OPEQUON CREEK WATERSHED TMDL IMPLEMENTATION PLAN

Prepared by:

Opequon Creek IP Steering Committee

Virginia Tech Department of Biological Systems Engineering and Center for TMDL and Watershed Studies

University of Virginia Institute for Environmental Negotiation

West Virginia University Division of Resource Management

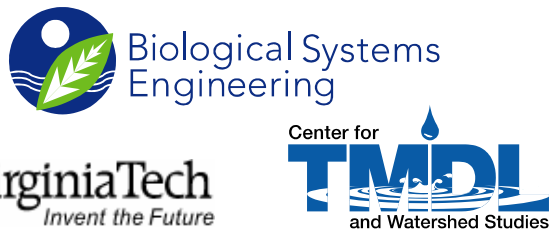
In Cooperation With:

Virginia Department of Environmental Quality

and

Virginia Department of Conservation and Recreation

July 5, 2006



Project Personnel

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Steering Committee

			Working Group Participation	
Participant	**Affiliation**	**Steering Committee**	**Urban**	**Agric./ Rural**
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Carol Boughton	US Geological Survey	•	•	
Bob Carpenter	Valley Farm Credit	•		•
Cheryl Crowell	Lord Fairfax Soil and Water Conservation District	•		•
Gerald Crowell	Virginia Department of Forestry	•		•
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1.0 EXECUTIVE SUMMARY

1.1 Introduction

The Federal Water Pollution Control Act, known as the "Clean Water Act" (CWA), was enacted by Congress in 1972 with the stated objective being *"to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."* Section 303(d) of the Act requires states to identify those water bodies not meeting the published water quality standards for any given pollutant. If a particular water body is listed as "impaired," the state must develop a "total maximum daily load" for any pollutant that exceeds water quality standards in that water body. The "total maximum daily load," or TMDL, is essentially a "water pollution budget." A TMDL study defines the amount of pollutant each source in the watershed can contribute to the water body while still allowing the water body to comply with applicable water quality standards.

Once a water body is listed as impaired and a subsequent TMDL study has been conducted, then the state, in conjunction with watershed stakeholders, must develop and implement a strategy that will limit the pollutant loadings to those levels allocated in the TMDL study. Such a strategy, also known as an Implementation Plan (IP), must contain actions that will work to achieve the reduced pollutant loadings needed to bring the water body into compliance with the standard. Although such Implementation Plans are alluded to in the federal CWA legislation, they are not a requirement of that Act. Such Implementation Plans are, however, a state requirement. Virginia's 1997 Water Quality Monitoring, Information and Restoration Act (WQMIRA) states in section 62.1-44.19:7 that the "Board shall develop and implement a plan to achieve fully supporting status for impaired waters." This means that after a TMDL is developed for an impaired water, an Implementation Plan (IP) must be developed and implemented with the goal of meeting the water quality standards for the water body.

The Opequon Creek watershed includes portions of Virginia's Clarke and Frederick counties and encompasses the City of Winchester. Five stream segments in the Opequon Creek watershed are currently listed on Virginia's 303(d) list of impaired waters. Abrams Creek, Lower Opequon Creek, and Redbud Run are listed due to water quality violations of the General Standard (benthic impairment) and the instantaneous bacteria standard (bacteria impairment). In addition, Upper Opequon Creek and Lick Run are listed as impaired due to violations of the bacteria standard.

Inclusion on the 303(d) list for violations of the fecal coliform bacteria standard was based on water quality sampling. Abrams and Upper and Lower Opequon Creeks were first included on the 303(d) list based on samples collected between July 1992 and June 1997. The water samples had fecal coliform concentrations that exceeded the 1000 cfu/100 mL standard in 17%, 19%, and 12% of water samples from Abrams, Upper Opequon, and Lower Opequon Creeks, respectively. The 2004 water quality assessment data were based on monitoring conducted between January 1, 1998 and December 31, 2002. All six stations within the greater Opequon watershed on Abrams, Upper Opequon, Lower Opequon Creeks, Lick Run and Redbud Run were rated as impaired in the 2004 assessment with violation rates of 22%, 14%, 12%, 17%, and 16%, respectively.

Violations of the General Standard (benthic impairment) were identified through biological monitoring conducted by the Virginia Department of Environmental Quality (VADEQ) in Abrams Creek from October 1994 to October 2001 and in Lower Opequon Creek from October 1994 to May 2002. During these periods, all seven benthic samples from Abrams Creek were rated as "moderately" impaired and five of the ten samples from Lower Opequon Creek were rated as "moderately" impaired and five were rated as "slightly" impaired. The moderately and slightly impaired ratings resulted in Abrams Creek and Lower Opequon Creek segments being listed as not supporting of the Aquatic Life designated use in both the 1998 and 2002 303(d) impaired waters lists.

TMDLs were developed for three of the stream segments (Abrams, Upper Opequon, and Lower Opequon) in 2003 and approved by USEPA in 2004; two additional segments, Redbud Run and Lick Run, were identified as impaired in the 2004 assessment cycle. TMDLs have not been developed for these two stream segments; however, since they are contained within the Opequon Creek watershed, this IP includes practices that address those impairments. The purpose of the IP presented in this document is to address the bacteria and benthic impairments in the Opequon Creek watershed such that the waters can meet the water quality standards. Specifically, the IP describes implementation actions to achieve the water quality goals in the Opequon Creek watershed.

1.2 Review of TMDL Development

The TMDLs for Opequon Creek were developed by characterizing the sources of bacteria and sediment in each watershed and then, through modeling, determining the reduction required from each of those sources to meet the applicable water quality standards. VADEQ listed nonpoint source (NPS) urban pollution as the probable cause of the benthic impairment for Abrams Creek and both urban and agricultural NPS pollution as the probable cause for Lower Opequon Creek and Redbud Run. The probable cause of the bacteria impairments was cited as urban NPS pollution for Abrams and Upper Opequon Creeks and agricultural and urban NPS pollution for Lower Opequon Creek. As part of the TMDL study, sediment was determined to be the most probable cause of the benthic impairments in Abrams and Lower Opequon Creeks. Thus, the TMDLs to address the benthic impairment were developed for sediment.

Potential sources of bacteria and sediment considered in the development of the TMDL included both point source and nonpoint source (NPS) contributions. In addition, two Phase II municipal separate storm sewer system (MS4) permits have been issued in the Abrams Creek watershed. Point sources of fecal coliform bacteria in Opequon Creek watershed include all municipal and industrial plants that treat human waste, as well as private residences that fall under general permits. Virginia issues Virginia Pollutant Discharge Elimination System (VPDES) permits for point sources.

The Opequon Creek watershed is experiencing urban growth and development that was accounted for in the TMDL development process. Future land use scenarios were investigated and the decision was made to develop the TMDL assuming an anticipated 25% build-out within Frederick County's "Urban Development Areas" and "Commercial Centers."

NPS pollution originates from diffuse sources on the landscape (e.g., agriculture and urban) and is strongly affected by precipitation events – runoff from rain or snowmelt. In some cases, a precipitation event is not required to deliver NPS pollution to a stream (e.g., direct deposition of fecal matter by wildlife or livestock and contamination from leaking sewer lines or straight pipes). Nonpoint sources were assessed during TMDL development through an extensive analysis of land use with consideration for delivery mechanisms (e.g., direct loadings to the stream or land-based loadings that require a precipitation event for delivery of the pollutants to the stream from pervious and impervious surfaces).

Different scenarios were evaluated to identify reasonable scenarios for implementation that meet both the calendar-month geometric mean *E. coli* criterion (126 cfu/100 mL) and the single sample maximum *E. coli* criterion (235 cfu/100 mL) with zero violations. The margin of safety (MOS) was implicitly incorporated into each TMDL by conservatively estimating several factors affecting bacteria loadings, such as animal numbers, production rates, and contributions to streams. The final allocation scenarios from each watershed are shown in Table 1.1.

Table 1.1 Allocation scenarios for each subwatershed for fecal coliform loadings, using 25% build-out scenario

Watershed	Percent reduction in loading from existing condition				Percent violation of E. coli standard	
	Direct deposit (wildlife natural)	Direct Deposit (cattle)	Loads from residential pervious land uses (PLS)	Loads from impervious land uses (ILS)	Geometric mean	Instantaneous
Abrams Creek	0	30	96	96	0	0
Upper Opequon Creek	95	100	90	90	0	0
Lower Opequon Creek	0	0	80	80	0	0

TMDL allocation scenarios for sediment loadings were developed by consolidating NPS loads into six categories: agriculture, urban, forestry, channel erosion, MS4, and point sources. The MOS was explicitly defined as 10% of the calculated TMDL. The waste load allocation (WLA) was calculated as the sum of all permitted total suspended solids (TSS) loads. The load allocation (LA) – the allowable sediment load from nonpoint sources – was calculated as the target TMDL load minus the MOS minus the WLA. Different scenarios were evaluated to meet the TMDL for Abrams Creek of 2,846 t/yr of sediment and the TMDL for Lower Opequon Creek of 17,057 t/yr of sediment. The final allocation scenarios are shown in Table 1.2.

Table 1.2 Allocation scenarios for each subwatershed for sediment loadings

Watershed	Percent reduction in loading from 25% build-out scenario						
	Agriculture	Urban	Forestry	Channel Erosion	MS4	Point Sources	Total
Abrams Creek	10	25	0	55	25	0	22
Lower Opequon Creek	15	15	0	35	15	0	17

1.3 Public Participation

The personnel involved in developing this implementation plan included a Resource Team, a Steering Committee, two Working Groups, and the general public. Members of the Resource Team and Steering Committee are listed at the beginning of this document. The Working Groups and the Steering Committee were comprised of watershed stakeholders. Public participation occurred via a series of steering committee and working group meetings. All meetings took place in Winchester, VA. The role of the two working groups, one ("Urban") focused on both urban residential and public works issues and one ("Agricultural/Rural") focused on both agriculture and rural residential issues, was to discuss, analyze, and evaluate all available actions and prioritize which actions stakeholders are most willing to support. This information was then funneled to the Steering Committee whose job it was to balance the interests and desires voiced in the working groups. The Steering Committee encouraged each group to include representatives that would and could address cross-cutting issues: environmental, governmental, public works, commercial, and educational.

The first 'public' event held in association with the Opequon TMDL implementation planning process was an informal interest/informational meeting on March 22, 2005. The Steering Committee organizational meeting was held on May 11, 2005. The first of two public meetings occurred on June 13, 2005. The purpose of this first public meeting was to expand awareness and to solicit stakeholder participation in the Working Groups. Following the introductory session, attendees broke into brief, organizational Working Group meetings.

Working Group meetings occurred on July 7 and August 4, 2005. Both Working Groups met at each of these meetings. The Working Groups breakout sessions provided an opportunity for participants to give direct feedback to the Resource Team about potential sources of problems and appropriate solutions to impairments in the TMDL study area. A series of four Steering Committee meetings were held on September 15 and November 15, 2005, and January 24 and April 21, 2006. The second and final public-noticed public meeting occurred on May 10, 2006 in Winchester, VA. Twenty stakeholders, in addition to the Resource Team, attended the meeting. The purpose of this final public meeting was to present the draft of the Opequon Creek TMDL IP to stakeholders.

The local project coordinator worked with staff from VADEQ and VADCR to publicize the meetings and encourage citizens to attend. For example, for the first public meeting, over 1100

mailings were sent to residents of the City of Winchester and Frederick and Clarke Counties including riparian landowners on Abrams and Opequon Creeks. Advance articles were published in the Northern Virginia Daily and Winchester Star. Public service announcements were made on two local radio stations. The meeting was also promoted on Winchester Community Television when Jim Lawrence and Woodward Bousquet (Shenandoah University) were interviewed by Mr. Barry Lee for a segment aired on *Winchester Cable Talk*. Meeting flyers were posted in public places along with larger outdoor signs in highly visible areas throughout the watershed. The local project coordinator made personal contacts via phone calls. Announcements were also sent via email to individuals and organizations and posted on web sites and electronic newsletters.

An electronic mailing list of stakeholders was initiated at the beginning of the project and expanded throughout the duration of the project. Meeting announcements and reminders were sent via this list. Additional announcements of interest to stakeholders were sent via this list. The Center for TMDL and Watershed Studies at Virginia Tech also maintained a threaded-discussion forum for the project (http://www.tmdl.net/forum/forum.asp?FORUM_ID=12).

To obtain additional feedback from local communities, two types of surveys (questionnaires) were distributed. A random sample of 2,300 local households in Clarke and Frederick counties received a survey with questions about their use and knowledge of Abrams and Opequon Creeks, local environmental quality, trust in various institutions acting in the sphere of water quality protection, benefits from the creeks' clean-up, and other improvements that the participants would like to see after the clean-up. An additional 200 surveys were distributed to a random sample of riparian landowners in the watershed. In addition to the questions previously described, these surveys asked participants about their willingness to implement various BMPs with or without cost share program support. These surveys provided a vehicle for greater public participation in the TMDL implementation planning process and increased awareness of water quality issues within the watershed area. Results also provided measures of public willingness-to-pay for water quality improvement in the watershed. Combined, the results provide insights that will be useful to area stakeholders as well as policy makers. Additional information about the survey can be found at http://www.caf.wvu.edu/resm/faculty/borisova/OpequonProject.htm.

1.4 Implementation Actions

Working groups identified potential actions and strategies to address each problem/source of bacteria and sediment. The priority of each action was assessed by the steering committee with respect to the need for a particular action in the watershed and its likelihood of successful implementation. The impact of the high priority actions on achieving the TMDLs was evaluated using the same models (HSPF and GWLF) used in the TMDL study. The analyses were conducted separately for Abrams Creek, Upper Opequon Creek, and Lower Opequon Creek watersheds. The goal was to identify implementation scenarios for each watershed to achieve 0% violations of the bacteria standards and the required reduction in sediment yield. The goal was achieved for Abrams Creek and for sediment and the geometric mean criterion for bacteria for Upper Opequon and Lower Opequon. The instantaneous bacteria criterion was exceeded 2% of the time for Upper Opequon and 3% of the time for Lower Opequon. The implementation actions are summarized in Table 1.3 for Abrams Creek, Upper Opequon, and Lower Opequon Creek.

Table 1.3 Implementation actions required to achieve bacteria and sediment TMDLs in Abrams, Upper Opequon, and Lower Opequon Creeks watersheds

Implementation Action	Unit	Units required (#)	Avg cost per unit ($)	Total cost ($)
All three watersheds				
Pet waste education program	program	1	10,000	10,000
Geese and duck waste clean-up	sweeper/vacuum	1	15,000	15,000
Abrams Creek				
Repair/replace failing septic systems	system	44	9,100	409,100
Infiltration basin/trench (Rain garden/bioretention)	acre treated	1,652 (2,066)	14,520 (19,239)	23,987,040 (39,747,774)[1]
Establishment/enhancement of forested riparian buffer zones	acre (linear ft)	29 (35,980)[2]	750	21,750
Enhanced E&S[3] efficiency	E&S inspector	–	–	Costs are shown in Table 1.4
Upper Opequon				
Fencing with off-stream watering (SL-6 Grazing Land Protection)	linear ft	55,282	17	939,794
WP-2T (fencing)	linear ft	32,208	3.50	112,728
WP-2T (fencing maintenance)	linear ft	32,208	0.50	16,104
Establishment/enhancement of forested riparian buffer zones	acre (linear ft)	21.9 (27,300)	750	16,425
Pasture management	acre	7,726	85	656,710
Repair/replace failing septic systems	system	350	6,160	2,292,500
Infiltration basin/trench (Rain garden/bioretention)	acre	637 (797)	14,520 (19,239)	9,249,240 (15,333,483)
Loafing lot management	system	1	50,000	50,000
Cover crop	acre	1,866	40	74,640
Lower Opequon				
Pasture management	acre	10,323	85	877,455
Loafing lot management	system	1	50,000	50,000
Repair/replace failing septic systems	system	372	6,160	2,436,600
Establishment/enhancement of forested riparian buffer zones	acre	85	750	63,750
All practices implemented				41,278,836 (63,123,813)

[1]The values shown for infiltration basin/trench and rain garden/bioretention indicate the number of impervious acres from which stormwater would still need to be treated to achieve the required reductions in bacteria loading after all the other listed practices are installed. The range in cost results from assuming that all of one practice or the other was used. A combination of bioretention and infiltration basins would cost in between the two values.
[2]assumed buffer width of 35 ft
[3]erosion and sediment control

Approximately 80% of the costs shown in Table 1.3 are for treating runoff from impervious areas in Abrams and Upper Opequon Creek watersheds and about 12% of the costs are for septic system repair/replacement throughout all three watersheds. Geese, ducks, and pets are the primary sources of bacteria from impervious surfaces. The IP includes reductions in these sources. It was assumed the planned actions will reduce these sources by 50%. If higher source reductions are achieved, less runoff will need to be treated.

Technical assistance will be needed for design and installation of implementation actions, as well as for educational outreach. Personnel requirements, in terms of full-time equivalents (FTE), and costs (Table 1.4) were estimated based on similar projects and experience and knowledge of the steering committee. Educational outreach will include strategies identified by stakeholders for facilitating implementation of priority actions.

Table 1.4 Technical assistance needs associated with implementation actions to meet bacteria and sediment TMDLs

Implementation Practice	FTE[1]/year	Cost/FTE ($)	Total Cost ($)
Pet waste education program	0.5	50,000	25,000
Sweeper/vacuum technician	0.5	50,000	25,000
E&S inspection	1.0	50,000	50,000
Septic system technician	1.0	50,000	50,000
Stormwater BMP technician	1.0	50,000	50,000
Total Annual Cost			200,000
Stream exclusion practices (SL-6 System,WP-2T fencing)	5[2]	50,000	250,000

[1]full-time equivalent
[2]one time cost for design and supervision of installation

The primary outcome of TMDL implementation will be cleaner waters in the Opequon watershed, where pollution levels will be reduced to meet water quality standards. The benefits of meeting water quality standards in Opequon Creek are numerous. As a result of reducing bacteria and sediment loading, watershed residents can anticipate improved public health, conservation of natural resources (*e.g.*, soil and soil nutrients),. improved riparian habitat, reductions in the amount of flood damage, improved recreational opportunities, greater economic opportunities (*e.g.*, improved agricultural production and tourism), and enhanced real estate values for farms, homes, and businesses located near creeks in the watershed. Reducing sediment loads as a result of best management practices installed to improve benthic and bacteria water quality impairments will help achieve goals of the Chesapeake Bay Tributary Strategy.

Quantifying the value of all of the benefits listed in the previous paragraph would be very difficult. Many would say, for example, that a value can not be put on human health. If the benefits could be valued monetarily, it is clear that the value would be very large. In an attempt to quantify at least a few of the benefits, the expected benefits from improved aquatic life (game fish population) and the safety of swimming and wading were estimated using the contingent valuation (CV) method. CV involves the use of surveys to measure a community's willingness-

to-pay (WTP) for environmental improvements. Since water quality improvement in Virginia can have downstream benefits, surveys were mailed to households in both Virginia and West Virginia portions of the Opequon watershed.

An econometric modeling technique called grouped tobit was used to estimate WTP models in Virginia and West Virginia (Greene, 1997). For Virginia general public respondents, the median annual amount for an increase in taxes is approximately $48 per household, for five years. For riparian landowner respondents, the annual median amount for an increase in taxes is approximately $62, for five years. In West Virginia, the median WTP per household for out-of-state clean-up is approximately $17. Because survey response rates were lower than expected, non-respondent WTP was estimated using statistical model coefficients produced when analyzing respondent WTP, imputed values, and zip code Census statistics. Virginia non-respondents were estimated to have a median WTP of $24 annually for five years, while West Virginia non-respondents were estimated to have a median WTP of $11 for Virginia clean-up in the form of a one-time donation. Because response rates for riparian landowners were higher than those for the general public, it was assumed that the non-respondents would have the same WTP as respondents. Three different scenarios were constructed that varied the discount rate for Virginia WTP responses. Based on a review of previous studies, discount rates ranging from 4.25% to 29% were applied for the purpose of converting future payments to current dollars.

