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Upper Goose Creek, Cromwells Run, and Little River TMDL Implementation Plan

Prepared by

Virginia Department of Environmental Quality (DEQ)

in cooperation with

Local stakeholders
Interstate Commission on the Potomac River Basin
Rappahannock-Rapidan Regional Commission

September 2017

Cover Photo
Photo taken in the Goose Creek watershed (June 2016).

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Abbreviations

ACS	American Community Survey
AVMA	American Veterinary Medical Association
AWG	Agricultural Working Group
BMP	Best Management Practice
CCU	Confined Canine Unit
CDBG	Community Development Block Grant
CFNOVA	Community Development Fund of Northern Virginia
CFR	Code of Federal Regulations
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CWA	Clean Water Act
DCR	Virginia Department of Conservation and Recreation
DEQ	Virginia Department of Environmental Quality
DOE	Virginia Department of Education
DOF	Virginia Department of Forestry
E. coli	Escherichia coli
EDF	Environmental Defense Fund
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
FSA	Farm Service Agency
FWS	U.S. Fish and Wildlife
GCA	Goose Creek Association
GWG	Government Working Group
HH	Households
ICPRB	Interstate Commission on the Potomac River Basin
IP	Implementation Plan
IRT	Inter-Agency Review Team
JMSWCD	John Marshall Soil and Water Conservation District
LSWCD	Loudoun Soil and Water Conservation District
MRLC	Multi-Resolution Land Characteristics Consortium
N/A	Not Applicable
NFWF	National Fish and Wildlife Foundation
NLCD	National Land Cover Dataset
NPS	Nonpoint Source
NRCS	Natural Resources and Conservation Service
NVRC	Northern Virginia Regional Commission
O&M	Operation and Maintenance
PEC	Piedmont Environmental Council
PS	Point Source
RCPP	Regional Conservation Partnership Program
RRRC	Rappahannock-Rapidan Regional Commission
RWG	Residential Working Group
SC	Steering Committee
SER-CAP	Southeast Rural Community Assistance Project
SPCA	Society for the Prevention of Cruelty to Animals
SWCB	State Water Control Board
SWCD	Soil and Water Conservation District
TBD	To Be Determined
TMDL	Total Maximum Daily Load

TU	Trout Unlimited
UGC	Upper Goose Creek
USCB	U.S. Census Bureau
USCC	U.S. Composting Council
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
UT	Unnamed Tributary
VACS	Virginia Agriculture and Consumer Services
VCAP	Virginia Conservation Assistance Program
VCE	Virginia Cooperative Extension
VCWRLF	Virginia Clean Water Revolving Loan Funds
VDH	Virginia Department of Health
VOF	Virginia Outdoors Foundation
VPA	Virginia Pollution Abatement
VPDES	Virginia Pollutant Discharge Elimination System
WHIP	Wildlife Habitat Incentive Program
WIP	Chesapeake Bay Watershed Implementation Plan
WLA	Wasteload Allocation
WQMIRA	Water Quality Monitoring, Information, and Restoration Act
WQMP	Water Quality Management Plan

Units of Measurement

cfu	colony forming units
ft	foot
mL	milliliters
sq ft	square foot
yr	year

Executive Summary

The plan contained in this report provides a detailed, multi-year framework to restore water quality in the Upper Goose Creek (UGC) planning area to healthy conditions. It describes current water quality status, identifies the bacteria reductions needed to meet water quality standards, and summarizes a suite of management actions to restore water quality to attain those standards. The plan also summarizes the many programs, partners, and funding resources that can contribute to putting this plan into action.

Goose Creek and its tributaries are part of the Potomac River basin, within a watershed that covers 386 square miles in Loudoun and Fauquier Counties on the western edge of the Washington D.C. metropolitan area. The watershed is primarily rural in character, with forest and agricultural land uses predominant, and is well known for its scenic horse farms. More dense development is present in the northeastern portion of the watershed, where most population growth in the watershed is occurring.

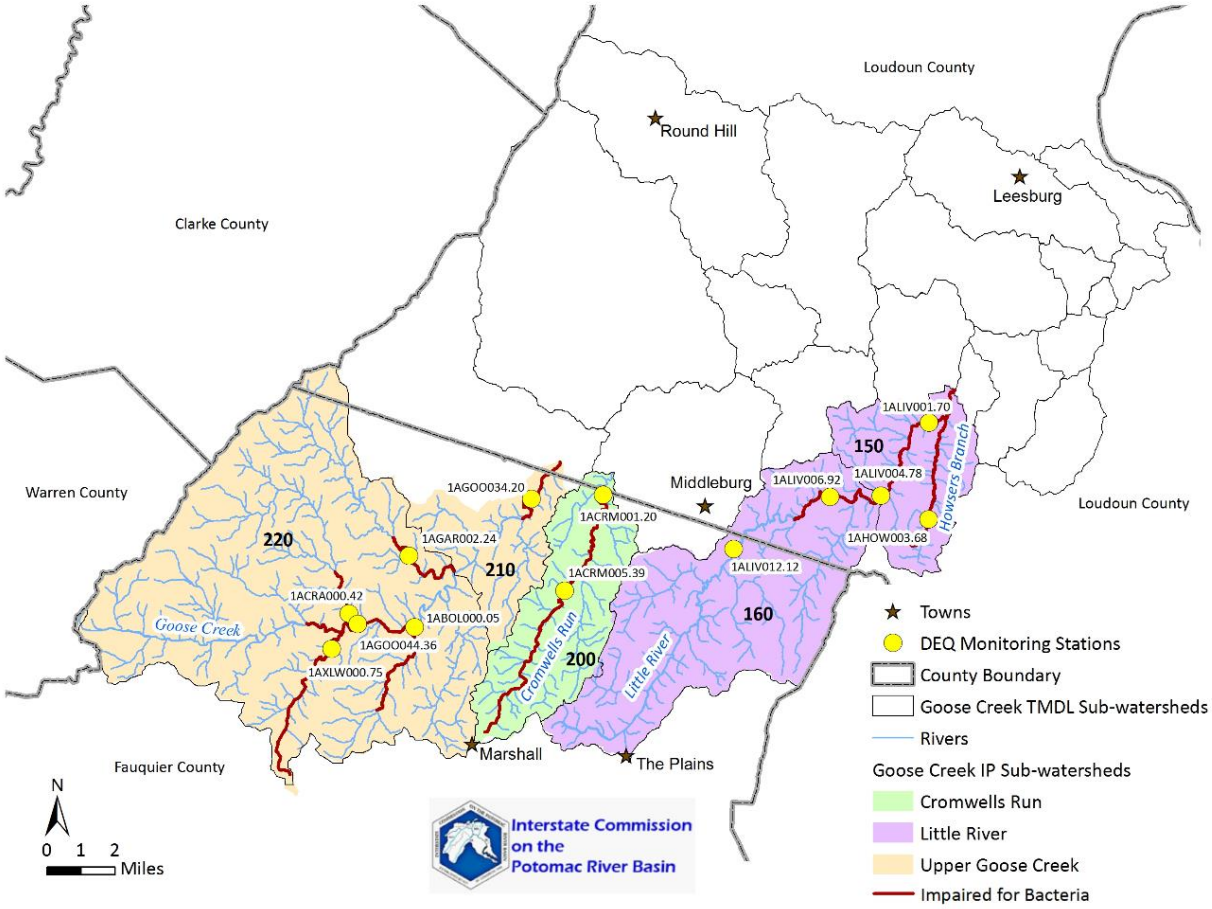
Goose Creek has been designated as a scenic river under Virginia's Scenic River Act, yet it also has degraded water quality that required management action. The mainstem of Goose Creek and six of its tributaries were listed as impaired on Virginia's 1998 and draft 2002 303(d) Total Maximum Daily Load (TMDL) Priority List and Report due to exceedances of the state's water quality standard for fecal coliform bacteria. The impaired stream segments do not meet designated uses for primary contact recreation (e.g. swimming); in other words, coming in direct contact with the Goose Creek's water could cause illnesses such as intestinal disorders.

The Virginia Department of Environmental Quality (DEQ) completed a TMDL study in 2003 for the entire Goose Creek watershed and set limits on the amount of bacteria each individual waterbody can receive and still support its designated recreational use standard. This TMDL Implementation Plan (IP) explains and quantifies the control measures, in the form of best management practices (BMPs), recommended over the next 15 years to reduce bacteria levels within the UGC watershed area (Upper Goose Creek, Cromwells Run and Little River) (**Figure ES-1**) and be removed from the impaired waters list. **Figure ES-2** shows the plan area within the Goose Creek watershed.

Figure ES-1. A section of Little River.

The vast majority of bacteria reaching Goose Creek watershed streams come from nonpoint sources, primarily agricultural activities. Within the sub- watersheds covered by this plan, only one point source (PS) is subject to a Virginia Pollutant Discharge Elimination System (VPDES) permit, and just three additional general permits address small businesses/residences.

Figure ES-2. Location of the Upper Goose Creek TMDL IP area within the Goose Creek watershed (Data Source: DEQ).



Review of the TMDL: The 2003 bacteria TMDLs called for elimination (100% reduction) of bacteria from failing septic systems and direct deposition from cattle into area streams. In addition, the TMDLs identified a need to reduce the bacteria loads from pastures by 98-99%. Given the passage of more than a decade of time since the TMDLs were prepared, planning for implementation actions required a comprehensive update of land uses within the upper watershed, as well as human, pet, and livestock populations.

The TMDL model calculations were also revisited to estimate instream delivered loads rather than the originally reported edge-of-field loads to match current DEQ practice. At the bottom-line, the water quality modeling confirmed the overall scope and distribution of reductions called for in the 2003 TMDL report, with a modest decrease in the need for bacteria reductions from pasture lands.

It is encouraging that many water quality management actions have been put into place since the TMDL was developed, and it was important that the IP consider their impact before determining the additional actions needed. An estimated 100 miles of livestock exclusion fencing has been installed along streams in the UGC watershed since 2002, and both Loudoun and Fauquier counties have active septic system programs that have repaired approximately 130 septic systems in the 2002-2016 timeframe.

DEQ analyzed the most current water quality monitoring data to identify current conditions in the plan area. DEQ's 2014 Integrated Report (DEQ 2014) documented water quality improvements across the area, using *E. coli* data collected in 2007 and 2012, but most sites continue to exceed bacteria water quality standards, and thus

remain impaired for recreational uses. Current conditions call for significant additional action to restore water quality and enable the water quality standards for bacteria to be achieved.

Finally, the original bacteria pollutant reduction scenarios contained in the 2003 TMDL report were reviewed and an alternative scenario was selected by DEQ. The 2003 Goose Creek TMDL was one of the first bacteria TMDLs prepared in Virginia, and it called for bacteria reductions sufficient to achieve no exceedance over a ten year modeling period of the maximum assessment criterion. This would require near elimination of all major sources of bacteria throughout the watershed.

The current expectation for TMDL implementation plans is to achieve bacteria reductions that will result in no exceedance of the geometric mean criterion value, and less than a 10.5% exceedance rate of the maximum assessment criterion. These water quality end-points fully achieve the Commonwealth of Virginia's recreational use water quality standard. In light of current practices, it was appropriate to revisit the bacteria reduction allocations in the TMDL modeling and select a more viable scenario than that selected for the 2003 TMDL allocations.

The pollutant reduction scenario that is the foundation for this implementation plan spreads load reductions more broadly by also addressing cropland, stormwater, and pet waste. This provides an opportunity to broadly engage the local community in watershed protection and restoration. As a result, bacteria reductions needed from pasture have been reduced from the 98-99% levels called for in the TMDL to a more viable level (75%) in this plan.

Public Participation: Local stakeholders were broadly informed of the need for an IP in a June 21, 2016 public meeting, and agricultural, residential, and government workgroups were convened to seek input on how best to address bacteria contamination in UGC. Workgroup participants provided essential local knowledge throughout the process.

A SC comprised of selected workgroup members from local government agencies, local non-governmental organizations, and the John Marshall Soil and Water Conservation District (JMSWCD) provided valuable feedback on this draft plan during its May 25, 2017 meeting. DEQ hosted a Final Public Meeting to present the draft plan on June 21, 2017. A 30-day public comment period followed this meeting to seek additional public input that enabled DEQ to further clarify and refine the plan before submitting it for final approvals.

Recommended Management Measures: A broad suite of agricultural, residential, and education and outreach actions are recommended to reduce the sources of bacteria and restore safe recreational uses of the planning area's waters. In summary, these actions include:

- 169 additional miles of livestock exclusion fencing, with riparian buffers, at an estimated cost of $5.8 million.
- 9,917 acres of pasture and cropland improvements, and sediment retention structures addressing drainage for nearly 3,800 acres, at an estimated cost of $7.3 million.
- 3,600 acres of targeted conversion of pasture/cropland to forest or permanent vegetative cover, for steep slope land and critical stream habitat areas (these costs are included in pasture/cropland).
- Three community and over 300 individual equine manure composting systems, and over 100 barnyard runoff control systems for horse farms, at an estimated cost of $3.7 million.
- Extensive residential septic system improvements, including some 6,500 septic pump-outs, 400 repairs, 80 system replacements, and 20 public sewer system hookups, costing $4.8 million.
- Demonstration projects to improve stormwater management, at an estimated cost of $83 thousand, and pet waste management actions estimated to cost between $51 and 121 thousand.
- A comprehensive 15-year education, outreach and technical assistance program, costing approximately $778 thousand.

Benefits: The direct benefit of the actions called for in this plan will be restoration of water quality to enable safe recreational uses of the area's streams. The recommended actions are designed to allow delisting of the current bacteria impairments of waters in the UGC watershed. These water quality benefits also contribute to improving the quality of downstream waters of Goose Creek, the Potomac River, and the Chesapeake Bay, while broadly enhancing the natural resource values of the watershed. This plan's actions will provide additional benefits of enhanced agricultural productivity, livestock health, and aquatic habitat within the watershed. Residential septic improvements will reduce the incidence of higher cost system failures and improved stormwater and pet waste management can reduce local flooding and improve community aesthetics.

The plan's recommended actions are proposed to be put into place over a 15-year timeframe. Strong local leadership, support from both state and federal government agencies, and a multitude of local stakeholders will be critical for success. An approved IP will increase opportunities for Fauquier and Loudoun county local agencies and watershed residents to obtain funding to support their installation of the recommended BMPs. Sustained actions consistent with the recommendations of this plan are projected to allow for delisting of the impaired waters of the IP area by 2031.

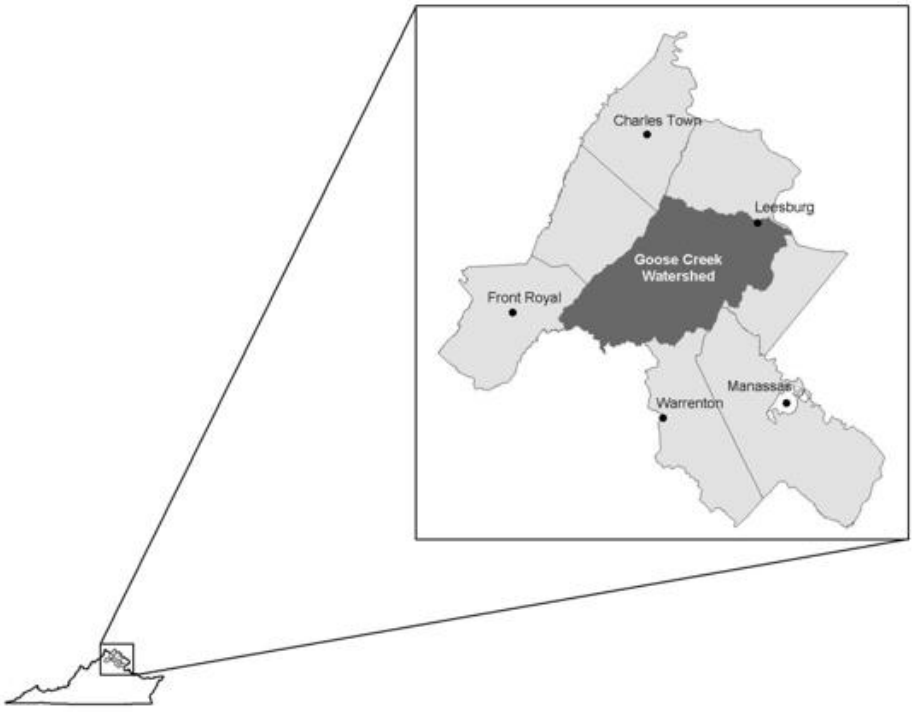
1. Introduction

The Virginia TMDL program is designed to improve water quality and restore impaired waters in Virginia. A TMDL identifies the maximum amount of a pollutant that a water body can receive without surpassing the state water quality standards. These standards are established to protect six beneficial uses: drinking water, recreational (i.e., primary contact/ swimming), fishing, shellfishing, aquatic life, and wildlife. If the water body exceeds the water quality criteria used to measure the standard during an assessment period, Section 303(d) of the Clean Water Act (CWA) and EPA's Water Quality Management and Planning Regulation (40 CFR Part 130) both require states to develop a TMDL for each pollutant contributing to its impairment.

Figure 1-1. Beef farm in the Goose Creek watershed.

Goose Creek and its tributaries are part of the Potomac River basin. The Goose Creek watershed covers 386 square miles in Loudoun and Fauquier counties on the western edge of the Washington D.C. metropolitan area, as shown in **Figure 1-2**. The watershed is primarily rural in character (**Figure 1-1**), with forest and agricultural land uses predominant, though more dense development is present in the northeastern portion of the watershed. Goose Creek has been designated as a scenic river under Virginia's Scenic River Act.

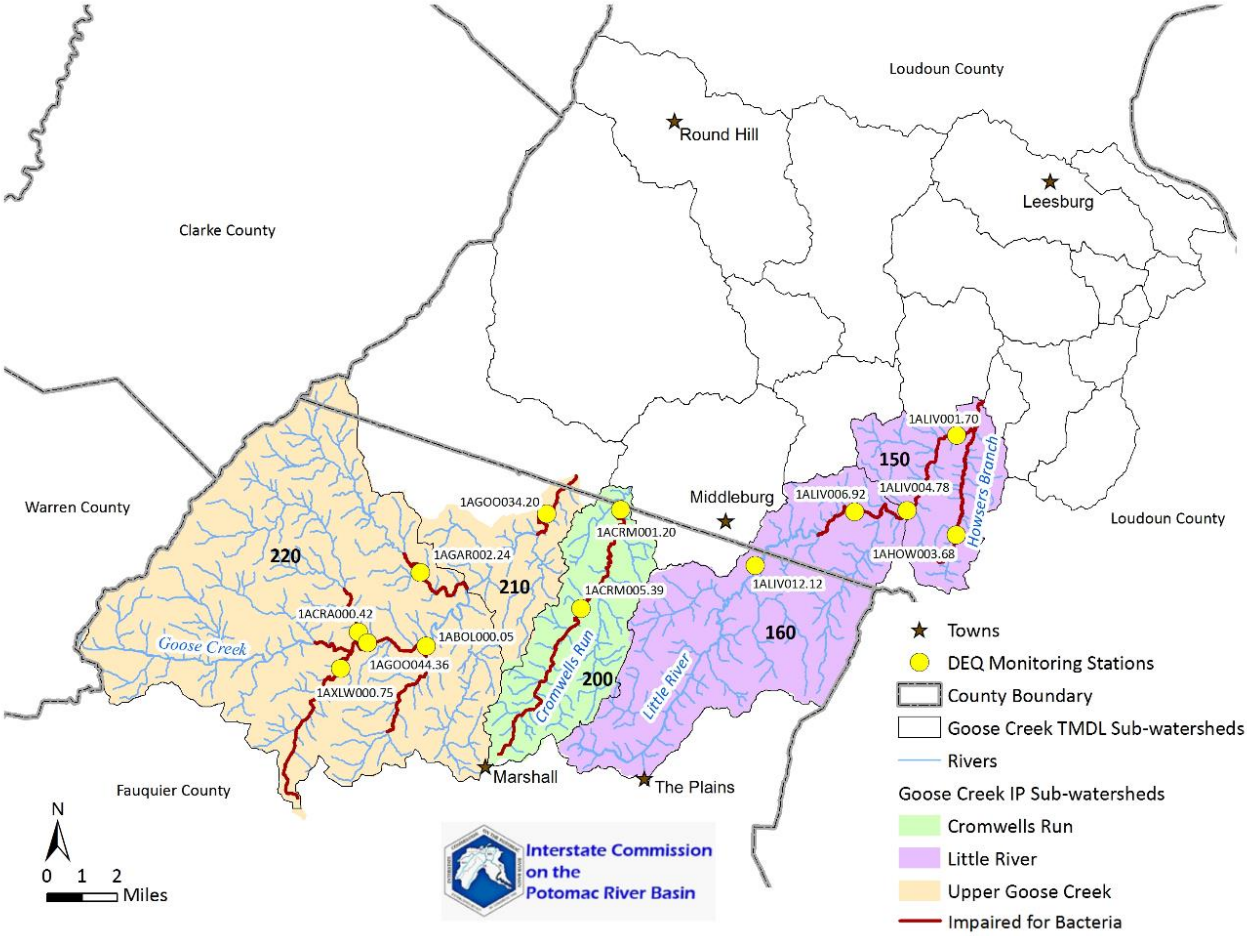
Figure 1-2. Location of Goose Creek watershed in Northern Virginia.



The mainstem of Goose Creek and six of its tributaries were listed as impaired on Virginia's 1998 and 2002 303(d) TMDL Priority List and Report (DEQ 1998 and 2002) due to exceedances of the State's water quality standard for fecal coliform bacteria. The impaired stream segments did not meet designated uses for primary contact recreation (e.g. swimming). In addition, a five-mile segment of the mainstem of Goose Creek, below its impoundment to the inlet to the Potomac River, and Little River were also listed for benthic impairments in 1998, due to violation of the Commonwealth's General Standard.

After these listings, in 2003, DEQ completed a TMDL study for the Goose Creek watershed that identified bacteria sources in each sub-watershed and set limits on the amount of bacteria these waterbodies can receive and still support their designated recreational use standard. (A separate TMDL report for the benthic impairments was completed in 2004, but that is not the focus of this IP.) As part of the 2003 TMDL study, additional sections of the Little River and Cromwells Run and sections of Howsers Branch, Goose Creek, Gap Run, Bolling Branch, Crooked Run and an Unnamed Tributary of Goose Creek were also listed as impaired for bacteria. All identified impairments in the UGC watershed are addressed by this plan. **Figure 1-3** shows the portion of the entire watershed that comprises the upper watershed area addressed here, which includes the Upper Goose Creek, Cromwells Run, and Little River subwatersheds.

Figure 1-3. Location of the Upper Goose Creek TMDL IP area within the Goose Creek watershed (Data Source: DEQ).



The TMDL IP described in this report explains and quantifies actions needed to reduce bacteria levels to meet water quality standards and allow a delisting of the impaired waters from the Section 303(d) List. The TMDL IP describes control measures, commonly called BMPs, to be implemented in a staged process over the next 15 years. Local support and successful implementation of the plan will result in the restoration of Upper Goose Creek and enhancement of the natural resource values of the watershed more broadly. An approved IP will increase opportunities for Fauquier and Loudoun counties, other local organizations, and watershed residents to obtain funding to support installation of the recommended BMPs.

This public document is an abbreviated version of a more detailed technical document, which can be obtained at: http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/TMDL/TMDLImplementation/TMDLImplementationPlans.aspx, accessed 9/28/2017.

2. Federal and State Requirements

Both state and federal requirements and recommendations were followed in developing this plan. 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 (DEQ 1997). WQMIRA directs the State Water Control Board (SWCB) to "develop and implement a plan to achieve fully supporting status for impaired waters."

In order for IPs to be approved by the Commonwealth, they must meet the following requirements of WQMIRA:

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

EPA regulations (40 CFR 130.33(b)(10)) require the inclusion of an implementation plan as an element of TMDL submittal. The EPA minimum elements of an approvable IP are described in EPA's 1999 *Guidance for Water Quality-Based Decisions: The TMDL Process*, and 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.

