grant Program
Conservation Reserve Program (CRP)
Conservation Reserve Enhancement Program (CREP)
Environmental Quality Incentives Program (EQIP)
Wildlife Habitat Incentive Program (WHIP)
Wetland Reserve Program (WRP)

State

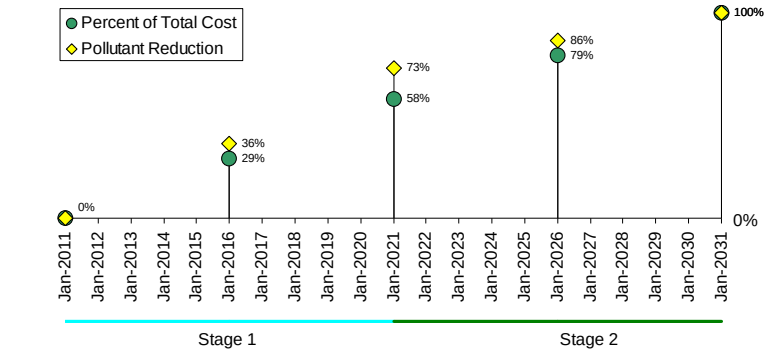
Clean Water State Revolving Fund
Virginia Agricultural Best Management Practices Cost-Share Program
Virginia Agricultural Best Management Practices Tax Credit Program
Virginia Agricultural Best Management Practices Loan Program
Virginia Small Business Environmental Assistance Fund Loan Program
Virginia Water Quality Improvement Fund

Local
City of Lynchburg (CSO Program and MS4 permit compliance)
Indoor Plumbing Rehabilitation program
Amherst County – Watershed Protection Program (Graham Creek & Harris Creek)

Private
Small Watershed Grants Program
Southeast Rural Community Assistance Project (SE/R-CAP)
National Fish and Wildlife Foundation

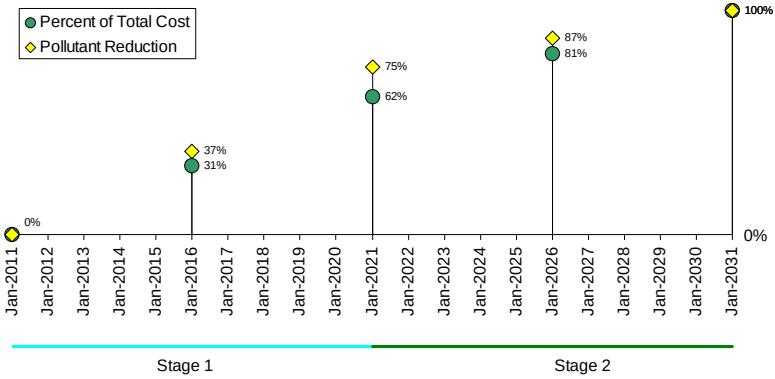
Timeline and Milestones
The intended implementation goal is to restore the James River and Tributaries water quality to attain the bacteria standards and the removal of these streams from Virginia's Section 303(d) impaired waters list. Progress toward end goals will be assessed during implementation through tracking of BMP installations 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 BMPs installed each year, while water quality milestones establish the corresponding improvements in water quality that can be expected. The milestones described here are intended to achieve full implementation of the TMDL within 20 years. Stage I and Stage II timelines extend out to 2031 with expected pollutant reductions shown in the timeline of implementation milestones, Figures 10 through 14.



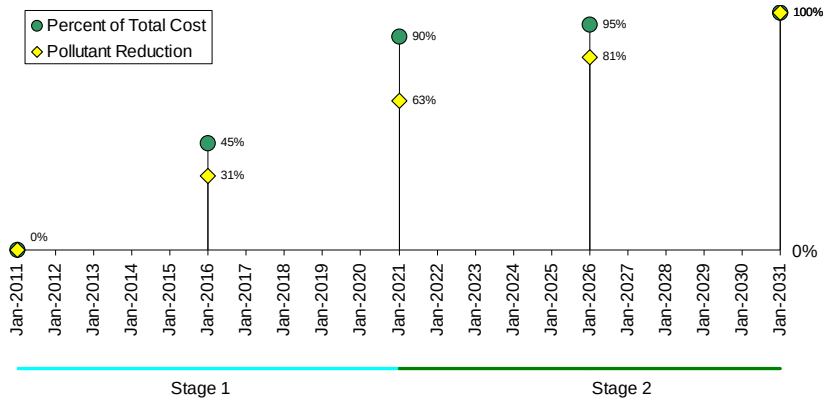
Note: Assumes unlimited funding for, and uniform implementation of, CSO program.