The total benefits from improved aquatic life (game fish population) and the safety of swimming and wading resulting from improved water quality within the Virginia portion of Opequon Creek in current dollars were determined to range from $2.0 to $2.75 million (Table 1.5), based on aggregating individual WTP estimates for the entire population living in the West Virginia and Virginia portions of the watershed. As indicated above, these estimates are only based on two specific benefits: improved aquatic life (game fish population) and the safety of swimming and wading. The additional benefits enumerated above are not included in the estimates given in Table 1.5. As indicated above, those benefits are very difficult, if not impossible, to quantify, but are clearly very large.

Table 1.5 Benefits determined through contingent valuation from improved aquatic life (game fish population) and the safety of swimming and wading within the Virginia portion of the Opequon Creek watershed as a result of TMDL implementation.

Discount Rate Scenario	Expected benefits from improved aquatic life (game fish population) and the safety of swimming and wading resulting from TMDL implementation (in millions of dollars)		
	Virginia	West Virginia	Total
Low (4.25%)	2.46	0.29	2.75
Medium (11%)	2.17	0.29	2.46
High (29%)	1.71	0.29	2.00

1.5 Measurable Goals and Milestones

Implementation milestones define the percentage of implementation actions to be installed within certain timeframes. Water quality milestones establish the corresponding improvements

in water quality that can be expected as the implementation milestones are met. Reducing violations of the bacteria standard to less than 10.5%, the criterion for removal from the 303(d) list (de-listing), is the first water quality milestone, referred to as Stage 1 implementation hereafter. Sets of implementation actions that could achieve that water quality milestone were determined through modeling with HSPF for bacteria and GWLF for sediment. The set of implementation actions (Table 1.6) was selected by the stakeholders and resource team based on considerations of costs, funding sources, and resource availability, including contractors and technical assistance. The water quality milestones associated with Stage 1 implementation are given in Table 1.7.

Table 1.6 Implementation actions required to meet water quality milestone of less than 10.5% violations of the instantaneous bacteria criterion in Abrams and Opequon Creeks[1]

Action	Unit	Watershed	Units implemented or impacted (#)
Repair/replace failing septic systems	system	Abrams	0
		Upper Opequon	175
		Lower Opequon	74
Infiltration basin/trench (Rain garden/bioretention)	acre treated	Abrams	149 (186)
Fencing with off-stream watering (SL-6 Grazing Land Protection)	linear ft	Upper Opequon	13,820
Fencing (WP-2T)	linear ft	Upper Opequon	8,052
Fencing maintenance (WP-2T)	linear ft	Upper Opequon	8,052
Pet waste education program	FTE[2] (Program assistant)	All	0.50
Geese and duck waste clean-up	FTE (Technician)	All	1.0
Establishment/enhancement of forested riparian buffer zones	acre (linear ft)	Abrams	28.9 (35,980)
		Upper Opequon	21.9 (27,300)
Enhanced E&S efficiency	FTE (E&S inspector)	Abrams	1.0
Loafing lot management	system	Upper Opequon	1
		Lower Opequon	1
Pasture management	acres	Upper Opequon	7,809
		Lower Opequon	10,323

[1]The resulting violations of the bacteria geometric mean are 1%, 3%, and 3% for Abrams, Upper Opequon, and Lower Opequon Creeks, respectively; violations of the instantaneous bacteria standard are 9%, 10%, and 9% for Abrams, Upper Opequon, and Lower Opequon Creeks, respectively. This scenario would also reduce the sediment load below the TMDLs for Abrams and Lower Opequon Creeks.
[2]full-time equivalent

Table 1.7 Water quality milestones for staged implementation in Abrams, Upper Opequon, and Lower Opequon Creek watersheds

	Water Quality Milestones							
	% Violations of Bacteria Standard						Sediment Reduction (%)[1]	
	Abrams		Upper Opequon		Lower Opequon		Abrams	Lower Opequon
Time	Geo[2]	Inst[3]	Geo	Inst	Geo	Inst		
Existing[4]	na[5]	22	na	14	na	12	0	0
5 years	1	9	3	10	3	9	>22%	>17%
11 years	0	0	0	2	0	3	>22%	>17%

[1]The sediment reduction required to meet the TMDL is 22% for Abrams Creek and 17% for Lower Opequon Creek.
[2]The geometric mean, based on two or more samples during any calendar month, can not exceed 126 *E coli*/100 mL.
[3]The single sample maximum can not exceed 235 *E. coli*/100 mL (9 VAC 25-260-170.A.2)
[4]2004 water quality assessment data
[5]not available

The second stage of implementation will occur over years 6 through 12. A slower rate of implementation of some practices is planned in Stage 2 to allow some practices, such as riparian buffers and pasture management to mature and impact water quality, so that judgments can be made as to whether all of the currently projected practices are needed to meet water quality standards. Because the modeling used to develop the IP was conservative, i.e., tended to underpredict effectiveness of practices, monitoring might show that this extent of implementation is not necessary.

1.6 Stakeholders' Roles and Responsibilities

Stakeholders are individuals who live or have land management responsibilities in the watershed, including government agencies, businesses, private individuals, and special interest groups. Stakeholder participation and support is essential for achieving the goals of this TMDL effort (i.e., improving water quality and removing streams from the impaired waters list).

Primary federal and state agency stakeholders involved in this TMDL effort include the U.S. Department of Agriculture-Natural Resources Conservation Service (NRCS), Virginia Department of Environmental Quality (VADEQ), Virginia Department of Conservation and Recreation (VADCR), Virginia Department of Health (VDH), Virginia Department of Forestry (VDOF). NRCS assists private landowners with conserving their soil, water, and other natural resources. Local, state and federal agencies and policymakers also rely on the expertise on NRCS staff. NRCS is also a major funding stakeholder for impaired water bodies through the Conservation Reserve Enhancement Program (CREP) and the Environmental Quality Incentive Program (EQIP). VADEQ is the lead state agency in the TMDL process and provided funding for the development of this IP. VADCR is authorized to administer Virginia's NPS pollution reduction programs in accordance with §10.1-104.1 of the Code of Virginia and §319 of the Clean Water Act. EPA requires much of the §319 grant monies be used for the development of TMDLs. The staff resources in VADCR's TMDL program focus primarily on providing technical assistance and funding to stakeholders to develop and carry out IPs, and support to VADEQ in TMDL development related to NPS impacts. The VDH is responsible for

maintaining safe drinking water measured by standards set by the EPA. For TMDLs, VDH has the responsibility of enforcing actions to correct failed septic systems and/or eliminate straight pipes. The VDOF provides assistance to forest landowners and the professional forest community on proper BMPs and technical specifications for installation of BMPs in forested areas, as well as expertise related to forested riparian buffers.

The primary regional and local government stakeholders include the Lord Fairfax Soil and Water Conservation District (LFSWCD), the City of Winchester, and Frederick and Clarke Counties. The LFSWCD's role is to increase voluntary conservation practices among farmers, ranchers, and other land users. District staff work closely with watershed residents and have valuable knowledge of local watershed practices. The City of Winchester has responsibility for meeting regulations related to stormwater runoff quality, which is an important part of achieving the TMDLs in the watershed. Frederick and Clarke Counties have an important role in integrating the IP with other efforts, through policies and planning efforts.

Two important local watershed groups are The Opequon Watershed, Inc. (TOW) and Friends of the Shenandoah River. TOW leads and participates in many activities aimed at improving the water quality of Opequon Creek. Friends of the Shenandoah is particularly involved in monitoring efforts that contribute to the TMDL effort.

1.7 Integration with Other Watershed Plans

Each watershed within the state is under the jurisdiction of a multitude of individual yet related water quality programs and activities, many of which have specific geographical boundaries and goals. In addition to the IP, some watershed plans and programs of particular significance to the Opequon Creek watershed include the Chesapeake Bay 2000 Agreement, Tributary Nutrient Reduction Plans, erosion and sediment control regulations, and stormwater management through Municipal Separate Storm Sewer Systems (MS4) Permits, Phase II, with which the City of Winchester must comply.

1.8 Potential Funding Sources

Potential sources of funds for implementing the actions identified in this plan include a variety of state and federal sources. Some sources are available to individual landowners, while others are available to groups and agencies. Two important state sources include the Water Quality Improvement Fund and the Virginia Agricultural BMP Cost-Share Program. The purpose of the Water Quality Improvement Fund is to provide water quality improvement grants to local governments, soil and water conservation districts, and individuals for point and nonpoint source pollution prevention, reduction and control programs. The VADEQ is responsible for administering point source grants, and the VADCR administers nonpoint source grants. VADCR staff provides technical assistance, as well as financial assistance. The Virginia Agricultural BMP Cost-Share Program provides funds to help install conservation practices that protect water and make farms more productive. Funding availability varies by Soil and Water Conservation District (SWCD). The state provides SWCDs with funds to target areas with known water quality needs. Areas with the greatest need receive the greatest funding.

Through its Nonpoint Source Implementation Grants (319 program), USEPA provides formula grants to the states and tribes to implement nonpoint source projects and programs in accordance with section 319 of the Clean Water Act (CWA). Nonpoint source pollution reduction projects can be used to protect source water areas and the general quality of water resources in a watershed. The Conservation Reserve Enhancement Program (CREP) is a voluntary land retirement program that helps agricultural producers protect environmentally sensitive land, decrease erosion, restore wildlife habitat, and safeguard ground and surface water. CREP is administered by USDA's Farm Service Agency (FSA). CREP is a community-based, results-oriented effort centered around local participation and leadership. The Environmental Quality Incentives Program (EQIP) administered by NRCS was established to provide a voluntary conservation program for farmers and ranchers to address significant natural resource needs and objectives. Nationally, it provides technical, financial, and educational assistance; sixty percent of it is targeted to livestock-related natural resource concerns and the rest to more general conservation priorities.

2.0 INTRODUCTION

2.1 Background

In 1972, the US Congress enacted the Federal Water Pollution Control Act known as the "Clean Water Act" (CWA). The founding objective of that legislation was well defined in its opening paragraph,

> *"to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."*

The legislation covers a range of water quality efforts aimed at reaching this objective. Immediately relevant to this project are the requirements that states develop and promulgate water quality standards for waters within their jurisdictions. In section 303(d) of the Act, the federal government requires states to identify those water bodies not meeting the published water quality standards for any given pollutant. This list is often called the "303(d) list" or the "impaired waters list." Virginia's first impaired waters list was published and reported to USEPA in 1994. Recently, the 303(d) list has been combined with the 305(b) water quality assessment report which describes the overall quality of a state's waters. Virginia publishes and submits this "305(b)/303(d) Integrated Report" to USEPA every two years.

Section 303(d) requires that, if a particular water body is listed as "impaired," the state must develop a "total maximum daily load" for any pollutant that exceeds water quality standards in that water body. The "total maximum daily load" or TMDL is essentially a "water pollution budget." A TMDL study defines the amount of pollutant each source in the watershed can contribute to the water body while still allowing the water body to comply with applicable water quality standards.

Virginia's 1997 Water Quality Monitoring, Information and Restoration Act (WQMIRA) states in section 62.1-44.19:7 that the "Board shall develop and implement a plan to achieve fully supporting status for impaired waters." This means that after a TMDL is developed for an impaired water, an Implementation Plan (IP) must be developed and implemented with the goal of meeting the water quality standards for the water body.

Five stream segments in the Opequon Creek watershed are currently listed on Virginia's 303(d) list of impaired waters for aquatic life use and fecal coliform impairments. TMDLs were developed for three of the stream segments (Abrams, Upper Opequon, and Lower Opequon) in 2003 and approved by USEPA in 2004; two additional segments, Redbud Run and Lick Run, were identified as impaired in the 2004 assessment cycle. TMDLs have not been developed for these two stream segments; however, since they are contained within the Opequon Creek watershed, this IP includes practices that address those impairments. The purpose of the IP presented in this document is to address the bacteria and benthic impairments in the Opequon Creek watershed such that the waters can meet the water quality standards. Specifically, the IP describes implementation actions to achieve the water quality goals in the Opequon Creek watershed.

2.2 Description of the Benthic and Bacteria Impairments in the Opequon Creek Watershed

The Opequon Creek watershed includes portions of Virginia's Clarke and Frederick counties and encompasses the City of Winchester. Five stream segments (Table 2.1, Figure 2.1) within the Opequon Creek watershed were determined to not meet the water quality standards for fecal coliform bacteria and the aquatic life use standard (commonly called a benthic impairment). The impaired segments are in the Abrams Creek, Lick Run, and Redbud Run tributaries of Opequon Creek, as well as on the main stem of Opequon Creek. For the purposes of this plan, the impaired segments of Opequon Creek are referred to as Upper Opequon Creek and Lower Opequon Creek.

Table 2.1 Impaired segments within the Opequon watershed

Segment	Impairment	Upstream Limit	Downstream Limit	Miles Affected
Abrams Creek	Benthic Bacteria	Headwaters	Confluence with Opequon Creek	10.80
Upper Opequon Creek	Bacteria	Headwaters	Confluence with Abrams Creek	24.88
Lower Opequon Creek	Benthic Bacteria	Confluence with Abrams Creek and Upper Opequon Creek	West Virginia state line	8.82
Lick Run	Bacteria	Headwaters	Confluence with Opequon Creek	8.87
Redbud Run	Bacteria Benthic	Headwaters	Confluence with Opequon Creek	8.07

VADEQ listed nonpoint source (NPS) urban pollution as the probable cause of the benthic impairment for Abrams Creek and both urban and agricultural NPS pollution as the probable cause for Lower Opequon Creek and Redbud Run. The probable cause of the bacteria impairments was cited as urban NPS pollution for Abrams and Upper Opequon Creeks and agricultural and urban NPS pollution for Lower Opequon Creek.

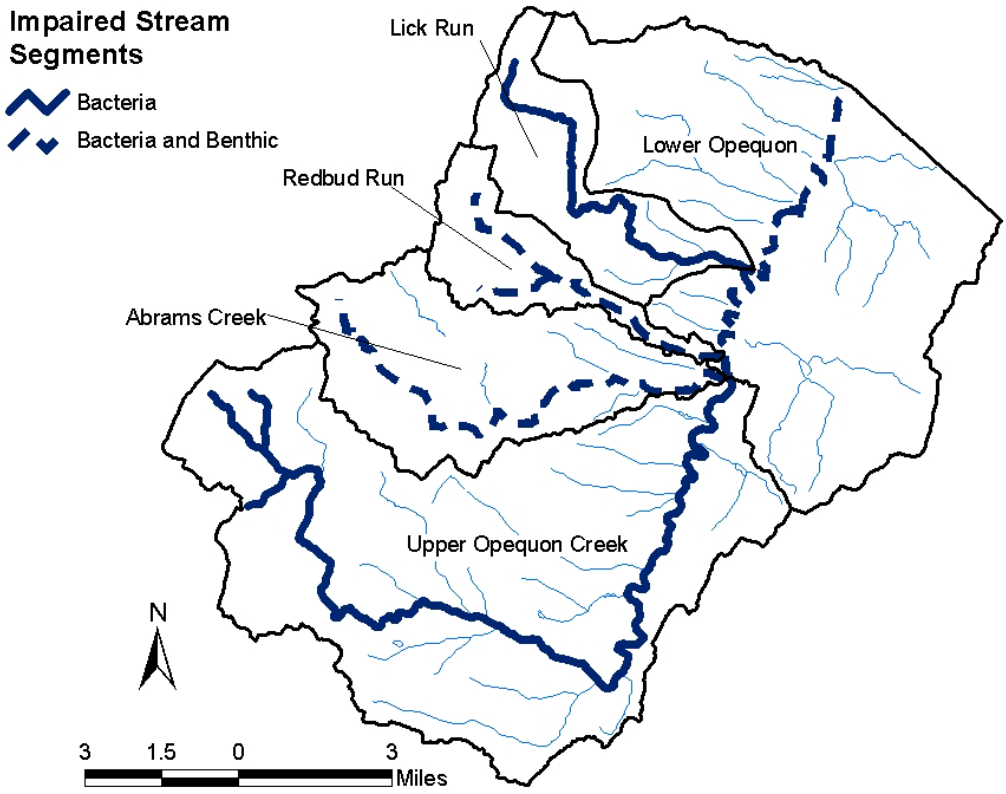

Figure 2.1 Locations of Impaired Stream Segments in the Opequon Creek watershed

2.3 Designated Use and the Applicable Water Quality Standard

According to 9 VAC 25-260-5 of Virginia's State Water Control Board *Water Quality Standards*, the term 'water quality standards' means "…provisions of state or federal law which consist of a designated use or uses for the waters of the Commonwealth and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law and the federal Clean Water Act."

The "Designation of Uses" of all waters in Virginia is defined in the Code of Virginia (9 VAC 25-260-10) (SWCB, 2003):

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

The applicable water quality standard for the benthic impairment is Virginia's narrative General Standard (9 VAC 25-260-20, also known as the Aquatic Life Use standard), which states in part (SWCB, 2003):

> All state waters, including wetlands, shall be free from substances attributable to sewage, industrial waste, or other waste in concentrations, amounts, or combinations which contravene established standards or interfere directly or indirectly with designated uses of such water or which are inimical or harmful to human, animal, plant, or aquatic life.
>
> Specific substances to be controlled include, but are not limited to: floating debris, oil scum, and other floating materials; toxic substances (including those which bioaccumulate); substances that produce color, tastes, turbidity, odors, or settle to form sludge deposits; and substances which nourish undesirable or nuisance aquatic plant life. Effluents which tend to raise the temperature of the receiving water will also be controlled.

The biological monitoring program in Virginia that is used to evaluate compliance with the above standard is run by the VADEQ. Evaluations of monitoring data from this program focus on the benthic (bottom-dwelling) macro (large enough to see) invertebrates (insects, mollusks, crustaceans, and annelid worms) and are used to determine whether or not a stream segment has a benthic impairment. Changes in water quality generally result in alterations to the quantity and diversity of the benthic organisms that live in streams and other water bodies. Besides being the major intermediate constituent of the aquatic food chain, benthic macroinvertebrates are "living recorders" of past and present water quality conditions. This is due to their relative immobility and their variable resistance to the diverse contaminants that are introduced into streams. The community structure of these organisms provides the basis for the biological analysis of water quality.

The applicable water quality criteria for fecal bacteria impairments are contained in Section 9 VAC 25-260-170. At the time the Upper and Lower Opequon Creek and Abrams Creek segments were placed on the 303(d) list, the criteria for fecal coliform bacteria included two parts: (1) the fecal coliform bacteria count shall not exceed a geometric mean of 200 per 100 mL of water for two or more samples taken over a 30-day period, and (2) the fecal coliform bacteria count shall not exceed 1,000 per 100 mL at any time. Most of VADEQ's ambient water quality monitoring is done on a monthly or quarterly basis. This sampling frequency does not provide the two or more samples within 30 days needed for use of the geometric mean part of the standard. Therefore, VADEQ used the 1,000 per 100 mL part of the standard in the assessment of the fecal coliform bacteria monitoring data.