The TMDL IP for Upper Goose Creek fully addresses both the EPA and Virginia requirements and recommendations for TMDL implementation plans.

2.1 Requirements for Section 319 Funding Eligibility

The EPA has developed guidelines that describe the process and criteria used to award CWA Section 319 nonpoint source grants to States. The "*Nonpoint Source Program and Grants Guidelines for State and Territories*" (April, 2013) continues long-standing emphasis on the following nine elements for meeting Section 319 program requirements:

1. Identify the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in the watershed-based plan;
2. Estimate the load reductions expected to achieve water quality standards;

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

Once complete, DEQ presents TMDL IPs to the SWCB for approval to guide efforts to implement pollutant allocations and reductions contained in the TMDL. DEQ also requests inclusion of new IPs in the appropriate Water Quality Management Plan (WQMP), in accordance with CWA Sec. 303(e) and Virginia's Public Participation Guidelines for Water Quality Management Planning.

3. Review of the 2003 TMDL and Updated Analysis

A TMDL study was completed by DEQ and approved by EPA for the lower mainstem of Goose Creek and portions of six tributaries in 2003. The study identified sources and quantified the amount of bacteria that streams within the watershed could receive without exceeding water quality standards. The TMDLs for each of seven streams were designed to meet Virginia's water quality standards for recreational uses, using the criteria established for fecal coliform bacteria, and *E. coli.*

The vast majority of bacteria reaching Goose Creek watershed streams come from nonpoint sources, primarily agricultural activities. There are a total of 31 PS discharge permits in the Goose Creek watershed. Within the sub-watersheds covered by this IP, only one PS is subject to a VPDES permit, and just three additional general permits address small businesses/residences.

The TMDL provided wasteload allocations (WLAs) for point sources based on their VDPES permit limits. The WLAs were adjusted slightly upward in a 2006 TMDL Modification to allow for future population growth in the service areas of the wastewater treatment facilities.

NPS bacteria loads were estimated in the 2003 TMDL from land use data, since forest, cropland, pasture, and developed lands have different levels of bacteria runoff. Given the passage of more than a decade of time since the TMDLs were prepared, planning for TMDL implementation actions required a comprehensive update of land uses within the watershed.

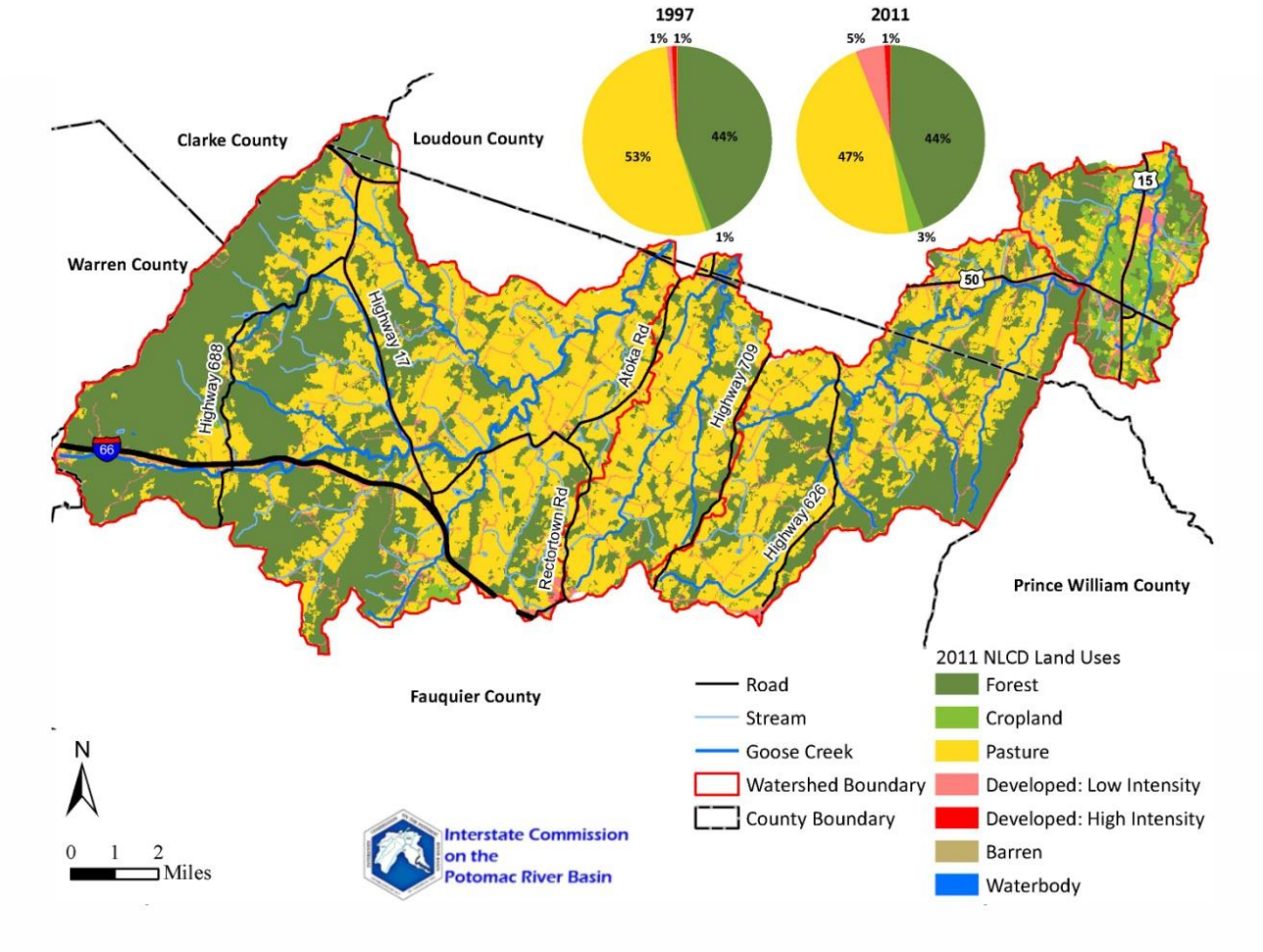
Land use updates were completed using the 2011 National Land Cover Dataset (NLCD) (Homer et al. 2015). Results showed minor changes to forest and pasture land uses for the upper watershed as a whole and very substantial increase in cropland and developed lands. **Table 3-1** and **Figure 3-1** summarize this information. Much of the increase in cropland is believed to be transitory, associated with a temporary rotation from pasture. The greatest increase in impervious developed lands occurred in the northeastern portion of the upper watershed, along Rt. 15 in the Little River sub-watershed. Updated land use values documented that overall, the IP area remains predominantly rural in character, with forest and pasture land uses accounting for more than 90% of the

land area. **Attachment A** includes land use analysis for the Upper Goose Creek (**Table A-6**), Cromwells Run (**Table A-7**), and Little River (**Table A-8**) sub-watersheds.

Table 3-1. Goose Creek IP area land use comparison.

Land Use Type		1997 (Acres)	2011 (Acres)	Change (Acres)	% Change
Pervious	Forest	46,516	46,796	280	1
	Cropland	1,031	2,746	1,715	166
	Pasture	56,053	49,570	-6,483	-12
	Developed Pervious	921	5,264	4,343	472
Impervious	Developed Impervious	816	1,070	254	31
	Barren	110	1	-109	-99

Figure 3-1. Goose Creek IP area land use comparison. The map displays the 2011 National Land Cover Dataset (NLCD) data. The pie charts compare 1997 Multi-Resolution Land Characteristics Consortium (MRLC) land use percentages with 2011 NLCD land use percentages using colors that also correspond to the map legend.



Population and household data were also updated using the 2014 American Community Survey (ACS) (USCB 2015). This analysis identified current populations served by the area's wastewater treatment facilities, as well as

those utilizing septic systems. Overall, the watershed population grew by 12% since 2003, with most growth occurring within the Little River sub-watershed. **Attachment A** provides additional detail on population changes (**Table A-1**) and septic system and public sewer system connections (**Table A-2**, **Table A-3**, **Table A-4**, and **Table A-5**).

The updated land use and population data were used to improve pet population estimates as well. Using residential population growth and the 2012 American Veterinary Medical Association (AVMA) information, the pet population is estimated to have grown by approximately 20% since 2003. Details of this analysis are included in **Attachment A** (**Table A-9**). Livestock population estimates were updated by comparing 2002 and 2012 U.S. Department of Agriculture (USDA) census of agriculture data for Loudoun and Fauquier counties, and allocating the data pro rata to the portions of each county falling within the project area (USDA 2014; USDA 2004). The results of this analysis are an increase of 8% to the beef cattle population, and increase of 3% to the horse population, and a decrease of 35% to the dairy cow population included in the 2003 TMDL. Details of this analysis are also shown in **Attachment A** (**Table A-11**).

As part of the TMDL update, the original model was re-run for the upper watershed segments (Upper Goose Creek, Cromwells Run, and Little River) addressed in the IP to estimate instream delivered loads rather than the originally reported edge-of-field loads, per current DEQ practice. At the bottom-line, updated water quality modeling confirmed the overall scope and distribution of reductions called for in the 2003 TMDL report, with a modest decrease in the need for pasture load reductions. Changes in watershed conditions reflected in the updated source assessment were then credited towards accomplishing the load reductions called for in the TMDL. This analysis is shown for each sub-watershed in **Attachment A** (**Table A-12**, **Table A-13**, and **Table A-14**).

Finally, the original bacteria pollutant reduction scenarios contained in the 2003 TMDL report were reviewed and an alternative scenario (to the one used in the 2003 TMDLs) was selected by DEQ. The 2003 Goose Creek TMDL was one of the first bacteria TMDLs prepared in Virginia, and it called for bacteria reductions sufficient to achieve no exceedance over a ten year modeling period of the maximum assessment criterion. The modeling scenario (Scenario 8 in the 2003 TMDL report) that was the basis of the 2003 TMDL allocations called for 100% reduction of direct deposition of bacteria from cattle in streams, 100% reduction of bacteria from failing septic systems, and 98-99% (varied by sub-watershed) reduction of bacteria runoff from pasture; essentially, this equates to near elimination of all major sources of bacteria throughout the watershed.

The current DEQ bacteria TMDL development process is to present load allocation reductions that will result in no exceedances of the geometric mean criterion value. In addition, one or more load allocation scenarios are provided that will result in less than a 10.5% exceedance rate of the maximum assessment criterion. This (latter) value is used by DEQ to identity bacteria impaired waters and to remove waters from the impaired waters list as water quality improvements are attained. DEQ uses a phased implementation approach in bacteria TMDL implementation plans to achieve the water quality milestones that are described.

The current DEQ (and EPA) expectation for TMDL implementation plans is to achieve bacteria reductions that will result in no exceedance of the geometric mean criterion value, and less than a 10.5% exceedance rate of the maximum assessment criterion. These water quality end-points fully achieve the Commonwealth of Virginia's recreational use water quality standard. In light of current practices, it was appropriate to revisit the bacteria reduction allocations in the TMDL modeling and select a more viable scenario than that selected for the 2003 TMDL allocations.

The pollutant reduction scenario (Scenario 9 in the 2003 TMDL report) that is the foundation for this plan lessens the required pasture bacteria reductions from 98-99% to 75%, and adds cropland and developed land reductions of 75%. This shift reduces pasture land management controls to a more viable level, and also spreads load reductions more broadly by also requiring cropland, stormwater, and pet waste management actions. The revised allocations

provide an opportunity to more broadly engage the local community in watershed protection and restoration by requiring more management actions on developed lands.

3.1 Water Quality Update

In addition to watershed land use and population changes, many water quality improvement actions have been completed since the TMDL was developed. Most significantly, according to the Virginia Department of Conservation and Recreation (DCR) database of agricultural practices (DCR 2016), an estimated 100 miles of livestock exclusion fencing have been installed along streams in the project area since 2002. In addition, both Loudoun and Fauquier Counties have active septic system maintenance programs that have resulted in approximately 130 septic system repairs between 2002 and 2016.

DEQ's 2014 Integrated Report documented water quality improvement across the area, using *E. coli* data collected in 2007 and 2012, but most sites continue to exceed bacteria water quality standards, and remain impaired for recreational use. A detailed presentation of the impaired stream segments within the IP area is shown in **Attachment A** (**Table A-17**). The most recent water quality monitoring information for 2013-2016 is shown below in **Table 3-2**. While water quality improvements are evident, water quality standard violations remain of concern. Violation rates dropped for Station 1AGAR002.24 on Upper Goose Creek from 60 to 44%, for Station 1ACRM001.20 on Cromwells Run from 40 to 20%, and for Station 1ALIV004.78 on Little River from 54 to 25%. One segment of Little River, from the confluence with Hungry Run (near Aldie) downstream to confluence with Goose Creek, was delisted in the 2010 DEQ Impaired Waters/Integrated Report (DEQ 2010). But some water quality monitoring stations in the IP area showed increased violation rates. Overall, the most current water quality monitoring information shows that additional management actions, as recommended in this plan, are needed to achieve compliance with Virginia's water quality standards for bacteria.

Table 3-2. Comparison of bacteria water quality standard violations pre-TMDLs (before 2003) and present (2013-April 2016). Raw data provided in **E. coli*, ***fecal coliform, or +both. Cells with "-" denote no samples were taken, "0" denotes no samples were in violation of water quality standards.

Station ID	Sub-watershed	Pre-TMDL (Before 2003)		Present (2013-April 2016	
		Number of Samples	Number of Samples in Violation	Number of Samples	Number of Samples in Violation
1ACRM001.20	Cromwells Run	42**	17	15*	3
1AGAR002.24	Upper Goose Creek	5**	3	9*	4
1AGOO036.61	Upper Goose Creek	2**	0	12*	2
1AGOO039.63	Upper Goose Creek	-	-	1*	0
1AGOO044.36	Upper Goose Creek	136**	43	19*	3
1ALIV004.78	Little River	46+	25	12*	3
1ALIV004.79	Little River	-	-	1*	1
1ALIV012.12	Little River	1**	0	12*	5

In addition to DEQ's water quality monitoring, the Goose Creek Association (GCA) has led a strong local voluntary monitoring program for the watershed for more than a decade. The specific locations of GCA's monitoring are described in **Attachment A** (**Table A-17**). Because not all of EPA/DEQ's rigorous requirements for use voluntary monitoring data are satisfied, the GCA data is noted to have detected "Observable Effects" for bacteria, but DEQ does not make water quality impairment determinations from this data.

4. Public Participation

Collecting input from the public on conservation and outreach strategies to include in the TMDL IP is a critical step in the planning process. Since these plans are implemented primarily by watershed stakeholders on a voluntary basis (often with financial incentives), local input and support are the primary factors that will determine success in carrying out the IP's recommended actions.

A public meeting to formally begin development of the IP was held on the evening of June 21, 2016 at the Wakefield school in The Plains, Virginia (**Table 4-1**). The public meeting was publicized through email announcements, fliers, and signs posted throughout the watershed; in total 27 people attended, including private citizens, government agency representatives, local business interests, and representatives from several area non-profit organizations. This meeting served as an opportunity for local residents to learn more about the condition of local streams, and to work together to identify ideas to protect and restore water quality in their community. The meeting began with a brief presentation on existing water quality conditions in the streams, updates to the 2003 Goose Creek watershed TMDL, and the types of actions and information that could be included in an IP to improve water quality. The public participation process that DEQ uses in developing these plans was also described to attendees. **Attachment B** provides a summary of public comments received following the first public meeting as well as the responses by DEQ staff. **Attachment C** includes the comment letters received following the first public meeting.

Table 4-1. Meetings held during the TMDL IP development process.

Date	Meeting Type	Location	Attendance
06/21/16	Public Meeting	The Wakefield School	27
06/21/16	Agricultural & Residential Working Group #1	The Wakefield School	17
09/08/16	Governmental Working Group	Tri County Feeds	19
09/22/16	Agricultural & Residential Working Group #2	The Wakefield School	15
05/25/17	Steering Committee	Tri County Feeds	11
06/21/17	Final Public Meeting	The Wakefield School	17

A local farmer shared his experience with using a variety of BMPs on farmland he leased near the meeting location, which gave participants a better understanding of water quality management measures for agricultural lands. Following the presentation, attendees split into two working groups: a residential group and an agricultural group.

The working groups discussed how residential and agricultural land use practices are affecting the quality of local streams, and reviewed different management practices that could be included in the IP. These discussions were facilitated by staff from DEQ, the Rappahannock-Rapidan Regional Commission (RRRC), and the Interstate Commission on the Potomac River Basin (ICPRB).

The final public meeting was held on June 21, 2017 in The Plains, Virginia. The primary purpose of this meeting was to present the final TMDL IP. A presentation was given describing the IP and its major components. Maps with land use, topographic features, and analysis of BMPs recommended for each watershed were displayed and discussed during the presentation.

There were questions and discussion of how the 75% bacteria reductions from pasture would be obtained and about stream exclusion fencing needs. It was noted that riparian buffers and improved pasture management practices will help address the load reductions needed for pasture land by filtering runoff from farm fields before it enters streams. Several participants stressed the need to "ground-truth" estimated stream exclusion fencing needs in light of fencing already installed and land use changes. DEQ clarified that during project implementation such validation/corrections can be made, and that technical assistance funded with CWA §319 grants could

address this need. Additional discussion stressed the importance of addressing horse farm sources of bacteria, and conveyed participants' perspective that wildlife populations (especially deer and geese) seem to be increasing. **Attachment D** provides a summary of public comments received following the final public meeting as well as responses by DEQ staff. **Attachment E** includes the comment letters received following the final public meeting.

4.1 Agricultural Working Group

The role of the Agricultural Working Group (AWG) is to review potential conservation practices and outreach strategies from a local agricultural perspective, identify any obstacles (and solutions) related to BMP implementation, and provide input on the type, number, and costs of BMPs. During the first AWG meeting on June 21, 2016, the group began to consider stream fencing opportunities within the watershed. The group discussed the need to ground-truth potential fencing areas identified through data analysis JMSWCD had begun for the plan area. The group also discussed the challenge of enhancing conservation measures for leased properties.

The AWG thought it would be valuable to include groups like the GCA in outreach efforts. Farm tours could provide information about the multiple benefits of BMPs, including water quality and wildlife habitat improvements and improved livestock health and agricultural productivity. They discussed portable watering systems as a promising way to enhance participation in rotational grazing. There is a substantial number of existing conservation easements in the area and the workgroup discussed potential easement program changes to require stream fencing in future easement agreements. Hobby farms, in particular those with horses, may need to be offered composting opportunities at the regional scale, given the cost to install individual small-farm composting.

A second AWG meeting was held on September 22, 2016. This meeting included a presentation about the Gilberts Corner Farm Project, which addressed bacterial sources comprehensively using Soil and Water Conservation District (SWCD) cost-share programs to create multiple benefits. At a total cost of $125,000, more than two miles of stream fencing, two hardened stream crossings, and water piping for six watering tank vaults were installed. Benefits of improved agricultural production, enhanced wildlife habitat, and water quality were discussed. Participants of the second AWG meeting completed a BMP scoring sheet to determine which conservation measures would be the most applicable and popular with area farmers. In order of popularity with AWG members, the results were as follows:

1. Streamside livestock exclusion fencing,
2. Rotational grazing/Grazing land management, tied with
3. Forested streamside buffers,
4. Grassed streamside buffers,
5. Manure composting/storage facilities (equine),
6. Continuous no-till/Conservation tillage,
7. Forestation of crop, pasture or hayland.

Meeting participants then identified, in priority order, the following obstacles that will need to be addressed to achieve the desired level of stream exclusion:

1. Cost of installing fencing and creating off-stream water supplies,
2. Concern (economic) of giving up production of 35 linear feet for a stream buffer zone,
3. Grazing land is often rented with short-term leases,
4. Fence maintenance is costly and time-consuming.

Some participants also observed that low levels of government trust impede participation in cost-share programs.

4.2 Residential Working Group

The primary role of the Residential Working Group (RWG) was to discuss methods needed to reduce human and pet sources of bacteria entering the creeks, recommend methods to identify and correct or replace failing septic systems and straight pipes, and provide input on the residential BMPs to include in the plan. The June 21, 2016 meeting participants discussed recent Fauquier and Loudoun county data on septic systems repairs in each county. Recent septic system improvements have informed estimates of the need for additional septic system repairs and replacements in the IP.

Both Loudoun and Fauquier counties have ordinances requiring that septic systems be pumped out every five years, and septic haulers report actual pump outs to the respective health departments. The group agreed that more education is needed for septic system owners, especially for owners of newer homes which frequently have alternative septic systems. RWG participants identified realtors as a group that could help with septic maintenance educational outreach during real estate transactions. There was also discussion of the recent upgrades completed for the Broad Run Wastewater Treatment Facility to accommodate increased septic waste volume at the plant (regularly 20+ trucks per day) since Loudoun County established its septic system pump-out requirements. Any changes to septic pump-out programs triggered by the TMDL IP will need to account for the ability of local wastewater treatment facilities to handle increased loadings.

Options for pet waste BMPs were discussed; including composters, bag stations, leash bag holders, and confined canine units for kennel and hunt club operations. Information was shared about diseases that can affect both humans and pets when pet waste is not collected and allowed to run off into area streams. The group discussed some popular dog walking areas and homeowner associations that may be viable locations for new pet waste bag stations. The Parks and Recreation departments in both counties could provide maintenance of those stations on public property.

There are some good examples of proper pet waste management in the area, such as the Fauquier Society for the Prevention of Cruelty to Animals (SPCA). Special septic systems are needed to treat dense dog wastes, and they are expensive; less expensive dry stack composting methods may be more likely to be installed. Fauquier County requires kennel operations to provide plans for pet waste management when they apply for a kennel license. The RWG also discussed special consideration and practices relevant to horses. Educating the many area horse owners on barnyard and pasture management techniques is important. Educational materials could be provided at kiosks along horse trails in the area. The residential work group participants believe there would be interest among local horse owners in a regional manure composting facility, as an alternative to individual farm manure composting units.

A second RWG meeting was held on September 22, 2016. The group continued and built-upon its previous discussions of septic system issues, pet waste, and equine topics. It was observed that while both counties have strong septic program requirements, Loudoun County has a stronger inspection program. Nevertheless, most area residents don't understand septic and alternative septic system maintenance needs. RWG participants see value in a septic pump out program, with no exclusions for those at greater distances from streams, and also believed there will be opportunities for more public wastewater system connections in the future within Loudoun County. Turning to the pet waste issue, several promising locations for pet waste stations were identified and some saw potential for successful introduction of pet waste composters if an effective educational program is included. Finally, there was brief discussion of opportunities to address equine waste, perhaps most effectively in partnership with the Middleburg Agricultural Research and Extension (MARE) Center.

4.3 Government Work Group

The goals of the Government Working Group (GWG) were to identify water quality controls currently in place in the watersheds (e.g. livestock stream exclusion fencing and sewer line connections), to identify existing programs

and technical resources that may enhance implementation efforts, and to propose additional programs that would support implementation. A single GWG meeting was held with local government and conservation agency representatives on September 8, 2016. The group discussed a number of issues and ideas, including:

- Potential that nutrient trading may increase interest in reforestation of crop/pasture lands.
- Fine-tuning the projected number of conservation practices for small acreage grazing, including equine operations, and the opportunities and challenges given their small economic scale relative to requirements of agricultural cost-share programs.
- Septic system work will be affected by changes underway in the manner that septic repair vs. upgrade are defined, and this may affect residential BMP participation.
- Alternative septic system maintenance needs seem to be poorly understood and should be addressed in the IP.
- It may be valuable to direct some Section 319 funding to conduct research on BMPs for confined canine units.

The final portion of the GWG meeting included a presentation by the U.S. Geological Survey (USGS) of holistic water budget modeling work they are performing for Fauquier County. The monitoring stations this initiative includes may present opportunities to contribute to water quality monitoring for the TMDL IP.