Figure 10 Timeline for implementation in the James River.



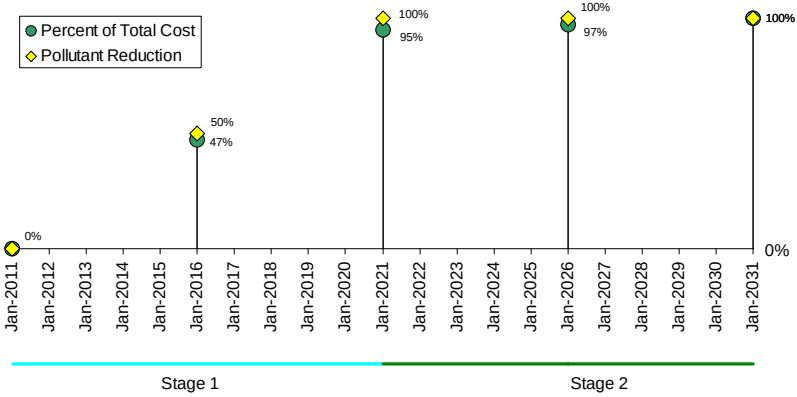
Note: Assumes unlimited funding for, and uniform implementation of, CSO program.

Figure 11 Timeline for implementation in Blackwater Creek.



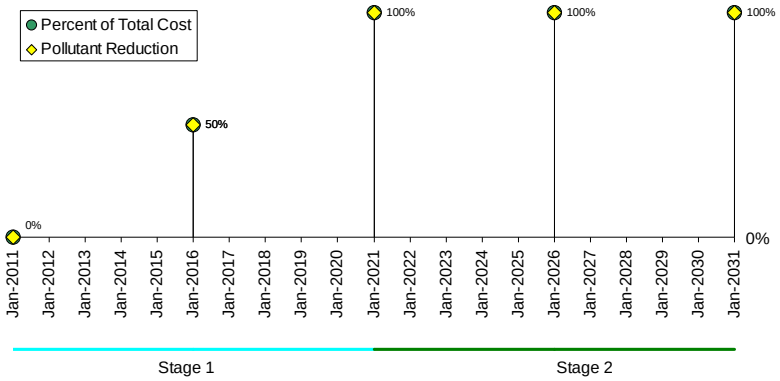
Note: Assumes unlimited funding for, and uniform implementation of, CSO program.

Figure 12 Timeline for implementation in Beaver Creek



Note: Assumes unlimited funding for, and uniform implementation of, CSO program.

Figure 13 Timeline for implementation in Judith Creek.



Note: Assumes unlimited funding for, and uniform implementation of, CSO program.

Figure 14 Timeline for implementation in Fishing Creek.

Following the idea of a staged implementation approach, resources and finances will be concentrated on the most cost-efficient control measures first. These measures will be the focus of Stage I. Following Stage I implementation and if a de-listing is not yet attained, the steering committee should evaluate water quality improvements and determine how to proceed to implement additional BMPs during Stage II. The estimated violation rates of the geometric mean standard (126 cfu/100mL) after Stage I implementation are shown in Table 10.

Table 10 Estimated violation rates of the geometric mean standard after Stage I implementation.

Impairment	Standard Violation Rate
James River	8%
Blackwater - Inclusive*	3%
Beaver Creek	27%
Judith Creek	0%
Fishing Creek	2%

*Blackwater Inclusive includes its tributary watersheds: Ivy Creek, Tomahawk Creek, and Burton Creek

Stage II focuses on BMPs that are necessary for the stream to fully comply with the TMDL allocation requirements. The Department of Environmental Quality's E. coli bacterial standard states that there can be no exceedances of the calendar month geometric mean (126 cfu/100 ml). Fully complying with the standard may require BMPs that are more difficult and costly to implement. Tables 11 through 15 show the types and quantities of BMPs to be installed during each stage.

Table 11 Stage I and Stage II BMP implementation goals for the James River.