USEPA recommended that all states adopt an *E. coli* or *Enterococci* standard for fresh water and *Enterococci* criteria for marine waters by 2003 because there is a stronger correlation between the concentration of these organisms (*E. coli* and *Enterococci*) and the incidence of gastrointestinal illness than between fecal bacteria and gastrointestinal illness. *E. coli* and *Enterococci* are both bacteriological organisms that can be found in the intestinal tract of warm-blooded animals. Like fecal bacteria, these organisms indicate the presence of fecal

contamination. In line with this recommendation, Virginia adopted and published revised bacteria criteria on June 17, 2002. The revised criteria became effective on January 15, 2003. As of that date, the *E. coli* standard (Table 2.2) applies to all freshwater streams in Virginia. Additionally, prior to June 30, 2008, the following interim fecal coliform standard must be applied at any sampling station that has fewer than 12 samples of *E. coli*.

> **Interim Fecal Coliform Standard:** Fecal coliform bacteria shall not exceed a geometric mean of 200 fecal coliform bacteria per 100 mL of water for two or more samples over a calendar month nor shall more than 10% of the total samples taken during any calendar month exceed 400 fecal coliform bacteria per 100 mL of water.

Table 2.2 *E. coli* standard for fresh water outlined in 9 VAC 25-260-170.A.2

	Geometric Mean[1]	Single Sample Maximum
E.coli (#/100 mL)	126	235

[1]For two or more samples taken during any calendar month.

The bacteria TMDLs for the impaired stream segments of the Opequon Creek watershed were developed to meet the new criteria (Table 2.2), including both the geometric mean and the single sample maximum.

3.0 State and Federal Requirements for TMDL Implementation Plans

3.1 Background

Once a water body is listed as impaired and a subsequent TMDL study has been conducted, then the state, in conjunction with watershed stakeholders, must develop and implement a strategy that will limit the pollutant loadings to those levels allocated in the TMDL study. Such a strategy, also known as an Implementation Plan (IP), must contain actions that will work to achieve the reduced pollutant loadings needed to bring the water body into compliance with the standard. While the federal CWA legislation alludes to, but does not require, IPs, they are a state requirement in Virginia.

3.2 State Requirements

The TMDL IP is a requirement of Virginia's 1997 Water Quality Monitoring, Information, and Restoration Act (§62.1-44.19:4 through 19:8 of the Code of Virginia), or WQMIRA. WQMIRA directs the VADEQ to "develop and implement a plan to achieve fully supporting status for impaired waters." In order for an IP to be approved by the State Water Control Board, the IP must include the following required components, as outlined in 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.

3.3 Federal Recommendations

Section 303(d) of the CWA and current USEPA regulations do not require the development of implementation strategies, though their guidance clearly describes this as the next step leading to the attainment of water quality objectives. In its 1999 "Guidance for Water Quality-Based Decisions: The TMDL Process," USEPA recommends the following minimum elements for an approvable IP:

- 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.

These recommendations closely track the State's WQMIRA requirements.

3.4 Requirements for Section 319 Fund Eligibility

Beyond the regulatory requirements listed above, the CWA was amended in 1987 to establish the Nonpoint Source Management Program in Section 319 of that act. Through that program, States, Territories, and Native American Tribes can receive grant monies for a variety of activities, including the restoration of impaired stream segments. Although there are several sources of

money to help with the TMDL implementation process, Section 319 funds are substantial and most relevant to TMDL implementation. Therefore, the requirements to obtain these funds are discussed in this chapter. The Virginia Department of Conservation and Recreation (VADCR) strongly suggests that these USEPA recommendations be addressed in the IP (in addition to the required components as described by WQMIRA).

The USEPA develops guidelines that describe the process and criteria to be used to award CWA Section 319 nonpoint source grants to States. The guidance is subject to revision and the most recent version should be considered for IP development. The "Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories in FY 2003" identifies the following nine elements that must be included in the IP to meet the 319 requirements:

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

3.5 Staged Implementation

In general, the Commonwealth of Virginia intends for NPS pollutant TMDL reductions to be implemented in a staged fashion. Staged implementation is an iterative process that incrementally implements management measures, initially targeting those sources and/or practices with the largest impact on water quality, coupled with a monitoring plan to continuously assess progress toward full attainment of designated uses. For example, a promising management practice in agricultural areas of a watershed with a bacteria impairment is livestock exclusion from streams. This has been shown to be very effective in lowering bacteria concentrations in streams, both from the cattle deposits themselves and from additional buffering in the riparian zone. This practice also has the additional benefit of reducing stream bank degradation and sediment detachment by hoof action on the banks.

There are many benefits of staged implementation, including:

1. as stream monitoring continues to occur, it allows for water quality improvements to be recorded as they are being achieved;
2. it provides a measure of quality control, given the uncertainties that exist in any model used in development of a TMDL and a TMDL IP;
3. it provides a mechanism for developing public support;
4. it helps to ensure the most cost effective practices are implemented initially; and
5. it allows for the evaluation of the adequacy of the TMDL in achieving the water quality standard.

With successful development and implementation of IPs, Virginia will be well on the way to restoring impaired waters and enhancing the value of this important resource. Additionally, development of an approved IP will improve a locality's chances for obtaining monetary assistance during implementation.

4.0 Review of the Opequon and Abrams Creek TMDL Studies

4.1 Background

A TMDL is calculated as follows:

$$TMDL = WLA + LA + MOS \quad (4.1)$$

where WLA is the waste load allocation (point sources), LA is the load allocation (nonpoint sources), and MOS is the margin of safety. A TMDL study determines the TMDL for the pollutant and then allocates that loading between point sources (WLA) and nonpoint sources (LA).

This chapter describes how the TMDLs were developed for the impaired segments of Abrams and Upper and Lower Opequon Creeks and the load allocations required to meet the TMDLs. The TMDLs are described in the following reports: "Opequon Watershed TMDLs for Benthic Impairments: Abrams Creek and Lower Opequon Creek, Frederick and Clarke Counties, Virginia", available at http://www.deq.virginia.gov/tmdl/apptmdls/shenrvr/abropebc.pdf with modifications available at http://www.deq.virginia.gov/tmdl/apptmdls/mod/abrmod.pdf, and "Bacteria TMDLs for Abram Creek and Upper and Lower Opequon Creek Located in Frederick and Clarke County, Virginia", available at http://www.deq.virginia.gov/tmdl/apptmdls/shenrvr/abropefc.pdf, with modifications available at http://www.deq.virginia.gov/tmdl/apptmdls/mod/abrmod.pdf.

4.2 Description of Impairments

Five stream segments (table 2.1 and figure 2.1) in the Opequon Creek watershed are currently listed on Virginia's 303(d) list of impaired waters for aquatic life use and fecal coliform impairments. TMDLs were developed for three of the stream segments (Abrams, Upper Opequon, and Lower Opequon) in 2003 and approved by USEPA in 2004; two additional segments, Redbud Run and Lick Run, were identified as impaired in the 2004 assessment cycle. Abrams Creek, Lower Opequon Creek, and Redbud Run are listed due to water quality violations of the General Standard (benthic impairment) and the instantaneous bacteria standard (bacteria impairment). In addition, Upper Opequon Creek and Lick Run are listed as impaired due to violations of the bacteria standard.

Inclusion on the 303(d) list for violations of the fecal coliform bacteria standard was based on water quality sampling. Abrams and Upper and Lower Opequon Creeks were first included on the 303(d) list based on samples collected between July 1992 and June 1997. The water samples had fecal coliform concentrations that exceeded the 1000 cfu/100 mL standard (described in section 2.3) in 17%, 19%, and 12% of water samples from Abrams, Upper Opequon, and Lower Opequon Creeks, respectively. The 2004 water quality assessment data were based on monitoring conducted between January 1, 1998 and December 31, 2002. All six stations within the greater Opequon watershed on Abrams, Upper Opequon, Lower Opequon Creeks, Lick Run

and Redbud Run were rated as impaired in the 2004 assessment with violation rates of 22%, 14%, 12%, 17%, and 16%, respectively.

Violations of the General Standard (benthic impairment) were identified through biological monitoring conducted by VADEQ in Abrams Creek from October 1994 to October 2001 and in Lower Opequon Creek from October 1994 to May 2002. During these periods, all seven benthic samples from Abrams Creek were rated as "moderately" impaired and five of the ten samples from Lower Opequon Creek were rated as "moderately" impaired and five were rated as "slightly" impaired. The moderately and slightly impaired ratings resulted in Abrams Creek and Lower Opequon Creek segments being listed as not supporting of the Aquatic Life designated use in both the 1998 and 2002 303(d) impaired waters lists. Since the TMDLs were developed, the 2004 assessment identified Abrams Creek, Lower Opequon, and Redbud Run as "moderately" impaired, based on monitoring at three stations.

As part of the TMDL study (summarized in the following sections), sediment was determined to be the most probable cause of the benthic impairments in Abrams and Lower Opequon Creeks. Thus, the TMDLs to address the benthic impairment were developed for sediment.

4.3 Description of Watershed Characteristics

The Opequon Creek watershed includes portions of Virginia's Clarke and Frederick counties and encompasses the City of Winchester. Opequon Creek discharges into the Potomac River, which flows into the Chesapeake Bay. Abrams Creek, a tributary of Opequon Creek, drains a mainly urban watershed, with the City of Winchester covering approximately 50% of the watershed. Forest (22%) and agriculture (27%) comprise the remainder of the watershed (figure 4.1). The Upper Opequon and Lower Opequon watersheds are mainly agricultural (about 50%), characterized by a rolling valley. The majority of the remainder of the Upper Opequon watershed is divided between forest (33%) and urban land uses (14%). The majority of the remainder of the Lower Opequon watershed is divided between forest (29%) and urban land uses (19%).

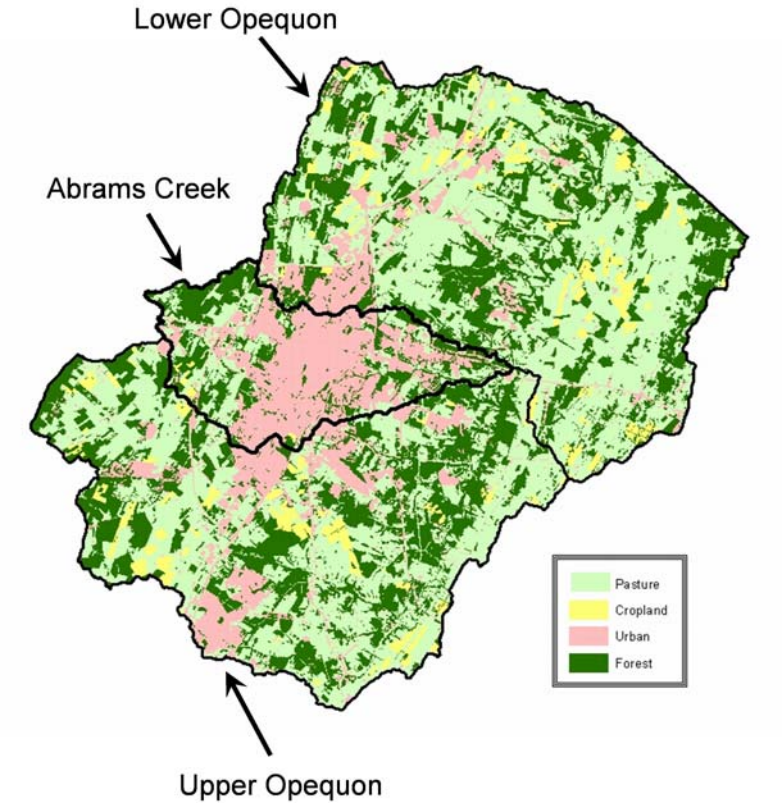

Figure 4.1 Landuse distribution of Abram-Opequon watersheds

4.4 Description of Water Quality Monitoring

Several organizations are and have been involved in monitoring efforts in the Opequon Creek watershed. The first four VADEQ stations listed in Table 4.1 provided the data that were used in the TMDL study. Water quality samples will continue to be obtained on a monthly basis through June 2006 from the three water quality stations.

The VADEQ currently uses a six-year rotation as the basis for their state-wide ambient water quality monitoring network, which includes such parameters as temperature, dissolved oxygen, specific conductance, pH, bacteria, and nutrients. As part of this system, a station is monitored for two years of every six-year period (two years on, four years off). There are four ambient stations in the Opequon Creek watershed, with two sites that are currently monitored and two that have been monitored in the past (Table 4.1 and Figure 4.2). Biological monitoring is conducted on a bi-annual basis at four different sites in the watershed, located on Abrams Creek, Opequon Creek, and Redbud Run. Two sites on the main stem of Opequon Creek and one site on Abrams Creek are currently enrolled in monthly monitoring through June 2006. These monthly data will help form a baseline for measuring TMDL implementation success. In July 2006, monitoring will return to the regular ambient rotating schedule. When funding is available and implementation begins, VADEQ will resume monthly monitoring at the "TMDL" stations to gauge progress.

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Table 4.1 VADEQ Monitoring Stations in Abrams/Opequon watersheds

Stream	Station	Station Location	Station Type	Frequency
Abrams Creek	1AABR000.78	Abrams Creek at Rt.659 bridge	TMDL[1] Biological	Monthly through June 2006, Bi-annually
Opequon Creek	1AOPE025.10	Opequon Creek at Rt.672 bridge	TMDL	Monthly through June 2006
Opequon Creek	1AOPE029.61	Opequon Creek at Rt. 660 bridge below confluence with Abrams Creek	Biological	Bi-annually
Opequon Creek	1AOPE036.13	Opequon Creek at Rt.655 bridge above confluence with Abrams Creek	TMDL Biological	Monthly through June 2006, Bi-annually
Opequon Creek	1AOPE039.70	Opequon Creek at Rt.644 Bridge	Ambient	Bi-Monthly through Jun 2007
Opequon Creek	1AOPE044.17	Opequon Creek at Rt.522 at Parkins Mills	Ambient	Bi-monthly[2] (6-yr rotation)
Lick Run	1ALIR000.95	Lick Run at Rt.664 bridge	Ambient	Bi-monthly[2] (6-yr rotation)
Redbud Run	1ARED000.46	Redbud Run at Rt.659 bridge	Ambient, Biological	Bi-monthly through Jun 2007, Bi-annually

[1]used in the TMDL study development and will be used again to monitor implementation progress
[2]not being sampled currently

State agency efforts have been supplemented by monitoring conducted by two citizen groups, The Opequon Watershed, Inc. (TOW) in conjunction with the Friends of the Shenandoah River (FOSR). Although 2002 was the last year nutrient and ambient data were collected, there is new enthusiasm and a new monitoring schedule is planned to coordinate with Coliscan monitoring, described in the next paragraph. The FOSR laboratory at Shenandoah University was recently certified by the VADEQ, meaning that their volunteer monitoring data may be used in conjunction with VADEQ data to delist the impaired reaches of Abrams Creek and Opequon Creek should they begin to meet water quality standards. Shenandoah University also includes water quality monitoring, wetland evaluation and stormwater monitoring as part of their Environmental Science coursework. Although this data source may not be consistent, it can help to paint a current, on-the-ground picture of the status of the watershed.

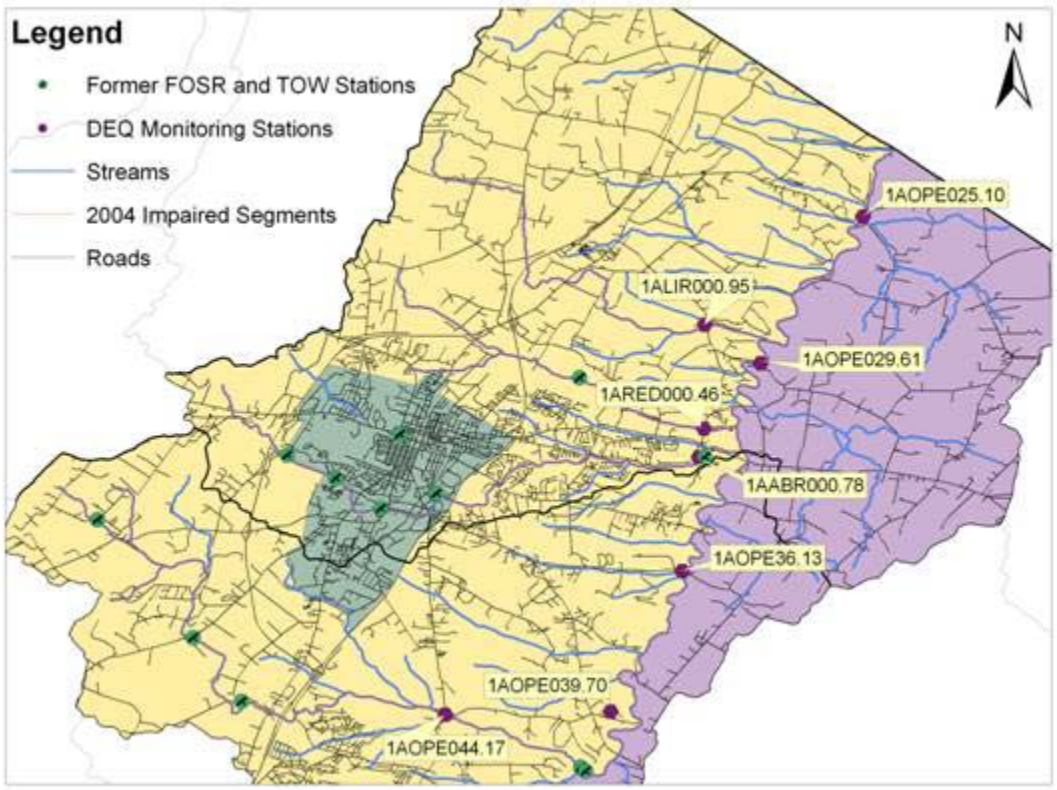

Figure 4.2 Locations of VADEQ and citizen monitoring stations in the Opequon Creek watershed. Descriptions of VADEQ stations are included in Table 4.2.

Additional monitoring of *Escherichia coli* (*e. coli*) bacteria concentrations will be conducted by citizen monitors through a one-year program sponsored by VADEQ. Coliscan Easygel® has been approved for screening purposes by VADEQ based on a comparison study with USEPA-approved methods, and has accuracy and precision comparable to membrane filtration. These monitoring data may be used to collect current data and gage the success of implementation in reducing the amount of *e. coli* bacteria in the streams, but it cannot be used for the purpose of listing or delisting the streams based on observed degradation or improvement. Volunteers are currently being trained in Coliscan methods, chemical monitoring, and benthic sampling (Save Our Streams (SOS) method) and will conduct monthly sampling with the help and support of the FOSR laboratory at Shenandoah University. This effort is in conjunction with Frederick-Winchester Service Authority's voluntary chemical water quality monitoring program, which is conducted by students from Frederick County high schools.

4.5 Description of Water Quality Modeling

4.5.1 Bacteria Modeling

The Hydrologic Simulation Program – FORTRAN (HSPF) was used to simulate the fate and transport of fecal coliform bacteria in the Abrams Creek, Upper Opequon, and Lower Opequon watersheds. To identify localized sources of fecal coliform within each watershed, the Abrams Creek watershed was divided into eleven sub-watersheds, the Upper Opequon Creek watershed was divided into sixteen sub-watersheds, and the Lower Opequon Creek watershed was divided into fifteen sub-watersheds. For the Abrams, Upper Opequon, and Lower Opequon Creek TMDLs, a margin of safety (MOS) was implicitly incorporated into each TMDL by conservatively estimating several factors affecting bacteria loadings, such as animal numbers, production rates, and contributions to streams.