4.4 Steering Committee

The Steering Committee (SC) consisted of eleven representatives from the AWG, RWG, and GWG; GCA; Piedmont Environmental Council (PEC); JMSWCD; RRRC; DEQ; and ICPRB. Its members evaluated recommendations from working groups, reviewed BMP quantification and cost estimates, provided input to refine the draft IP document, and evaluated materials and presentations for final public meeting.

The Loudoun County member of the SC provided additional input on the County's program for steam exclusion fencing for horse farms, their Water and Wastewater Community Assistance Program, and Loudoun County's conservation easement and riparian planting buffer programs. SC members also clarified goals of the Goose Creek Scenic River Advisory Committee and water quality monitoring work by the GCA, Loudoun Wildlife Conservancy, and the JMSWCD. The JMSWCD representative also stressed the importance of verifying estimated needs for livestock exclusion fencing and offered to oversee work to complete a field survey of true needs.

The PEC member updated the committee on their conservation easement program work, which is approaching its goal that 50% of the land in the watershed be enrolled in a conservation easement program. The Loudoun Water representative clarified conventional and alternative septic systems inspection and maintenance requirements, and requested consultation on plans to increase septic system pump-outs so they can plan for increased wastewater treatment needs. Finally, several members commented on the increased number of resident geese in the watershed, and suggested it would be valuable to include some measures – such as vegetated buffers around ponds – targeted to reducing the bacteria that geese add to local waters.

5. Implementation Actions

Implementation actions (aka BMPs or management measures) are the heart of the UGC IP. Individual actions will incrementally improve water quality and, in sufficient quantities and combinations, will enable the streams in the plan area to be removed from the impaired waters list.

Drawing on the updated technical analysis and the extensive public input described in the previous sections, DEQ completed a comprehensive assessment and developed a customized suite of actions for the UGC watershed. This assessment identified and quantified bacteria reduction measures that can enable the impaired stream segments to be removed from the Virginia impaired waters list by the end of a 15-year implementation period. The proposed management measures are voluntary and are designed to be adaptable to respond to changes in water quality over the course of the IP's 15-year timeline.

The 2003 bacteria TMDLs called for elimination (100% reduction) of bacteria from failing septic systems (as well as any "straight pipe" sewage discharges), and direct deposition from cattle into area streams. In addition, the TMDLs identified a need to reduce by 98-99% the bacteria loads from pastures within the sub-watersheds of the plan area. The TMDL identified other sources of bacteria, such as wildlife and developed land, but their relative contributions are so small relative to total bacteria loads that no specific goals for their reduction are contained in the TMDLs.

It was decided that the IP should not place its entire bacteria source reductions on livestock exclusion, pasture, and failing septic system needs. Doing so would miss the opportunity to more broadly engage the local community in watershed protection and restoration, and could be perceived as inequitable by the agricultural sector.

Accordingly, DEQ has reviewed the original bacteria pollutant reduction scenarios contained in the 2003 TMDL report, and selected an alternative scenario (to the one used in the 2003 TMDLs). The alternative selected for this plan achieves the required reductions, but spreads load reductions more broadly to also include cropland, equine sources, stormwater, and pet waste. As a result, reductions required from pasture are reduced from the 98-99% levels called for in the TMDL to 75% as shown in **Table 5-1** below. Information on the methodology used to determine the reduction goals shown in **Table 5-1** is contained in the 2003 TMDL report (ICPRB 2003) and is also described in the Upper Goose Creek TMDL IP Technical Report (IP Technical Report).

Table 5-1. Major reductions required to meet delisting goals by bacteria source.

Load Reductions (%)	Bacteria Sources				
	Cropland	**Pasture**	**Developed Land (without failing septic systems)**	**Failing Septic Systems**	**Direct Deposition from Cattle**
Upper Goose, Cromwells Run, and Little River sub-watersheds	75	75	75	100	100

A wide range of management measures were considered to determine the desired suite of measures to include in the plan – they are presented in the **Attachment A (Table A-18).**

5.1 Agricultural Implementation Needs

Approximately 99% of the bacteria reductions needed to meet delisting requirements come from the agricultural sector (cropland, pasture, and direct deposition from cattle). Seventy-nine percent of the needed bacteria reductions come from pasture alone (see **Table A-12**, **Table A-13**, and **Table A-14** in **Attachment A**). The proposed management measures to achieve the required reductions include livestock exclusion fencing and pasture management.

5.1.1 Livestock Exclusion Fencing

Removing livestock from riparian corridors and limiting their access to surface waterbodies is a priority management measure. The 2003 TMDLs set forth a 100% reduction goal for bacteria coming from livestock in the water. Complete elimination of livestock access to streams will provide about 20% of total bacteria reductions

needed to achieve the bacteria water quality standards for the plan area. Studies show restricting livestock access to streams also increases livestock productivity and reduces incidence of disease through improved pasture and water quality.

There are 269 miles of streams in the IP area that could potentially be accessed by livestock. This estimate of stream exclusion needs was determined using DEQ's Guidance Manual for TMDL Implementation Plans (2003), by calculating the length of stream segments that intersect pasture lands within the IP area. As noted above, according to DCR records, the JMSWCD and Loudoun Soil and Water Conservation District (LSWCD) worked with landowners to install 100 miles of livestock exclusion fencing in the project area since 2002. To achieve the reduction target, it is currently estimated that 169 additional miles of livestock exclusion fencing is needed. **Table 5-2** provides a summary of the livestock exclusion opportunity analysis conducted and the amount of livestock exclusion fencing recommended in each sub-watershed in the IP area. **Figure 5-1** identifies the stream segments where livestock exclusion fencing is appropriate, but not yet in place. Full details of the recommended livestock exclusion measures are presented in **Table A-18** of **Attachment A**, and more information on how the specific suite of recommended BMP practices were selected is found in the IP Technical Report. As noted earlier, it is recommended that additional field survey work be undertaken to more precisely identify fencing needs.

Table 5-2. Summary of livestock exclusion opportunities by sub-watershed.

Description	Upper Goose Creek	Cromwells Run	Little River	Total
Length of total streambank fencing opportunities (feet)	807,449	233,513	377,634	1,418,596
Length of streambank fencing installed since 2002 (feet)	294,550	53,940	176,538	525,028
Length of remaining streambank fencing opportunities (feet)	512,899	179,573	201,096	893,568

The total cost of recommended livestock exclusion fencing for the IP area is approximately $5.8 million. The greatest share of these measures is proposed for Upper Goose Creek, at a cost of $3.4 million. The Cromwells Run and Little River sub-watersheds have similar fencing needs, each costing approximately $1.2 million. The specific types of exclusion systems proposed for each of the three sub-watersheds and the detailed cost information is shown in **Table 5-3**.

Figure 5-1. Location of livestock exclusion fencing opportunities.

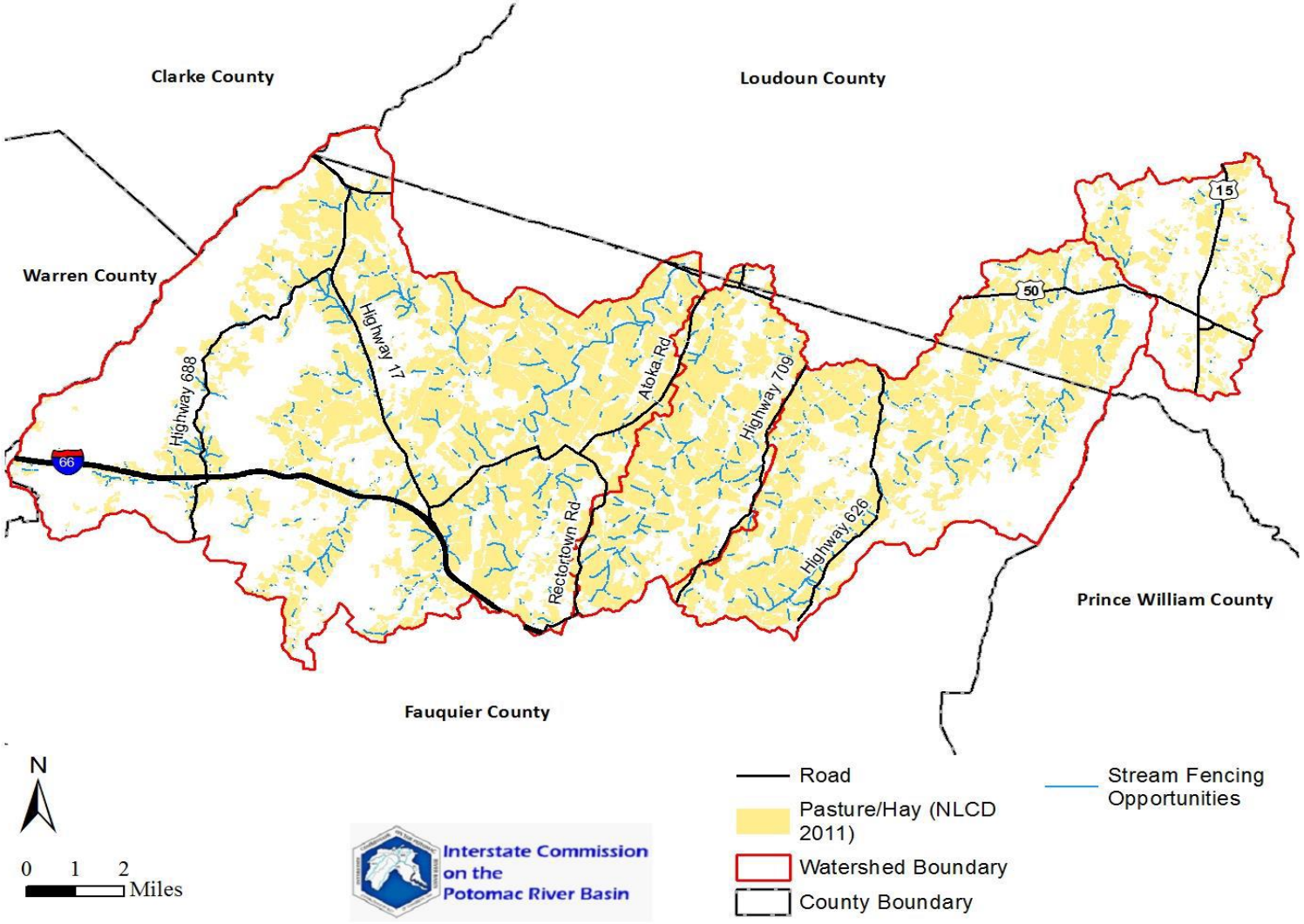
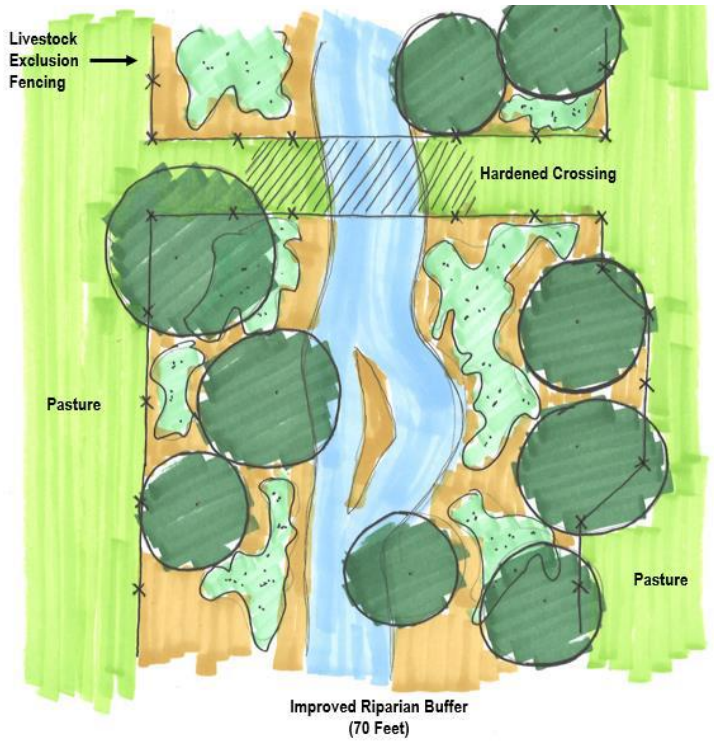


Table 5-3. Livestock exclusion management measures, average length (ft) per unit, average unit cost ($), and program division.

Livestock Exclusion System	Program Division (%)	Average Unit Cost ($)	Average Streamside Fencing (ft)	Upper Goose Creek		Cromwells Run		Little River		Total Units	Total Estimated Cost ($)
				Units	Estimated Cost ($)	Units	Estimated Cost ($)	Units	Estimated Cost ($)		
Livestock Exclusion System (CREP, CRSL-6)	8	18,000	2,900	18	324,000	6	108,000	2	36,000	26	468,000
Livestock Exclusion System (EQIP)	11	15,000	4,080	18	270,000	4	60,000	2	30,000	24	360,000
Stream Exclusion with Grazing Land Management (SL-6)	20	36,000	3,680	28	1,008,000	10	360,000	11	396,000	49	1,764,000
Livestock Exclusion with Riparian Buffers (LE-1T)	30	36,000	3,680	42	1,512,000	15	540,000	16	576,000	73	2,628,000
Livestock Exclusion with Reduced Setback (LE-2 / LE-2T)	14	12,000	3,400	22	264,000	8	96,000	8	96,000	38	456,000
Stream Exclusion (CCI-SE-1)	14	1	N/A	47,268	47,268	23,634	23,634	55,146	55,146	126,048	126,048
Stream Protection (WP-2 / WP-2T)	2	2,500	2,691	3	7,500	1	2,500	2	5,000	6	15,000
Total Estimated Cost ($)	N/A	N/A	N/A	N/A	3,432,768	N/A	1,190,134	N/A	1,194,146	N/A	5,817,048

Multiple cost-share programs are available through DCR and DEQ to help off-set the capital costs of installing livestock exclusion fencing in the plan area. A typical livestock exclusion practice requires a 35-foot riparian buffer, and cost-share funding of 75-85% is available for stream fencing, cross fencing, and providing alternate water supplies for livestock. Approximately two-thirds of the recommended livestock exclusion measures are of this type. Hardened stream crossings may also be required as an effective way to allow livestock to cross the stream while minimizing negative water quality impacts and maintaining the benefits of installed buffers (**Figure 5-2**).

Figure 5-2. Livestock exclusion fencing with hardened stream crossing schematic.



For producers who are not able to dedicate 35 feet for a stream buffer, alternative livestock exclusion measures allow for a reduced setback (10 feet). Approximately one-third of the recommended stream exclusion fencing is of this type, which is supported with 60% cost-share funding; it is most appropriate for use along smaller tributaries or on smaller farm parcels.

Areas adjacent to G.R. Thompson State Wildlife Management Area and Sky Meadows State Park, along with the headwater streams of Cromwells Run and Little River, are high priorities for fencing. Many streams in these areas have full or partial livestock exclusion already installed and filling gaps or extending fencing systems further downstream will help maintain water quality conditions as flows move downstream from conservation areas and forested lands to agricultural working lands and developed areas.

An average 100-foot buffer along the main stem of Goose Creek is strongly encouraged, to the extent feasible, to help achieve state scenic river conservation goals. A 100-foot buffer will also provide bacteria reduction benefits from pasture as the larger riparian buffer can remove more bacteria and nutrients from runoff.

While not a requirement of livestock exclusion systems, improvements to riparian buffers are encouraged through planting of native plant species and tree plantings. An improved riparian buffer will increase bacteria and nutrient removal efficiencies providing additional water quality and habitat benefits. Landowners can partner with local watershed organizations, such as the GCA, or schools to help improve the newly established riparian buffers. LSWCD has a non-agricultural stream buffer planting project to support the creation of new riparian buffers.

5.1.2 Implementation Measures for Pasture and Cropland

Bacteria runoff from pasture and cropland accounts for about 79% of bacteria reductions required to achieve water quality goals in the IP area. In the Upper Goose Creek, Cromwells Run, and Little River sub-watersheds, bacteria load from pasture account for 74%, 88%, and 89% of the total baseline load, respectively (see **Table A-12**, **Table A-13**, and **Table A-14** in **Attachment A**).

The primary ways to reduce bacteria runoff from pasture or cropland include installing vegetative buffers, using improved pasture management or rotational grazing practices, reducing tillage, planting cover crops, and planting

crops along field contours. Since 2002, these types of BMPs installed with funding from state cost-share programs have benefited 10,770 acres across the IP area. The majority of BMPs were installed in the Upper Goose Creek sub-watershed. While progress to reduce bacteria loads in the watershed has been steady since 2002, the bacteria reductions from pasture improvement measures completed between 2002 and 2016 only yielded approximately five percent of necessary reductions (many existing measures have relatively low bacteria reduction efficiencies). Updated analysis shows that significant additional farm field improvements are required to achieve water quality goals. In total, the management measures included in the IP call for some 27,350 additional acres of pasture and cropland improvements in addition to the livestock exclusion measures, all designed to optimize bacteria reduction efficiencies.

Cropland contributes a small percentage (less than 1%) of overall bacteria to Upper Goose Creek, Cromwells Run, and Little River (see **Table A-12**, **Table A-13**, and **Table A-14** in **Attachment A**). Frequent crop rotation and conversion from cropland to pasture to hay are management measures that help reduce bacteria runoff from farm fields. Distributing water systems across pasture increases forage utilization and has been shown in some cases to allow farmers to increase animal density. Livestock exclusion fencing provides a benefit to pasture and therefore was also included in calculating total bacteria reductions from pasture lands. The efficiency of management measures to reduce bacteria runoff from pasture range from 50 to 99%, with most measures having bacteria reduction efficiencies of 50%. The pasture and cropland measures recommended in this plan provide the additional bacteria controls needed to achieve the 75% reduction allocated to pasture and cropland.

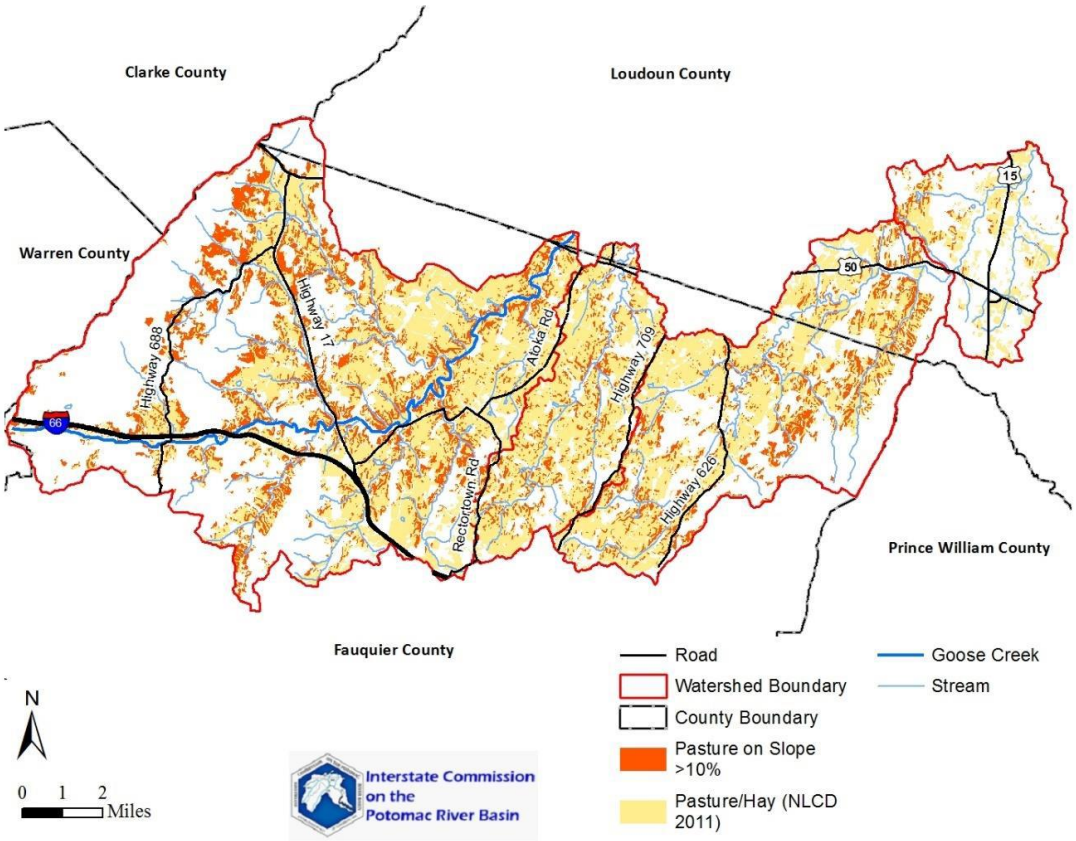
Table 5-4 provides a list of management measures to reduce bacteria runoff from pasture and cropland. Because the bacteria efficiency for each of these measures is 50 percent, the specific combination of management measures may be mixed and matched depending on the individual circumstances of each landowner and the resources available. Local SWCDs and stakeholders, working together, can find the optimal, site-specific combination of practices for each farm.

Table 5-4. Management measures to address bacteria runoff from pasture and cropland.