Control Measure	Unit	Stage I	Stage II
Agricultural			
Livestock Exclusion	System[1]	91	0
Stream Protection -TMDL	System	13	0
Streamside Fence Maintenance	Feet	5,475	5,475
Improved Pasture Management	Acres	10,173	0
Conservation Tillage	Acres	150	0
Manure Incorporation	Acres	22	0
Retention Ponds - Pasture	Acres-Treated	0	3,000
Dairy Waste Storage Facilities	System	0	0
Livestock Feeding Area	System	2	0
Residential			
Septic Systems Pump-out Program (RB-1)	System	2,622	2,623
Septic System Repair (RB-3)	System	91	91
Septic System Installation/Replacement (RB-4)	System	62	61
Alternative Waste Treatment System Installation (RB-5)	System	246	246
Community Pet Waste Education Program	Program	1	ongoing
Residential Pet Waste Composters	System	0	0
Vegetated Buffers – Residential Land	Acres	0	0
Rain Gardens	Acres-Treated	0	0
Bioretention Basins	Acres-Treated	0	0

[1] The average system length installed within the area is 1,900 ft.

Table 12 Stage I and Stage II BMP implementation goals for Blackwater Creek - Inclusive.[*]

Control Measure	Unit	Stage I	Stage II
Agricultural			
Livestock Exclusion	System[1]	57	0
Stream Protection -TMDL	System	6	0
Streamside Fence Maintenance	Feet	3,525	3,525
Improved Pasture Management	Acres	18,980	0
Conservation Tillage	Acres	366	0
Manure Incorporation	Acres	82	0
Retention Ponds - Pasture	Acres-Treated	0	7,700
Dairy Waste Storage Facilities	System	1	0
Livestock Feeding Area	System	0	0
Residential			
Septic Systems Pump-out Program (RB-1)	System	8,058	8,058
Septic System Repair (RB-3)	System	128	127
Septic System Installation/Replacement (RB-4)	System	78	77
Alternative Waste Treatment System Installation (RB-5)	System	305	304
Community Pet Waste Education Program	Program	1	ongoing
Residential Pet Waste Composters	System	1,600	0
Vegetated Buffers – Residential Land	Acres	12	0
Rain Gardens	Acres-Treated	100	0
Bioretention Basins	Acres-Treated	350	0

[1] The average system length installed within the area is 1,900 ft.

[*] Blackwater Inclusive includes its tributary watersheds: Ivy Creek, Tomahawk Creek, and Burton Creek

Table 13 Stage I and Stage II BMP implementation goals for Beaver Creek.

Control Measure	Unit	Stage I	Stage II
Agricultural			
Livestock Exclusion	System[1]	38	0
Stream Protection -TMDL	System	2	0
Streamside Fence Maintenance	Feet	2,415	2,415
Improved Pasture Management	Acres	6,666	0
Conservation Tillage	Acres	188	0
Manure Incorporation	Acres	79	0
Retention Ponds - Pasture	Acres-Treated	0	4,100
Dairy Waste Storage Facilities	System	0	0
Livestock Feeding Area	System	2	0
Residential			
Septic Systems Pump-out Program (RB-1)	System	1,079	1,079
Septic System Repair (RB-3)	System	74	0
Septic System Installation/Replacement (RB-4)	System	47	0
Alternative Waste Treatment System Installation (RB-5)	System	187	0
Community Pet Waste Education Program	Program	1	ongoing
Residential Pet Waste Composters	System	0	0
Vegetated Buffers – Residential Land	Acres	0	0
Rain Gardens	Acres-Treated	0	0
Bioretention Basins	Acres-Treated	0	0

[1] The average system length installed within the area is 1,900 ft.

Table 14 Stage I and Stage II BMP implementation goals for Judith Creek.

Control Measure	Unit	Stage I	Stage II
Agricultural			
Livestock Exclusion	System[1]	9	0
Stream Protection -TMDL	System	1	0
Streamside Fence Maintenance	Feet	660	660
Improved Pasture Management	Acres	0	0
Conservation Tillage	Acres	0	0
Manure Incorporation	Acres	0	0
Retention Ponds - Pasture	Acres-Treated	0	0
Dairy Waste Storage Facilities	System	0	0
Livestock Feeding Area	System	0	0
Residential			
Septic Systems Pump-out Program (RB-1)	System	364	365
Septic System Repair (RB-3)	System	18	0
Septic System Installation/Replacement (RB-4)	System	13	0
Alternative Waste Treatment System Installation (RB-5)	System	52	0
Community Pet Waste Education Program	Program	0	0
Residential Pet Waste Composters	System	0	0
Vegetated Buffers – Residential Land	Acres	0	0
Rain Gardens	Acres-Treated	0	0
Bioretention Basins	Acres-Treated	0	0

[1] The average system length installed within the area is 1,900 ft.