4.5.2 Sediment Modeling

Because Virginia has no numeric in-stream criteria for sediment, a "reference watershed" approach was used to define allowable TMDL sediment loading rates in the impaired watershed. The reference watershed approach pairs two watersheds: one whose streams are supportive of their designated uses and one whose streams are impaired. This approach is based on the assumption that reduction of the stressor loads in the impaired watershed to the level of the loads in the reference watershed will result in restoration of the benthic community to a "non-impaired" state. The reference watershed approach involves selection of an appropriate reference watershed, model parameterization of the reference and TMDL watersheds, and definition of the TMDL endpoint using modeled output from the reference watershed.

The Upper Opequon Creek watershed was selected as the TMDL reference for both Abrams Creek and the Lower Opequon Creek watersheds. The TMDL sediment target load was defined as the modeled sediment load for existing conditions from the non-impaired Upper Opequon watershed, area-adjusted separately to each of the two impaired watersheds.

The Generalized Watershed Loading Function (GWLF) model (Haith et al., 1992) was selected for comparative modeling of the sediment loads in the impaired and reference watersheds in the TMDL study. Model parameter values were comparably evaluated using the same data sources and procedures recommended in the GWLF Users Manual (Haith et al., 1992) for the land uses and conditions found in these watersheds.

4.6 Description of Sources Considered

Potential sources of bacteria and sediment considered in the development of the TMDL included both point source and nonpoint source (NPS) contributions. In addition, two Phase II municipal separate storm sewer system (MS4) permits have been issued in the Abrams Creek watershed.

4.6.1 Point Sources

The TMDL's waste load allocation (WLA) accounts for the portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Point sources of fecal coliform bacteria in Opequon Creek watershed include all municipal and industrial plants that treat human waste, as well as private residences that fall under general

permits. Virginia issues Virginia Pollutant Discharge Elimination System (VPDES) permits for point sources. The point sources of bacteria in the Opequon Creek watershed are listed in Table 4.2, along with their permitted discharges and load allocations in the TMDLs. The waste load allocation (WLA) for each point source was set at the permitted load.

Table 4.2 Permitted point source bacteria discharges in Upper Opequon Creek and Lower Opequon Creek watersheds

Watershed	Permit Number	Facility	Flow (MGD)	Permitted FC Concentration (cfu/100 mL)	Permitted FC Load (cfu/yr)	Allocated FC Load (cfu/yr)	Allocated E. Coli Load (WLA) (cfu/yr)
Upper Opequon	VA0075191	Parkins Mill STP	6.3[a]	200	1.68E+13	1.68E+13	1.10E+13
	VA0088722	Stonebrook Swim and Racquet Club	0.004	200	1.11E+10	1.11E+10	6.96E+09
	VA0088471	Frederick Co. Landfill	0.15	200	4.14E+11	4.14E+11	2.61E+11
	22 Domestic waste general permits		0.022	200	6.08E+10	6.08E+10	3.83E+10
						Total	1.13E+13
Lower Opequon	VA0065552	Opequon Region AWT	12.2[b]	200	3.37E+13	3.37E+13	2.12E+13
	VA0090808	APAC-Virginia Inc.	0.005	200	1.38E+10	1.38E+10	8.70E+09
	VA0029653	Missionary Servants of the Most Holy Trinity	0.007	200	1.93E+10	1.93E+10	1.22E+10
	11 Domestic waste general permits		0.011	200	3.04E+10	3.04E+10	1.91E+10
						Total	2.13E+13

[a]Parkins Mill STP is permitted to discharge at 5.0 MGD for June-November and 7.6 MGD for December-May.
[b]Located above the Abrams and Opequon confluence, but discharges into the Lower Opequon. Design flow is 8.4 MGD for June-November and 16 MGD for December-May; the average is 12.2 MGD.

4.6.2 Municipal Separate Storm Sewer (MS4) Permits

Two Phase II municipal separate storm sewer system (MS4) permits have been issued in the Abrams Creek watershed for the City of Winchester (VAR040053) and VDOT-Winchester Urban Area (VAR040032) (Table 4.3). MS4 permits are National Pollutant Discharge Elimination System (NPDES)-regulated stormwater discharges that must be addressed by the WLA component of a TMDL (40 C.F.R. §130.2(h)). These permits are designed to compel

awareness of the quality of water discharging from publicly owned storm sewer outfalls and to reduce pollution from the MS4 area, although no numerical limits for any specific water quality parameter are stipulated in these permits. While the MS4 permits are regulated similarly to point source discharges, water quality discharging from the MS4s is nearly exclusively dictated by nonpoint source runoff (along with an unknown, but presumed small, amount of illicit connections). Fecal coliform loads related to stormwater runoff from areas covered by MS4 permits were modeled with HSPF as contributions from impervious land use categories.

Current USEPA Region III guidance says that, in most cases, MS4 permits located in TMDL waters can include best management practices (BMPs) and monitoring requirements to improve water quality and address compliance with the TMDL's WLA. The expectation is that, at the time of the next permit reissuance, water quality improvements can be demonstrated. If this is not the case, different control strategies or numeric limits may be required.

The point sources of sediment in the Abrams Creek and Lower Opequon watersheds are listed in Tables 4.3 and 4.4, respectively. The waste load allocation (WLA) for each point source was set at the permit limits. A clear permit limit was not defined in the permits for the MS4 areas. The WLA for the MS4 areas was set to the bacteria load expected to come from the MS4 areas after they have achieved reductions to the 'maximum extent practicable,' as specified in the permit.

Table 4.3 Permitted point sources of sediment in Abrams Creek watershed

Permit Number	Facility	Permitted Design Flow (MGD)	Permitted Monthly Avg. Conc. (mg/L TSS)	WLA (t/yr)
253 acres of Construction Stormwater General Permits [a]				30.82
Industrial Stormwater General Permits [b]				
VAR050810	O'Sullivan Corp			0.86
Non-metallic Mineral Mining General Permits [c]				
VAG840142	Stuart M Perry Inc. – Winchester	0.099	30	4.10
MS4 General Permits [d]				
VAR040053	City of Winchester			442.70
VAR040053	VDOT – Winchester Urban Area			
			Total	478.49

[a] WLAs for Construction Stormwater General Permits were calculated as: Load = 253 acres x 30.11 cm maximum annual runoff depth x 100 mg/L TSS concentration x 0.000040473 units conversion factor.

[b] WLAs for Industrial Stormwater General Permits were calculated as: Load = 38.29 in rainfall amount x (0.050 + 0.009 x percent impervious area) x drainage area x 60 mg/L TSS concentration x 0.0001135 units conversion factor.

[c] WLAs for Non-metallic Mineral Mining General Permits were calculated as: Load = reported flow x permitted TSS concentration.

[d] MS4 loads were assigned in aggregate based on the allocation reductions to the modeled loads from urban transitional and impervious areas within the watershed and inside City limits.

Table 4.4 Permitted point sources of sediment in Lower Opequon Creek watershed

Permit Number	Facility	Permitted Average Daily Load (kg/d)	Permitted Design Flow (MGD)	Permitted Monthly Avg. Conc. (mg/L TSS)	WLA (t/yr)
VA0029653	Missionary Servants of the Most Holy Trinity	0.8	0.007	30	0.29
VA0065552	Opequon Regional AWT	1385.5	12.2	30	505.71
VA0075191	Parkins Mill STP[a]		6.3		87.04
VA0088471	Frederick Co. Landfill	9.08	0.15	30	3.31
VA0088722	Stonebrook Swim Club	0.45	0.004	30	0.16
VA0089010	Franciscan Center		0.000241	30	0.01
VA0090808	APAC Virginia WWTP	0.6	0.005	30	0.22
VA0087815	Fay Spring WTP		0.031	30	1.28
33 Domestic Waste General Permits			0.033	30	1.37
641 acres of Construction Stormwater General Permits[b]					63.70
Industrial Stormwater General Permits[c]					
VAR050810	O'Sullivan Corporation				0.86
VAR051329	Stanley Doors				0.15
VAR051342	FedEx Freight East Inc.				0.08
VAR051409	Frederick County Landfill				6.64
VAR051335	Trelleborg Engineered Products Inc – MPD				0.07
VAR051336	Trelleborg Engineered Products Inc – EPD				0.07
VAR050950	APAC Virginia/L.F. Franklin & Sons				0.14
VAR050846	Zuckerman Company Inc.				0.47
VAR050844	Lear Corporation				0.41
VAR050957	North Stephenson Inc.				0.90
VAR050972	Cives Steel Company				0.26
VAR050789	Winchester Pasta LLC				1.03
VAR050819	BFI Waste Systems of North America				0.07
VAR050889	Kraft Foods North America Inc				0.14
VAR050816	Crown Beverage Packaging USA Inc.				0.41
VAR050840	Green Bay Packaging				0.26
VAR050935	Quarles Petroleum				0.01
VAR050967	Plumly Flooring				0.27
VAR051560	Rolling-Frito Lay				0.11
Non-metallic Mineral Mining General Permits[d]					
VAG840024	Global Stone Chemstone Corporation		2.16	30	89.52
VAG840142	Stuart M. Perry Inc.		0.099	30	4.10

Permit Number	Facility	Permitted Average Daily Load (kg/d)	Permitted Design Flow (MGD)	Permitted Monthly Avg. Conc. (mg/L TSS)	WLA (t/yr)
Redi-mix Concrete General Permits[c]					
VAG110028	Shockey Precast Group				0.68
Carwash General Permits					
VAG750046	A&K Car Wash		0.005	60	
MS4 General Permits [e]					0.41
VAR040053	City of Winchester				
VAR040032	VDOT – Winchester Urban Area				269.20
				Total	1039

[a] Parkins Mill STP is permitted to discharge at 5.0 MGD for June-Nov. and 7.6 MGD for Dec.-May

[b] WLAs for Construction Stormwater General Permits were calculated as: Load – 253 acres x 30.11 cm maximum annual runoff depth x 100 mg/L TSS concentration x 0.000040473 units conversion factor. For Lower Opequon, the load from 253 acres in Abrams x 0.55 (sediment delivery ratio adjustment) was added to the load from 389 acres in the Lower Opequon Remnant.

[c] WLAs for Industrial Stormwater General Permits were calculated as: Load = 38.29 in rainfall amount x (0.050 + 0.009 x percent impervious area) x drainage area x 60 mg/L TSS concentration x 0.0001135 units conversion factor.

[d] WLAs for Non-metallic Mineral Mining General Permits were calculated as: Load = report flox x permitted TSS concentration.

[e] MS4 loads were assigned in aggregated based on the allocation reductions to the modeled loads from urban transitional and impervious areas within the watershed and inside City limits.

4.6.3 Nonpoint Sources

NPS pollution originates from diffuse sources on the landscape (e.g., agriculture and urban) and is strongly affected by precipitation events – runoff from rain or snowmelt. In some cases, a precipitation event is not required to deliver NPS pollution to a stream (e.g., direct deposition of fecal matter by wildlife or livestock and contamination from leaking sewer lines or straight pipes). Nonpoint sources were assessed during TMDL development through an extensive analysis of land use with consideration for delivery mechanisms (e.g., direct loadings to the stream or land-based loadings that require a precipitation event for delivery of the pollutants to the stream from pervious and impervious surfaces).

The Opequon Creek watershed is experiencing urban growth and development that was accounted for in the TMDL development process. Future land use scenarios were investigated and the decision was made to develop the TMDL assuming an anticipated 25% build-out within Frederick County's "Urban Development Areas" and "Commercial Centers." The resulting change in land-use distribution in broad categories for the whole Opequon Creek watershed is given in Table 4.5.

Table 4.5 Land-use distribution in whole Opequon Creek watershed for existing and future conditions (25% build-out)

Land Use Category	Percent of watershed area	
	Existing	25% Build-out
Agriculture	56.5	53.3
Urban	16.9	22.1
Forest	26.6	24.6

According to the TMDL studies conducted for Opequon Creek, nonpoint sources of fecal coliform in the Upper and Lower Opequon Creek watersheds are primarily agricultural with a significant fecal coliform load due to cattle directly depositing manure in streams. In the Abrams Creek watershed, the predominant nonpoint sources include loadings from impervious land segments, accounting for almost 80% of the mean daily *E.coli* concentration. While direct deposits to streams by cattle and wildlife are responsible for only 16.4% of the mean daily E. coli concentration, these sources can have a significant impact on water quality at any given time because fecal material is deposited directly in the stream and is not subject to die-off during transport as are land-applied sources. Non-agricultural nonpoint sources of fecal coliform loadings include failing septic systems and pet waste. The fecal coliform sources in each watershed are summarized in Table 4.6.

Sediment is delivered to the impaired segments of Abrams Creek and Lower Opequon Creek through the processes of surface runoff, channel and streambank erosion, and from point source inputs, as well as from background geologic processes. Natural sediment generation is accelerated through human-induced land-disturbing activities related to a variety of agricultural, forestry, and urban land uses. During runoff events, sediment loading occurs from both pervious and impervious surfaces in the watershed. Streambank erosion is caused by reductions in riparian cover resulting in streambank instability and increased runoff rates related to anthropogenic activities in the watershed, particularly increasing areas of imperviousness from

urban growth and development. Animals grazing on pastures in riparian areas with access to streams also contribute to streambank erosion. The sediment sources are summarized in Table 4.7.

Table 4.6 Annual nonpoint source fecal coliform loads under existing and 25% build-out conditions

Source	Fecal Coliform Loading (x 10^{12} cfu)					
	Abrams		Upper Opequon		Lower Opequon	
	Existing	25% Build-out	Existing	25% Build-out	Existing	25% Build-out
Cattle direct deposit	4.10	4.10	93.6	93.6	16.2	16.2
Wildlife direct deposit	12.7	12.5	13.2	12.8	1.8	1.7
Cropland	6.6	7.1	92.3	92.6	205	205
Pasture	2,950	2,950	13,600	13,600	21,300	21,300
Residential	2,470	2,770	2,030	2,580	1,300	1,430
Loafing Lot	2,280	2,280	297	297	966	966
Forest	1,090	1,090	583	583	592	593
ILS[1] non-MS4	257	333	4.7	7.0	3.90	6.55
ILS MS4	451	485	na[2]	na	na	na
Total	9,520	9,930	16,700	17,300	24,400	24,600

[1]impervious land segment
[2]not applicable

Table 4.7 Annual nonpoint source sediment loading under existing and 25% build-out conditions

Source	Sediment Loading (t/yr)			
	Abrams		Lower Opequon	
	Existing	25% Build-out	Existing	25% Build-out
Agriculture		1,269		13,162
Urban		1,419		4,018
Forestry		30		86
Channel Erosion		319		2,275
MS4 areas		586		314
Total		3,623		19,854

4.7 Load Allocation Results and Load Reductions Required to Restore Water Quality

The VADEQ provided guidance for developing *E. coli* TMDLs when the available bacteria data, as described above are fecal coliform. The recommended procedure was to conduct the needed modeling using fecal coliform loadings as the bacteria source in the watershed and then to use an equation developed by VADEQ to convert the daily average fecal coliform concentrations output by the model to daily average *E. coli* concentrations. The equation is:

$$E.\ coli \text{ concentration} = 2^{-0.0172} \times (\text{FC concentration})^{0.91905} \quad (4.2)$$

where the bacteria concentrations (*E. coli* and FC) are in cfu/100 mL. After applying equation (4.2) to the output from the HSPF model, daily E. coli loads were determined by multiplying the daily concentrations by the average daily flow. Average annual load was determined by summing the daily loads and dividing by the number of years in the allocation period.

Different scenarios were evaluated to identify reasonable scenarios for implementation that meet both the calendar-month geometric mean *E. coli* criterion (126 cfu/100 mL) and the single sample maximum *E. coli* criterion (235 cfu/100 mL) with zero violations. The MOS (margin of safety) was implicitly incorporated into each TMDL by conservatively estimating several factors affecting bacteria loadings, such as animal numbers, production rates, and contributions to streams. The final allocation scenarios from each watershed are shown in table 4.8.

Table 4.8 Allocation scenarios for each subwatershed for fecal coliform loadings, using 25% build-out scenario

Watershed	Percent reduction in loading from existing condition				Percent violation of E. coli standard	
	Direct deposit (wildlife natural)	Direct Deposit (cattle)	Loads from residential pervious land uses (PLS)	Loads from impervious land uses (ILS)	Geometric mean	Instantaneous
Abrams Creek	0	30	96	96	0	0
Upper Opequon Creek	95	100	90	90	0	0
Lower Opequon Creek	0	0	80	80	0	0

Direct deposit by cattle in streams needs to be eliminated in the Upper Opequon Creek watershed and reduced by 30% in the Abrams Creek watershed. Significant reductions from agricultural and other pervious landuses and impervious landuses are also required to reduce the bacterial loading to the streams.

TMDL allocation scenarios for sediment loadings were developed by consolidating NPS loads into six categories: agriculture, urban, forestry, channel erosion, MS4, and point sources. The margin of safety (MOS) was explicitly defined as 10% of the calculated TMDL. The waste load allocation (WLA) was calculated as the sum of all permitted total suspended solids (TSS) loads. The load allocation (LA) – the allowable sediment load from nonpoint sources – was calculated as the target TMDL load minus the MOS minus the WLA. Different scenarios were evaluated to meet the TMDL for Abrams Creek of 2,846 t/yr of sediment and the TMDL for Lower Opequon Creek of 17,057 t/yr of sediment. The final allocation scenarios are shown in table 4.9.

Table 4.9 Allocation scenarios for each subwatershed for sediment loadings

Watershed	Percent reduction in loading from 25% build-out scenario						
	Agriculture	**Urban**	**Forestry**	**Channel Erosion**	**MS4**	**Point Sources**	**Total**
Abrams Creek	10	25	0	55	25	0	22
Lower Opequon Creek	15	15	0	35	15	0	17

5.0 Public Participation

5.1 Introduction

An essential step in implementing a TMDL and putting together a plan for such purpose is the input from a broad range of individuals, agencies, organizations and businesses because of their interest and familiarity with local water quality needs and conditions. Public participation facilitates dialogue between local stakeholders and government agencies to commit resources to TMDL implementation, such as funding and technical support. Community members are best suited to identify and resolve sources of water quality problems.

The personnel involved in developing this implementation plan included a Resource Team, a Steering Committee, Working Groups, and the general public. Members of the Resource Team and Steering Committee are listed at the beginning of this document. The Working Groups, one focused on rural areas and the other on urban areas, and the Steering Committee were comprised of watershed stakeholders. Public participation occurred via a series of steering committee and working group meetings (Table 5.1). These meetings, as well as additional public participation activities, are described in the following sections. Detailed meeting summaries are included in Appendix A.

Table 5.1 Opequon Creek TMDL Implementation Planning Meetings

Meeting Date	Meeting Type
March 22, 2005	Initial interest meeting for stakeholders
May 11, 2005	Steering Committee Meeting
June 13, 2005	First Public-Noticed Public Meeting
July 7, 2005	Working Groups meeting
August 4, 2005	Working Groups meeting
September 15, 2005	Steering Committee Meeting
November 15, 2005	Steering Committee Meeting
January 24, 2006	Steering Committee Meeting
April 21, 2006	Steering Committee Meeting
May 10, 2006	Final Public-Noticed Public Meeting

5.2 Synopsis of Opequon Creek TMDL Implementation Planning Meetings

The first 'public' event held in association with the Opequon TMDL implementation planning process was an informal interest/informational meeting. The meeting was held on March 22, 2005. Approximately 100 invitations were sent via email to government agency personnel and individuals representing key constituencies within the Opequon Creek watershed. The invitation list included those people, agencies, and groups that had participated in the public meetings during the Abrams and Opequon Creek TMDL studies. Invitees included representatives of the following groups:

Citizen stakeholders
Local homebuilders associations
Frederick and Clarke Counties
Lord Fairfax Soil and Water Conservation District
Virginia Department of Conservation and Recreation
Virginia Department of Environmental Quality
Virginia Department of Game and Inland Fisheries
City of Winchester
Chamber of Commerce
Shenandoah University
Local Historical Societies
Potomac Conservancy
Izaak Walton League

Thirty-two individuals attended the March 22 meeting. All participants were invited to join the Opequon Creek TMDL Implementation Plan Steering Committee and to attend the Steering Committee organizational meeting.