Pasture and Cropland Measures	Units for Tracking	Average Unit Cost ($)	Upper Goose Creek		Cromwells Run		Little River		Total Units	Total Estimated Cost ($)
			Units	Estimated Cost ($)	Units	Estimated Cost ($)	Units	Estimated Cost ($)		
Reforestation of Erodible Cropland and Pastureland (FR-1)	Acres	450	2,600	1,170,000	--	--	400	180,000	3,000	1,350,000
Woodland Filter Buffer Area (FR-3)	Acres	1,500	10	15,000	--	--	--	--	10	15,000
Streambank Stabilization (WP-2A)	Linear Feet	150	33	4,950	33	4,950	33	4,950	99	14,850
Grazing Land Management (SL-9)	Acres	165	4,010	661,650	462	76,230	238	39,270	4,710	777,150
Pasture Management for TMDL Implementation (SL-10T / EQIP 528)	Acres	75	3,773	282,975	439	32,925	793	59,475	5,005	375,375
Permanent Vegetative Cover on Critical Areas (SL-11)	Acres	2,440	520	1,268,800	--	--	80	195,200	600	1,464,000
Conservation Tillage (SL-15A)	Acres	100	77	7,700	24	2,400	0	0	101	10,100
Cover Crops (SL-8B)	Acres	50	77	3,850	24	1,200	0	0	101	5,050
Grass Riparian Buffers (WQ-1)	Acres	165	5	825	5	825	0	0	10	1,650
Support for Extension of CREP Watering Systems (SL-7)	System	TBD	8	--	7	--	--	--	15	--
Sediment Retention, Erosion, or Water Control Structure (WP-1)	Drainage Area (acres)	870	3,750	3,262,500	--	--	36	31,320	3,786	3,293,820
Permanent Vegetative Cover on Cropland (SL-1)	Acres	175	10	1,750	10	1,750	10	1,750	30	5,250
Forage and Biomass Planting (EQIP - 512)	Acres	TBD	5	--	5	--	5	--	15	--
Total Estimated Cost ($)	N/A	N/A	N/A	6,680,000	N/A	120,280	N/A	511,965	N/A	7,312,245

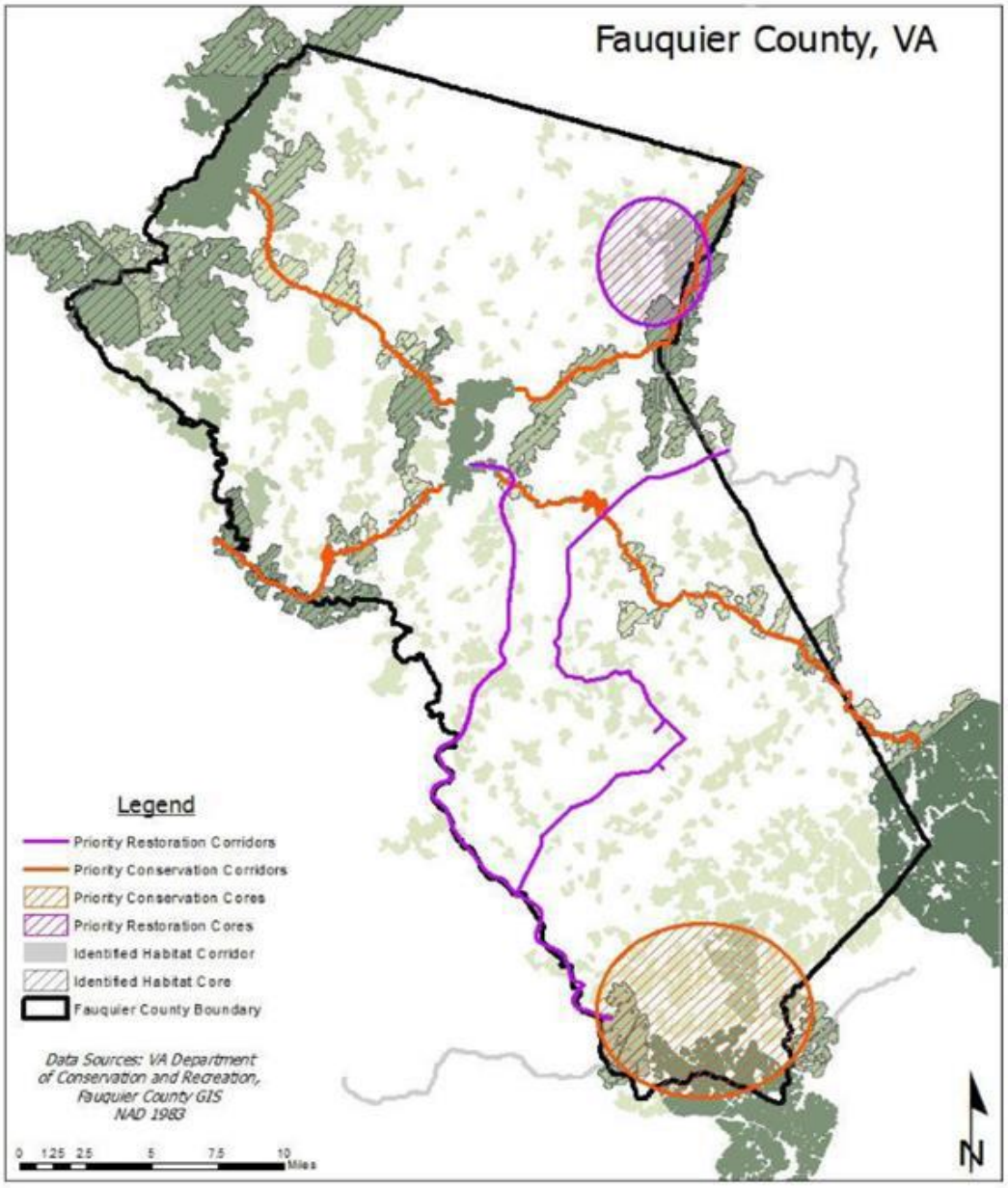
The total cost for the recommended pasture and cropland management measures is approximately $7.3 million, with the vast majority of these costs ($6.7 million) for Upper Goose Creek. Of these, nearly half ($3.3 million) is for Sediment Control, Erosion or Water Control structures due to the concentration of steep slope pasture there (**Figure 5-3**). These structures represent the highest cost BMP included in this IP, and are primarily included in Phase II, so that water quality improvements associated with the initial Phase I management measures can be assessed before final decisions are made for additional controls. The recommended pasture and cropland management measures for Cromwells Run and Little River are much less costly, at approximately $100 and $500 thousand, respectively. Taking out the Phase II Sediment Control, Erosion or Water Control structures, the overall cost of pasture and cropland measures for the entire IP area would drop from $7.3 to $4.0 million.

Figure 5-3. Location of pasture land on greater than ten percent slope.



A total of 3,600 acres of pasture land is on slopes greater than ten percent within the plan area Reforestation projects should be prioritized for these areas to stabilize slopes and reduce erosion and sedimentation of adjacent streams. In 2012 the University of Virginia conducted a green infrastructure study for Fauquier County which identified priorities for landscape restoration to maintain habitat cores and wildlife corridors. A wildlife corridor from G.R. Thompson State Wildlife Management Area crossing southeast across the IP area was identified (**Figure 5-4**), and restoration and conservation projects within these areas will contribute to achieving habitat and water quality goals. Reforestation projects in support of water quality improvement would provide additional resource management benefits within this corridor area by also supporting county green infrastructure goals.

Figure 5-4. Priority restoration zones and wildlife corridors in Fauquier County (University of Virginia 2012).



Woodland filter buffers are strongly recommended where feasible to improve the bacteria reduction efficiency of livestock exclusion practices. Improving the stream buffer area along the main stem of Goose Creek is a priority to create a contiguous riparian corridor in the IP area. These management measures are considered land use conversion measures which achieve 99% reductions in bacteria coming from the acres to which they are applied. These buffers filter pasture runoff before it reaches the stream, producing additional water quality benefits. Stormwater management infrastructure can also be applied in agricultural settings to help manage runoff and prevent bacteria from entering local streams. Constructing stormwater infrastructure to manage runoff from pasture or fields can be cost prohibitive however, and should be considered only when other management measures are insufficient or contextually inappropriate.

5.1.3 Equine Management

Fauquier and Loudoun Counties are known for their bucolic horse farms nestled among historic sites along the foothills to the Blue Ridge Mountains. Since 2002, the area has seen a three percent growth in the horse population, and this trend is expected to continue. While the contribution to bacteria loads from equine activities in the UGC IP area is less than one percent, proactively working with owners and boarding operations to properly manage horse manure will help ensure bacteria is kept out of area streams. Proposed equine management measures were separated from the other agriculture BMPs to help identify opportunities for implementation and in obtaining funding assistance.

Figure 5-5. Horse manure composting micro-bins (McCormick Environmental, Inc n.d.).

Table 5-5 provides a list of management measures to address bacteria runoff specifically from horse farms that were identified at the AWG meeting, in discussions with local stakeholders, and in consideration of potential funding opportunities. Composting in combination with improved pasture management is strongly encouraged. Composting facilities can vary in size and capital costs depending on the number of horses present at an individual farm. Small composting systems designed to handle manure from three to five horses cost about $1,200 to construct three micro-bins (**Figure 5-5**) while landowners with more than five horses will require larger systems. The Virginia Resource Conservation Service (NRCS) has developed a new(demonstration) manure composting management practice that is intended for application on horse farms.

Table 5-5. Management measures to address bacteria runoff from equestrian facilities.

Equine Measures	Average Unit Cost ($)	Upper Goose Creek		Cromwells Run		Little River		Total Units	Total Estimated Cost ($)
		Units	Estimated Cost ($)	Units	Estimated Cost ($)	Units	Estimated Cost ($)		
Community Manure Composting Facility	$215,000	1	215,000	1	215,000	1	215,000	3	645,000
Equine Manure Storage / Composting	$1,200	152	182,400	49	58,800	122	146,400	323	387,600
Barnyard Runoff Controls	$20,000	50	1,000,000	16	320,000	40	800,000	106	2,120,000
Small Acreage Grazing Systems (SL-6AT)	$9,000	30	270,000	15	135,000	15	135,000	60	540,000
Total Estimated Cost ($)	N/A	N/A	1,667,400	N/A	728,800	N/A	1,296,400	N/A	3,692,600

Use of composted manure in gardening applications has many environmental benefits, but warrants care as well. In 2013, the U.S. Composting Council (USCC) has documented harm (extensive damage to garden vegetables and crops) caused by compost contaminated with persistent herbicides, and called for regulatory action to ban their use (USCC 2013). This concern needs to be factored into planning for construction of the community composting facilities recommended in this plan.

Barnyard runoff controls are structures which collect and divert runoff from barnyard or associated buildings into areas of low environmental impact. These structures are similar to stormwater management practices applied in a barnyard setting; they store and filter NPS pollution related to equine or other livestock.

During the first AWG meeting, a community composting program was suggested as a way to provide options for smaller farms that lack room for on-site composting infrastructure. Such a program can reduce capital costs to individual farms while providing benefits to the environment and community. The Marshall Livestock Exchange and Mare Center were identified as potential sites for a pilot project. Under a proposed composting program, manure would be collected at a central composting facility and then sold or distributed to provide compost for gardening. **Figure 5-6** is an example of the scale of a proposed community composting facility. Further studies and discussion are required to determine the appropriate size of a facility and collection methods.

Figure 5-6. Community composting facility with stormwater BMP (O2Compost 2016).

Total costs for the recommended equine management measures are approximately $3.7 million. These are more evenly spread across the subwatersheds than the other agricultural BMPs discussed above. Upper Goose Creek has the greatest needs, at $1.7 million, with Little River close behind at $1.3 million and an additional $0.7 million needed for Cromwells Run.

5.2 Residential Implementation Needs

All non-agriculture sources of bacteria are referred to as residential and include sources from septic systems, pets, and stormwater. Bacteria contributions from residential sources are less than one percent of the total bacteria load in the plan area (see **Table A-12**, **Table A-13**, and **Table A-14** in **Attachment A**). Reducing these sources of bacteria will incrementally improve water quality and can also help address issues such as localized flooding through implementation of stormwater BMPs.

5.2.1 Septic Systems

Due to the rural nature of the region, the majority of the plan area is served by private septic systems. Proper design and maintenance of these systems is required to prevent bacteria from entering surface water and groundwater resources. Using updated population and household data, an estimated 2,158 septic systems existed in the IP area in 2014. According to the county health departments, the septic system failure rate is 1.6% (35 septic systems per year). There are no known straight pipes that convey raw sewage to plan area streams; however local representatives believe that greywater straight pipes may exist. Greywater comes from household or business sinks, showers, clothes or dish washing machines and other sources that have no fecal contamination.

Since 2002, Fauquier County has repaired or replaced 129 systems, and additional households were connected to existing or expanded municipal sewer treatment plants. If Fauquier and Loudoun counties continue repairing and replacing septic systems at their current rates, bacteria reduction targets from septic systems will be achieved.

Table 5-6 describes management measures to help support existing county programs. These measures were identified to achieve necessary load reductions at the working group meetings, in discussions with local stakeholders, and in consideration of potential funding opportunities. Municipal codes in Fauquier and Loudoun counties require homeowners to pump-out their septic systems once every five years to prevent bacteria from reaching local waterways (Fauquier County 2016a; Loudoun County 2015). Distributing proper maintenance guidelines and pump-out reminders can inform homeowners of their obligations and prevent septic system failure.

Table 5-6. Management measures to address bacteria loads from septic systems.

On-Site Sewage Disposal System Measures	Program Division (%)	Average Unit Cost ($)	Upper Goose Creek		Cromwells Run		Little River		Total Units	Total Estimated Cost ($)
			Units	Estimated Cost ($)	Units	Estimated Cost ($)	Units	Estimated Cost ($)		
Septic Tank Pump-out (RB-1)	100*	300	2,790	837,000	615	184,500	3,069	920,700	6,474	1,942,200
Septic Connection to Public Sewer System (RB-2)	4	12,500	--	--	--	--	21	262,500	21	262,500
Septic System Repair (RB-3)	76	3,500	188	658,000	9	31,500	208	728,000	405	1,417,500
Septic System Installation / Replacement (RB-4)	7	6,000	12	72,000	12	72,000	12	72,000	36	216,000
Septic System Installation / Replacement with Pump (RB-4P)	8	8,000	15	120,000	15	120,000	15	120,000	45	360,000
Alternative On-Site Systems (RB-5)	5	25,000	10	250,000	4	100,000	10	250,000	24	600,000
Total Estimated Cost ($)	N/A	N/A	N/A	1,937,000	N/A	508,000	N/A	2,353,200	N/A	4,798,200

*All septic systems are required by the counties to be pumped out at least every five years.

Households located in a municipal wastewater treatment service area should be encouraged to connect to the public sewer system. Over the course of the 15-year implementation timeline, there may be opportunities to connect residents to existing wastewater treatment facilities. The residential BMP cost-share program can partially offset the capital cost of connecting a residence to wastewater treatment facility sewer systems. This IP estimates the potential for 21 new connections based on the number of existing connections and total parcels within sewer service areas. To maximize additional public sewer system connections, increased low income household assistance through other grant or micro-loan programs should be made available when possible. To help meet this need, DEQ is proposing changes to its 2018 Residential Septic BMPs to provide a higher rate of cost-share for low income areas and individuals. For the lowest income residents in fiscally distressed areas, the cost-share is increased from the current uniform rate of 50% to 90%.

The total cost of recommended measures to address bacteria loads from residential septic systems is approximately $4.8 million. The majority of these costs are associated with pumping out nearly 6,500 septic systems, and repairing approximately 400 systems. The distribution of these costs links to existing population patterns within the plan area, with Little River having the greatest needs at $2.4 million, followed by Upper Goose Creek ($1.9 million) and Cromwells Run ($0.5 million).

5.2.2 Pet Waste

Waste from dogs, accounts for approximately 20% of bacteria entering local waterways from residential sources (for a description of the methodology used to calculate pet waste contributions, see the TMDL review and update in the IP Technical Report). During rain events, bacteria from dog waste can run off from lawns into local streams. Proper disposal of dog waste will eliminate associated bacteria from reaching local waterways, while also keeping public parks and gathering places cleaner.

Table 5-7 lists the management measures to address pet waste in the IP area. Mickie Gordon Memorial Park, along Main Street in The Plains, West Main Street and Community Center in Marshall are recommended locations to install pet waste stations. Installing waste stations and signage in Sky Meadows State Park and G.R. Thompson State Wildlife Management Area parking lots also help to remind pet owners to pick up after their dogs. Neighborhood homeowner associations are also encouraged to install pet waste stations.

Table 5-7. Management measures to address bacteria runoff from pet waste.

Pet Waste Measures	Average Unit Cost ($)	Upper Goose Creek		Cromwells Run		Little River		Total Units	Total Estimated Cost ($)
		Units	Estimated Cost ($)	Units	Estimated Cost ($)	Units	Estimated Cost ($)		
Pet Waste Stations	500	2	1,000	2	1,000	6	3,000	10	5,000
Pet Waste Composters	50	9	400	8	400	8	400	25	1,200
Confined Canine Unit (CCU)	6,000-20,000	2	12,000-40,000	2	12,000-40,000	1	6,000-20,000	5	30,000-100,000
Pet Waste Education	5,000	1	5,000	1	5,000	1	5,000	3	15,000
Total Estimated Cost ($)	N/A	N/A	18,400-46,400	N/A	18,400-46,400	N/A	14,400-28,400	N/A	51,200-121,200

There are five kennel operations in the IP area. Kennels have a higher concentration of pet waste due to the nature of their business, and are important opportunities for water quality improvement. Several approaches to managing waste are available to kennel owners including dry stackers, septic systems, and

hauling waste directly to landfills. The cost of these measures varies depending on the selected approach (see CCU's in **Table 5-7**).

A robust education and outreach campaign is recommended to inform pet owners of the importance of picking up after their pet. Distributing dog waste bag leash holders is an inexpensive and popular way to improve public awareness and change pet owner behaviors. Events at the Upperville Showgrounds, Warrenton Horse Show, and local farmers markets are prime opportunities to distribute educational materials.

The cost for recommended pet waste management measures is a very small portion of total management measure needs for the plan area. These costs are quite evenly distributed among the three sub-watersheds, and are estimated at between $50 and $120 thousand, with the actions taken to address confined canine units (kennels) being the variable factor.

5.2.3 Stormwater

Stormwater BMPs can help achieve numerous water quality objectives by filtering and retaining pollutants during and after storm events. Stormwater runoff from developed land accounts for less than one percent of the total bacteria load (and the majority of this bacteria is linked to pet waste), so the measures described here are pilot projects to serve as community demonstrations of best practices. Their value is as much or more in strengthening public awareness of actions individuals can take to protect and restore water quality as in the actual bacterial source reduction achieved.

The proposed measures in **Table 5-8** are meant to serve as few highly visible BMPs to increase awareness of the benefits these systems provide for water quality, flood reduction, and streetscape enhancement (**Figure 5-7**). County government facilities such as schools may provide ideal locations for installation of demonstration stormwater BMPs especially when capital improvements are already planned. For example, permeable pavement can be installed when parking lots need resurfacing.

Figure 5-7. Bioswale to catch runoff from parking lot, Marshall, Virginia (September 2016).

Costs associated with the limited pilot projects recommended to demonstrate sound stormwater management practices are modest, at less than $100,000. In the long-term, reducing impervious surfaces in the plan area would most effectively reduce the transport of pollutants in stormwater. Impervious surfaces can be reduced through adoption of county policies, voluntary actions taken as a result of citizen education campaigns, and through public investment in alternative infrastructure (e.g. porous pavement and other low-impact development measures). Putting these practices in place during new or re-development can be very cost effective, while retrofitting existing development to reduce impervious surfaces can be quite costly.

Table 5-8. Management measures to address bacteria pollution from stormwater.

Stormwater Measures	Units for Tracking	Average Unit Cost ($)	Upper Goose Creek		Cromwells Run		Little River		Total Units	Total Estimated Cost ($)
			Units	Estimated Cost ($)	Units	Estimated Cost ($)	Units	Estimated Cost ($)		
Vegetative Riparian Buffers (Residential)	Drainage Area (acres)	3,500	--	--	--	--	20.5	71,750	20.5	71,750
Rain Barrels	System	150	1	150	1	150	1	150	3	450
Redirecting Residential Downspouts	Roof Area (acres)	100	0.6	60	0.2	20	0.7	70	1.5	150
Porous Pavement	Area Treated (sq ft)	7.5	250	1,875	250	1,875	500	3,750	1,000	7,500
Rain Gardens	Area Treated (sq ft)	4	250	1,000	250	1,000	500	2,000	1,000	4,000
Infiltration Trench	Area Treated (acres)	11,300	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Total Estimated Cost ($)*	N/A	N/A	N/A	3,085	N/A	3,045	N/A	77,720	N/A	83,850

*These values do not include costs associated with infiltration trenches.

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5.3 Other Potential Implementation Needs

5.3.1 Education and Outreach

As has been noted in individual sections above, education and outreach programs are important to the successful implementation of proposed management measures. Informing residents of the importance of protecting local water quality and increasing their awareness of the programs available to partially off-set capital costs to install management measures will support successful implementation of this plan. Ongoing education and outreach also provides an opportunity for residents and stakeholders to provide feedback to inform plan implementers of adjustments that may help meet reduction goals during implementation. **Table 5-9** provides a list of the proposed education and outreach programs, some which currently exist and could benefit from integration with other watershed protection efforts.

The programs that comprise the education and outreach component of the IP are:

- ***Septic System Education and Septic System Education for Area Realtors:*** Information about septic system maintenance and septic system owner obligations under municipal codes can be disseminated as mailers in utility bills, refrigerator magnets, or similar materials. Outreach to area realtors will enable them to inform prospective homeowners of their obligations when purchasing a home with a septic system. Information about cost-share programs should be broadly distributed, and also targeted to lower income households.
- ***Incorporate Water-Related Curriculum into Area Classrooms:*** The Virginia Department of Education (DOE) requires watershed-related curriculum as part of 3rd through 6th grade science education. Local watershed organizations like GCA can ensure students receive a "meaningful watershed experience," as called for by DOE. These programs can provide a "sense of place" for the children, engage parents in local water quality, and bring communities together to find solutions.
- ***Student Field Trips:*** In collaboration with GCA and other local watershed groups, organize student field trips to areas in the plan area where management measures have been installed to support the lessons taught in the classroom.
- ***Farm Days:*** Both Fauquier and Loudoun counties organize farm day events to provide residents a chance to meet local farmers and learn how their food is produced. These events also can highlight farms that have incorporated best management measures.
- ***Distribute Educational Materials at Farmers Market:*** Farmers markets provide a great venue to inform stakeholders on water quality improvement measures. A booth can be setup a few times a year to distribute materials to local stakeholders.
- ***Horse Pasture Management Education:*** This outreach effort is designed to develop and distribute educational materials specifically for horse pasture management. Information on the potential adverse effects of persistent herbicides in composted manure should be included in these education and outreach materials. Distributing education and outreach information to horse owners can inform this growing segment of the watershed of opportunities to meet multiple, complementary objectives. Many opportunities exist to engage residents, including the Marriot Ranch spring event, farm demonstration days, livestock auctions, organized community hunts, and through the Cattleman's Association.

Information should be distributed through a variety of communication mediums including social media, print media, newsletters, and radio advertisements. Working with local veterinarians to increase awareness of cost-share programs and benefits of improved pasture management and livestock exclusion provides another educational opportunity. The total estimated cost for all of these education and outreach activities is approximately $28,000.

Table 5-9. Education and outreach programs.

Education and Outreach Measures	Units for Tracking	Average Unit Cost ($)	Upper Goose Creek		Cromwells Run		Little River		Total Units	Total Estimated Cost ($)
			Units	Estimated Cost ($)	Units	Estimated Cost ($)	Units	Estimated Cost ($)		
Septic System Education	Program	2,500	1	2,500	1	2,500	1	2,500	3	7,500
Septic System Education for Area Realtors	Program	625	1	625	1	625	1	625	3	1,875
Incorporate Water-Related Curriculum into Area Classrooms	Program	1,000	1	1,000	1	1,000	1	1,000	3	3,000
Organize Student Field Trips to observe BMPs	Program	1,000	1	1,000	1	1,000	1	1,000	3	3,000
Organize Farm Day Events	Program	1,000	1	1,000	1	1,000	1	1,000	3	3,000
Distribute Education Materials at the Farmers Market	Program	625	1	625	1	625	1	625	3	1,875
Horse Pasture Management Education	Program	2,500	1	2,500	1	2,500	1	2,500	3	7,500
Total Estimated Cost ($)	N/A	N/A	N/A	9,250	N/A	9,250	N/A	9,250	N/A	27,750

5.3.2 Assessment of Technical Assisstance Needs

Implementation of the actions called for in this plan are voluntary actions, and therefore will require local leadership and highly active community engagement. This will be accomplished through a full-time technical advisor funded by future grants. Technical assistance costs were estimated for Phase I (years 1-10) of the project assuming one full-time position, at a cost of $50,000/per year. The same level of technical assistance should continue for Phase II, bringing a total cost of $750,000 for the entire 15-year duration of the IP. (These figures are based on the existing staffing costs for SWCDs who are currently administering TMDL implementation projects in the Commonwealth).

6. Cost of Implementation

The total estimated costs for measures recommended as part of Phase I come to $12.3 million. The additional measures that constitute Phase II of this IP cost another $10.3 million, for a total IP cost estimate of $22.6 million. Total costs are summarized for agricultural and residential measures in **Table 6-1**. A detailed description of costs is provided in **Attachment A, Table A-20**.

Table 6-1. Estimated cost of recommended agricultural and residential management actions (in $thousands) by sub-watershed.

BMP Type	Upper Goose Creek	Cromwells Run	Little River	TOTAL
Agricultural	$11,780	$2,054	$ 3,002	$ 16,836
Residential	$1,995	$ 566	$ 2,468	$ 5,029
Total	$13,775	$ 2,620	$ 5,470	$ 22,615*

*Includes $750K in technical assistance which is not allocated across sub-watersheds.

7. Benefits of Management Measures

The primary objective of this plan is to meet the delisting requirements for bacteria in the plan area. Resolving the issues that cause the bacteria impairment, however, will improve more than just pollution from bacteria. Numerous direct and indirect improvements made through implementation of the management measures include economic benefits to local agricultural producers, improved ecosystem health and habitat creation, cleaner drinking water, enhanced recreation and tourism to benefit the local economy, and more engaged and proactive community support for watershed protection. Further, the measures implemented as a part of this plan also contribute to protecting the Chesapeake Bay and making progress towards meeting the Chesapeake Bay TMDL. Benefits of agricultural, residential, and education and outreach practices are discussed in more detail in the sections below.