Table 15 Stage I and Stage II BMP implementation goals for Fishing Creek.

Control Measure	Unit	Stage I	Stage II
Agricultural			
Livestock Exclusion	System	0	0
Stream Protection –TMDL	System	0	0
Streamside Fence Maintenance	Feet	0	0
Improved Pasture Management	Acres	0	0
Conservation Tillage	Acres	0	0
Manure Incorporation	Acres	0	0
Retention Ponds - Pasture	Acres-Treated	0	0
Dairy Waste Storage Facilities	System	0	0
Livestock Feeding Area	System	0	0
Residential			
Septic Systems Pump-out Program (RB-1)	System	4,211	0
Septic System Repair (RB-3)	System	3	0
Septic System Installation/Replacement (RB-4)	System	2	0
Alternative Waste Treatment System Installation (RB-5)	System	7	0
Community Pet Waste Education Program	Program	1	ongoing
Residential Pet Waste Composters	System	0	0
Vegetated Buffers – Residential Land	Acres	0	0
Rain Gardens	Acres-Treated	0	0
Bioretention Basins	Acres-Treated	0	0

Targeting

The impaired watershed was divided into subwatersheds for TMDL modeling purposes and this also helps with the targeting of BMP practices (Figure 15). Targeting of critical areas for livestock fencing was accomplished through analysis of livestock population and the fencing requirements for each subwatershed. The subwatersheds were ranked in descending order based on the ratio of animals per fence length along perennial streams Table 16.

Failing septic systems were ranked based on the sum of the bacteria loads in each subwatershed Table 17. If feasible, effort should be made to prioritize financial and technical resources in the order of subwatersheds shown in Tables 16 and 17.

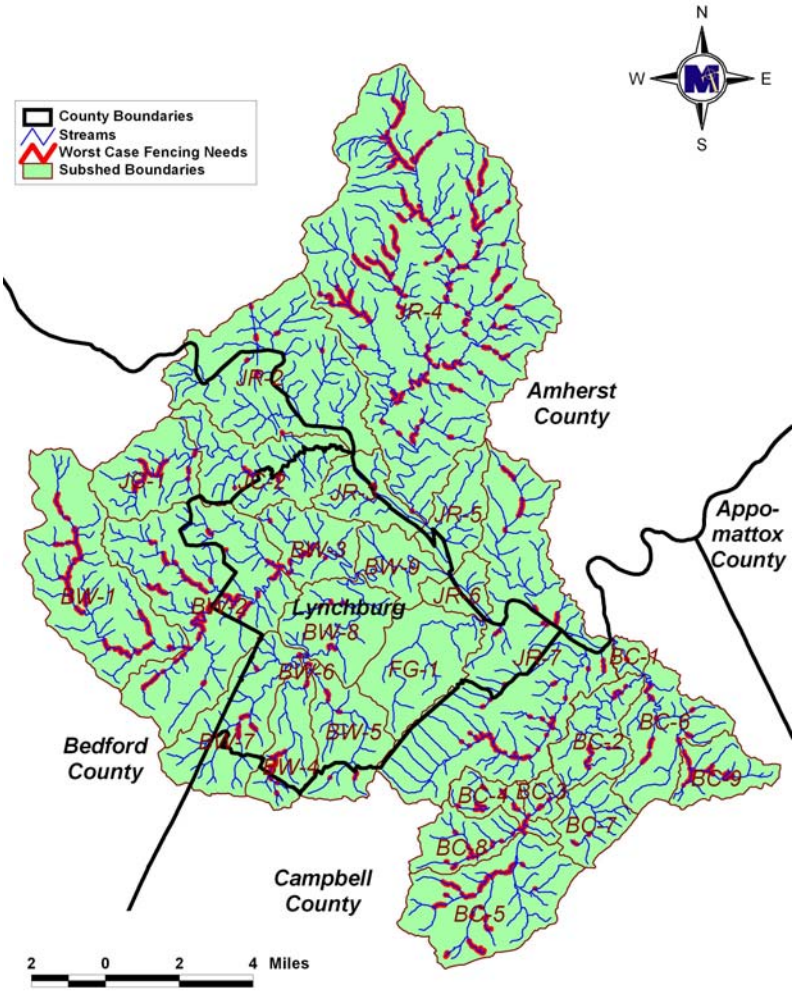


Figure 15 **Area available for streamside fencing the James River and Tributaries watershed.**