The Opequon Creek TMDL Implementation Plan Steering Committee organizational meeting was held on May 11, 2005 in Winchester, VA with 32 in attendance. At this meeting the Opequon Creek TMDL IP Resource team introduced the idea of Working Groups to explore and expand the toolbox of implementation actions or BMPs appropriate for a given interest-based sector, e.g., an 'agricultural group' would represent agricultural interests. At the May 11 meeting, the Steering Committee recommended the creation of two working groups, Urban and Agricultural/Rural. The Urban group focused on both urban residential and public works issues, while the Agricultural/Rural group focused on both agriculture and rural residential issues. The Steering Committee encouraged each group to include representatives that would and could address cross-cutting issues: environmental, governmental, public works, commercial, and educational. Each working group was responsible for discussing, analyzing, and evaluating all available actions and prioritizing which actions stakeholders are most willing to support. This information was then funneled to the Steering Committee whose job it was to balance the interests and desires voiced in the Working Groups.

The first of two public-noticed public meetings occurred on June 13, 2005 in Winchester, VA. Sixty-five stakeholders attended the first public meeting. The purpose of this first public meeting was to expand awareness and to solicit stakeholder participation on either the Urban and Agricultural/Rural Working Groups. The goals of the public meeting were:

- to provide a basic introduction to the process of implementing TMDLs;
- to engage the community through the steering committee and the working groups; and
- to explain the roles and responsibilities for each Working Group and the commitment needed for a successful process.

Following the introductory session, attendees broke into brief introductory and organizational Working Group meetings.

Working Group meetings occurred on July 7 and August 4, 2005. Both Working Groups met at each of these meetings. The Working Groups breakout sessions provided an opportunity for participants to give direct feedback to the Resource Team about potential sources of problems and appropriate solutions to impairments in the TMDL study area. The goals of these meetings were the following:

- to review the purpose and process of the IP;
- to update existing maps with respect to land use and bacteria and sediment sources;

- to identify locations of known or suspected water quality problems due to bacteria and sediment;
- to identify corrective measures (best management practices and other approaches) for reducing bacteria and sediment loads to the creeks; and
- to solicit feedback on a planned stakeholder survey about perceptions towards improving water quality in Abrams and Opequon Creeks.

As previously mentioned, the Steering Committee was responsible for balancing the interests and desires voiced in the Working Groups and providing direction to the TMDL IP development Resource Team. The process of refining Working Group input and working with the Resource Team was iterative. A series of four Steering Committee meetings were held on September 15 and November 15, 2005, and January 24 and April 21, 2006. The goals of the Steering Committee meetings were the following:

- to present the Steering Committee with a summary of the previous public and Working Group meetings (September 15 meeting only);
- to update the Steering Committee on the status of the IP and a summary of the previous meeting (every meeting);
- to collect and refine input from the Steering Committee on the suite of corrective measures (best management practices) recommended by the Working Groups (September 15, November 15, 2005, and January 24, 2006); and
- to present and solicit feedback on a draft Opequon Creek TMDL IP (April 21, 2006).

The second and final public-noticed public meeting occurred on May 10, 2006 in Winchester, VA. Twenty stakeholders attended the meeting. The purpose of this final public meeting was to present the draft of the Opequon Creek TMDL IP to stakeholders. The goals of the meeting were;

- to review the TMDL implementation planning process and the chronology of the Opequon Creek TMDL IP,
- to review the analysis and techniques used to determine the final suite of corrective measures included in the Opequon Creek TMDL IP, and
- to solicit stakeholder feedback (a formal 30-day public comment period followed the final public meeting).

5.3 Outreach Efforts to Solicit Public Participation

The local project coordinator (Jim Lawrence) worked with staff from VADEQ and VADCR to publicize the meetings and encourage citizens to attend. For the first public meeting, over 1100 mailings were sent to residents of the City of Winchester and Frederick and Clarke Counties including riparian landowners on Abrams and Opequon Creeks. Advance articles were published in the Northern Virginia Daily and Winchester Star. Public service announcements were made on two local radio stations. The meeting was also promoted on Winchester Community Television when Jim Lawrence and Woodward Bousquet (Shenandoah University) were interviewed by Mr. Barry Lee for a segment aired on *Winchester Cable Talk*. Meeting flyers were posted in public places along with larger outdoor signs in highly visible areas throughout the watershed. The local project coordinator made personal contacts via phone calls. Announcements were also sent via email to individuals and organizations and posted on web sites and electronic newsletters.

An electronic mailing list of stakeholders was initiated at the beginning of the project and expanded throughout the duration of the project. Meeting announcements and reminders were sent via this list. Additional announcements of interest to stakeholders were sent via this list. The Center for TMDL and Watershed Studies at Virginia Tech also maintained a threaded-discussion forum for the project (http://www.tmdl.net/forum/forum.asp?FORUM_ID=12).

Outreach presentations made in the watershed included three talks given by Brian Benham (Virginia Tech) of the Resource Team:

- "Improving Water Quality through the TMDL Process" presented at the April 27, 2005 *Winchester Watershed Workshop*, an event sponsored by the City of Winchester as part of their MS4 educational program and a local watershed organization, the Opequon Watershed, Inc.;
- "The TMDL Process in the Opequon Creek Watershed" presented on July 7, 2005 to the Society of Military Engineers Luncheon at the TransAtlantic Programs Office in Winchester, VA.; and
- "The Importance of Riparian Areas for Headwater Streams: Implications for Landuse Planning, Development, and Maintenance" presented on November 18, 2005 to the Winchester Public Services Committee in Council Chambers, Rouss City Hall, Winchester, VA

5.4 Survey of Watershed Residents and Riparian Landowners

To obtain additional feedback from local communities, two types of surveys (questionnaires) were distributed. A random sample of 2,300 local households in Clarke and Frederick counties received a survey with questions about their use and knowledge of Abrams and Opequon Creeks, local environmental quality, trust in various institutions acting in the sphere of water quality protection, benefits from the creeks' clean-up, and other improvements that the participants would like to see after the clean-up. An additional 200 surveys were distributed to a random sample of riparian landowners in the watershed. In addition to the questions previously described, these surveys asked participants about their willingness to implement various BMPs with or without cost share program support.

Approximately one-fourth of the watershed resident respondents were not familiar with any portion of Abrams or Opequon Creeks. Slightly more than one-half of VA watershed resident respondents indicated that they had used the creeks for some type of recreational activity. Over two-thirds of respondents thought the quality of the environment had declined in the past few years. With regard to the Opequon Creek watershed, 60% thought that there were general environmental problems. By far, trash was cited as the number one problem. Dirt/sediment, livestock, and flooding were noted by about 50% of respondents. Approximately 14% of watershed residents were aware of the TMDLs developed for Abrams and Opequon Creeks.

Riparian landowner responses indicated that, in the absence of government cost-sharing, landowners were most willing to implement the BMP of tree planting, while with government cost-sharing, stream bank restoration was the most commonly cited improvement. When asked about their awareness of the Abrams and Opequon Creek TMDLs, approximately 14% of the riparian landowner respondents, similar to the general watershed residents, indicated that they were aware of the TMDLs. Also, among riparian landowners, general stream pollution was

found to be the greatest concern, with trash in the stream ranked second. These respondents were the least concerned about recreational uses of the creeks.

These surveys provided a vehicle for greater public participation in the TMDL implementation planning process and increased awareness of water quality issues within the watershed area. Results also provided measures of public willingness-to-pay (WTP) for water quality improvement in the watershed (discussed in the Benefit Estimation section of this IP). Combined, the results provide insights that will be useful to area stakeholders as well as policy makers. Additional information about the survey can be found at http://www.caf.wvu.edu/resm/faculty/borisova/OpequonProject.htm.

6.0 IMPLEMENTATION ACTIONS

This chapter addresses the following questions:

- What types and quantities of implementation actions will be needed to restore water quality?
- What types and quantities of technical assistance will be needed to implement the actions?
- What are the associated costs and benefits of implementing these actions?

Implementation actions were identified, discussed, and prioritized for inclusion in this implementation plan through stakeholder input (working group, steering committee, and public meetings), source characterization and monitoring information from the TMDL study, and additional modeling analyses of alternative action scenarios.

6.1 Priority Implementation Actions Identified by the Steering Committee

The problems/pollutant sources listed in Table 6.1 were identified in the TMDL study. As part of the implementation plan development process, working groups identified potential actions and strategies to address each problem/source. The discussion and decision-making were facilitated through the use of a planning matrix. The planning matrix was organized by problem, with potential implementation actions listed to address each problem. For each implementation action, columns were included for the following information: priority of action; lead agency/organization; target parcels/locations/audiences; integration with other programs; extent; units; cost/unit; technical assistance requirements; potential cost-share source/tax credit/loan; cost-share rate; and notes. The priority of each action was assessed at steering committee meetings. The participants discussed the need for a particular action in the watershed and its likelihood of successful implementation. The group then voted on whether it was a high priority action. The resulting high priority actions identified by the Steering Committee are given in Table 6.2. Additional implementation actions suggested by the working groups that were considered and determined to be lower priority are given in Appendix B.

Table 6.1 Problems Identified in the Opequon Creek TMDL Study

Identified Problem	Pollutant[1]		Working Group Input[2]	
1. Livestock access to streams	S	B	R	U
2. Lack of streamside buffer/forest	S		R	U
3. Agricultural runoff	S	B	R	
4. Increased stormwater runoff (volumes/rates)	S			U
5. Pollutant buildup on impervious areas	S			U
6. Poor enforcement of Erosion & Sediment regulations at construction sites	S		R	U
7. Streambank erosion	S		R	U
8. Stream channel modifications	S			U
9. Failing septic systems		B	R	U
10. Improper pet waste disposal		B		U
11. Excessive resident waterfowl population		B		U

[1]S = Sediment; B = Bacteria
[2]U = Urban; R = Rural

Table 6.2 High priority practices identified by the Opequon Implementation Plan Development Steering Committee

Problem	Implementation Action[1]	Type of Practice		
		Primary	Policy	Education
1. Livestock access to streams	Fencing with off-stream watering (SL-6 Grazing Land Protection)	X		
	Permanent fencing (WP-2T Stream protection)	X		
	Off-stream water system (SL-6B Alternative Water System)	X		
	Stream crossing and hardened access (WP-2B)	X		
	Information to farmers about cost-share			X
	Increase cost-share for fencing/off-stream watering to 100%		X	
	Maintenance of stream exclusion fencing (WP-2T)	X		
2. Lack of streamside buffer/forest	Establish forested riparian buffers	X		
	Permanent preservation of streamside buffers from development		X	
	Permanent easements on riparian buffers		X	
	Incorporate stream buffers into development plans/projects	X	X	
	Increase awareness of CREP			X
3. Agricultural runoff	Establish forested riparian buffers	X		
	Cover crops	X		
	Vegetative buffers	X		
	Covered manure storage	X		
	Encourage nutrient management plan on agricultural areas			X
	Educational programs on BMPS (peer to peer)			X
4. Stormwater runoff	Steer/encourage future development using smart development guidelines and compliance with existing SWM plans		X	
	Change county ordinance to reduce required impervious area in future development; encourage ordinance changes to encourage LID		X	
	Encourage retrofits to infiltrate impervious area runoff		X	X
	Develop partnerships with developers to protect existing riparian buffers and to encourage use of bioretention, LID, and infiltration practices			X
	Encourage City of Winchester and Frederick County to pursue stormwater utility fee and incorporate incentive-based program to encourage LID		X	
5. Pollutant buildup on impervious surfaces	Coordinate with existing MS4 - document practices and educational programs that are part of MS4			X
	Protect existing riparian buffers		X	X
	Encourage use of bioretention, LID, and infiltration practices		X	X

Problem	Implementation Action[1]	Type of Practice		
		Primary	Policy	Education
6. Enforcement of E&S Regulations at Construction Sites	Document City's street sweeping and inlet clean-out activities; document expansion, if needed	X		
	Offer E&S educational programs that target developers			X
	Add 1 or 2 additional E&S inspectors; 1 for large projects, 1 for single family homes	X		
	Pass more uniform E&S ordinances among jurisdictions		X	
	Pass ordinances to facilitate establishment of vegetation in a timely manner following construction		X	
	Pass ordinances to reduce land stripping, possibly through tree protection		X	
	Modify E&S ordinances to apply to large tracts zoned RA (Rural Area) so that the ordinances apply when development takes place prior to the rezoning process		X	
7. Stream bank erosion	Stream restoration - geomorphology and riparian areas (Abrams)	X		
8. Stream channel modifications	Re-establish riparian forest buffers	X		
9. Failing septic systems	Increase public awareness of costshare money to repair failing systems			X
	Integrate maintenance fees with property taxes; maybe through ordinance that requires regular maintenance of septic systems		X	
	Map straight pipes, sinkholes, wells, and septic systems	X		
	Target high-risk areas for money to repair failing systems - older houses, karst areas		X	
	Septic tank pumpout (state cost share practice, RB-1)	X		
	Connect malfunctioning system to public sewer (RB-2)	X		
	Repair failing system (RB-3)	X		
	Septic tank installation/replacement (RB-4)	X		
	Install alternative on-site waste treatment systems: sand filters, elevated sand mounds, constructed wetlands, peat filters, vault privies, incinerator toilets, composting toilets (RB-5)	X		
10. Improper pet waste disposal	Develop City/County ordinance to address this source		X	
	Develop and execute education program			X
11. Excessive resident waterfowl population	Encourage City and Shenandoah University to utilize USDA nuisance wildlife control program	X		
12. Exfiltration from municipal sewer collection system	Integrate with city/county sewer maintenance and rehabilitation programs	X		
13. Watershed Management	Inventory watershed to determine priority locations for practices identified above	X		
	Develop and implement comprehensive monitoring program	X		

[1]State cost-share practices numbers are given in parentheses, where appropriate.

6.2 Implementation Actions and Costs to Meet the TMDLs

The high priority actions can be classified into several categories: primary practices for near-term implementation, policy initiatives/strategies, and educational strategies. The impact of the high priority actions on achieving the TMDLs was evaluated using the same models (HSPF and GWLF) used in the TMDL study. The analysis focused on the practices listed in Table 6.3, with the given pollutant reduction efficiencies.

The analyses were conducted separately for Abrams Creek, Upper Opequon Creek, and Lower Opequon Creek watersheds. The goal was to identify implementation scenarios for each watershed to achieve 0% violations of the bacteria standards and the required reduction in sediment yield. The goal was achieved for Abrams Creek and for sediment and the geometric mean criterion for bacteria for Upper Opequon and Lower Opequon. The instantaneous bacteria criterion was exceeded 2% of the time for Upper Opequon and 3% of the time for Lower Opequon. The implementation scenarios are given in Tables 6.4 through 6.6 for Abrams Creek, Upper Opequon, and Lower Opequon Creek, respectively.

The impervious areas in the Abrams Creek watershed have the greatest impact on the water quality of the stream. Residential BMPs such as pet waste education, goose and duck waste clean-up, and infiltration or bioretention practices have the greatest impact on reducing violations of the bacteria standard. There are few agricultural areas in the Abrams Creek watershed; modeling scenarios confirmed that implementing agricultural BMPs in the watershed would have little impact on overall water quality.

Pasture comprises about 48% of the Upper Opequon Creek watershed and cattle graze about half of this land. Most of the cattle in this watershed have access to the stream and contribute greatly to direct loading to the stream. Bacteria loads from pasture and cropland in the watershed also have a large impact on the water quality. Implementing various agricultural BMPs will be necessary to improve the water quality in this watershed. Residential BMPs will have less effect on the water quality, but are also needed to reduce bacteria loading to Opequon Creek. The Upper Opequon TMDL calls for substantial wildlife reductions that cannot be addressed in this implementation plan. For this reason, some violations of the single sample bacteria standard still exist after implementation of practices that address anthropogenic sources. If water quality goals still cannot be met, additional options could be explored related to wildlife options or a use attainability analysis (UAA).

About 55% of the Lower Opequon watershed is pasture, with cattle grazing about half of this land. Various scenarios evaluated through modeling indicated that runoff of bacteria from the grazed pastures is the driving mechanism for bacteria in Lower Opequon Creek. Although residential and urban land uses make up less than 10% of the watershed, some residential practices, such as pet waste education and failing septic repair, are needed to reduce bacteria loadings to the Creek. Some violations of the single sample bacteria standard continue to occur after implementation for two reasons. First, the reductions that were called for in the Lower Opequon Creek TMDL for overland loads are difficult to obtain using BMPs typically

implemented on pasture. Second, the inflows from Upper Opequon Creek also affect the results in Lower Opequon Creek.

Table 6.3 Primary implementation actions for meeting bacteria and sediment TMDLs in Opequon Creek watersheds

Implementation action	Pollutant Reduction Efficiency (%)			Unit	Cost per unit ($)
	Bacteria		Sediment		
	Source Reduction	Delivery Reduction	Delivery Reduction		
Fencing with off-stream watering (SL-6 Grazing Land Protection)	100	–	75 [1]	linear ft	17[2]
Fencing (WP-2T)	100	–	75 [1]	linear ft	3.50[2]
Fencing maintenance (WP-2T)	100	–	75 [1]	linear ft	0.50
Establishment/enhancement of forested riparian buffer zones	–	50[3]	70 [1]	acre	750[4]
Pasture management to improve vegetative cover	–	50[5]		acre	85[6]
Loafing lot management	–	100	0 [7]	system	50,000[2]
Cover crops	–	40[3]	40[3]	acre	40[2]
Replacement/repair of failing septic systems	100	–	0	system	12,400[8] (connection) 14,000[8] (replacement) 2,650 [2] (repair)
Pet waste education programs	50[9]	–	0	program	10,000[9]
Geese and duck waste clean-up	50[9]	–	79[10]	sweeper /vacuum	15,000[11]
Erosion and sediment control	–	25[9]	50[9]	FTE	50,000[9]
Infiltration basin/trench	–	50[3]	90[3]	acre treated	14,520[12]
Rain garden/bioretention	–	40[3]	75[13]	acre treated	19,239[12]

Sources:
(1) DCR 2002 NPS Watershed Assessment
(2) average based on DCR BMP database for Frederick and Clarke Counties
(3) DCR, DEQ 2003 IP Guidance Manual
(4) DCR, DEQ 2003 IP Guidance Manual cited $547/acre, which was increased here
(5) professional judgment based on effectiveness of other vegetative practices
(6) average based on USDA-NRCS Virginia list of costs, November 2005
(7) CBP Phase 4.3
(8) stakeholder estimates
(9) professional judgment and stakeholder input
(10) street sweeping, Montgomery Co., MD DEP, February 2002
(11)
(12) computed assuming treating 1inch of runoff from treated acre with cost of $5.30/ft^3 for bioretention and $4/ft^3 for infiltration (USEPA, 1999)
(13) MdDER, Prince Georges Co., BMP model

Table 6.4 Implementation actions required to achieve bacteria and sediment TMDLs in Abrams Creek

Implementation Action	Unit	Units required (#)	Avg cost per unit ($)	Total cost ($)
Repair/replace failing septic systems	system	44	9,100	409,100
Infiltration basin/trench (Rain garden/bioretention)	acre treated	1,652 (2,066)	14,520 (19,239)	23,987,040 (39,747,774)
Pet waste education program	program	1	10,000	10,000
Geese and duck waste clean-up	sweeper/vacuum	1	15,000	15,000
Establishment/enhancement of forested riparian buffer zones	acre (linear ft)	29 (35,980)[1]	750	21,750
Enhanced E&S[2] efficiency	E&S inspector	–	–	Costs are included in Table 6.7
All practices implemented				24,442,890 (40,203,624)[3]

[1]assumed buffer width of 35 ft
[2]erosion and sediment control
[3]The values shown for infiltration basin/trench and rain garden/bioretention indicate the number of impervious acres from which stormwater would still need to be treated to achieve the required reductions in bacteria loading after all the other listed practices are installed. The range in cost results from assuming that all of one practice or the other was used. A combination of bioretention and infiltration basins would cost in between the two values.