7.1 Agricultural Practices

Agricultural management measures (e.g. livestock exclusion, pasture and cropland, and equine practices) have numerous potential benefits in addition to reducing instream bacteria. Keeping livestock out of the stream through installation of watering systems, stream fencing and crossings, riparian buffers, and other measures has the added benefit of preventing the spread of cattle diseases like salmonella, leptospirosis, and mastitis (Nordstrom 2016). Additional livestock benefits of increased access to clean water can include weight gain, increased milk production, and decreased foot rot (DEQ 2016). Benefits like these have been documented in the plan area where BMPs have already been installed (personal communication, first IP public meeting, 6/21/2016).

Stabilizing streambanks, installing sediment retention structures, creating vegetative buffers, and reforestation of erodible lands reduce pollutant transport to the stream, thereby improving aquatic habitat and preventing costly water quality treatment for downstream drinking water utilities. These measures also create and/or improve existing aquatic and terrestrial wildlife habitats, while directly addressing the additional water quality impairments caused by excess sediment releases in the Goose Creek watershed.

Pasture and cropland management measures can increase profitability for the producer by reducing the amount of purchased feed required (DEQ 2016).

7.2 Residential Practices

Although residential contributions to the bacteria impairment are modest in the plan area (contributing less than one percent of the total bacteria load), residential measures like repair and replacement of septic systems, implementation of pet waste controls, and stormwater management efforts have a number of additional benefits. For example, proper septic tank maintenance extends the life of the system, saving the homeowner money. In addition, stormwater measures can help address issues such as localized flooding. Rain gardens and rain barrels can decrease water bills by reducing the amount of potable water used for irrigation. Residential measures also encourage community involvement and education, discussed below.

7.3 Education and Outreach

Participation of a wide range of local stakeholders will be required to fully implement the plan and achieve water quality goals. This wide-reaching involvement necessitates education and outreach. By providing the local community with awareness of the problem, knowledge of the issues, and skill and knowledge of actions that need to be taken, the community is more likely to act on these and other problems now and in the future (Hungerford and Volk 1990).

8. Measurable Goals and Milestones for Attaining Water Quality Standards

Delisting the impaired waters in the plan area is the ultimate goal of this plan. Water segments ("Assessable Units") within the plan area where water quality monitoring results show less than a 10.5% exceedance rate of the maximum assessment criterion of 235 colony forming units of *E. coli* per 100 milliliters (cfu/100mL) can be delisted from Virginia's impaired waters list. Full attainment of the recreational use water quality standard would be demonstrated by a geometric mean value based on at least four samples in a single month of no more than 126 cfu/100mL.

As noted, the IP will be carried out in two phases. Phase I covers the first ten years of implementation (Years 1-10). The measures selected for Phase I are considered those most important to achieving near-term improvements in water quality. Phase II is the final five years (Years 11-15), and will seek to fully achieve the water quality standard for recreational use.

Table A-21 shows the water quality outcomes that are projected once Phase I and Phase II BMPs are in-place. Specifically, there will be significantly reduced levels of exceedance of the maximum assessment criterion in each watershed after Phase I (12% for Upper Goose Creek, 7% for Comwells Run, and 13% for Little River). At the end of Phase II, each sub-watershed is projected to have < 10.5% exceedance rate of the maximum assessment criterion, and 0% exceedance of the geometric mean standard of 126 cfu/100 mL. Phase II water quality outcomes are projected by the TMDL model, and Phase I outcomes are calculated based on the share of all BMPs that are included in Phase I of the IP.

To best ensure ultimate success, the recommended management measures should be reevaluated toward the end of Phase I, in light of water quality monitoring results. Based on this reevaluation, Phase II BMPs may be altered or not implemented depending on the water quality improvements achieved through the implementation of Phase I measures.

Progress toward end goals will be assessed during the implementation process through tracking of BMP installations and through ongoing water quality monitoring. BMP installation milestones will track the percentage of implementation actions put into place over specified timeframes. Water quality monitoring activities will measure improvements in water quality over time as a result of BMP installation progress. These complementary approaches to assessing progress are inextricably linked because the proposed management measures are designed to reduce ambient bacteria levels in streams to achieve water quality standards for the UGC watershed plan area.

High priority practices for the first phase of implementation include improved pasture management and livestock exclusion from streams. These practices will provide the greatest extent of water quality benefits while also offering increased economic returns to agricultural producers. The Phase I goal is installation of approximately two-thirds (65%, or approximately 110 miles) of the total planned livestock exclusion fencing. While improved pasture management and livestock exclusion are priority practices for Phase I, implementation efforts will be driven by what local landowners are interested to install on their property. When producers are interested, opportunities to transition pasture to permanent forest or other native vegetation as part of nutrient banking should also be pursued during Phase I. More aggressive implementation of reforestation and buffer measures is envisioned during Phase II after other management measures have been implemented (and will be informed by monitoring results and BMP implementation progress).

Measures to reduce equine bacterial loads should be implemented evenly across Phases I and II. The complexities and high capital costs of establishing a community composting program make it unlikely to complete the three planned composting facilities before the end of Phase II, with one regional composting facility coming online every five years beginning in 2021. Measures to improve barnyard runoff NPS pollution should be implemented beginning in Phase I.

Fauquier and Loudoun Counties are effectively addressing failing septic systems across the IP area. The counties should continue to implement their current programs to repair or replace failing systems during Phases I and II. These programs can be supplemented by residential septic BMPs that would be a normal component of Sec. 319 grants that may be awarded to support implantation of the actions recommended in this plan.

The recommended stormwater BMP pilot projects should be installed within the first five years of Phase I if funding is available. Since these projects are meant to spur interest in implementing such measures throughout the plan area, they will have greatest value if installed in the early years of implementation. Management measures to address bacteria from pets should also be implemented during Phase I; however, extending implementation through Phase II for pet waste and stormwater management will not delay achieving the water quality of the UGC IP.

Finally, education and outreach programs and technical assistance will be on-going in Phases I and II. As noted, some education and outreach programs currently exist or have existed in the past. Work with local organizations and other partners can increase and improve citizen-led monitoring efforts during Phase I and II.

Details on the management measures called for during each phase of the plan, the number of units of each recommended measure, and the associated costs are included in **Attachment A** (see **Table A-19**, **Table A-20**, and **Table A-21**).

9. Water Quality Monitoring

The proposed monitoring program builds on ongoing efforts to facilitate evaluation of trends over time and assess progress towards achieving the bacteria water quality criteria. DEQ, in collaboration with local partners, will periodically evaluate the monitoring data to determine progress towards implementation goals. Proposed monitoring includes 1) continued DEQ monitoring, 2) citizen monitoring and, 3) additional monitoring. Each of these is discussed in more detail below.

9.1 DEQ Monitoring

DEQ regularly conducts monitoring in the IP area as part of its overall water quality monitoring program for the Commonwealth. Within the plan area, there is one DEQ monitoring program "Trend" station, at which water quality monitoring samples are taken bi-monthly every year, and two more Trend stations are located on Goose Creek below the IP area. In addition to these high frequency monitoring stations, on a five-year cycle DEQ samples other sites as a part of its probabilistic monitoring program, and other DEQ monitoring occurs periodically to meet specific program needs. These monitoring efforts will continue and be adapted as necessary to evaluate progress towards meeting the bacteria water quality criteria. DEQ's current network of monitoring stations within the IP watersheds is shown in **Figure 1-3**. Data collected by DEQ are used in the water quality assessment, which determines whether waters are meeting water quality standards. Assessment results are submitted as an Integrated Report to the EPA every two years, as required by the CWA.

9.2 Citizen Monitoring

Citizen water quality data can greatly improve the understanding of water quality conditions over time. For almost 15 years, the GCA has conducted water quality monitoring at many locations throughout the entire Goose Creek watershed, including within the plan area. This monitoring has included both chemical and benthic community parameters, with sustained monitoring of benthic community health. Bacteria data collected by GCA have been designated as Level II data through the DEQ citizen water quality monitoring program. Level II data may be used to educate the community, assist the SWCDs in prioritizing BMPs for implementation, and track performance of TMDL implementation.

These data are submitted to DEQ and may be used to identify waters for DEQ follow-up monitoring. While these data are a part of the water quality assessment, Level II data are not to be used by DEQ to directly determine whether waters are meeting their water quality standards. Citizen monitoring data must be designated as Level III, and collected with protocols that are equivalent to those used by the DEQ water quality monitoring program, to be used for water quality assessment determinations. DEQ and GCA will collaborate on the location of monitoring sites to optimize coverage and avoid unnecessary duplication in future monitoring efforts to track performance under this TMDL IP.

9.3 Additional Monitoring

Site specific monitoring efforts may assist in evaluation of management measure effectiveness and add flexibility within an adaptive implementation framework. To this end, collaboration with partners to design additional monitoring efforts will assist in the successful implementation of this plan. During the course of stakeholder discussions, several existing groups including USGS and Fauquier County's Emergency Management Planning mentioned an interest in contributing to the water quality monitoring efforts (personal communication, government working group meeting, 9/8/2016). USGS is conducting a five-year project with Fauquier County to assist in developing a holistic water budget for the county. Although this project is focused on water quantity – specifically how changes in precipitation affect the water budget – there may be opportunities for a collaborative effort to assist in obtaining water quality measurements. Fauquier County's Emergency Management Planning

may be able to assist with basic water quality monitoring efforts if funding is identified. In addition, JMSWCD has technical capability and interest to conduct supplement water quality monitoring grant projects.

10. Stakeholder Roles and Responsibilities

10.1 Agricultural and Residential Landowners

Since nonpoint sources of runoff to streams is the dominant cause of the bacteria impairment of the UGC watershed, action by the many local landowners within the watershed is essential to achieving the water quality restoration goals of this plan. While actions are required by many, and the cost of these actions can be significant, government agencies are able to provide both technical and financial assistance to support landowner efforts. Local government, local SWCD, and NRCS staff are uniquely positioned to serve as a liaison between individual landowners and the government agencies and programs that can assist them in addressing the sources of bacteria pollution. Their personal knowledge of the local communities, local economy, and natural resources positions them well to foster the collective actions required to achieve this plan's goals.

10.2 John Marshall Soil and Water Conservation District and Loudoun Soil and Water Conservation District

The JMSWCD and LSWCD staff have considerable technical assistance capabilities to offer landowners within the watershed. Together with NRCS, the local SWCDs continually reach out to farmers within their watersheds to provide conservation practice technical expertise. In the absence of this plan, these Districts would not have the ability to dedicate staff focused solely on the UGC watershed and this would limit the ability to achieve the ambitious BMP implementation measures called for. With dedicated staffing for the local watersheds, local SWCDs can provide agricultural BMP design and layout assistance to individual producers. Their staff will more broadly communicate with landowners in the watersheds to help advance environmental education and encourage participation in conservation programs, both agricultural and residential programs that focus on septic systems, pet waste and stormwater management. This IP meets the requirements for funding eligibility under EPA's Section 319 program, for which JMSWCD and LSWCD may apply for grant assistance to enable them to target their expertise to landowners.

10.3 Fauquier and Loudoun Counties

Decisions made by local government staff and elected officials regarding land use and zoning will play an important role in the implementation of this plan. This makes Fauquier and Loudoun county governments key partners in long term implementation efforts. Approximately 84% of the upper watershed area falls within Fauquier County, so it will have a relatively greater role in the plan's implementation. Both Fauquier and Loudoun counties administer conservation programs which have helped to encourage land conservation across the counties. Since 1979 when both counties created their Agricultural and Forestal District Programs, Fauquier County has established 13 districts covering over 78,000 acres and Loudoun County has established 22 districts with over 43,000 acres located throughout the county (Fauquier County 2016b; Loudoun County 2017).

Based on feedback from the public meeting and working group discussions, residential land development is a significant issue in the eastern portion (Little River) of the watershed, with the number of working farms in the area declining in recent years. Local government support of land conservation will become increasingly important as greater numbers of conservation measures are implemented across the watersheds.

As has been noted earlier, both counties have very active and effective residential septic system programs, as well as limited plans to expand wastewater treatment facility capacity and connections. Also, both counties will serve

as key partners in residential stormwater BMP outreach and implementation and may assist with the promotion of pet waste BMPs including composters and pet waste stations.

10.4 Virginia Department of Environmental Quality

DEQ has a lead role in the development of TMDL implementation plans. DEQ also provides available grant funding and technical support for TMDL implementation, and will work closely with project partners to track implementation progress. In addition, DEQ will work with interested partners on grant proposals to provide grant funds for projects included in the IP.

DEQ is also responsible for monitoring state waters to determine compliance with water quality standards. DEQ will continue monitoring water quality in Upper Goose Creek, Cromwells Run, and Little River and their tributaries in order to assess water quality and determine when restoration has been achieved and the streams can be removed from Virginia's list of impaired waters.

10.5 Virginia Department of Conservation and Recreation

DCR administers the Virginia Agricultural Cost Share Program, working closely with the SWCDs to provide cost share and operating grants needed to deliver this program at the local level and track implementation. In addition, DCR administers the state's Nutrient Management Program, which provides technical assistance to producers in appropriate manure storage and manure and commercial fertilizer.

10.6 Virginia Department of Forestry

The Virginia Department of Forestry (DOF) has prepared a manual to inform and educate forest landowners and the professional forest community on proper BMPs and technical specifications for installation of these practices in forested areas (http://dof.virginia.gov/infopubs/BMP-Technical-Guide_pub.pdf, accessed 5/15/2017). Forestry BMPs are primarily directed to control erosion. For example, streamside forest buffers provide nutrient uptake and soil stabilization, which can benefit water quality by reducing the amounts of nutrients and sediments that enter local streams. Although the DOF's BMP program is intended to be voluntary, it becomes mandatory for any silvicultural operation occurring within state waters (VA Silvicultural Water Quality Law 10.1-1181.2). *For more information:* visit Chapter 10 in the aforementioned manual.

10.7 Virginia Department of Health

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

10.8 Other Potential Local Partners

There are numerous additional opportunities for future partnerships in the implementation of this plan. Additional potential partners in implementation include:

10.8.1 Virginia Cooperative Extension

Both Fauquier and Loudoun counties have local offices of Virginia Cooperative Extension (VCE). These offices in Warrenton (Fauquier) and Leesburg (Loudoun) connect residents to Virginia's land-grant universities, Virginia

Tech and Virginia State University. Through educational programs based on research and developed with input from local stakeholders, VCE offices help improve local communities with programs in Agriculture and Natural Resources, Family and Consumer Sciences, 4-H Youth Development, and Community Viability. *For more information:* http://ext.vt.edu/, accessed 5/15/2017.

10.8.2 Piedmont Environmental Council

PEC was formed in 1972 and works with the citizens of its nine-county region to conserve land, create high-quality communities, strengthen rural economies, celebrate historic resources, protect air and water quality, build smart transportation networks, promote sustainable energy choices, restore wildlife habitat, and improve people's access to nature. PEC works to empower citizens to protect what makes the Piedmont a wonderful place and encourage them to pursue a positive vision for the region's future. PEC has a long history of working with land owners to conserve their land through easements. Forty percent of the entire Goose Creek watershed is under conservation easement currently, and many properties in the UGC planning area have been protected. PEC is now working to strengthen older easements to improve their water quality protections and increase the percentage of eased land in the watershed to fifty percent in the near-term, with a long-term target of seventy to eighty percent under easement in the watershed. *For more information:* http://www.pecva.org/, accessed 5/15/2017.

10.8.3 Goose Creek Association

The GCA was founded in 1970 to fight the discharge of sewage effluent into Goose Creek. Today the association addresses a broad array of issues, with an active board charged with monitoring stream water quality, proposed developments, legislation, zoning changes and other actions. Maintaining and improving the quality of the Goose Creek watershed is the overarching goal of the Association's efforts. GCA works together with many other conservation and preservation efforts to provide a unified voice for conservation/preservation–minded citizens in the area. *For more information:* http://www.goosecreek.org/, accessed 5/15/2017.

11. Integration with Other Planning Initiatives

11.1 Fauquier County Groundwater Study

In January 2016, USGS and the Virginia Water Science Center presented a Groundwater Resource Assessment and Monitoring Proposal to the Fauquier County Board of Supervisors. This proposal was endorsed and a study has been initiated to achieve the following objectives: (1) develop a county-wide water budget model to characterize hydrologic conditions affecting county aquifers; (2) couple groundwater and surface water monitoring to enable an assessment of the relationship of groundwater withdrawals and base stream flows; and (3) begin to collect data and develop tools to estimate the impacts of the county's population growth on its water resources. Fauquier County has initiated the five year USGS project and completed the water balance model.

11.2 Fauquier County Natural Resources Plan

In May 2016, the Fauquier County BOS adopted Chapter 2, Section A "Natural Resources" policy. Among its objectives are the following:

- Develop and implement a broad-based and robust water management program,
- encourage the establishment of stream buffers for water quality protection,
- seek to reduce pollution to our natural waters and stormwater systems, and

- identify fully functioning and healthy surface waters and explore means to sustain and maintain these baseline conditions.

11.3 Loudoun County Comprehensive Watershed Management Plan

In 2006-08, Loudoun County pursued an ambitious overall plan for watershed management, with technical assistance (via EPA and National Fish and Wildlife Foundation (NFWF) grants) from the University of Virginia and CH2M Hill. The proposed comprehensive framework for county-wide watershed management was presented to the Board of Supervisors in March 2009, with recommendations for implementation. In 2014 a detailed watershed plan for Upper Broad Run was completed under this framework. Additional watersheds, including parts of the Goose Creek watershed, may be the focus of future detailed plans.

11.4 Goose Creek Scenic River Advisory Committee

This committee, which is formally sanctioned by the Commonwealth of Virginia, actively reviews proposed land use changes and development activities in the Goose Creek watershed. The Committee works to promote environmental enhancements in development proposals, including increased use of riparian buffers. Ideally planted in trees and bushes, these buffers help to retain scenic views, reduce stream bank erosion, reduce flooding, and enhance habitat values and water quality.

11.5 Northern Virginia Regional Commission

In January 2012 the Northern Virginia Regional Commission (NVRC) issued a report titled “Conservation Corridor Planning” (NVRC 2012). This report presents important data analysis that informed the identification of regional conservation “cores” and “corridors” and opportunities for regional collaboration to protect and restore these resources. The Route 15 “Journey Through Hallowed Ground” is within one of the Plan’s five top priority corridors, and falls within the eastern section of the UGC plan area. The NVRC plan’s strategies are consistent with the goals of this IP, including enhancing ecosystem functions with good management and restoring degraded or missing (corridor) connections.

12. Funding for Implementation

A list of potential funding sources available for implementation is listed and discussed below. Detailed descriptions can be obtained from the parent agencies and the websites shown. While funding is currently being provided to the JMSWCD for agricultural BMPs and technical assistance for farmers, additional funding commitments are needed to fully implement the agricultural, residential, and urban practices included in the plan.

12.1 Loudoun County Non-Qualifying Livestock Exclusion (Horse Fencing) Cost Share Program

For the past three years, Loudoun County Government has dedicated approximately $50,000 annually to provide funding for fencing and water systems for small farms, primarily horse farms, that do not qualify for the State’s stream exclusion fencing cost-share program. The funds provide a 75% cost share, and in the most recent year, supported 14 projects totaling 6,037 feet of new stream fencing, and the maintenance of additional previously installed fencing in need of repair.

12.2 Loudoun County Water and Wastewater Community Assistance Program

This program was created to respond to the ongoing problem of failing septic systems in Loudoun County. The program is designed to help prevent and solve community water and wastewater issues by administering a comprehensive program that addresses multiple types of water and wastewater issues, and provides funds to ensure that citizens have a safe, adequate, and proper means of sewage disposal. Potential at-risk communities are described in the *Loudoun County Water and Wastewater Needs Assessment, 2011*. *For more information:* https://www.loudoun.gov/DocumentCenter/View/113279, accessed 6/9/2017. *For additional information* on the Program, including opportunities for financial assistance: https://www.loudoun.gov/index.aspx?NID=3650, accessed 6/9/2017.

12.3 Loudoun Non-Agricultural Stream Buffer Planting Project

The LSWCD and Loudoun County jointly administer a program to reimburse riparian land owners (individuals, commercial/residential businesses, and home owner associations) who plan riparian areas of a minimum of 35 feet in width. This voluntary program is currently funded at $35,000 annually and reimburses property owners for the cost of purchasing and planting native deciduous trees, with options for evergreen trees and shrubs. *For more information:* www.lswcd.org, accessed 6/9/2017.

12.4 Virginia Agricultural Best Management Practices Tax Credit Program

For all taxable years, any individual or corporation engaged in agricultural production for market, who has in place a soil conservation plan approved by the local SWCD, is allowed a credit against the tax imposed by Section 58.1-320 of the Code of Virginia equaling 25% of the first $70,000 expended for agricultural BMPs 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 in conjunction with other cost-share programs on the landowner's portion of BMP costs. It is also approved for use in supplementing the cost of repairs to streamside fencing. *For more information:* http://lfswcd.org/best-management-practices, accessed 5/15/2017.

12.5 Virginia Agricultural Best Management Practices Loan Program

Loan requests are accepted through DEQ. The interest rate is three percent per year and the term of the loan coincides with the life span of the practice. To be eligible for the loan, the BMP must be included in a conservation plan approved by the local SWCD Board. The minimum loan amount is $5,000 with no maximum limit. Eligible BMPs include structural practices such as animal waste control facilities and grazing land protection systems. Loans are administered through participating lending institutions. *For more information:* http://www.deq.virginia.gov/programs/water/cleanwaterfinancingassistance/agriculturalbmp.aspx, accessed 5/15/2017.

12.6 Virginia Conservation Assistance Program

The Virginia Conservation Assistance Program (VCAP) is a relatively new program that can provide reimbursements to landowners who install stormwater BMPs. The program is administered by the SWCDs, who accept and review BMP plans submitted by landowners, verify project eligibility, and issue and track reimbursements for completed projects. All non-agricultural property owners in eligible districts may apply. This includes businesses, public, and private lands. A manual has been developed for the program, which includes standards and specifications for BMPs eligible for reimbursement. The JMSWCD and LSWCD may have staff members available to apply for funds through this program in order to work with interested property owners on residential/urban stormwater BMPs. *For more information:* http://vaswcd.org/vcap, accessed 5/15/2017.

12.7 Virginia Small Business Environmental Assistance Fund Loan Program

This fund, administered through DEQ, is used to make or guarantee loans to small businesses for the purchase and installation of environmental pollution control equipment, or equipment and structures to implement agricultural BMPs. Loans are available up to $50,000 and will carry an interest rate of three percent, with repayment terms based on the borrower's ability to repay and the life of the equipment or BMP. 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. *For more information:* http://www.deq.virginia.gov/portals/0/deq/air/smallbusinessassistance/autobody/appendix13.pdf, accessed 5/15/2017.

12.8 Community Development Block Grant Program

"The Virginia Community Development Block Grant (CDBG) program provides funding to eligible units of local government for planning and implementing projects that address critical community development needs, including housing, infrastructure and economic development. The goal of the CDBG Program is to improve the economic and physical environment in Virginia's communities through activities which primarily benefit low- and moderate-income persons, prevent or eliminate slums and blighting conditions or meet urgent needs which threaten the welfare of citizens." *For more information:* http://www.dhcd.virginia.gov/index.php/community-partnerships-dhcd/76-community-development-block-grant-cdbg-competitive-grants.html, accessed 5/15/2017.

12.9 Virginia Water Quality Improvement Fund

This is a permanent, non-reverting fund established by the Commonwealth of Virginia in order to assist local stakeholders in reducing point and nonpoint nutrient loads to surface waters. Eligible recipients include local governments, SWCDs, and individuals. Grants for point and nonpoint sources are administered through DEQ. *For more information:* http://www.deq.virginia.gov/Programs/Water/CleanWaterFinancingAssistance/WaterQualityImprovementFund.aspx, accessed 5/15/2017.