Table 16 **Subwatershed targeting order for streamside fencing in James River and Tributaries watershed.**

Priority	Subwatershed	SWCD
1st	BC-1	REL
2nd	BC-8	REL
3rd	JR-2	PO*
4th	BC-2	REL
5th	BC-3	REL
6th	BC-6	REL
7th	JR-3	REL
8th	BW-6	REL
9th	BC-7	REL
10th	BC-9	REL
11th	JR-7	REL
12th	JC-2	PO*
13th	BC-4	REL
14th	BW-1	PO
15th	BW-2	PO*
16th	BC-5	REL
17th	BW-7	REL*
18th	BW-8	REL
19th	BW-5	REL
20th	BW-3	REL
21st	JC-1	PO
22nd	JR-4	REL
23rd	BW-4	REL
24th	BW-9	REL
25th	FG-1	REL
26th	JR-5	REL
27th	JR-6	REL

*These impairment subwatersheds do not fall neatly within a SWCD boundary, so they were assigned a SWCD based on their centroid. Therefore assistance could be from either the RELSWCD or POSWCD.

Table 17 **Subwatershed targeting order for residential waste BMPs in James River and Tributaries watershed.**

Priority	Subwatershed	SWCD
1st	BW-7	REL*
2nd	JR-7	REL
3rd	JR-4	REL
4th	BW-2	PO*
5th	BW-4	REL
6th	BC-5	REL
7th	BW-5	REL
8th	BW-8	REL
9th	BW-1	PO
10th	JR-5	REL
11th	JC-2	PO*
12th	JR-2	PO*
13th	BC-8	REL
14th	BC-6	REL
15th	BC-9	REL
16th	JC-1	PO
17th	JR-6	REL
18th	BC-7	REL
19th	BW-3	REL
20th	JR-3	REL
21st	BW-9	REL
22nd	BC-4	REL
23rd	FG-1	REL
24th	BC-2	REL
25th	BC-3	REL
26th	BC-1	REL
27th	BW-6	REL

*These impairment subwatersheds do not fall neatly within a SWCD boundary, so they were assigned a SWCD based on their centroid. Therefore assistance could be from either the RELSWCD or POSWCD.

Cost / Benefit Analysis

The primary benefit of this implementation is cleaner waters within the James River and its tributaries within the City of Lynchburg, as well as the Counties of Amherst, Bedford, and Campbell. The James River is a particularly popular recreational river for swimming, canoeing, fishing, and kayaking. Implementation will provide safer, cleaner waters for recreational use, and reduce the incidence of infection through contact with the water. Specifically, fecal bacteria contamination in the James River and Tributaries will be reduced to meet water quality standards and allow for safe recreational use.

It is difficult to gauge the impact that reducing fecal 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 required reductions, the incidence of infection from fecal sources, through contact with surface waters, should be considerably reduced.

Additionally, because of streambank protection that will be provided through exclusion of livestock from streams, the aquatic habitat will be improved in these waters. The vegetated buffers that are established will also serve to reduce bacteria runoff to the stream from upslope locations. In addition, as trees and shrubs in vegetated buffers grow, they serve as excellent shade sources for streams. This in turn reduces water temperature in the stream and increases dissolved oxygen, thereby improving aquatic habitat for numerous aquatic organisms. In areas where pasture management is improved, less bacteria will be washed into streams following precipitation events. Bacteria concentrations in the stream should be at or below the state standards.

A clean water source has been shown to improve herd health. Fresh clean water is the primary nutrient for livestock. Many livestock illnesses can be spread through contaminated water supplies. A clean water source can prevent illnesses that reduce production and incur the added expense of avoidable veterinary bills. Beef producers in several Virginia Counties have reported weight gains in cattle after providing alternative water sources. Studies also show increased milk and butterfat production from dairy cattle ingesting water from a clean source.