Table 6.5 Implementation actions required to achieve bacteria TMDL in Upper Opequon Creek watershed

Implementation Action	Unit	Units required (#)	Avg cost per unit ($)	Total cost ($)
Fencing with off-stream watering (SL-6 Grazing Land Protection)	linear ft	55,282	17	939,794
WP-2T (fencing)	linear ft	32,208	3.50	112,728
WP-2T (fencing maintenance)	linear ft	32,208	0.50	16,104
Establishment/enhancement of forested riparian buffer zones	acre (linear ft)	21.9 (27,300)	750	16,425
Pasture management	acre	7,726	85	656,710
Repair/replace failing septic systems	system	350	6,160	2,292,500
Infiltration basin/trench (Rain garden/bioretention)	acre	637 (797)	14,520 (19,239)	9,249,240 (15,333,483)
Loafing lot management	system	1	50,000	50,000
Cover crop	acre	1,866	40	74,640
Pet waste education program	program	1	Costs are included in Table 6.4 for whole watershed	Costs are included in Table 6.4 for whole watershed
Geese and duck waste clean-up	sweeper/vacuum	1	Costs are included in Table 6.4 for whole watershed	Costs are included in Table 6.4 for whole watershed
All practices implemented				13,408,141 (19,492,384)[1]

[1]The values shown for infiltration basin/trench and rain garden/bioretention indicate the number of impervious acres from which stormwater would still need to be treated to achieve the required reductions in bacteria loading after all the other listed practices are installed. The range in cost results from assuming that all of one practice or the other was used. A combination of bioretention and infiltration basins would cost in between the two values.

Table 6.6 Implementation actions required to achieve bacteria and sediment TMDLs in Lower Opequon Creek watershed assuming the TMDLs in Abrams and Upper Opequon Creeks are met

Implementation Action	Unit	Units required (#)	Avg cost per unit ($)	Total cost ($)
Pasture management	acre	10,323	85	877,455
Loafing lot management	system	1	50,000	50,000
Repair/replace failing septic systems	system	372	6,160	2,436,600
Pet waste education program	program	1	Costs are included in Table 6.4 for whole watershed	Costs are included in Table 6.4 for whole watershed
Geese and duck waste clean-up	sweeper/vacuum	1	Costs are included in Table 6.4 for whole watershed	Costs are included in Table 6.4 for whole watershed
Establishment/enhancement of forested riparian buffer zones	acre	85	750	63,750
All practices implemented				3,427,805

Technical assistance will be needed for design and installation of implementation actions, as well as for educational outreach. Personnel requirements, in terms of full-time equivalents (FTE), and costs (Table 6.7) were estimated based on similar projects and experience and knowledge of the steering committee. Educational outreach will include strategies identified by stakeholders for facilitating implementation of priority actions.

Table 6.7 Technical assistance needs associated with implementation actions to meet bacteria and sediment TMDLs

Implementation Practice	FTE[1]/year	Cost/FTE ($)	Total Cost ($)
Pet waste education program	0.5	50,000	25,000
Sweeper/vacuum technician	0.5	50,000	25,000
E&S inspection	1.0	50,000	50,000
Septic system technician	1.0	50,000	50,000
Stormwater BMP technician	1.0	50,000	50,000
Total Annual Cost			200,000
Stream exclusion practices (SL-6 System,WP-2T fencing)	5[2]	50,000	250,000

[1]full-time equivalent
[2]one time cost for design and supervision of installation

6.3 Benefits

The primary outcome of TMDL implementation will be cleaner waters in the Opequon watershed, where pollution levels will be reduced to meet water quality standards. The benefits of meeting water quality standards in Opequon Creek are numerous. As a result of reducing bacteria and sediment loading, watershed residents can anticipate improved public health, conservation of natural resources (*e.g.*, soil and soil nutrients), improved riparian habitat, reductions in the amount of flood damage, improved recreational opportunities, greater economic opportunities (*e.g.*, improved agricultural production and tourism), and enhanced real estate values for farms, homes, and businesses located near creeks in the watershed. Reducing sediment loads as a result of best management practices installed to improve benthic and bacteria water quality impairments will help achieve goals of the Chesapeake Bay Tributary Strategy.

Quantifying the value of all of the benefits listed in the previous paragraph would be very difficult. Many would say, for example, that a value can not be put on human health. If the benefits could be valued monetarily, it is clear that the value would be very large.

In an attempt to quantify at least a few of the benefits, the expected benefits from improved aquatic life (game fish population) and the safety of swimming and wading were estimated using the contingent valuation (CV) method. CV involves the use of surveys to measure a community's willingness-to-pay (WTP) for environmental improvements. Development and administration of the two surveys for Virginia residents is described in section 5.4. Since water quality improvement in Virginia can have downstream benefits, a similar survey was distributed to a random sample of 2,500 households in Berkley and Jefferson counties in West Virginia.

In the WTP question, water quality improvements were described in terms of improved sport fish population and the safety of swimming and wading. Respondents were asked how much they would be willing to pay for a hypothetical clean-up plan that would lead to such improvements. For Virginia residents, the question was phrased using taxes as the payment vehicle, whereas for West Virginia residents, the question was phrased using a one-time donation to a hypothetical fund as the payment vehicle.

An econometric modeling technique called grouped tobit was used to estimate WTP models in Virginia and West Virginia (Greene, 1997). The two Virginia sub-samples were compared to see if the separate sub-samples had the same characteristics that explained their WTP for improved water quality. Using statistical tests, we found that these sub-samples had different characteristics that explained their WTP.

Of the 230 Virginia general public returned surveys, 72% were supportive of the described hypothetical clean-up plan, 11% opposed the plan while approximately 17% remained neutral. When including general public respondents with a positive or zero WTP, the median annual amount for an increase in taxes is approximately $48 per household, for five years[1].

[1] Some zero WTP values were not included in the analysis because these respondents were found to be "protesting" against the CV question.

Of the 63 riparian landowner returned surveys, 67% were supportive of the described hypothetical clean-up plan, 21% opposed the plan while approximately 13% remained neutral. When including those riparian landowner respondents with a positive or zero WTP, the annual median amount for an increase in taxes is approximately $62, for five years. In West Virginia, when including the respondents with a positive or zero WTP, the median willingness-to-pay per household for out-of-state clean-up is approximately $17.

Statistical techniques were employed to determine which characteristics influence an individual WTP for improved water quality. Virginia residents who were aware of the TMDL and better educated tended to be very concerned about the creeks within the watershed, used the creeks within the watershed for recreation, were older with higher incomes, and were willing to pay more for improved water quality. In addition, those individuals who feel the overall quality of the environment has improved in the past few years are willing to pay less for improvements in water quality.

To estimate the total benefits from improved aquatic life (game fish population) and the safety of swimming and wading due to improving water quality within the Virginia portion of the Opequon watershed, we aggregated individual WTP estimates for the entire population living in the West Virginia and Virginia portions of this watershed. These estimates were then summed together. Because survey response rates were lower than expected, non-respondent WTP was estimated using the statistical model coefficients produced when analyzing respondent WTP, imputed values, and zip code Census statistics. Virginia non-respondents were estimated to have a median WTP of $24 annually for five years, while West Virginia non-respondents were estimated to have a median WTP of $11 for Virginia clean-up in the form of a one-time donation. Because response rates for riparian landowners were higher than those for the general public, it was assumed that the non-respondents would have the same WTP as respondents. Three different scenarios were constructed that varied the discount rate for Virginia WTP responses. Based on a review of previous studies, discount rates ranging from 4.25% to 29% were applied for the purpose of converting future payments to current dollars.

The total benefits from improved aquatic life (game fish population) and the safety of swimming and wading resulting from improved water quality within the Virginia portion of Opequon Creek in current dollars were determined to range from $2.0 to $2.75 million (Table 6.8). As indicated above, these estimates are only based on two specific benefits: improved aquatic life (game fish population) and the safety of swimming and wading. The value of the additional benefits enumerated at the beginning of this section are not included in the estimates given in Table 6.8. As indicated above, those benefits are very difficult, if not impossible, to quantify, but are clearly very large.

Table 6.8 Benefits from improved aquatic life (game fish population) and the safety of swimming and wading within the Virginia portion of the Opequon Creek watershed as a result of TMDL implementation.

Discount Rate Scenario	Expected benefits from improved aquatic life (game fish population) and the safety of swimming and wading resulting from TMDL implementation (in millions of dollars)		
	Virginia	West Virginia	Total
Low (4.25%)	2.46	0.29	2.75
Medium (11%)	2.17	0.29	2.46
High (29%)	1.71	0.29	2.00

7.0 MEASURABLE GOALS AND MILESTONES

This chapter answers the following questions:

- Who will be responsible for tracking control measure installations?
- What are the implementation milestones?
- What type of water quality monitoring will be continued during implementation?
- What annual goals are to be achieved during implementation?
- What are the methods to be used to assess "reasonable assurance" of successful implementation?
- What methods will be used during implementation for evaluating progress?
- What actions will be taken if water quality standards are not attained?

7.1 Implementation and Water Quality Milestones

Implementation milestones define the percentage of implementation actions to be installed within certain timeframes. Water quality milestones establish the corresponding improvements in water quality that can be expected as the implementation milestones are met. Reducing violations of the bacteria standard to less than 10.5%, the criterion for removal from the 303(d) list (de-listing), is the first water quality milestone, referred to as Stage 1 implementation hereafter. Sets of implementation actions that could achieve that water quality milestone were determined through modeling with HSPF for bacteria and GWLF for sediment. The set of implementation actions (Table 7.1) was selected by the stakeholders and resource team based on considerations of costs, funding sources, and resource availability, including contractors and technical assistance. The water quality milestones associated with Stage 1 implementation are given in Table 7.2. The timeline for achieving Stage 1 implementation is given in Table 7.3. The timeline includes the primary implementation actions shown in Table 7.1, as well as additional policy and education actions from Table 6.2 that will facilitate Stage 1 implementation. The costs associated with Stage 1 implementation are given in Table 7.4.

The second stage of implementation will occur over years 6 through 12. The implementation timeline is given in Table 7.5 and costs are given in Table 7.6. A slower rate of implementation of some practices is planned in Stage 2 to allow some practices, such as riparian buffers and pasture management, to mature and impact water quality. Evaluation of monitoring data will be used to determine if all of the currently projected practices are needed to meet water quality standards. Because the modeling used to develop the IP was conservative, i.e., tended to underpredict effectiveness of practices, monitoring might show that this extent of implementation is not necessary. Section 7.5 describes how progress will be measured and how the required extent of implementation can be modified based on water quality monitoring results.

Table 7.1 Implementation actions required to meet water quality milestone of less than 10.5% violations of the instantaneous bacteria criterion in Abrams and Opequon Creeks[1]

Action	Unit	Watershed	Units implemented or impacted (#)
Repair/replace failing septic systems	system	Abrams	0
		Upper Opequon	175
		Lower Opequon	74
Infiltration basin/trench (Rain garden/bioretention)	acre treated	Abrams	149 (186)
Fencing with off-stream watering (SL-6 Grazing Land Protection)	linear ft	Upper Opequon	13,820
Fencing (WP-2T)	linear ft	Upper Opequon	8,052
Fencing maintenance (WP-2T)	linear ft	Upper Opequon	8,052
Pet waste education program	FTE[2] (Program assistant)	All	0.50
Geese and duck waste clean-up	FTE (Technician)	All	1.0
Establishment/enhancement of forested riparian buffer zones	acre (linear ft)	Abrams	28.9 (35,980)
		Upper Opequon	21.9 (27,300)
Enhanced E&S efficiency	FTE (E&S inspector)	Abrams	1.0
Loafing lot management	system	Upper Opequon	1
		Lower Opequon	1
Pasture management	acres	Upper Opequon	7,809
		Lower Opequon	10,323

[1]The resulting violations of the bacteria geometric mean are 1%, 3%, and 3% for Abrams, Upper Opequon, and Lower Opequon Creeks, respectively; violations of the instantaneous bacteria standard are 9%, 10%, and 9% for Abrams, Upper Opequon, and Lower Opequon Creeks, respectively. This scenario would also reduce the sediment load below the TMDLs for Abrams and Lower Opequon Creeks.
[2]full-time equivalent

Table 7.2 Water quality milestones for staged implementation in Abrams, Upper Opequon, and Lower Opequon Creek watersheds

	Water Quality Milestones							
	% Violations of Bacteria Standard						Sediment Reduction (%)[1]	
	Abrams		Upper Opequon		Lower Opequon		Abrams	Lower Opequon
Time	Geo[2]	Inst[3]	Geo	Inst	Geo	Inst		
Existing[4]	na[5]	22	na	14	na	12	0	0
5 years	1	9	3	10	3	9	>22%	>17%
11 years	0	0	0	2	0	3	>22%	>17%

[1]The sediment reduction required to meet the TMDL is 22% for Abrams Creek and 17% for Lower Opequon Creek.
[2]The geometric mean, based on two or more samples during any calendar month, can not exceed 126 *E coli*/100 mL.
[3]The single sample maximum can not exceed 235 *E. coli*/100 mL (9 VAC 25-260-170.A.2)
[4]2004 water quality assessment data
[5]not available

Table 7.3 Stage 1 Implementation Timeline

Date		Technical Personnel							
		Septic	**Pet**	**Geese**	**E&S**	**Agri-culture**	**Storm water**	**Action Committee**	**Ordinance**
Years 1 and 2 7/1/06-7/1/08	Hire/assign personnel for life of project							X	
	Septic Systems								
	Increase public awareness of cost-share money for septic system repair	X							
	Target high-risk areas for money to repair failing septic systems – older houses, karst areas – start in Upper and Lower Opequon watersheds	X							
	Provide technical support for septic system repair/replacement – goal is 100 systems fixed	X							
	Pet Waste								
	Develop and implement pet waste education program		X						
	Develop City/County ordinance to address pet waste problem								X
	Resident Waterfowl								
	Develop and implement goose/duck waste clean-up program			X					
	Encourage City of Winchester and Shenandoah University to utilize USDA nuisance wildlife control program							X	
	Erosion and Sediment								
	Increase inspection of construction sites for E&S control				X				
	Offer E&S educational programs that target developers				X				
	Stormwater Runoff								
	Provide technical assistance for installation of urban riparian buffers– goal is buffers along 14,392 ft (2.7 mi) of stream (11.6 ac of buffer) in Abrams Creek watershed and 10,920 ft (2.1 mi) of stream (8.8 ac of buffer) in Upper Opequon Creek watershed						X		
	~~Steer/encourage future development using smart~~						X		

		Technical Personnel							
		Septic	**Pet**	**Geese**	**E&S**	**Agri-culture**	**Storm water**	**Action Committee**	**Ordinance**
	development guidelines and compliance with existing SWM plans								
	Change county ordinance to reduce required impervious area in future development; encourage ordinance changes to encourage LID								X
	Encourage retrofits to infiltrate impervious area runoff						X		
	Develop partnerships with developers to protect existing riparian buffers and to encourage use of bioretention, LID, and infiltration practices						X		
	Encourage City of Winchester and Frederick County to pursue stormwater utility fee and incorporate incentive-based program to encourage LID							X	
	Coordinate with existing MS4 - document practices and educational programs that are part of MS4						X		
	Protect existing riparian buffers								X
	Livestock Access to Streams								
	Provide information to farmers about cost-share					X			
	Provide technical assistance for fencing with off-stream watering (SL-6 Grazing Land Protection) – goal is 5,882 linear ft in Upper Opequon					X			
	Provide technical assistance for permanent fencing (WP-2T) – goal is 3,529 ft in Upper Opequon					X			
	Loafing Lot Management								
	Identify loafing lot issues					X			
	Provide technical assistance to loafing lots to solve problems					X			
	Pasture Management								
	Provide technical assistance to pasture owners to practice improved pasture management – goal is 3100 ac in Upper Opequon and 4100 ac in Lower Opequon watersheds					X			

		Technical Personnel							
		Septic	**Pet**	**Geese**	**E&S**	**Agri-culture**	**Storm water**	**Action Committee**	**Ordinance**
Years 3 and 4 7/1/08-7/1/10	**Septic Systems**								
	Integrate maintenance fees with property taxes; maybe through ordinance that requires regular maintenance of septic systems								X
	Continue to increase public awareness of cost-share money for septic system repair	X							
	Target high-risk areas for money to repair failing septic systems – older houses, karst areas – continue in Upper and Lower Opequon watersheds	X							
	Provide technical support for septic system repair/replacement – goal is 100 systems fixed	X							
	Pet Waste								
	Continue to implement pet waste education program		X						
	Resident Waterfowl								
	Continue goose/duck waste clean-up program			X					
	Encourage City of Winchester and Shenandoah University to utilize USDA nuisance wildlife control program							X	
	Erosion and Sediment								
	Continue higher level of inspection of construction sites for E&S control				X				
	Offer E&S educational programs that target developers				X				
	Pass more uniform E&S ordinances among jurisdictions								X
	Pass ordinances to facilitate establishment of vegetation in a timely manner following construction								X
	Pass ordinances to reduce land stripping, possibly through tree protection								X
	Modify E&S ordinances to apply to large tracts zoned RA (Rural Area) so that the ordinances apply when development takes place prior to the rezoning process								X

		Technical Personnel							
		Septic	**Pet**	**Geese**	**E&S**	**Agri-culture**	**Storm water**	**Action Committee**	**Ordinance**
	Stormwater Runoff								
	Provide technical assistance for installation of urban riparian buffers– goal is buffers along 14,392 ft (2.7 mi) of stream (11.6 ac of buffer) in Abrams Creek watershed and 10,920 ft (2.1 mi) of stream (8.8 ac of buffer) in Upper Opequon Creek watershed						X		
	Steer/encourage future development using smart development guidelines and compliance with existing SWM plans						X		
	Change county ordinance to reduce required impervious area in future development; encourage ordinance changes to encourage LID								X
	Encourage retrofits to infiltrate impervious area runoff						X		
	Develop partnerships with developers to protect existing riparian buffers and to encourage use of bioretention, LID, and infiltration practices						X		
	Encourage City of Winchester and Frederick County to pursue stormwater utility fee and incorporate incentive-based program to encourage LID							X	
	Coordinate with existing MS4 - document practices and educational programs that are part of MS4						X		
	Protect existing riparian buffers								X
	Livestock Access to Streams								
	Provide information to farmers about cost-share					X			
	Provide technical assistance for fencing with off-stream watering (SL-6 Grazing Land Protection) – goal is 5,882 linear ft in Upper Opequon					X			
	Provide technical assistance for permanent fencing (WP-2T) – goal is 3,529 ft in Upper Opequon					X			
	Pasture Management								
	Provide technical assistance to pasture owners to practice improved pasture management – goal is 3100					X			