12.10 Virginia Forest Stewardship Program

The program is administered by the DOF to protect soil, water, and wildlife and to provide sustainable forest products and recreation. *For more information:* http://dof.virginia.gov/manage/stewardship/index.htm, accessed 5/15/2017.

12.11 USDA Conservation Reserve Program

Through the USDA Conservation Reserve Program (CRP), cost-share assistance is available to establish trees or herbaceous vegetation covers on cropland. To be eligible for consideration, the following criteria must be met: 1) cropland was planted or considered planted in an agricultural commodity for two of the five most recent crop years, and 2) cropland is classified as "highly-erodible" by NRCS. The payment to the participant is up to 50% of the cost for establishing ground cover. *For more information:* http://www.nrcs.usda.gov/wps/portal/nrcs/main/va/programs/, accessed 5/15/2017.

12.12 USDA Conservation Reserve Enhancement Program

The USDA Conservation Reserve Enhancement Program (CREP) is an "enhancement" of the existing Farm Service Agency (FSA) CRP Continuous Signup. It has been "enhanced" by increasing the rental rates, and offering incentive payments to place the enrolled area under a 10-15-year contract. The average cost share

payment in this program is 75%; however, additional incentives are available to raise this rate if a landowner is willing to install additional control measures. Buffers consisting of native, warm-season grasses on cropland, and mixed hardwood trees on pasture, must be established in widths ranging from the minimum of 30% of the floodplain or 35 feet, whichever is greater, to a maximum average of 300 feet. Federal cost-sharing (50%) is available to help pay for fencing to exclude livestock from the riparian buffer, watering facilities, hardwood tree planting, filter strip establishment, and wetland restoration. The State of Virginia will make an additional payment to landowners who elect to place a perpetual easement on the enrolled area. *For more information:* https://www.fsa.usda.gov/Internet/FSA_File/va_crep_infosheet.pdf, accessed 5/15/2017.

12.13 USDA Environmental Quality Incentives Program

Approximately 65% of the USDA Environmental Quality Incentives Program (EQIP) funding for the state of Virginia is directed toward "Priority Areas." These areas are selected from proposals submitted by a locally led conservation work group. The remaining 35% of the funds are directed toward statewide priority concerns of environmental needs. EQIP offers up to 10-year contracts to landowners and farmers to provide financial assistance, and/or incentive payments to implement conservation practices and address the priority concerns statewide or in the priority area. Eligibility is limited to persons who are engaged in agricultural production. *For more information:* http://www.nrcs.usda.gov/wps/portal/nrcs/main/va/programs/financial/eqip/, accessed 5/15/2017.

12.14 USDA Regional Conservation Partnership Program

The USDA Regional Conservation Partnership Program (RCPP) is a five-year program that promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners. NRCS provides assistance to producers through partnership agreements and through program contracts or easement agreements. The RCPP competitively awards funds to conservation projects designed by local partners specifically for their region. Partners such as SWCDs and nonprofit organizations can then work with interested landowners to utilize these funds for BMP implementation. The Chesapeake Bay watershed is one of eight "Critical Conservation Areas" identified in this program. *For more information:* http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/farmbill/rcpp/?cid=stelprdb1254053, accessed 5/15/2017.

12.15 USDA Wildlife Habitat Incentive Program

The USDA Wildlife Habitat Incentive Program (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 ten-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: prescribed burning, converting fescue to warm season grasses, and creating habitat for waterfowl. *For more information:* http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/whip/, accessed 5/15/2017.

12.16 EPA Section 319 Grant Project Funds

Through Section 319 of the Federal CWA, Virginia is awarded grant funds to implement NPS programs. DEQ administers the money annually on a competitive grant basis to fund TMDL implementation projects, outreach and educational activities, water quality monitoring, and technical assistance for staff of local sponsor(s) coordinating implementation. In order to meet eligibility criteria established for 319 funding, all proposed project activities must be included in the TMDL IP covering the project area. In addition, this plan must include the nine

key elements of a watershed based plan (noted in **Section 2.1**). *For more information:* http://www.deq.virginia.gov/Programs/Water/CleanWaterFinancingAssistance/NonpointSourceFunding.aspx, accessed 5/15/2017.

12.17 EPA/VA Clean Water State Revolving Fund

The EPA awards grants to Virginia for its Clean Water Revolving Loan Funds (VCWRLF). The VCWRLF make loans for priority water quality activities throughout the Commonwealth. As recipients make payments, money is available for new loans to be issued to other recipients. Eligible projects include PS, NPS, and estuary protection projects. PS 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, silvicultural, rural, and some urban runoff control; on-site wastewater disposal systems (septic tanks); land conservation and riparian buffers; leaking underground storage tank remediation, etc. *For more information:* http://www.deq.virginia.gov/programs/water/cleanwaterfinancingassistance.aspx, accessed 5/15/2017.

12.18 Southeast Rural Community Assistance Project

The mission of the Southeast Rural Community Assistance Project (SER-CAP) 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. They can provide (at no cost): on-site technical assistance and consultation, operation and maintenance/management assistance, training, education, facilitation, volunteers, and financial assistance. Financial assistance includes $1,500 toward repair/replacement/ installation of a septic system and $2,000 toward repair/replacement/installation of an alternative waste treatment system. Funding is only available for families making less than 125% of the federal poverty level. *For more information:* http://www.sercap.org/se_loan_fund.htm, accessed 5/15/2017.

12.19 National Fish and Wildlife Foundation

The NFWF administers the Chesapeake Bay Stewardship Fund, which is dedicated to the protection and restoration of the Chesapeake Bay. The Stewardship Fun is supported through partnerships with government agencies and private corporations, and typically awards $8 million to $12 million per year through two competitive grant programs (Innovative Nutrient and Sediment Reduction Grants and Small Watershed Grants) and a technical assistance program. A request for proposals is typically issued in the spring and awards are made in the fall. *For more information:* http://www.nfwf.org/chesapeake/Pages/home.aspx, accessed 5/15/2017.

12.20 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 for the purpose of providing compensatory mitigation in advance of authorized impacts to similar resources. Mitigation banking is a commercial venture that provides compensation for aquatic resources. 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 state and federal agencies and chaired by DEQ and the Army Corps of Engineers. *For more information:* http://www.deq.virginia.gov/Programs/Water/WetlandsStreams/Mitigation.aspx, accessed 5/15/2017.

12.21 Additional Sources of Funding

Participants in the working group meetings also identified the following programs as additional potential sources of funding:

- Virginia Outdoors Foundation (VOF). *For more information:* http://www.virginiaoutdoorsfoundation.org/, accessed 5/15/2017.
- Virginia Nutrient Mitigation Bank Program. *For more information:* http://www.deq.virginia.gov/Programs/Water/PermittingCompliance/PollutionDischargeElimination/NutrientTrading.aspx/, accessed 5/15/2017.
- Community Development Fund of Northern Virginia (CFNOVA). *For more information:* http://www.cfnova.org, accessed 5/15/2017.
- U.S. Fish and Wildlife Service (FWS) Conservation Grant Program. *For more information:* https://www.fws.gov/grants/, accessed 5/15/2017.
- USDA Agricultural Conservation Easement Program. *For more information:* https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/acep/, accessed 5/15/2017.
- Trout Unlimited (TU). *For more information:* http://www.tu.org/connect/groups/9va-virginia, accessed 5/15/2017.
- Environmental Defense Fund (EDF). *For more information:* https://www.edf.org/, accessed 5/15/2017.
- Ducks Unlimited. *For more information:* http://www.ducks.org/, accessed 5/15/2017.
- Potomac Conservancy. *For more information:* https://potomac.org/mission-programs/, accessed 5/15/2017.

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Attachment A – Supplementary Information

Population by Sub-watershed

Table A-1. Population and households (HH) by sub-watershed for the years 2000 and 2014.

Sub-watershed	2000			2014 (Estimate)		
	Population	Avg HH Size	HH	Population	Avg HH Size	HH
Upper Goose Creek, Segment 210	272	2.36	115	238	2.48	96
Upper Goose Creek	2,349	2.48	947	2,495	2.45	1,003
Cromwells Run	805	2.40	335	657	2.47	266
Upper Little River	1,536	2.41	637	1,503	2.37	634
Little River	717	2.65	271	1,506	2.86	526
Total	5,679		2,305	6,363		2,525

Septic Systems by Sub-watershed

Table A-2. Number of households connected to sewer systems by sub-watershed for the year 2016.

Sub-watershed	Households on Sewer
Upper Goose Creek, Segment 210	0
Upper Goose Creek	169
Cromwells Run	61
Upper Little River	104
Little River	33
Total	367

Table A-3. Estimated number of septic systems by sub-watershed for the year 2002.

Sub-watershed	Number of Septic Systems	Number of Failing Systems	Number of Failing Systems < 50 feet from a Stream
Upper Goose Creek, Segment 210	117	6	1
Upper Goose Creek	947	47	5
Cromwells Run	335	17	2
Upper Little River	637	40	3
Little River	271	14	0
Total	2,307	124	11

Table A-4. Estimated number of septic systems by sub-watershed for the year 2014.

Sub-watershed	Number of Septic Systems	Number of Failing Systems
Upper Goose Creek Segment 2010	96	2
Upper Goose Creek	834	13
Cromwells Run	205	3
Upper Little River	530	8
Little River	493	8
Total	2,158	35

Table A-5. Septic system percent change between 2003 and 2014.

Sub-watershed	Septic Systems % Change	Failing Systems % Change
Upper Goose Creek, Segment 210	-18	-67
Upper Goose Creek	-11	-72
Cromwells Run	-39	-82
Upper Little River	-17	-70
Little River	82	-43
Total	-6	-72

Sub-watershed Land Use Comparisons

Table A-6. Upper Goose Creek land use comparison.

Land Use Type		1997 (Acres)	2011 (Acres)	Change (Acres)	% Change
Pervious	Forest	28,370	29,237	867	3
	Cropland	535	285	-250	-47
	Pasture	28,190	25,591	-2,599	-9
	Developed Pervious	449	2,507	2,058	458
Impervious	Developed Impervious	518	534	16	3
	Barren	93	0	-93	-100

Table A-7. Cromwells Run land use comparison.

Land Use Type		1997 (Acres)	2011 (Acres)	Change (Acres)	% Change
Pervious	Forest	3,217	3,334	117	4
	Cropland	23	0	-23	-100
	Pasture	8,653	8,110	-543	-6
	Developed Pervious	115	532	417	362
Impervious	Developed Impervious	72	112	40	56
	Barren	8	0	-8	-100

Table A-8. Little River land use comparison.

Land Use Type		1997 (Acres)	2011 (Acres)	Change (Acres)	% Change
Pervious	Forest	14,929	14,224	-705	-5
	Cropland	473	2,461	1,988	420
	Pasture	19,210	15,868	-3,342	-17
	Developed Pervious	357	2,225	1,868	523
Impervious	Developed Impervious	226	424	198	87
	Barren	9	1	-8	-85

Estimated Dog Population by Sub-watershed

Table A-9. Estimated dog populations and percent change by sub-watershed in the Goose Creek IP area. Households were calculated using census data from the years 2000 and 2014 for the TMDL and IP, respectively (USCB 2015; USCB 2012; USCB 2002). Average number of dogs per household were calculated using AVMA data (AVMA 2012) from the years 2002 and 2012 for the TMDL and IP, respectively.

Sub-watershed	TMDL (2003)		IP (2017)		% Change
	Households	Dog (#)	Households	Dog (#)	
Upper Goose Creek, Segment 210	115	62	96	56	-9
Upper Goose Creek	947	506	1,003	586	16
Cromwells Run	335	179	266	155	-13
Upper Little River	637	340	634	370	9
Little River	271	144	526	307	113
Total	2,305	1,230	2,525	1,474	20

Livestock Population by Sub-watershed

Table A-10. Livestock population comparison between 2002 and 2012.

Sub-watershed	Beef Cattle		Dairy Cattle		Sheep		Horses	
	2002	2012	2002	2012	2002	2012	2002	2012
Upper Goose Creek	6,042	6,345	17,808	12,267	2,862	1,974	1,431	1,269
Cromwells Run	1,862	2,025	5,488	3,915	882	630	441	405
Little River	2,790	3,164	3,162	1,017	2,511	2,825	744	1,017
Total	10,694	11,534	26,458	17,199	6,255	5,429	2,616	2,691

Table A-11. Livestock population percent change between 2002 and 2012.

Sub-watershed	Beef Cattle	Dairy Cattle	Sheep	Horses
Upper Goose Creek	5%	-31%	-31%	-11%
Cromwells Run	9%	-29%	-29%	-8%
Little River	13%	-68%	13%	37%
Total	8%	-35%	-13%	3%

Baseline and Allocated *E. coli* Loads by Sub-watershed

Table A-12. *E. coli* load allocation for Upper Goose Creek.

Source	Baseline Load (cfu/yr)	IP Allocated Load (cfu/yr)	IP Reduction
Forest	1.23E+12	1.23E+12	0%
Cropland	8.58E+10	2.15E+10	75%
Pasture	3.30E+14	8.25E+13	75%
Developed Land (without failing septic systems)	7.70E+10	1.93E+10	75%
Failing Septic Systems	1.16E+12	0	100%
Straight Pipes / Septic Systems within 50 ft of Surface Water	6.05E+04	0	100%
Direct Deposition from Cattle	1.11E+14	0	100%
Direct Deposition for Wildlife	9.56E+11	9.56E+11	0%
Total Load Allocation	4.44E+14	8.47E+13	81%

Table A-13. *E. coli* load allocation for Cromwells Run.

Source	Baseline Load (cfu/yr)	IP Allocated Load (cfu/yr)	IP Reduction
Forest	1.60E+12	1.60E+12	0%
Cropland	1.40E+10	3.50E+09	75%
Pasture	8.80E+13	2.20E+13	75%
Developed Land (without failing septic systems)	3.73E+10	9.33E+09	75%
Failing Septic Systems	5.38E+11	0	100%
Straight Pipes / Septic Systems within 50 ft of Surface Water	2.82E+05	0	100%
Direct Deposition from Cattle	9.28E+12	0	100%
Direct Deposition for Wildlife	4.98E+11	4.98E+11	0%
Total Load Allocation	9.99E+13	2.41E+13	76%

Table A-14. *E. coli* load allocation for Little River.

Source	Baseline Load (cfu/yr)	IP Allocated Load (cfu/yr)	IP Reduction
Forest	2.78E+12	2.78E+12	0%
Cropland	3.37E+11	8.43E+10	75%
Pasture	4.94E+14	1.24E+14	75%
Developed Land (without failing septic systems)	1.61E+11	4.03E+10	75%
Failing Septic Systems	2.39E+12	0	100%
Straight Pipes / Septic Systems within 50 ft of Surface Water	3.42E+05	0	100%
Direct Deposition from Cattle	5.51E+13	0	100%
Direct Deposition for Wildlife	1.33E+12	1.33E+12	0%
Total Load Allocation	5.56E+14	1.28E+14	77%

Updated Water Quality Monitoring Information

Table A-15. Comparison of bacteria water quality standard violations pre-TMDLs (before 2003) and present (2013-April 2016). Raw data provided in **E. coli*, ***fecal coliform, or +both. Cells with "-" denote no samples were taken, "0" denotes no samples were in violation of water quality standards.

Station ID	Sub-watershed	Pre-TMDL (Before 2003)		Present (2013-April 2016)	
		Number of Samples	Number of Samples in Violation	Number of Samples	Number of Samples in Violation
1ACRM001.20	Cromwells Run	42**	17	15*	3
1AGAR002.24	Upper Goose Creek	5**	3	9*	4
1AGOO036.61	Upper Goose Creek	2**	0	12*	2
1AGOO039.63	Upper Goose Creek	-	-	1*	0
1AGOO044.36	Upper Goose Creek	136**	43	19*	3
1ALIV004.78	Little River	46+	25	12*	3
1ALIV004.79	Little River	-	-	1*	1
1ALIV012.12	Little River	1**	0	12*	5

Table A-16. Comparison of bacteria water quality standard violation rates pre-TMDLs (before 2003) and present (2013-April 2016). Cells with "-" denote no samples were collected, "0" denotes no samples were in violation of water quality standards.

Station ID	Sub-watershed	Pre-TMDL (Before 2003)	Present (2013-April 2016)
		Violation Rate	Violation Rate
1ACRM001.20	Cromwells Run	40%	20%
1AGAR002.24	Upper Goose Creek	60%	44%
1AGOO036.61	Upper Goose Creek	0%	17%
1AGOO039.63	Upper Goose Creek	-	0%
1AGOO044.36	Upper Goose Creek	32%	16%
1ALIV004.78	Little River	54%	25%
1ALIV004.79	Little River	-	100%
1ALIV012.12	Little River	0%	42%

Table A-17. DEQ water quality assessment (2014), DEQ and citizen monitoring stations.

IP Sub-watershed	HUC12 Name (Code)	Water Name	VAHU6	2014IR DEQ Assessment Unit ID	2014IR Impairment Length (miles)	2014IR Impairment Length Description	2014IR Citizen Monitoring Station (DEQ Station Name)	2014IR DEQ Listing Station	2014IR: Recreation Use
Little River	Little River (020700080701)	Bartons Creek		VAN-A08R_BAO01A06	4.81	headwaters downstream to confluence with Little River	16 (1aBAO-16-SOS)	---	Observed effect**
		Howsers Branch		VAN-A08R_HOW01A08‡	5.10	headwaters downstream to confluence with Little River	---	1aHOW003.68	Impaired
		Hungry Run		VAN-A08R_HUN01A06	6.23	headwaters downstream to confluence with Little River (rivermile 6.25)	17 (1AHUN-17a-SOS)	---	Observed effect**
		Little River	PL13	VAN-A08R_LIV02A06‡	2.48	confluence with UT* downstream to confluence with Hungry Run (~1.5 rivermiles upstream from Route 50 near Aldie)	---	1aLIV006.92	Impaired
				VAN-A08R_LIV01A00	6.41	confluence with Hungry Run (~1.5 rivermiles upstream from Route 50 near Aldie) downstream to confluence with Goose Creek	--	1aLIV001.70 1aLIV004.78 1aLIV004.79	Fully Supporting (delisted 2010)
				VAN-A08R_LIV02B10	4.36	confluence with Bartons Creek downstream to confluence with UT	--	1aLIV012.12	Fully Supporting
				VAN-A08R_LIV03A06	5.86	confluence with UT* to Little River (~0.6 rivermile upstream from the Route 705 crossing) downstream to confluence with Bartons Creek	12 (1aLIV-12-SOS)	---	Observed effect**
							23 (1aLIV-23-SOS)	---	Observed effect**
Cromwells Run	Cromwells Run (020700080504)	Cromwells Run, UT*		VAN-A05R_XMI01A12	4.11	headwaters downstream to confluence with Cromwells Run	14 (1aXMI-14-SOS)	---	Observed effect**
		Cromwells Run	PL09	VAN-A05R_CRM02A06‡	6.76	headwaters downstream to confluence with UT* XMI (at rivermile 4.61)	15 (1aCRM-15A-SOS)	1aCRM005.39	Impaired
				VAN-A05R_CRM01A00†	3.81	confluence with UT* to Cromwells Run (~0.78 rivermile downstream from Route 715) downstream to confluence with Rocky Creek (~0.4 rivermile downstream from Route 50)	---	1aCRM001.20	Impaired
Upper Goose Creek	Goose Creek-Mitchell Branch (020700080501)	Goose Creek, UT*		VAN-A04R_GOO01B00‡	4.31	confluence with Kettle Run downstream to confluence with Bolling Branch	5 (1aGOO-5-SOS)	1aGOO044.36	Impaired
				VAN-A04R_XLW01A14‡	5.91	headwaters downstream to the confluence with Goose Creek (at rivermile 45.10)	---	1aXLW000.75	Impaired
		Goose Creek	PL06	VAN-A04R_GOO02A04	8.11	headwaters downstream to confluence with Kettle Run	6 (1aGOO-6-SOS)	---	Observed effect**
							7 (1aGOO-7-SOS)	---	Observed effect**

IP Sub-watershed	HUC12 Name (Code)	Water Name	VAHU6	2014IR DEQ Assessment Unit ID	2014IR Impairment Length (miles)	2014IR Impairment Length Description	2014IR Citizen Monitoring Station (DEQ Station Name)	2014IR DEQ Listing Station	2014IR: Recreation Use
Upper Goose Creek	Goose Creek-Crooked Run- Gap Run (0207000805)	Gap Run	PL07	VAN-A04R_ GAR01A04‡	3.21	confluence with a UT* to Gap Run (just downstream from Route 712) downstream to confluence with Goose Creek	8 (1aGAR-8-SOS)	1aGAR002.24	Impaired
		Bolling Branch		VAN-A04R_ BOL01A04‡	3.64	confluence with UT* to Bolling Branch (just upstream from Route 723) downstream to confluence with Goose Creek	9 (1aBOL-9-SOS) 18 (1aBOL-18-SOS)	1aBOL000.05	Impaired
		Crooked Run		VAN-A04R_ CRA01A04‡	1.85	confluence with a UT* to Crooked Run (just downstream from Route 724) downstream to confluence with Goose Creek	---	1aCRA000.42	Impaired
				VAN-A04R_ CRA02A08	3.58	confluence UT* to Crooked Run (rivermile 5.23) downstream to confluence with another UT* to Crooked Run (just downstream from Route 724)	10 (1aCRA-10-SOS)	---	Observed effect**
		Goose Creek		VAN-A04R_ GOO01A08	3.51	confluence with Bolling Branch downstream to confluence with Gap Run	4 (1aGOO-4-SOS)	---	Observed effect**
		Goose Creek	PL07	VAN-A05R_ GOO02B06‡	2.68	confluence with UT* to Goose Creek (rivermile 35.28) downstream to confluence with Panther Skin Creek	2 (1aGOO-2-SOS)	1aGOO034.20	Impaired
				VAN-A05R_ GOO02C04	3.27	confluence with Gap Run downstream to confluence with UT* to Goose Creek (rivermile 35.28)	3 (1aGOO-3-SOS)	1AGOO036.61	Observed effect**
				VAN-A05R_ GOO02C04	3.27	confluence with Gap Run downstream to confluence with UT* to Goose Creek (rivermile 35.28)	11 (1aGOO-11-SOS)	1AGOO036.61	Observed effect**

†Assessment unit impaired at the time of TMDL development
‡Assessment unit impaired after TMDL development
*UT: unnamed tributary
**Insufficient information with an observed effect for bacteria

Summary of Management Measures

Table A-18. Summary of management measures, average unit cost, and bacteria reduction efficiency.