Taking the opportunity to initiate 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 - 40% and, consequently, improve the profitability of the operation. 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.

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 with it. In terms of economic benefits to homeowners, an improved understanding of private sewage 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. 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 three to five years. The cost of proper maintenance, as outlined here, is relatively inexpensive in comparison to repairing or replacing the entire system.

Implementation of this plan will help foster continued local economic vitality and strength based on the recognition that clean water improves 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 are expected to provide economic and environmental benefits to the landowner. Specifically, alternative (clean) water sources, exclusion of livestock from streams, intensive pasture management, and private sewage system maintenance will each provide economic benefits.

Monitoring

Improvements in water quality will be determined in the James River and Tributaries watershed through monitoring conducted by the DEQ's ambient monitoring program. The extent of monitoring is subject to the potential budget constraints of VADEQ's ambient monitoring program. The monitoring data include bacteria, physical parameters (dissolved oxygen, temperature, pH, and conductivity), nutrients and suspended and dissolved solids. The VADEQ uses the data to determine overall water quality status. The water quality status will help gauge the success of implementation aimed at reducing the amount of bacteria in the streams of the James River and Tributaries watershed.

The DEQ monitoring stations in the James River and Tributaries watershed are described in Table 18 and shown in Figure 16. Stations are monitored every other month within the monitoring period. Currently, no volunteer monitoring is occurring in the James River and Tributaries Watershed.

Table 18 DEQ's Existing and Proposed Monitoring Stations in the James River and Tributaries Watershed.

Station ID	Station Location	Monitoring Period
2-JMS258.54	Under Rt 29 Bridge - Percivals Island Lot	2013-2014
2-JTH001.52	Rt 645 (Trents Ferry Road)	2013-2014
2-BKW000.40	Blackwater Creek at Rivermont Avenue	2013-2014
2-BUN001.64	Off Fort Avenue, below Rub's rest	2015-2016
2-IVA000.22	Ivy Creek at Bus Rt 501	2015-2016
2-BCR000.20	Rt 609 Bridge - Campbell County	2015-2016
2-OPP000.16	Rt 460 Bridge - Campbell County	2017-2018
2-FSG000.85	Fishing Creek at Winchester Road	2017-2018
2-THK002.33	Tomahawk Creek at Graves Mill Rd	2017-2018

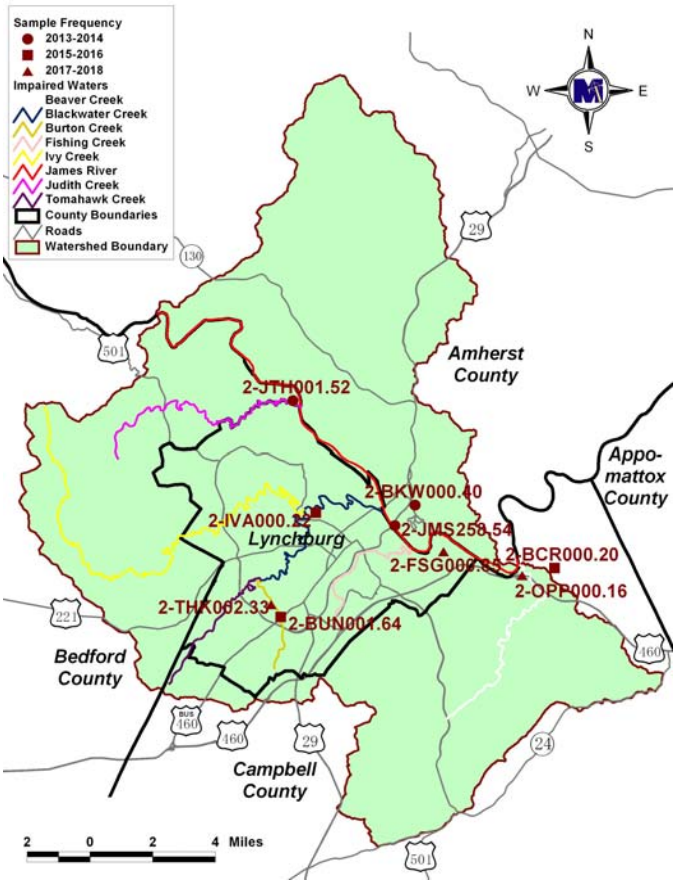


Figure 16 **DEQ's Proposed Monitoring Stations in the James River and Tributaries Watershed.**