		Technical Personnel							
		Septic	**Pet**	**Geese**	**E&S**	**Agri-culture**	**Storm water**	**Action Committee**	**Ordinance**
	ac in Upper Opequon and 4100 ac in Lower Opequon watersheds								
Year 5 7/1/10-7/1/11	**Septic Systems**								
	Continue to increase public awareness of cost-share money for septic system repair	X							
	Target high-risk areas for money to repair failing septic systems – older houses, karst areas – continue in Upper and Lower Opequon watersheds	X							
	Provide technical support for septic system repair/replacement – goal is 50 systems fixed	X							
	Pet Waste								
	Continue to implement pet waste education program		X						
	Resident Waterfowl								
	Continue goose/duck waste clean-up program			X					
	Encourage City of Winchester and Shenandoah University to utilize USDA nuisance wildlife control program							X	
	Erosion and Sediment								
	Continue higher level of inspection of construction sites for E&S control				X				
	Stormwater Runoff								
	Provide technical assistance for installation of urban riparian buffers– goal is buffers along 7,196 ft (1.4 mi) of stream (5.8 ac of buffer) in Abrams Creek watershed and 5,460 ft (1.1 mi) of stream (4.4 ac of buffer) in Upper Opequon Creek watershed						X		
	Steer/encourage future development using smart development guidelines and compliance with existing SWM plans						X		

		Technical Personnel							
		Septic	**Pet**	**Geese**	**E&S**	**Agri-culture**	**Storm water**	**Action Committee**	**Ordinance**
	Change county ordinance to reduce required impervious area in future development; encourage ordinance changes to encourage LID								X
	Encourage retrofits to infiltrate impervious area runoff						X		
	Continue partnerships with developers to protect existing riparian buffers and to encourage use of bioretention, LID, and infiltration practices						X		
	Encourage City of Winchester and Frederick County to pursue stormwater utility fee and incorporate incentive-based program to encourage LID							X	
	Coordinate with existing MS4 - document practices and educational programs that are part of MS4						X		
	Protect existing riparian buffers								X
	Livestock Access to Streams								
	Provide information to farmers about cost-share					X			
	Provide technical assistance for fencing with off-stream watering (SL-6 Grazing Land Protection) – goal is 2,056 linear ft in Upper Opequon					X			
	Provide technical assistance for permanent fencing (WP-2T) – goal is 1,195 ft in Upper Opequon					X			
	Pasture Management								
	Provide technical assistance to pasture owners to practice improved pasture management – goal is 1600 ac in Upper Opequon and 2100 ac in Lower Opequon watersheds					X			

Table 7.4 Costs for Stage 1 Implementation

Item	Cost ($) Year 1	2	3	4	5	Stage 1 Total
Personnel						
Pet waste education technician	25,000	25,000	25,000	25,000	25,000	125,000
Sweeper/vacuum technician	25,000	25,000	25,000	25,000	25,000	125,000
E&S inspector	50,000	50,000	50,000	50,000	50,000	250,000
Septic system technician	50,000	50,000	50,000	50,000	50,000	250,000
Stormwater BMP technician	50,000	50,000	50,000	50,000	50,000	250,000
Agricultural technician	50,000	50,000	50,000	50,000	50,000	250,000
Practice Implementation						
Septic system replacement/repair	326,714	326,714	326,714	326,714	326,714	1,633,570
Materials for pet waste education program	10,000	5,000	5,000	5,000	5,000	30,000
Purchase equipment for geese and duck waste clean-up	15,000	0	0	0	0	15,000
Maintain/operate equipment for geese and duck waste clean-up	5,000	5,000	5,000	5,000	5,000	25,000
Installation of forested riparian buffers	7,650	7,650	7,650	7,650	7,650	38,250
Fencing with off-stream watering (SL-6)	50,000	50,000	50,000	50,000	34,950	234,950
Fencing (WP-2T)	6,000	6,000	6,000	6,000	4,182	28,182
Fencing maintenance (WP-2T)	850	850	850	850	626	4,026
Loafing lot management	50,000	50,000	0	0	0	100,000
Pasture management	306,000	306,000	306,000	306,000	314,500	1,538,500
Infiltration basin/trench (Rain garden/bioretention)	432,115 (715,691)	432,115 (715,691)	432,115 (715,691)	432,115 (715,691)	432,115 (715,691)	2,160,576 (3,578,454)
Total	1,459,329 (1,742,905)	1,439,329 (1,722,905)	1,389,329 (1,672,905)	1,389,329 (1,672,905)	1,380,737 (1,664,313)	7,058,054 (8,475,932)

Table 7.5 Stage 2 Implementation Timeline

Action	Unit	Watershed	Years				
			1-5 (Stage 1)	6-7	8-9	10-11	Total
			Units implemented or impacted (#)				
Repair/replace failing septic systems	system	Abrams	0	10	10	24	44
		Upper Opequon	175	50	50	75	350
		Lower Opequon	74	50	124	124	372
Infiltration basin/trench (Rain garden/bioretention)	acre treated	Abrams	149 (186)	501 (627)	501 (627)	501 (627)	1,652 (2,066)
		Upper Opequon	0 (0)	212 (266)	212 (266)	213 (265)	637 (797)
Pet waste education program	program	All	1	1	1	1	1
Geese and duck waste clean-up	sweeper/vacuum	All	1	1	1	1	1
Enhanced E&S efficiency	E&S inspector	Abrams	1	1	1	1	1
Loafing lot management	System	Upper Opequon	1	0	0	0	1
		Lower Opequon	1	0	0	0	1
Pasture management	acres	Upper Opequon	7809	0	0	0	7809
		Lower Opequon	10,323	0	0	0	10,323
Fencing with off-stream watering (SL-6 Grazing Land Protection)	linear ft	Upper Opequon	13,820	13,820	13,820	13,820	55,280
WP-2T (fencing)	linear ft	Upper Opequon	8,253	7,895	7,895	7,895	32,208
WP-2T (fencing maintenance)	linear ft	Upper Opequon	8,523	7,895	7,895	7,895	32,208

Table 7.6 Costs for Stage 2 Implementation

Item	Cost ($)						
	Year						Stage 2 Total
	6	7	8	9	10	11	
Personnel							
Pet waste education technician	12,500	12,500	12,500	12,500	12,500	12,500	75,000
Sweeper/vacuum technician	25,000	25,000	25,000	25,000	25,000	25,000	150,000
E&S inspector	50,000	50,000	50,000	50,000	50,000	50,000	300,000
Septic system technician	50,000	50,000	50,000	50,000	50,000	50,000	300,000
Stormwater BMP technician	50,000	50,000	50,000	50,000	50,000	50,000	300,000
Agricultural technician	50,000	50,000	50,000	50,000	50,000	50,000	300,000
Practice Implementation							
Infiltration basin/trench (Rain garden/bioretention)	5,176,380 (8,590,213)	5,176,380 (8,590,213)	5,176,380 (8,590,213)	5,176,380 (8,590,213)	5,183,640 (8,580,594)	5,183,640 (8,580,594)	31,072,800 (51,522,040)
Materials for pet waste education program	2,000	2,000	2,000	2,000	2,000	2,000	12,000
Maintain/operate equipment for geese and duck waste clean-up	5,000	5,000	5,000	5,000	5,000	5,000	30,000
Septic system replacement/repair	373,825	373,825	614,850	614,850	763,640	763,640	3,504,630
Fencing with off-stream watering (SL-6 Grazing Land Protection)	117,470	117,470	117,470	117,470	117,470	117,470	704,820
WP-2T (fencing)	13,816	13,816	13,816	13,816	13,816	13,816	82,896
WP-2T (maintenance)	1,974	1,974	1,974	1,974	1,974	1,974	11,844
Total	5,927,965 (9,291,798)	5,927,965 (9,291,798)	6,168,990 (9,532,823)	6,168,990 (9,532,823)	6,325,040 (9,671,994)	6,325,040 (9,671,994)	36,843,990 (56,993,230)

7.2 Reasonable Assurance

The high level of public participation in the development of the implementation plan, as well as in other watershed activities, provides reasonable assurance that corrective actions will be implemented. Public participation in the IP development is documented in Chapter 5. Other watershed activities are described in Chapter 9. During the public participation process, the Steering Committee was particularly interested in establishing a structure that would facilitate implementation of the developed IP. That structure is described in Section 8.5. The stakeholders' concern about and effort to establish such a structure provides further assurance that the actions will be implemented.

7.3 Implementation Tracking

Implementation actions will be tracked to ensure that practices are installed and maintained appropriately. Tracking of agricultural practices will be done by the Lord Fairfax Soil and Water Conservation District (LFSWCD) and will include the locations and numbers of practices installed in the watershed. In addition, strategies to facilitate implementation, such as educational programs and other outreach activities, will also be tracked.

An implementation action committee (described in section 8.5 of this plan) is being formed in the watershed. That committee will determine who will track residential and urban practices.

7.4 Water Quality Monitoring

Water quality monitoring in the watershed is described in detail in Section 4.4. After funding for implementation is secured, the monthly monitoring at the "TMDL" stations (Table 4.1) will resume. In addition, VADEQ's rotational ambient monitoring, as well as biological monitoring, will continue. The monthly monitoring data will be used to determine progress in meeting water quality standards as implementation proceeds. Official delisting (removal of a stream segment from the 303(d) list will be based on the biennial water quality assessment conducted by VADEQ.

7.5 Evaluation of Progress

The ultimate goal of implementation is to meet water quality standards. Monitoring, as described above, will indicate if water quality standards are met. If water quality standards are met, delisting of the water body will occur as part of the regular statewide water quality assessment process documented in the biennial 305(b) report and following the established 305(b) guidance requirements.

If water quality standards are not met, progress toward implementation and water quality milestones will be evaluated on an annual basis by the implementation action committee. Several different conclusions could be reached during the annual review. Those conclusions and the resulting steps to be taken are summarized in Figure 7.1 and described in Table 7.7.

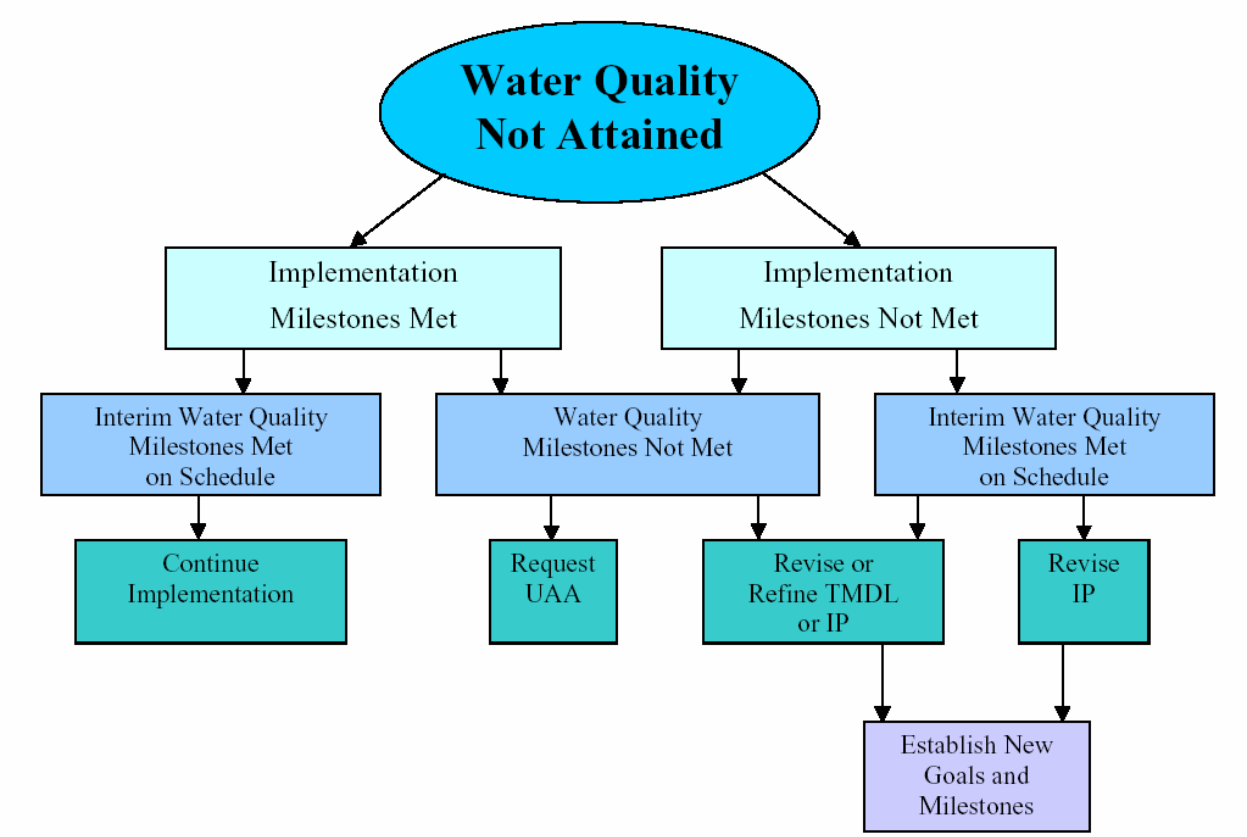

Figure 7.1 Follow-up actions if water quality standards are not met (VADCR and VADEQ, 2003)

Table 7.7 Potential outcomes of annual review of implementation and water quality milestones and resulting actions to be taken by action committee

Conclusion of annual review	Actions to be taken
implementation milestones[1] met water quality milestones[2] met	Continue implementation as planned
implementation milestones met water quality milestones not met	First, determine if the expected water quality impact was in error. If the previous assessment of expected water quality impact is found to be in error, reassess the expected water quality impact and adjust water quality milestones, implementation milestones, and implementation schedule accordingly. It might also be necessary to adjust one or more of the implementation actions. Second, determine if additional time is needed for the implemented practices to have the expected impact on water quality. For example, some practices, such as riparian buffer zones, do not reach maximum effectiveness immediately upon implementation. If it is determined that the practices need to mature, then implementation will continue as planned. Third, if after completing the first two steps, it is determined that the TMDL is not attainable with the implementation of reasonable corrective measures, it might be necessary to conduct a Use Attainability Analysis (UAA). The action committee would consult with DEQ prior to deciding on this approach.
implementation milestones not met water quality milestones met	Revise the implementation schedule to reflect the accelerated progress that is being made. Establish new milestones and continue to evaluate progress.
implementation milestones not met water quality milestones not met	Determine what the deterrents to progress are. If external forces such as lack of funding or lag in stakeholder commitment are the problem, revise the implementation schedule accordingly and establish new milestones. If the implementation actions are determined to be the problem, then adjust the implementation actions, milestones, and schedule accordingly.

[1]Implementation milestones are provided in Tables 7.3 (Stage 1) and 7.5 (Stage 2)
[2]Water quality milestones are provided in Table 7.2

8.0 STAKEHOLDERS' ROLES AND RESPONSIBILITIES

Stakeholders are individuals who live or have land management responsibilities in the watershed, including government agencies, businesses, private individuals and special interest groups. Stakeholder participation and support is essential for achieving the goals of this TMDL effort (i.e. improving water quality and removing streams from the impaired waters list). The purpose of this chapter is to identify and define the roles of the stakeholders who will work together to develop the IP. The roles and responsibilities of some of the major stakeholders are described below.

8.1 Federal Government

U.S. Environmental Protection Agency (EPA) has the responsibility of overseeing the various programs necessary for the success of the Clean Water Act. However, administration and enforcement of such programs falls largely to the states. The U.S. Department of Agriculture-Natural Resources Conservation Service (NRCS) is the federal agency that works hand-in-hand with U.S. citizens to conserve natural resources on private lands. NRCS assists private landowners with conserving their soil, water, and other natural resources. Local, state and federal agencies and policymakers also rely on the expertise on NRCS staff. NRCS is also a major funding stakeholder for impaired water bodies through the Conservation Reserve Enhancement Program (CREP) and the Environmental Quality Incentive Program (EQIP). For more information on NRCS, visit http://www.nrcs.usda.gov/.

8.2 State Government

In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. Currently, there are five state agencies responsible for regulating and/or overseeing statewide activities that impact water quality in Opequon Creek watershed. These agencies are:

Virginia Department of Environmental Quality (VADEQ) – The State Water Control Law authorizes the State Water Control Board to control and plan for the reduction of pollutants impacting the chemical and biological quality of the State's waters resulting in the degradation of the swimming, fishing, shell fishing, aquatic life, and drinking water uses. For many years the focus of VADEQ's pollution reduction efforts was the treated effluent discharged into Virginia's waters via the VPDES permit process. The TMDL process has expanded the focus of VADEQ's pollution reduction efforts from the effluent of wastewater treatment plants to the nonpoint source pollutants causing impairments of the streams, lakes, and estuaries. The reduction tools are being expanded beyond the permit process to include a variety of voluntary strategies and BMPs.

VADEQ is the lead agency in the TMDL process and is providing funding for the development of this IP. The Code of Virginia directs VADEQ to develop a list of impaired waters, develop TMDLs for these waters, and develop IPs for the TMDLs. VADEQ administers the TMDL process, including the public participation component, and formally submits the TMDLs to EPA and the State Water Control Board for approval. VADEQ is also responsible for implementing

point source WLAs, assessing water quality across the state, and conducting water quality standard related actions.

Virginia Department of Conservation and Recreation (VADCR) – VADCR is authorized to administer Virginia's NPS pollution reduction programs in accordance with §10.1-104.1 of the Code of Virginia and §319 of the Clean Water Act. EPA requires much of the §319 grant monies be used for the development of TMDLs. Because of the magnitude of the NPS component in the TMDL process, VADCR is a major participant in the TMDL process. VADCR has a lead role in the development of IPs to address correction of NPSs contributing to water quality impairments. VADCR also provides available funding and technical support for the implementation of NPS components of IPs. The staff resources in VADCR's TMDL program focus primarily on providing technical assistance and funding to stakeholders to develop and carry out IPs, and support to VADEQ in TMDL development related to NPS impacts. VADCR staff will also be working with other state agencies, Soil and Water Conservation Districts, and watershed groups to gather support and to improve the implementation of TMDL plans through utilization of existing authorities and resources.

Virginia Department of Agriculture and Consumer Services (VDACS) – The VDACS Commissioner of Agriculture has the authority to investigate claims that an agricultural producer is causing a water quality problem on a case-by-case basis (Pugh, 2001). If deemed a problem, the Commissioner can order the producer to submit an agricultural stewardship plan to the local soil and water conservation district. If a producer fails to implement the plan, corrective action can be taken, which may include civil penalties. The Commissioner of Agriculture can issue an emergency corrective action if runoff is likely to endanger public health, animals, fish and aquatic life, public water supply, etc. An emergency order can shut down all or part of an agricultural activity and require specific stewardship measures.

Virginia Department of Health (VDH) – The VDH is responsible for maintaining safe drinking water measured by standards set by the EPA. Their duties also include septic system regulation and regulation of biosolids land application. Like VDACS, VDH is complaint driven. Complaints can range from a vent pipe odor that is not an actual sewage violation and takes very little time to investigate, to a large discharge violation that may take many weeks or longer to effect compliance. For TMDLs, VDH has the responsibility of enforcing actions to correct failed septic systems and/or eliminate straight pipes (Sewage Handling and Disposal Regulations, 12 VAC 5-610-10 et seq.).

Virginia Department of Forestry (VDOF) – The VDOF has prepared a manual to inform and educate forest landowners and the professional forest community on proper BMPs and technical specifications for installation of BMPs in forested areas (http://www.dof.virginia.gov/wq/index-bmp-guide.shtml). Forestry BMPs are directed primarily to control erosion. For example, streamside forest buffers provide nutrient uptake and soil stabilization, which can benefit water quality by reducing the amount of nutrients and sediments that enter local streams. VDOF's BMP program is voluntary.