Control Measure	Unit	Average Unit Cost ($)	Reduction Efficiency (%)
Livestock Exclusion			
Livestock Exclusion System (CREP, CRSL-6)	System	18,000	50 (100)[1]
Livestock Exclusion System (EQIP)	System	15,000	50 (100)[1]
Stream Exclusion with Grazing Land Management (SL-6)	System	36,000	50 (100)[1]
Livestock Exclusion with Riparian Buffers (LE-1T)	System	36,000	50 (100)[1]
Livestock Exclusion with Reduced Setback (LE-2 / LE-2T)	System	12,000	50 (100)[1]
Stream Exclusion (CCI-SE-1)	Linear Feet	1	(100)[1]
Stream Protection (WP-2 / WP-2T)	System	2,500	50 (100)[1]
Pasture and Cropland			
Reforestation of Erodible Cropland and Pastureland (FR-1)	Acres	450	99
Woodland Filter Buffer Area (FR-3)	Acres	1,500	40
Streambank Stabilization (WP-2A)	Linear Feet	150	N/A
Grazing Land Management (SL-9)	Acres	165	50
Pasture Management for TMDL Implementation (SL-10T / EQIP 528)	Acres	75	50
Permanent Vegetative Cover on Critical Areas (SL-11)	Acres	2,440	99
Conservation Tillage (SL-15A)	Acres	100	61
Cover Crops (SL-8B)	Acres	50	20
Grass Riparian Buffers (WQ-1)	Acres	165	40
Support for Extension of CREP Watering Systems (SL-7)	System	TBD	50
Sediment Retention, Erosion, or Water Control Structure (WP-1)	Drainage Area (acres)	870	75
Permanent Vegetative Cover on Cropland (SL-1)	Acres	175	75
Forage and Biomass Planting (EQIP – 512)	Acres	TBD	75
Equine			
Community Manure Composting Facility	System	215,000	80
Equine Manure Storage / Composting	System	1,200	80
Barnyard Runoff Controls	System	20,000	100
Small Acreage Grazing Systems (SL-6AT)	System	9,000	100
On-Site Sewage Disposal Systems			
Septic Tank Pump-out (RB-1)	System	300	10
Septic Connection to Public Sewer System (RB-2)	System	12,500	100
Septic System Repair (RB-3)	System	3,500	100
Septic System Installation / Replacement (RB-4)	System	6,000	100
Septic System Installation / Replacement with Pump (RB-4P)	System	8,000	100
Alternative On-Site Systems (RB-5)	System	25,000	100
Pet Waste Management			
Pet Waste Stations	System	500	75
Pet Waste Composters	System	50	100

Control Measure	Unit	Average	Reduction
Confined Canine Unit (CCU)	System	6,000 – 20,000	100
Pet Waste Education	Program	5,000	70
Stormwater Management			
Vegetative Riparian Buffers (Residential)	Drainage Area (acres)	3,500	40
Rain Barrels	System	150	90
Redirecting Residential Downspouts	Roof Area	100	70
Porous Pavement	Area Treated (sq ft)	7.5	50
Rain Gardens	Area Treated (sq ft)	4	70
Infiltration Trench	Area Treated (acres)	11,300	90
Education and Outreach			
Septic System Education	Program	2,500	N/A
Septic System Education for Area Realtors	Program	625	N/A
Work with Local School District to Incorporate Water-Related Curriculum into the Classroom	Program	1,000	N/A
Organize Field Trips to Demonstrate Water Quality BMPs for Students	Program	1,000	N/A
Organize a “Farm Day” Event with Local Landowners to Demonstrate Agricultural BMPs	Program	1,000	N/A
Distribute Education Materials at the Farmer’s Market	Program	625	N/A
Horse Pasture Management Education	Program	2,500	N/A
Technical Assistance			
Agricultural and Residential	Full time Equivalent	50,000 / yr	N/A

[1] Direct load reduction efficiency in parenthesis

Management Measures by Implementation Phase and Cost

Table A-19. Management measure by implementation phase.

Control Measure	Upper Goose Creek	Cromwells Run	Little River
Livestock Exclusion			
Livestock Exclusion System (CREP, CRSL-6)	I & II	I & II	I & II
Livestock Exclusion System (EQIP)	I & II	I & II	I & II
Stream Exclusion with Grazing Land Management (SL-6)	I & II	I & II	I & II
Livestock Exclusion with Riparian Buffers (LE-1T)	I & II	I & II	I & II
Livestock Exclusion with Reduced Setback (LE-2 / LE-2T)	I & II	I & II	I & II
Stream Exclusion (CCI-SE-1)	I & II	I & II	I & II
Stream Protection (WP-2 / WP-2T)	I	I	I
Pasture and Cropland			
Reforestation of Erodible Cropland and Pastureland (FR-1)	I & II	N/A	I & II
Woodland Filter Buffer Area (FR-3)	I	N/A	N/A
Streambank Stabilization (WP-2A)	I & II	I & II	I & II
Grazing Land Management (SL-9)	I & II	I & II	I & II
Pasture Management for TMDL Implementation (SL-10T / EQIP 528)	I & II	I & II	I & II
Permanent Vegetative Cover on Critical Areas (SL-11)	I & II	N/A	I & II
Conservation Tillage (SL-15A)	I	I	N/A
Cover Crops (SL-8B)	I	I	N/A
Grass Riparian Buffers (WQ-1)	I	I	N/A
Support for Extension of CREP/EQIP Watering Systems (SL-7)	I & II	I & II	N/A
Sediment Retention, Erosion, or Water Control Structure (WP-1)	I & II	I & II	I & II
Permanent Vegetative Cover on Cropland (SL-1)	I	I	I
Forage and Biomass Planting (EQIP – 512)	I	I	I
Equine			
Community Manure Composting Facility	I & II	I & II	I & II
Equine Manure Storage / Composting	I & II	I & II	I & II
Barnyard Runoff Controls	I & II	I & II	I & II
Small Acreage Grazing Systems (SL-6AT)	I & II	I & II	I & II
On-Site Sewage Disposal Systems			
Septic Tank Pump-out (RB-1)	I & II	I & II	I & II
Septic Connection to Public Sewer System (RB-2)	N/A	N/A	I & II
Septic System Repair (RB-3)	I & II	I & II	I & II
Septic System Installation / Replacement (RB-4)	I & II	I & II	I & II
Septic System Installation / Replacement with Pump (RB-4P)	I & II	I & II	I & II
Alternative On-Site Systems (RB-5)	I & II	I & II	I & II
Pet Waste Management			
Pet Waste Stations	I	I	I
Pet Waste Composters	I	I	I
Confined Canine Unit (CCU)	I	I	I

Control Measure	Upper	Cromwells	Little
Pet Waste Education	I & II	I & II	I & II
Stormwater Management			
Vegetative Riparian Buffers (Residential)	I	I	I
Rain Barrels	I	I	I
Redirecting Residential Downspouts	I	I	I
Porous Pavement	I	I	I
Rain Gardens	I	I	I
Infiltration Trench	TBD	TBD	TBD
Education and Outreach			
Septic System Education	I & II	I & II	I & II
Septic System Education for Area Realtors	I & II	I & II	I & II
Work with Local School District to Incorporate Water-Related Curriculum into the Classroom	I & II	I & II	I & II
Organize Field Trips to Demonstrate Water Quality BMPs for Students	I & II	I & II	I & II
Organize a "Farm Day" Event with Local Landowners to Demonstrate Agricultural BMPs	I & II	I & II	I & II
Distribute Education Materials at the Farmer's Market	I & II	I & II	I & II
Horse Pasture Management Education	I & II	I & II	I & II
Technical Assistance			
Agricultural and Residential	I & II	I & II	I & II

Table A-20. Cost breakdown by implementation phase.

Control Measure	Phase I Cost ($)	Phase II Cost ($)	Total ($)
Livestock Exclusion			
Livestock Exclusion System (CREP, CRSL-6)	288,000	180,000	468,000
Livestock Exclusion System (EQIP)	225,000	135,000	360,000
Stream Exclusion with Grazing Land Management (SL-6)	1,008,000	756,000	1,764,000
Livestock Exclusion with Riparian Buffers (LE-1T)	1,620,000	1,008,000	2,628,000
Livestock Exclusion with Reduced Setback (LE-2 / LE-2T)	276,000	180,000	456,000
Stream Exclusion (CCI-SE-1)	75,629	50,419	126,048
Stream Protection (WP-2 / WP-2T)	15,000	--	15,000
Total ($), Livestock Exclusion	**3,507,629**	**2,309,419**	**5,817,048**
Pasture and Cropland			
Reforestation of Erodible Cropland and Pastureland (FR-1)	405,000	945,000	1,350,000
Woodland Filter Buffer Area (FR-3)	15,000	--	15,000
Streambank Stabilization (WP-2A)	9,600	5,250	14,850
Grazing Land Management (SL-9)	441,540	335,610	777,150
Pasture Management for TMDL Implementation (SL-10T / EQIP 528)	236,550	138,825	375,375
Permanent Vegetative Cover on Critical Areas (SL-11)	439,200	1,024,800	1,464,000
Conservation Tillage (SL-15A)	10,100	--	10,100
Cover Crops (SL-8B)	5,050	--	5,050
Grass Riparian Buffers (WQ-1)	1,650	--	1,650
Support for Extension of CREP Watering Systems (SL-7)	TBD	TBD	TBD
Sediment Retention, Erosion, or Water Control Structure (WP-1)	823,890	2,469,930	3,293,820
Permanent Vegetative Cover on Cropland (SL-1)	5,250	--	5,250
Forage and Biomass Planting (EQIP – 512)	TBD	--	TBD
Total ($), Pasture and Cropland*	**2,392,830**	**4,919,415**	**7,312,245**
Equine			
Community Manure Composting Facility	430,000	215,000	645,000
Equine Manure Storage / Composting	255,600	132,000	387,600
Barnyard Runoff Controls	1,400,000	720,000	2,120,000
Small Acreage Grazing Systems (SL-6AT)	360,000	180,000	540,000
Total ($), Equine	2,445,600	1,247,000	3,692,600
On-Site Sewage Disposal Systems			
Septic Tank Pump-out (RB-1)	1,294,800	647,400	1,942,200
Septic Connection to Public Sewer System (RB-2)	212,500	50,000	262,500
Septic System Repair (RB-3)	934,500	483,000	1,417,500
Septic System Installation / Replacement (RB-4)	144,000	72,000	216,000
Septic System Installation / Replacement with Pump (RB-4P)	240,000	120,000	360,000
Alternative On-Site Systems (RB-5)	425,000	175,000	600,000
Total ($), On-Site Sewage Disposal Systems	**3,250,800**	**1,547,400**	**4,798,200**

Control Measure	Phase I	Phase II	Total
Pet Waste Management			
Pet Waste Stations	5,000	--	5,000
Pet Waste Composters	1,200	--	1,200
Confined Canine Unit (CCU)	100,000	--	100,000
Pet Waste Education	10,000	5,000	15,000
Total ($), Pet Waste Management	**116,200**	**5,000**	**121,200**
Stormwater Management			
Vegetative Riparian Buffers (Residential)	71,750	--	71,750
Rain Barrels	450	--	450
Redirecting Residential Downspouts	150	--	150
Porous Pavement	7,500	--	7,500
Rain Gardens	4,000	--	4,000
Infiltration Trench	TBD	TBD	TBD
Total ($), Stormwater Management*	**83,850**	**0**	**83,850**
Education and Outreach			
Septic System Education	3,750	3,750	7,500
Septic System Education for Area Realtors	937.5	937.5	1,875
Work with Local School District to Incorporate Water-Related Curriculum into the Classroom	1,500	1,500	3,000
Organize Field Trips to Demonstrate Water Quality BMPs for Students	1,500	1,500	3,000
Organize a “Farm Day” Event with Local Landowners to Demonstrate Agricultural BMPs	1,500	1,500	3,000
Distribute Education Materials at the Farmer’s Market	937.5	937.5	1,875
Horse Pasture Management Education	3,750	3,750	7,500
Total ($), Education and Outreach	**13,875**	**13,875**	**27,750**
Technical Assistance			
Agricultural and Residential	**500,000**	**250,000**	**750,000**
Total ($)	**12,310,784**	**10,292,109**	**22,602,893**

*These costs do not include estimates for TBD categories.

Table A-21. Number of management measure units per phase by sub-watershed and exceedance rates by implementation phase.

Control Measure	Upper Goose Creek		Cromwells Run		Little River		Total	
	Phase I Units	Phase II Units	Phase I Units	Phase II Units	Phase I Units	Phase II Units	Phase I Units	Phase II Units
Livestock Exclusion								
Livestock Exclusion System (CREP, CRSL-6)	11	7	4	2	1	1	16	10
Livestock Exclusion System (EQIP)	11	7	3	1	1	1	15	9
Stream Exclusion with Grazing Land Management (SL-6)	16	12	6	4	6	5	28	21
Livestock Exclusion with Riparian Buffers (LE-1T)	26	16	9	6	10	6	45	28
Livestock Exclusion with Reduced Setback (LE-2 / LE-2T)	13	9	5	3	5	3	23	15
Stream Exclusion (CCI-SE-1)	28,361	18,907	14,180	9,454	33,088	22,058	75,629	50,419
Stream Protection (WP-2 / WP-2T)	3	--	1	--	2	--	6	--
Pasture and Cropland								
Reforestation of Erodible Cropland and Pastureland (FR-1)	780	1,820	--	--	120	280	900	2,100
Woodland Filter Buffer Area (FR-3)	10	--	--	--	--	--	10	--
Streambank Stabilization (WP-2A)	21	12	21	12	21	12	63	36
Grazing Land Management (SL-9)	2,284	1,726	259	203	133	105	2,676	2,034
Pasture Management for TMDL Implementation (SL-10T / EQIP 528)	2,377	1,396	277	162	500	293	3,154	1,851
Permanent Vegetative Cover on Critical Areas (SL-11)	156	364	--	--	24	56	180	420
Conservation Tillage (SL-15A)	77	--	24	--	--	--	101	--
Cover Crops (SL-8B)	77	--	24	--	--	--	101	--
Grass Riparian Buffers (WQ-1)	5	--	5	--	--	--	10	--
Support for Extension of CREP Watering Systems (SL-7)	5	3	4	3	--	--	9	6
Sediment Retention, Erosion, or Water Control Structure (WP-1)	938	2,812	--	--	9	27	947	2,839
Permanent Vegetative Cover on Cropland (SL-1)	10	--	10	--	10	--	30	--
Forage and Biomass Planting (EQIP - 512)	5	--	5	--	5	--	15	--
Equine								
Community Manure Composting Facility	--	1	1	--	1	--	2	1
Equine Manure Storage / Composting	100	52	32	17	81	41	213	110
Barnyard Runoff Controls	33	17	11	5	26	14	70	36
Small Acreage Grazing Systems (SL-6AT)	20	10	10	5	10	5	40	20

Control Measure		Upper Goose Creek		Cromwells Run		Little River		Total	
		Phase I Units	Phase II Units	Phase I Units	Phase II Units	Phase I Units	Phase II Units	Phase I Units	Phase II Units
On-Site Sewage Disposal Systems									
Septic Tank Pump-out (RB-1)		1,860	930	410	205	2,046	1,023	4,316	2,158
Septic Connection to Public Sewer System (RB-2)		--	--	--	--	17	4	17	4
Septic System Repair (RB-3)		124	64	6	3	137	71	267	138
Septic System Installation / Replacement (RB-4)		8	4	8	4	8	4	24	12
Septic System Installation / Replacement with Pump (RB-4P)		10	5	10	5	10	5	30	15
Alternative On-Site Systems (RB-5)		7	3	3	1	7	3	17	7
Pet Waste Management									
Pet Waste Stations		2	--	4	--	4	--	10	--
Pet Waste Composters		8	--	8	--	8	--	24	--
Confined Canine Unit (CCU)		1	--	2	--	2	--	5	--
Pet Waste Education		0.5	0.5	0.5	0.5	0.5	0.5	2	2
Stormwater Management									
Vegetative Riparian Buffers (Residential)		--	--	--	--	20.5	--	20.5	--
Rain Barrels		1	--	1	--	1	--	3	--
Redirecting Residential Downspouts		0.6	--	0.2	--	0.7	--	1.5	--
Porous Pavement		250	--	250	--	500	--	1,000	--
Rain Gardens		250	--	250	--	500	--	1,000	--
Infiltration Trench		TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Exceedance Rate (%)									
DEQ Monitoring Station		1AGAR002.24		1ACRM001.20		1ALIV004.78			
Maximum Assessment Criterion Exceedance Rate (%) of 235 cfu/100 mL	Pre-TMDL (before 2003)	60		40		54			
	Present (2013-April 2016)	44		20		25			
	IP Phase I	12		7		13			
	IP Phase II	<10.5		<10.5		<10.5			
Geometric Mean Bacteria Standard Exceedance Rate (%) of 126 cfu/100 mL	IP Phase II	0		0		0			

Note: The TMDL model indicates that the maximum assessment criterion exceedance rates of less than 10.5% and geometric mean bacteria standard exceedance rates of 0% will be achieved under Scenario 9 for all segments modeled under the original impairments. Phase 1 exceedance rates are calculated based on percent implementation expected to be complete by the end of the phase.

Note: Education and outreach and technical assistance categories are not included in this table as they are expected to proceed continuously throughout implementation.

Attachment B – First Public Meeting Comments and Responses

Summary of Public Comments following the First Public Meeting
(June 21, 2016) and Staff Responses

Total Maximum Daily Load Implementation Plan Report for the Upper Goose Creek Watershed

August 21, 2017

Two written comments were received by DEQ following the June 21, 2016 first public meeting for the draft UGC TMDL IP. The substantive issues raised in these comments are presented below followed by STAFF's response. A copy of the full comments follows in **Attachment C**.

Commenter 1: Jeff Sledjeski, Upper Goose Creek watershed resident

Comment 1 - Private Citizen: *Mr. Sledjeski asked that the meeting record identify him as a watershed resident, and not a representative of his employer.*

Staff Response: This correction has been made.

Comment 2 - Workgroups: *Mr. Sledjeski recommended that there be a single workgroup for Agriculture and Residential interests, given the relatively few residential developments in the plan area.*

Staff Response: The initial Agricultural and Residential workgroup meetings were held in separate breakout groups immediately following the first public meeting (on June 16, 2016). The second/final workgroup meetings were held sequentially on the same date (Sept. 22, 2016), so that those attending could participate in all discussions.

Comment 3 - Septic Systems: *Mr. Sledjeski shared his view that the Chesapeake Bay Watershed Implementation Plan (WIP) call for a 50% reduction in nitrogen output from on-site septic systems can only be achieved through use of alternative onsite septic systems, and they should either be required by legislation or the WIP should be amended to admit the nitrogen reduction goal for septic cannot be achieved with use of conventional onsite septic systems.*

Staff Response: This comment has been shared with DEQ's Chesapeake Bay office, and will be considered during development of the Phase 3 Watershed Implementation Plan for the Bay TMDL over the next year. In addition, it is noted that this implementation plan is focused on addressing the bacteria impairments within the Upper Goose Creek watershed, and does not specifically address nutrient and other pollutants that are the focus of the Chesapeake Bay TMDL and WIP.

Comment 4 - Agricultural Erosion, Sediments and Stormwater Controls: *Mr. Sledjeski noted the high cost of residential property development stormwater, erosion and sediment controls, and observed that the amount of pollutant reductions they provide is trivial in comparison to the pollutant loadings contributed by agricultural activities. He commented that it is time to rethink the exemptions given to agriculture from erosion and sediments controls and stormwater management.*

Staff Response: The concern raised is not within the scope or purview of the TMDL IP development process, which is based on current statutes, policies and regulations. Legislative authorization would be needed to modify current regulatory requirements in the manner advocated.

Comment 5 - Wire Mesh Fencing: *Mr. Sledjeski commented that he has observed wire mesh fencing extending to the ground used in livestock exclusion fencing at the PEC's Gilbert's Corner demonstration farm, and in areas nearby his residence. He recommended that when used, a 1-2 foot gap be left above the ground to allow for movement of small animals.*

Staff Response: This comment has also been shared with a representative of PEC. DEQ staff has discussed the use of wire mesh fencing with DCR, and understands it is generally considered undesirable for use in livestock exclusion fencing in areas prone to flooding, as many riparian buffer areas are (open wiring that doesn't trap debris is best used in such areas). Staff also raised this concern to the attention of the local NRCS and SWCD leads in the Upper Goose Creek plan area. They do not share the commenter's perspective that wire mesh fencing is commonly or increasingly used for livestock exclusion purposes, but appreciated this concern being raised to their attention. When wire mesh is used, the JMSWCD recommends use of short width woven wire fence to allow 10-12 inches for animals to pass under. The LSWCD observed that for sheep producers who have trouble with dogs and coyotes, keeping the fence very close to the ground is appropriate as a deterrent for predators and to keep lambs from getting under the fence.

Comment 6 - Reduced Set-back Requirements: *Mr. Sledjeski raised concern with a proposed decrease in setback requirements for livestock exclusion fencing.*

Staff Response: There is no proposed reduction in setback requirements. Existing cost-share program BMPs allow for both standard 35' setback fencing, at a 70% cost-share rate, and a reduced 15' setback, at a 50% cost-share rate. Standard fencing is preferred as it provides greater bacteria runoff reductions, but where a producer is not willing to decrease pasture size by the amount needed to create a 35' buffer, the lower cost-share option for a 15' buffer is preferable to allowing free access of livestock to streams.

Comment 7 - Septic System Maintenance: *Mr. Sledjeski observed that many septic system owners are not knowledgeable of and attentive to the operation and maintenance (O&M) requirements of their septic systems. He recommended that at the time of land transfers, owners should be required to sign a notarized statement acknowledging their sole responsibility for septic system O&M with the local health district. Health districts would keep these on file and send annual reminder postcards to all septic system owners.*

Staff Response: DEQ staff discussed this comment with Loudoun Water, as local governments have the authority to address this recommendation. Loudoun County has a very active septic system oversight program, and requires conventional septic system owners to certify that they have pumped out their system every five years. If certifications are not received, reminders are sent and fines may be assessed. Similarly, owners of alternative septic systems are required to certify they have had their system inspected annually, and Loudoun Water notifies and may fine owners who do not comply with this requirement. DEQ recommends the commenter contact the VDH, who has state-wide responsibility for public health and environmental issues associated with the use of septic systems.

Comment 8 - Stormwater Management/Rain Barrels: *Mr. Sledjeski commented that a 1000 square foot roof generates 600 gallons of stormwater in a 1" rainstorm, and that use of 55 gallon rain barrels is not a meaningful way to address residential stormwater, and more effective measures (rain harvesting and vegetative roofs) are too expensive for residential uses. He concluded that no discussion of stormwater was warranted in the UGC IP, since rural and agricultural areas are exempt from stormwater management requirements.*

Staff Response: Including a modest suite of stormwater management measures in the plan can raise awareness of the benefits of effectively managing stormwater runoff. The measures recommended in the plan represent less than 0.5% of the total estimated cost of the UGC IP control measures. The potential benefits of increased environmental awareness and voluntary improvements in stormwater management are worth this modest investment.

Comment 9 – Ban on Horses and Cattle from Floodplains: *Mr. Sledjeski expressed concern that residential stormwater requirements are extremely expensive and provide small incremental benefits in pollutant reductions, while agricultural producers are the dominant source of nutrient and bacteria pollutants, yet have little or no pollutant reduction requirements. Mr. Sledjeski suggested that as a starting point, there should be a ban on all horses and cattle from floodplains, and that a setback should be required from perennial streams.*

Staff Response: The concern raised is not within the scope or purview of the TMDL IP development process, which is based on current statutes, policies and regulations. Changes of the nature recommended would require action by the legislature.

Commenter #2: Lynn Crump, Virginia Department of Conservation and Recreation

Comment: *Ms. Crump had been asked to comment on a report on a Goose Creek water withdrawal increase, since it is a Virginia Scenic River. She asked if there was a connection to the water withdrawal permit and the UGC IP process, and commented that the water quality chemical and biologic concerns would increase if the amount of water in the creek went down.*

Staff Response: The DEQ Office of Water Supply is aware of the concerns over the Goose Creek withdrawals and previously commented on this particular matter.

There is little, if any connection between the Upper Goose Creek Implementation Plan project area and the water withdrawal issue in Goose Creek, for the following reasons:

1. The Goose Creek IP project is located in different sub-watersheds from the water withdrawal. The farthest downstream point for the IP project is where the Little River enters the Goose Creek main stem, and the reservoir is ~6-7 miles downstream of their confluence.
2. Downstream withdrawals should not affect the IP project's projected flows or bacteria loads. The model used to simulate flow is sequential - flow starts upstream moving from headwaters to downstream. Withdrawal effects won't be seen until the point of withdrawal and downstream of that point and therefore do not change the results of modeled loads.

Should an Implementation Plan be developed for the lower portions of the Goose Creek watershed in the future, the matter of withdrawals of water from the overall system will be important to consider at that time.

Attachment C – First Public Meeting Comment Letters

Jeff Sledjeski
6308 Herringdon Road
The Plains, VA 20198
July 4, 2016

Comments on Upper Goose Creek, Cromwells Run, and
Little River Implementation Plan Public Meeting

I enjoyed participating in the meeting and have some comments to make on the discussions.

I would like to correct the record that has me listed as attending as a representative of Soil Tech, Inc. In this case I am attending as a resident of this Implementation Plan area. All my comments and opinions are my own and are not meant to be representative of my company.