Education

Personnel from the Robert E. Lee SWCD and the Peaks of Otter SWCD will initiate contact with farmers in this watershed to encourage the installation of agricultural BMPs. This one-on-one contact will facilitate communication of the water quality problems and the corrective actions needed. The technical staff for the IP will conduct a number of outreach activities in the watershed to raise local awareness,

encourage community support and participation in reaching the implementation plan milestones. Such activities will include information exchange through newsletters, postcard mailings, field days and, presentations at local Ruritan and Rotary Clubs. The technical staff will work with organizations such as Virginia Cooperative Extension to sponsor farm tours and field days.

Stakeholders' Roles and Responsibilities

Stakeholders are individuals who live or have land management responsibilities in the watershed, including government agencies, businesses, private individuals and special interest groups. Stakeholder participation and support is essential for achieving the goals of this TMDL implementation plan effort.

Environmental Protection Agency
The EPA has the responsibility for overseeing the various programs necessary for the success of the Clean Water Act. 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 six state agencies responsible for regulating activities that impact water quality with regard to this implementation plan. These agencies include: DEQ, DCR, VDH, VCE, DOF, and Virginia Department of Agriculture and Consumer Services (VDACS).

Department of Environmental Quality
DEQ has responsibility for monitoring the waters to determine compliance with state standards and for requiring permitted point dischargers to maintain loads within permit limits. They have 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 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 groundwater contamination. In response to increasing demand from the public to develop new regulations dealing with animal waste, in 1999 the Virginia General Assembly passed legislation requiring DEQ to develop regulations for the management of poultry waste in

operations having more than 200 animal units of poultry (about 20,000 chickens) (ELI, 1999). On January 1, 2008 the Virginia Department of Environmental Quality (DEQ) assumed regulatory oversight of all land application of treated sewage sludge, commonly referred to as biosolids. DEQ's Office of Land Application Programs within the Water Quality Division to manages the biosolids program. The biosolids program includes having and following nutrient management plans for all fields receiving biosolids, unannounced inspections of the land application sites, certification of persons land applying biosolids, and payment of a $7.50 fee per dry ton of biosolids land applied.

Department of Conservation and Recreation
DCR is a major participant in the TMDL process. DCR has a lead role in the development of IPs to address non-point source pollutants such as bacteria from failing septic systems, pet waste, and livestock operations that contribute to water quality impairments. DCR provides available funding and technical support for the implementation of NPS components of IPs.

Soil and Water Conservation Districts
The Robert E. Lee SWCD and the Peaks of Otter SWCD will provide outreach, technical and financial assistance to farmers and property owners in the James River and Tributaries watershed through the Virginia Agricultural BMP Cost-Share and Tax Credit programs. Their responsibilities will include promoting implementation goals, available funding and the benefits of BMPs and providing assistance in the survey, design, layout, and approval of agricultural BMPs. Education and outreach activities are a significant portion of their responsibilities.

Virginia Department of Agriculture and Consumer Services
Through Virginia's Agricultural Stewardship Act, the VDACS Commissioner of Agriculture has the authority to investigate claims that an agricultural producer is causing a water quality problem on a case-by-case basis (Pugh, 2001). If deemed a problem, the Commissioner can order the producer to submit an agricultural stewardship plan to the local soil and water conservation district. If a producer fails to implement the plan, corrective action can be taken which can include a civil penalty 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. The enforcement of the Agricultural Stewardship Act is entirely complaint-driven. This Act is considered as a state regulatory tool that can support implementing conservation practices to addresses pollutant sources in TMDL impaired watersheds even though the Act does not specifically reference pathogens as a pollutant.

Virginia Department of Health

VDH is responsible for maintaining safe drinking water measured by standards set by EPA. Their duties also include septic system regulation and, in the past, regulation of biosolids land application. Like VDACS, VDH's program is 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 the scheme of this TMDL IP, VDH has the responsibility of enforcing actions to correct or eliminate failed septic systems and straight pipes, respectively. VDH staff also issue permits for the repair and installation of septic systems and the installation of alternative waste treatment systems.

Local Governments

The local governments of Amherst County, Bedford County, Campbell County, and the City of Lynchburg can develop programs and ordinances involving pollution prevention measures and play a very active role in the TMDL implementation process. Actions include, in order of priority:

- Promoting or requiring a septic system maintenance program.
- Exploring options for providing sewer service to more residents, including conventional and alternative systems (e.g., STEG/STEP, decentralized systems)
- Making landowners in the watershed aware of implementation goals, cost-share assistance, and voluntary options that are beneficial. Programs may include:
    - Information for pet owners, signage describing water quality concerns related to pet waste, and disposal bags and receptacles in areas of high pet traffic.
    - Demonstration projects in urban areas, such as, a series of rain barrel demonstrations downtown.

- A low impact development (LID) information packet, to be distributed to local developers, land design engineers and construction companies.
- A brochure/mailing, explaining specific practices individuals and small groups can use to reduce pollution (particularly bacteria) from reaching streams.

- Requiring dog kennel owners to produce a plan for the proper disposal of waste from the facility when licenses are issued.
- Establishing set backs from streams to allow for development of a vegetated buffer area.
- Promoting the use of sustainable growth practices that minimize or eliminate storm water runoff in future subdivisions.
- Requiring a septic system drainfield reserve area for land parcels using on-site wastewater treatment. This reserve area is for use in the event the on-site system fails.
- Track BMP installation.

Successful implementation depends on stakeholders taking responsibility for their role in the process. This could include using pet waste composters if they have dogs, getting septic tanks pumped on a regular basis and talking with friends and neighbors about things they can do to protect water quality. While the primary role falls on the landowner, local, state and federal agencies also have a stake in seeing that Virginia's waters are clean and provide a healthy environment for its citizens. While it is unreasonable to expect that the natural environment (e.g., streams and rivers) can be made 100% free of risk to human health, it is possible and desirable to minimize anthropogenic problems. Virginia's approach to correcting NPS pollution problems has been, and continues to be, encouragement of participation through education and financial incentives. However, if progress is not made toward restoring water quality using this voluntary approach, regulatory controls may be established and enforced.

Water Quality Programs and Activities

This watershed, like all watersheds in the state, is under the jurisdiction of a multitude of individual, yet related, water quality programs and activities which have specific geographic boundaries and goals. In the James River watershed these include, but are not limited to, the

Chesapeake Bay TMDL and Watershed Implementatin Plan (WIP), The City of Lynchburg's Long Term Control Plan (LTCP), The Middle James Roundtable, and the Amherst County Source Water Protection Program. Other programs may include: water quality management plans, erosion and sediment control regulations, and stormwater management plans. Coordination of the implementation project with these existing programs could result in additional resources and increased participation.

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List of Acronyms

BMP	Best Management Practice
BST	Bacteria Source Tracking
CREP	Conservation Reserve and Enhancement Program
CSO	Combined Sewer Overflow
CWA	Clean Water Act
DCR	Virginia Department of Conservation and Recreation
DEQ	Virginia Department of Environmental Quality
DOF	Virginia Department of Forestry
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentive Program
LID	Low Impact Development
LTCP	Long Term Control Plan
NPS	Non-point Source (pollution)
SWCD	Soil and Water Conservation District
TMDL	Total Maximum Daily Load

List of Contacts

Virginia Dept. of Environmental Quality 7705 Timberlake Road Lynchburg, VA 24502	(434) 582-5120
Virginia Dept. of Conservation and Recreation **New River Watershed Office** Dublin, VA. 24084	(540) 643-2533
Virginia Dept. of Health **Central Virginia Health District** 1900 Thomson Drive Lynchburg, VA 24501	(434) 947-6785
Virginia Cooperative Extension Service 163 Kabler Lane Agricultural Building Rustburg, VA 24588	(434) 332-9538
Virginia Cooperative Extension Service 177 Morton Lane County Office Building Appomattox, VA 24522	(434) 352-8244
Natural Resources Conservation Service **Farmville Service Center** 100 Dominion Drive Farmville, VA 23901	(434) 392-4906
Robert E. Lee Soil and Water Conservation District 7631 A Richmond Highway Appomattox, VA 24522	(434) 352-5610
Peaks of Otter Soil and Water Conservation District 1031 Turnpike Rd. Bedford, VA 24523	(540) 586-9195
Virginia Dept. of Agriculture and Consumer Services P.O. Box 1163 Richmond, VA 23218	(804) 786-3501
MapTech, Inc. 3154 State Street Blacksburg, VA 24060	(540) 961-7864