Working Groups –

It is my opinion that there should be 1 Working Group for this IP area. There are relatively few traditional residential developments and those that do exist are newer and already comply with the Chesapeake Bay Act. The rest of the residents are living on land zoned Agricultural and have the same issues as the actual farmers. The pet waste issue is not a major issue here, unless you are talking about pet horses and cattle.

Septic Systems –

I was disappointed that there were no representatives from the Loudoun and Fauquier Dept. of Environmental Health. Their input would have been very helpful.

The Chesapeake Bay Watershed Implementation Plan calls for a 50% reduction in Nitrogen output from onsite septic systems. This can only be achieved thru use of Alternative Onsite Septic Systems. If legislation does not address this, then we either need to amend the WIP or just admit that the reduction will never be met as long as there are Conventional Onsite Septic Systems.

Agriculture and Stormwater Management –

Due to the Chesapeake Bay Preservation Act, there have been historic changes over the last couple of years in the enforcement of stormwater management in Virginia. The biggest has been the requirement for SWM for all individual small scale (1/2 acre of less) residential projects. This has added thousands of properties in suburban and urban areas. Based on my company's work, these requirements have added $20,000 - $40,000 or more to the cost of new home construction or any major remodeling project. This cost mitigates 2 – 3 ounces of phosphorus per year that is calculated to be produced for the residence. In Mr. Jennings excellent presentation, he notes that a single steer produces 60 lbs. of manure a day. Using the most conservative value I could find this results in 2 – 3 ounces of phosphorus per day being produced by a single steer or horse.

I doubt any residential property owner would be content to being forced to pay ten of thousands of dollars for their yearly discharge of a pollutant into the Bay while at the same time that an agricultural property owner not only does not have to pay anything but instead get rewarded with cost sharing and tax breaks for adding an equivalent amount of pollutant in a day per animal to the Bay.

My point is that I believe the time has come to rethink the exemptions given to agriculture from erosion and sediments controls and stormwater management or at least redefine what the practice of agriculture is. I am under no illusions that this would be simple; there are many well-funded special interest groups who would oppose any regulations that would impact their members. But at least the conversation can be started.

Jeff Sledjeski
6308 Herringdon Road
The Plains, VA 20198
October 15, 2016

Comments on Upper Goose Creek, Cromwells Run, and
Little River Implementation Plan Public Meeting

I am proud to be a Virginian. I love the entire Commonwealth, from the Appalachians to the Eastern Shore. I feel particularly blessed to be a resident of The Plains the past 25 years. I consider myself lucky to live a mile or so from Augustus McCrae's cattle ranch. I enjoy sharing the dirt road I live on with past and future Olympians on horseback. I have developed a deep love for the pageantry of foxhunting. I am tickled pink that I live in one of the few places on Earth where you can get your yard trashed by both Beagles and Hounds during a Hunt. I relish the amazing beef, lamb and pork that is raised here.

My work takes me back and forth on Route 50 everyday. From Lenah Road to Gilbert's Corner I see a half dozen new subdivisions being built before I get to the Hallowed Ground that runs along Rt.15. Even though new home construction is my business, the last thing I want to see is more cookie cutter McMansions with their sterile landscaping ruining the viewshed. But, because of my work, I am very cognizant of the actual toll in pollutants that is produced by this development that affects the Chesapeake Bay Watershed. With the tools provided by DEQ it is possible to measure these pollutants down to 1/100 of a pound. And sadly I have come to the conclusion that of all the different types of Land Uses (Residential, Commercial/Industrial, Agricultural) the worst for the waters of the Chesapeake is Bovine and Equine Livestock. I have not had the time to confirm this, but if you were to add up the total Nitrogen and Phosphorus for all the houses being built on this stretch of road, it would still be less than what is produced by a half dozen cows on the PEC property at Gilberts Corner. While the developers are forced to spend hundreds of thousands of dollars for sewage disposal and stormwater management to mitigate their pollutant load, the cattle owners are exempt from any E&S controls or required to avoid perennial streams. What fencing they do put up is reimbursed through cost sharing. And while the residences will be generating thousands of dollars in taxes, the agricultural land is for most part exempt.

This is the dilemma I see everyday. And I have come to the conclusion that the Implementation Plans being developed here and elsewhere around the Commonwealth are inadequate. Education, Cost Sharing and Viewshed Easements do not provide any real reduction in the Pollutants reaching the Chesapeake Bay, which I believe is the whole point of these meetings. We have lulled ourselves into thinking that as long as there are no new houses for people to move into we have somehow saved the Environment. I have a hard time justifying the tens of thousands of dollars that my clients spend on stormwater BMPs for their houses when the horse I see riding along the Little River is producing exponentially more pollutants into the water without any restrictions.

If we are going to take this project seriously we need to directly address the problem. It is time to recognize the harm created by Agriculture and not just ignore them. I have brought many of the poor land use decisions of my neighbors to the attention of various government agencies (John Marshall SWCD, Fauquier Building & Inspections, DCR, Dept. of Agriculture, VOF) and they all tell me the same thing, that everything they do is considered agricultural use and is exempt from any enforcement. When I try to bring it to my friends and neighbors attention, they tell me that their land use attorneys and the government all tell them that what they are doing is allowed and legal. That needs to stop. It is time for a paradigm shift in how livestock are dealt with. Just starting with a ban on all horses and cattle from floodplains would be a straightforward start. Requiring a setback from any perennial streams would also be highly beneficial. The huge amount of Nitrogen and Phosphorus removed from the Bay would be a lifesaver for the ecosystem. And even though no one has the funds to determine where all the fecal coliforms are coming from, I bet they would drop precipitously as well.

Of course, the practice of Foxhunting would be expressly exempt from all this. I know it's selfish of me, but I think the crabs and oysters can survive alongside the Hunt.

Jeff Sledjeski
6308 Herringdon Road
The Plains, VA 20198

Meeting Comments

PEC - Gilberts Corner

I have noticed both there and where I live an increasing use of Wire Mesh fencing for livestock exclusion. If possible, can there be a requirement to provide a minimum 1 - 2 foot separation between the bottom of the mesh and the ground? I am concerned that this practice is also excluding the free movement of all mammalian, reptilian and amphibious life. This is having the unintended consequence of destroying needed habitat and harming the ecosystem. My other issue is the reliance on using Round Up along the bottom of theses fences for landscaping purposes only. This practice is very obvious along Route 626 between Middleburg and The Plains.

I also have issues with the proposed decrease in setback requirement. Any onsite wastewater disposal system that pretreats waste and uses the natural onsite soils as a Receiving Environment is required to be at least 50 feet from any perennial stream. It seems logical that direct dispersal of waste to the ground surface with no pretreatment would require at least the same setback if not more.

Septic Systems

As I mentioned during the meeting, there are already numerous sources of information available to homeowners about their septic system. Based upon my decades of involvement in septic, the sad truth is that everyone is willfully ignorant of what happens to their waste once they flush. This is true for all systems, conventional and alternative. I believe the best thing is that any land transfer involving onsite septic should require the purchaser to sign a notarized statement that the care and maintenance of it is their sole financial responsibility. The local Health District would keep a copy on file and mail it to the Owner once a year as a reminder. Then they might take advantage of all the available educational resources.

Concentrating solely on overtly failing septic systems ignores another major issue with onsite septic. While repairing these systems keeps the effluent from flowing directly into streams, it ignores the fact that there are still coliforms, nitrogen and phosphorous reaching our aquifers. Many existing conventional septic systems (including mine) do not meet the required setbacks to water table that are part of our Code. The Health Department realizes this and instead of confronting the issue they try to mask it by coming up with "Voluntary Upgrades" that will allow basic mechanical repairs without fixing the underlying problem.

Stormwater Management

A good rule of thumb I use frequently at work is that 1 inch of rain on 1000 square feet of roof produces 600 gallons of stormwater runoff. Since the average rain barrel holds 55 gallon you can see why I was so dismissive of all the local SWCD reliance on them for stormwater management. And while DEQ's solution of Rainwater Harvesting and Vegetative Roofs make for great demonstration projects for large commercial and industrial project, they are useless for single family homes.

I do not see the need to even discuss Stormwater Management in our IP area since the regulations have been written to specifically exempt all rural and agricultural areas at the expense of the urban.

Thanks again for this opportunity to participate in this dialogue.

Attachment D – Final Public Meeting Comments and Responses

Summary of Public Comments and Staff Responses

Draft Total Maximum Daily Load Implementation Plan Report for the Upper Goose Creek Watershed

August 21, 2017

Two written comments were received by DEQ during the June 21-July 21, 2017 public comment period for the draft UGC IP. The substantive issues raised in these comments are presented below followed by DEQ's response. A copy of the full comments can be found in **Attachment E**.

Commenter #1: Jeff Sledjeski, Upper Goose Creek watershed resident

Summary: Mr. Sledjeski provided brief final comments, which referenced and appended earlier comments he had submitted (on July 4 and October 15, 2016) following the initial Public Meeting and Workgroup meetings. His aggregate comments touched on many aspects of water pollution control, with a focus on the disparity between rigorous and costly residential property stormwater regulatory controls and the broad exemption of bovine and equine agriculture from regulatory pollution controls. Those included in the final comment letter are discussed below, and topics only raised in his earlier letters are addressed in **Attachment B.**

Comment 1: *Mr. Sledjeski expressed concern that many stakeholders are under the belief that since bovine and equine livestock operations are specifically exempted from Virginia's Stormwater and Erosion control regulations, there is no need to be concerned about their waste management.*

DEQ Response: Addressing the runoff of bacteria pollutants from bovine livestock is at the heart of the UGC IP, and significant attention is given to bacteria from equine operations as well. As the commenter has correctly observed, bovine and equine livestock agricultural activities are not subject to Virginia's Stormwater and Erosion control regulations (which focus on land development and construction), and their waste management largely occurs through voluntary programs. This Implementation Plan has been developed to identify the scope and type of voluntary measures that can reduce bacteria in streams from nonregulated sources within the plan area to achieve Virginia's recreational use water quality standard.

In addition to the voluntary measures that are the subject of this plan, the Virginia Pollution Abatement (VPA) Regulation and General Permit for Animal Feeding Operations and Animal Waste Management (9VAC25-192-20) governs the pollutant management activities at animal feeding operations having 300 or more animal units utilizing a liquid manure collection and storage system not covered by a VPDES permit and animal waste utilized or stored by animal waste end-users. More specific information about this general permit can be found at: http://law.lis.virginia.gov/admincode/title9/agency25/chapter192/

Comment 2: *Mr. Sledjeski expressed concern that Virginia's TMDL IP development process is overly standardized and does not effectively engage watershed residents. He shared his perception that different IPs across the Commonwealth are too similar in terms of their substance, and that participation in meetings was dominated by special interest groups and government agency staff.*

DEQ Response: Virginia develops TMDL IPs to both satisfy eligibility requirements for CWA Section 319 nonpoint source grant funding, and to guide voluntary and collaborative efforts under local leadership to reduce pollutants from nonregulated sources that impair water quality. Meeting the requirements for Section 319 funding

is done by addressing the nine elements of EPA's watershed planning guidelines, and results in plans across the Commonwealth having a very similar structure and content. Virginia also has standard expectations for public engagement in IP development, holding Initial and Final Public Meetings, and convening work groups and an overall SC to provide input, make recommendations, and provide feedback to DEQ in the course of plan development. DEQ broadly publicizes these opportunities for engagement in the planning process, using local press and radio, local organization websites, email distribution lists and more.

Comment 3: *Mr. Sledjeski expressed concern that livestock exclusion fencing could not realistically achieve a 75% reduction in bacteria reaching streams from pasture lands.*

DEQ Response: As represented in **Table A-18Table 5-8**, livestock exclusion fencing is estimated to eliminate (100% reduction) the **direct** deposition of bacteria into streams by livestock and reduce the overland movement of bacteria by 50% from pastures into streams. These bacteria reduction efficiency estimates are accepted average values by DCR. The 50% bacteria reduction from pastures is a composite estimate based on a comprehensive search of peer-reviewed academic studies of reductions in bacteria transported to streams when exclusion fencing using a 35 foot buffer is in place. Actual reductions vary by soil type, pasture conditions, and the width and vegetative cover in the stream buffer.

Comment 4: *Mr. Sledjeski recommended an expansion of Virginia's Nutrient Credit Program to provide double or triple credit for removing cattle and horses from a watershed, or credit for removing horse trails and paddocks from floodplains and along streams. He said this would produce more pollutant reductions than the approaches taken in TMDL implementation plans.*

DEQ Response: The concern raised is not within the scope or purview of the TMDL IP development process. The commenter may obtain more information, including contacting information, on the Nutrient Credit/Trading program at:
http://www.deq.virginia.gov/Programs/Water/PermittingCompliance/PollutionDischargeElimination/NutrientTrading.aspx

Commenter #2: Gem Bingol, Piedmont Environmental Council

Summary: Ms. Bingol's comments explained the long-standing role that PEC has played in promoting conservation of rural lands, educating landowners about agricultural BMPs, and securing funding to support residential BMPs. General comments acknowledged the significant pollution that has resulted over generations from the agricultural sector, while noting concern for the more permanent impacts developed land with impervious surfaces can have on streams and watersheds. The comments concluded with strong support for the measures called for in the draft UGC IP, including the key role of education for watershed residents, and committed to partnering with others to attract funding for implementation of the plan. A few more specific comments follow:

Comment #1: *The Northern Virginia Regional Commission's 2012 report "Conservation Corridor Planning" includes a priority corridor for conservation ("Journey Through Hallowed Ground") that lies partly within the Upper Goose Creek plan area. This report should be mentioned in the IP in light of overlapping goals.*

DEQ Response: In response to your comment, a summary of the "Conservation Corridor Planning" report has been added to the UGC IP section "Integration with Other Planning Initiatives" (**Section 11.5**).

Comment #2: *A typographical error was identified, "daily" should be "dairy" on p. 5 of the draft IP.*
DEQ Response: This error has been fixed.

Comment #3: *In the context of the draft plan recommendations for three regional-scale equine manure composting facilities, the commenter shared a U.S. Composting Council position paper from 2013 on persistent herbicides. The issue discussed in this paper relates to four herbicides sold under 20 trade names that were identified to have toxic effects on plant growth if present in compost. The commenter wished to raise DEQ's awareness of this issue for consideration relative to the plan's recommendations for equine manure composting.*

DEQ Response: This matter is highly germane to the UGC IP. We have begun follow up discussions within DEQ and with other Virginia agencies that may have an interest in this matter – including VDH; DCR; and Agriculture and Consumer Services (VACS). We also will note this issue has been raised to DEQ's attention in **Section 5.1.3** ("Equine Management") and **Section 5.3.1** ("Education and Outreach: Horse Pasture Management Education"). Additionally, DEQ will ensure this issue is addressed in any future grants awarded to provide cost-share funding for manure composting facilities.

Attachment E – Final Public Meeting Comment Letters

Piedmont Environmental Council

Safeguarding the landscape, communities and heritage of Virginia's Piedmont by involving citizens in related public policy and land conservation

July 21, 22017

David Evans
Nonpoint Source Coordinator
Water Quality Planning Program
Northern Regional Office
Department of Environmental Quality
13901 Crown Court
Woodbridge, Virginia 22193

Dear Mr. Evans:

We appreciate having had the opportunity to participate in the Stakeholder Committee for the Upper Goose Creek, Cromwell's Run, Little River TMDL Implementation Plan (IP). The Piedmont Environmental Council (PEC) has had a long-standing commitment to maintaining and improving the health of Goose Creek and its tributaries in Fauquier and Loudoun counties. PEC has taken a multi-faceted approach to watershed protection, working—for example-- to promote permanent conservation of rural land that limits impervious surfaces; educating landowners about and facilitating implementation of agricultural best management practices (BMPs), and securing funding to assist homeowner associations implement residential BMPs. These approaches address the specific impacts from pollutants such as the bacterial pollution that is the target of this Implementation Plan, but also seek to address more comprehensively the overall health of the watershed.

The IP indicates that agricultural practices are a contributor to impaired water quality in the Upper Goose Creek watershed, a finding that is similar in impaired streams across the nation. None of these problems are the result of a single farmer or even one generation of farmers but come from hundreds of years of accumulated impacts.

Residential development has also had a negative impact on streams and watersheds. While more limited in connection with this IP, when farmland is converted to residential uses, changes to the hydrology, vegetative cover and impervious cover create a host of additional impacts. One of our goals has been to minimize the sprawl that creates these conditions. While it is challenging and time-consuming to reverse the accumulated impacts of traditional agricultural practices, once land is developed, the challenges are even higher, and unlikely to be reversed.

We support the measures in this IP to offset all of these impacts in a holistic way. As such, PEC supports working with the entire community, not just with farmers, to communicate how local actions have cascading impacts on nearby streams, to communities downstream, and finally all the way to the Chesapeake Bay.

The focus on stewardship and shared ownership is critical for the short and long term and we commend that approach. Keeping the land rural is critical to improving and maintaining its water quality. Everyone in the community needs to know and appreciate this basic fact and help to support that goal as no single sector of the community can bear that burden alone. The role of education is key, and as a partner, we understand that we must help in that effort in order to achieve the clean water goal.

Main Office: PO Box 460 Warrenton, VA 20188 • T: 540.347.2334 • F: 540.349.9003 • www.pecva.org

Specific to this IP are several points of note:

- Significant reductions in bacterial pollution from 100 miles of livestock exclusion BMPS installed to date, but bacterial exceedances still persist and it will take all of the measures in combination to achieve the water quality standards
    - Soil and Water Conservation Districts have been major force in the progress to date
        - If 100% of fencing BMPs are complete, it only contributes to the overall pollution reduction by 20%.
        - Going forward in Loudoun there are FEMA-based stumbling blocks to installing fencing and planting trees in the 100 year floodplain, practices that are critical to reestablishing robust forested riparian buffers. The FEMA barriers to implementing these practices must be resolved and eliminated
        - Riparian buffer plantings play an important role in decreasing pasture runoff.
            - Riparian buffer plantings will help accomplish multiple goals related to habitat and wildlife corridors, and county green infrastructure goals as well as runoff reduction.
    - Septic system inspection programs have been successful in reducing the number of failing septic systems
- Pasture- associated runoff accounts for 79% of the needed reductions to meet the IP goals
    - This requires a significant amount of education (and funding) to help farmers understand, implement and reap the economic benefits of alternative pasture management practices
        - PEC is ready to partner to help accomplish this goal.
- An increase in equine population has warranted a focus on manure management and composting systems
    - One issue of note is the use of new and persistent chemicals that are now creating long-term problems for the reuse of compost. These chemicals persist through the composting process and have the ability to destroy the positive benefits of the compost for reuse.
        - The chemicals include Clopyralid, Aminopyralid, Aminocyclopyrachlor and Picloram (fact sheet attached)
        - This potential problem should be noted and a plan to avoid it should be incorporated into plans for community composting facilities.
- Increased human population has brought significant (but more limited in scope) development-related impacts
    - A 12% increase in human population has resulted in an increase in impervious cover by 87% and developed pervious vegetative cover by 362% or 5,264 acres as of 2011.
        - On the developed lands, it would be helpful to include the percentage of the overall residential development impacts that comes from septic systems, from stormwater runoff and pet waste, impervious cover and pervious cover.
        - Further, it would be very helpful to have figures or references that state the relative cost of implementing residential BMPs at the time of development versus through retrofits to help support appropriate county regulations.
        - Landowner education can help to reverse negative property management impacts and increase the water quality benefits of pervious developed areas.
        - Stormwater ponds associated with development generally have inadequate buffers which have contributed to an increase in the goose population and increased pollution loads. Such BMPs would be important to include in the plan.
    - This points to the critical importance of maintaining the watershed in minimal development to protect long-term water quality and why PEC is committed to land conservation in this watershed.
        - Note that when landowners put conservation easements on their land, these are permanent deed restrictions (see pg. 10)

Public participation in the IP development has been very limited. To be successful, the level of awareness, education and involvement must be much higher.

PEC is committed to the goals of the IP. Using PEC's Roundabout Meadows property at Gilberts Corner as a demonstration site, PEC is and will continue to educate students, landowners, and the general public about the water quality, wildlife habitat, and agricultural productivity benefits of implementing BMPs and a suite of other rural land management practices.

Unfortunately, the cost of clean-up is substantial, and success won't come without the needed funding. PEC is also committed to partnering to attract funding to support the IP, and to keep the watershed healthy and rural in the long-term.

A couple of minor notes on the draft IP:

- In January 2012, the Northern Virginia Regional Commission published a report entitled "Conservation Corridor Planning." The report appears to include some of the Goose Creek watershed areas subject to the IP. Note page 12, Corridor D in the report. Mention of this plan should be included in the IP due to overlapping goals.
- Edit on page 18, 2nd paragraph, the daily cow population should be dairy cow

Thank you for the opportunity to provide input.

Sincerely,

Gem Bingol

Gem Bingol
Field staff for Loudoun & Clarke Counties

Jeff Sledjeski
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July 20, 2017

Comments on Upper Goose Creek, Cromwells Run, and
Little River Implementation Plan Public Meeting

To keep these comments as brief as possible, I am attaching my previous comments from 7/4/2016 and 10/15/2016. These comments cover most of the concerns I had then that are still the same today with the latest draft IP. This process has been a great learning experience for me and I appreciate the work done by the agencies in charge.

The presentations and discussions have been revelatory for me. My decades of work in the private sector analyzing soils for onsite wastewater disposal systems and stormwater management has helped me reach an unfortunate conclusion. Of all the possible land uses adjacent to the waters of the Chesapeake Bay (Residential, Commercial, Industrial, Agricultural, etc...) the worst possible use is Bovine and Equine Livestock. Not only are they enormous producers of the pollutants we are most concerned about, they are also the least regulated. As I pointed out in earlier comments the hundreds of houses being constructed on Route 50 between Lenah Road and Route 15 combined will result in less pollutants flowing into the Chesapeake Bay than the PEC's herd of cattle at Gilbert's Corner.

Unfortunately, the stakeholders seem to be under the belief that since Bovine and Equine Livestock are specifically exempted from all Stormwater Management and Erosion controls regulations there is no need to be concerned about waste management. One telling moment for me was during a discussion of this issue, a representative of one of the local environmental commented that they "chain harrow their horse pasture and let God take care of it". This is a huge mistake. This practice only helps move the effluent into the waterways quicker during rain events. God has not had direct interest in the Chesapeake Bay since his little boo-boo in celestial mechanics 35 million years ago that created the Bay.

These IP meetings throughout the Commonwealth are less about protecting the Bay and more about meeting the criteria of the TMDL IP Guidance Manual. This partially explains every IP Plan I have read is almost exactly the same with the exceptions of photos of the local flora and fauna. The meetings have little participation by local residents; instead are controlled by special interest groups whose main concern is preventing any regulations that might affect their members along with government officials whose attendance is mandatory.

The belief that Livestock Exclusion fencing will decrease pollutants by 75% is highly misleading. All research I have reviewed is based upon treated livestock waste being applied to cropland following explicit procedures for biosolids. This is inapplicable to untreated livestock waste randomly deposited next to a wire fence. If this were the case, then there should not be any concern about failed septic systems as long as they are more than 35 feet from a stream. And yet the main concern of these IP meetings is to find new funding sources to pay farmers to do what they should be doing in the first place.

The solution will not come from these meetings. The solution will come from expansion of the Nutrient Credit Program. By doubling or tripling the amount of credits given for removing Cattle and Horses from the Watershed as well as including more ways to earn credits (i.e. removing horse trails and paddocks from floodplains and along streams) there should be an actual decrease in most types of pollutants. This expansion will be necessary to meet the demands for phosphorous removal for Urban single family homes that are impossible to meet using DEQ's BMP Clearinghouse.

In conclusion, I believe we should all heed the words of the great 20th century visionary Marcus Garvey.

Emancipate yourselves from mental slavery, none but ourselves can free our minds!