Virginia Cooperative Extension (VCE) – VCE is another state entity with responsibilities for activities that impact water quality in the Opequon Creek watershed. VCE is an educational

outreach program of Virginia's land grant universities (Virginia Tech and Virginia State University), and a part of the national Cooperative State Research, Education, and Extension Service, an agency of the United States Department of Agriculture. VCE is a product of cooperation among local, state, and federal governments in partnership with citizens. VCE offers educational programs and technical resources for topics such as crops, grains, livestock, poultry, dairy, natural resources, and environmental management. VCE has published several publications that deal specifically with TMDLs. For more information on these publications and to find the location of county extension offices, visit www.ext.vt.edu.

8.3 Regional and Local Government

Regional and local government groups work closely with state and federal agencies throughout the TMDL process; these groups possess insights about their regional and local community that may help to ensure the success of TMDL implementation. These stakeholders have knowledge about a community's priorities, how decisions are made locally, and how the watershed's residents interact. Some local government groups and their roles in the TMDL process are listed below.

Lord Fairfax SWCD – Soil and Water Conservation Districts (SWCDs) are local units of government responsible for the soil and water conservation work within their boundaries. The districts' role is to increase voluntary conservation practices among farmers, ranchers and other land users. District staff work closely with watershed residents and have valuable knowledge of local watershed practices.

Planning District Commissions – Planning District Commissions (PDCs) were organized to promote the orderly and efficient development of the physical, social and economic elements of the district by assisting and encouraging local governmental agencies to plan for the future. PDCs focus much of their efforts on water quality planning, which is complementary to the TMDL process. The area covered by Northern Shenandoah Valley Regional Commission (NSVRC) includes the Opequon Creek watershed.

City of Winchester – City government staff work closely with PDCs and state agencies to develop and implement TMDLs. They may also help to promote education and outreach to citizens, businesses and developers to introduce the importance of the TMDL process.

Frederick and Clarke Counties – County government staff work closely with PDCs and state agencies to develop and implement TMDLs. They may also help to promote education and outreach to citizens, businesses and developers to introduce the importance of the TMDL process.

8.4 Businesses, Community Groups, and Citizens

While successful implementation depends on stakeholders taking responsibility for their role in the process, the primary role falls on the local groups that are most affected; that is, businesses, community watershed groups, and citizens.

Community Watershed Groups – Local watershed groups, e.g., The Opequon Watershed, Friends of the Shenandoah River, Save Our Streams, offer a meeting place for groups to share

ideas and coordinate preservation efforts and are also a showcase site for citizen action. Watershed groups also have a valuable knowledge of the local watershed and river habitat that is important to the implementation process.

Citizens and Businesses – The primary role of citizens and businesses is simply to get involved in the TMDL process. This may include participating in public meetings, assisting with public outreach, providing input about the local watershed history, and/or implementing best management practices to help restore water quality.

Community Civic Groups – Community civic groups take on a wide range of community service including environmental projects. Such groups include the Ruritan, Farm Clubs, Homeowner Associations and youth organizations such as 4-H and Future Farmers of America. These groups offer a resource to assist in the public participation process, educational outreach, and assisting with implementation activities in local watersheds.

Animal Clubs/Associations – Clubs and associations for various animal groups (*e.g.*, beef, equine, poultry, swine, and canine) provide a resource to assist and promote conservation practices among farmers and other land owners, not only in rural areas, but in urban areas as well, where pet waste has been identified as a source of bacteria in water bodies. Virginia's approach to correcting nonpoint source pollution problems continues to be encouragement of participation through education and financial incentives; that is, outside of the regulatory framework. If, however, voluntary approaches prove to be ineffective, it is likely that implementation will become less voluntary and more regulatory.

Some other important stakeholders who were not involved in development of the IP include the Virginia Department of Transportation (VDOT), homeowners associations, property managers, and developers. The Action Committee described in the next section (section 8.5) will try to bring these stakeholders into the process.

8.5 Abrams/Opequon TMDL Action Committee

During the course of developing the Opequon Creek TMDL IP stakeholders suggested the development of the Abrams/Opequon TMDL Action Committee (Action Committee). The proposed Action Committee would include representatives from local government, state government, the private sector, citizen groups, and academia (Table 8.1). The purpose of the Action Committee would be to educate and seek endorsement from citizens, riparian landowners, and decision makers in order to implement specific strategies of the IP. Specific proposed Action Committee goals include:

- Identifying and designating water quality responsibilities as they pertain to the Abrams/Opequon TMDL Implementation Plan including, but not limited to:
  - Promotion and installation of agricultural BMPs
  - Public education regarding septic system maintenance
  - Incorporation of water quality-based stormwater BMPs (LID) into planning and development
  - Promotion and installation of urban BMPs including LID and erosion and sediment control practices

- Helping the many parties with water quality responsibilities in the Abrams/Opequon watershed communicate with one another on a regular basis about their individual and joint activities;
- Helping the parties having water quality responsibilities coordinate activities as appropriate, including grant proposals, projects;
- Providing accountability to local and state government by periodically providing information about implementation actions; and
- Coordinating monitoring activities to evaluate progress and recommend changes to ensure water quality improvement consistent with the goals of the Implementation Plan.

8.6 Natural Resources Advisory Board

Also being considered is the formation of a regional Natural Resources Advisory Board, which was originally called for by the Winchester-Frederick Community Consensus Coalition in its Water Resources Management Position Paper. Such an advisory board would be a critical source for information to address natural resource conservation at a variety of levels in the local decision making processes. Studies are presently being done in Frederick County to review ordinances and zoning in both the rural areas and the Urban Development Area (UDA). The Natural Resources Advisory Board could serve as the mechanism to integrate strategies from the IP and the basic principles of Green Infrastructure into local ordinances and comprehensive plans. The Natural Resources Advisory Board could support the Opequon Action Committee. A member of the Action Committee could be designated as liaison to the Board to keep the members abreast of water quality issues in the watershed.

Table 8.1 Proposed Abrams/Opequon TMDL Action Committee Membership

Agency/Organization	Position	Agency/Organization	Position
Lord Fairfax SWCD	District Administrator Conservation Specialist	Shenandoah University	Grounds & Maintenance Environmental Studies Program
NRCS	District Conservationist	Lord Fairfax Community College	Department of Natural Resources
VA Cooperative Extension	Extension Agent	Frederick County Public Schools	Designated Representative
City of Winchester	City Engineer Director or Planner Director of Environmental Maintenance City Arborist Designated Representative Common Council Representative	Winchester City Public Schools	Designated Representative
		Clarke County public Schools	Designated Representative
		Top of VA Building Association	Designated Representative
		Community Consensus Coalition	Designated Representative
		Industrial Parks Association	Designated Representative
		Winchester-Frederick Chamber of Commerce	Designated Representative
Frederick/Winchester Health Department.	Environmental Health Specialist	Winchester-Frederick Economic Development Commission	Designated Representative
Frederick County	Senior Planner Designated Representative Director or Engineer Designated Representative Designated Representative Board of Supervisors Representative	Winchester Industrial Development Authority	Designated Representative
		Potomac Conservancy Conservation Program	Manager or Asst.
		The Opequon Watershed	Board member
		Friends of the Shenandoah River	Program Director
		Shenandoah Valley Battlefields Foundation	Designated Representative
		Civil War Preservation Trust	Designated Representative
Town of Stephens City	Designated Representative	Valley Conservation Council	Designated Representative
Clarke County	Natural Resource Planner Designated Representative BOS Representative Designated Representative	Northern Shenandoah Valley Audubon Society	Designated Representative
		Frederick Farm Bureau	Designated Representative
		Clarke Farm Bureau	Designated Representative
		Frederick County Fruit Growers	Designated Representative
Northern Shenandoah Valley Regional Commission	Water Resources Policy Committee Representative	Winchester Green Circle Advisory Committee	Designated Representative
Winchester Chapter-Izaak Walton League	Designated Representative	Winchester Joint Council of Garden Clubs	Designated Representative
Winchester Trout Unlimited	Designated Representative		

9.0 Integration with Other Watershed Plans

Each watershed within the state is under the jurisdiction of a multitude of individual yet related water quality programs and activities, many of which have specific geographical boundaries and goals. These include, but are not limited to, Chesapeake Bay 2000 Agreement, Tributary Nutrient Reduction Plans, Total Maximum Daily Loads, water quality management plans (WQMPs), erosion and sediment control regulations, stormwater management (SWM), Source Water Assessment Program (SWAP), and local comprehensive plans.

9.1 Continuing Planning Process

According to Perciasepe (1997) the continuing planning process (CPP) established by Section 303(e) of the Clean Water Act provides a good framework for implementing TMDLs, especially the NPS load allocations. Under the Section 303(e) process, states develop and update statewide plans that include TMDL development and adequate implementation of new and revised water quality standards, among other components. The water quality management regulations at 40 CFR 130.6 require states to maintain WQMPs that are used to direct implementation of key elements of the continuing planning process, including TMDLs, effluent limitations, and NPS management controls. These state WQMPs are another way for states to describe how they will achieve TMDL load allocations for NPSs. The CPP in Virginia is implemented in various state programs, all aimed toward achieving and maintaining the state water quality standards. Virginia Code Sections 62.1-44.15(10) & (13), 62.1-44.17:3, and 62.1-44.19:7 give the Virginia State Water Control Board (Board) the duty and authority to conduct the CPP in Virginia. Under the authority of Virginia Code Section 10.1-1183, VADEQ serves as the administration arm of the Board. Virginia WQMPs consist of initial plans produced in accordance with Sections 208 and 303(e) of the CWA and approved updates to the plans. Currently, Virginia has a total of 18 WQMPs developed under Sections 208 and 303(e). Many of these plans are outdated, and efforts are underway to update them. The updated plans will serve as repositories for all TMDLs approved by EPA and adopted by the Board, as well as IPs approved by the Board.

9.2 Watershed and Water Quality Management Planning Programs in Virginia

Chesapeake 2000 Agreement – Watershed Management Planning - Commitment calls for two-thirds of the Bay watershed to be covered by locally supported watershed management plans by 2010 to address the protection, conservation and restoration of stream corridors, riparian forest buffers, and wetlands for the purpose of improving habitat and water quality. Watershed plans will be developed and implemented by local governments, community groups, and watershed organizations. VADCR is in the process of developing a Small-Watershed Planning Guide that will reference the coordination of TMDL implementation planning.

Chesapeake Bay Tributary Nutrient Reduction Plans – Virginia has worked to develop and implement water quality plans since the early 1990s for each major tributary to the Bay, as well as for smaller creeks of the state's Eastern Shore. These plans address the reduction of nutrients and sediment that have been identified to be the greatest water quality problem faced by the Chesapeake Bay. These plans are cooperative rather than regulatory and were designed to achieve equity among point and nonpoint sources of nutrients. These strategies will be revised

beginning in April 2003 to address new pollutant load reductions for each of the tributaries. The modified load reductions are necessary because new water quality standards are being adopted for the Bay.

TMDLs – TMDLs are the maximum amount of pollutant that a water body can assimilate without surpassing state water quality standards. TMDLs are developed for water bodies that are listed on a state's 303(d) list, known as the "Impaired Waters List." The TMDL develops a waste load allocation for point sources and a load allocation for NPSs and incorporates a "margin of safety" in defining the assimilation capacity of the water body. The IP outlines strategies to meet the allocations.

WQMPs – Water Quality Management Plans (WQMPs) are produced and updated by VDEQ in accordance with Sections 208 and 303(e) of the CWA as outlined in the CPP section above. These plans will be the repository for TMDLs and TMDL IPs.

Erosion and Sediment Control Regulations – VDCR implements the state Erosion and Sediment Control (ESC) Program according to the *Virginia Erosion and Sediment Control Law, Regulations, and Certification Regulations* (VESCL&R). The ESC Program goal is to control soil erosion, sedimentation, and nonagricultural runoff from regulated "land-disturbing activities" to prevent degradation of property and natural resources. The regulations specify "Minimum Standards," which include criteria, techniques and policies that must be followed on all regulated activities. These statutes delineate the rights and responsibilities of governments that administer a local ESC program and those of property owners who must comply. For more information, visit http://www.VDCR.state.va.us/sw/e&s.htm.

SWM – Stormwater Management (SWM) programs are implemented according to the Stormwater Management Law and Virginia Stormwater Management Regulations (VSWML&R). These statutes are specifically set forth regarding land development activities to prevent water pollution, stream channel erosion, depletion of ground water resources, and more frequent localized flooding to protect property values and natural resources. SWM programs operated according to the law are designed to address these adverse impacts and comprehensively manage the quality and quantity of stormwater runoff on a watershed-wide basis. VDCR oversees regulated activities undertaken on state and federal property, while localities have the option to establish a local program to regulate these same activities on private property in their jurisdiction. For more information, visit http://www.VDCR.state.va.us/sw/stormwat.htm.

Municipal Separate Storm Sewer Systems (MS4) Permits, Phase II – (City of Winchester) The Storm Water Phase II Regulations requires all operators of urban municipal separate storm sewer systems (MS4s) to: 1) obtain a NPDES permit and 2) develop a storm water management program designed to prevent harmful pollutants from being washed by storm water into the storm sewer, then discharged from the storm sewer into local water bodies. The program must contain elements for each of the following six minimum control measures:

- public education and outreach,
- public involvement and participation,
- illicit discharge and detection elimination,

- construction site stormwater runoff control,
- post-construction stormwater management in new development and redevelopment, and
- pollution prevention/good housekeeping for municipal operations.

SWAP – Section 1453 of the 1986 Amendments of the Safe Drinking Water Act (SDWA) requires each state to develop a Surface Water Assessment Plan (SWAP) that will delineate the boundaries of the assessment areas from which public water systems receive drinking water using hydrogeologic information, water flow, recharge, and discharge and other reliable information. The VDH is the primary agency for drinking water and is therefore responsible for SWAP. In Virginia, all 187 surface water intakes serving 151 public waterworks have completed surface water assessments. All 4,584 ground water source assessments, serving nearly 4,000 public waterworks, were completed by the end of 2003.

Local Comprehensive Plans – (Frederick County, Clarke County, and City of Winchester) Virginia state law requires all local governments have an adopted comprehensive plan. Typical topics addressed in a comprehensive plan include the analysis of population change, land use and trends, natural and environmental features, transportation systems, and community facilities and services. Local comprehensive plans should be referred to in the TMDL development process as well as TMDL implementation, especially the latter for urbanized watersheds.

Redbud Run Greenway – This initiative is a multifaceted project involving a diverse group of partners. Winchester Trout Unlimited, The Opequon Watershed, Inc. (TOW), and Lord Fairfax Soil & Water Conservation District have worked with the City of Winchester and the Shenandoah Valley Battlefields Foundation to implement the Conservation Reserve Enhancement Program (CREP) in the headwaters of the lower section of Redbud Run. CREP is a state and federal program that provides cost share, along with incentive and rental payments to exclude livestock from streams and restore forested riparian buffers by planting trees. The Virginia Department of Game & Inland Fisheries (VADGIF) has reintroduced native brook trout to the stream as a result of this protection.

The Shenandoah Valley Battlefields Foundation and the Civil War Preservation Trust have permanently protected over 350 acres in the corridor, which covers five miles to the confluence with Opequon Creek. The Battlefields Foundation and Trout Unlimited negotiated with a developer to lessen the impact on the stream through best management practices (BMPs) and permanent land protection. As a result, 30 acres and three-quarters of a mile of stream from a 155-acre tract were donated to VADGIF in late 2004.

The project partners are working closely with VADGIF and Frederick County on the development of a management plan for the preservation parcel. The group is also working with the Frederick County Schools Administration to involve students from nearby Millbrook High and Redbud Elementary. A variety of opportunities exist on both the VADGIF property and the adjoining Civil War Preservation Trust property. Trail design and construction, tree planting and control of invasive species, natural and historic interpretation, water quality monitoring, fish population surveys, and habitat assessment are some of the projects in which students can participate and receive instruction from volunteers and VADGIF staff. Winchester Trout

Unlimited also will sponsor the Trout in the Classroom program where students raise fingerlings to be released in Redbud Run.

The water quality challenge for Redbud will be in the upper watershed, which is within the Frederick County UDA. Water quality and aquatic life can be severely impacted by storm flows from this rapidly urbanizing area. Development of the Redbud Run Greenway and the involvement of Frederick County schools will raise awareness about the pristine and unique qualities of lower Redbud Run. The project will serve as a demonstration highlighting the many benefits and facets of natural resource conservation. It is also a tangible connection that the public and decision makers can look to as support for current and future initiatives such as the Frederick County Easement Authority, funding for purchase of development rights, and the proposed Natural Resources Advisory Board.

10.0 Potential Funding Sources

Virginia Environmental Endowment – The Virginia Mini-Grant Program supports community-based efforts to strengthen environmental education and to promote stewardship of Virginia's waterways. Preference is given to modest local projects. Public and private schools (K-12) and nongovernmental, nonprofit community organizations in Virginia are eligible to apply for one-year Mini-Grant awards up to $5,000. Local, state, and federal government agencies and programs are not eligible.

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

Urban and Community Forestry Challenge Cost-Share Grants – The U.S. Forest Service's Urban and Community Forestry Challenge Cost-Share Grant Program seeks to establish sustainable urban and community forests by encouraging communities to manage and protect their natural resources. The program works to achieve a number of goals, including (1) effectively communicating information about the social, economic, and ecological values of urban and community forests; (2) involving diverse resource professionals in urban and community forestry issues; and (3) supporting a holistic view of urban and community forestry. In particular, the program supports an ecosystem approach to managing urban forests for their benefits to air quality, stormwater runoff, wildlife and fish habitat, and other related ecosystem concerns. The Forest Service awards these grants based on recommendations made by the National Urban and Community Forestry Advisory Council, a 15-member advisory council created by the 1990 Farm Bill to provide advice to the Secretary of Agriculture on urban and community forestry.

Nonpoint Source Implementation Grants (319 Program) – Through its 319 program, USEPA provides formula grants to the states and tribes to implement nonpoint source projects and programs in accordance with section 319 of the Clean Water Act (CWA). Nonpoint source pollution reduction projects can be used to protect source water areas and the general quality of water resources in a watershed. Examples of previously funded projects include installation of best management practices (BMPs) for animal waste; design and implementation of BMP systems for stream, lake, and estuary watersheds; basinwide landowner education programs; and lake projects previously funded under the CWA section 314 Clean Lakes Program.

Five-Star Restoration Program – The USEPA supports the Five-Star Restoration Program by providing funds to the National Fish and Wildlife Foundation and its partners, the National Association of Counties, NOAA's Community-based Restoration Program, and the Wildlife Habitat Council. These groups then make subgrants to support community-based wetland and riparian restoration projects. Competitive projects will have a strong on-the-ground habitat restoration component that provides long-term ecological, educational, and/or socioeconomic benefits to the people and their community. Preference will be given to projects that are part of a larger watershed or community stewardship effort and include a description of long-term management activities. Projects must involve contributions from multiple and diverse partners, including citizen volunteer organizations, corporations, private landowners, local conservation organizations, youth groups, charitable foundations, and other federal, state, and tribal agencies and local governments. Each project would ideally involve at least five partners who are expected to contribute funding, land, technical assistance, workforce support, or other in-kind services that are equivalent to the federal contribution.

Canaan Valley Institute Small Grants Program – Canaan Valley Institute (CVI) seeks to support local stakeholder organizations committed to restoring and protecting the natural resources of their watersheds. Therefore, applications must address water quality or quantity issues or aquatic habitat. CVI encourages groups to submit projects that can show quantifiable/measurable outcomes. Priority will be given to projects that address wastewater, source water, flooding, stream restoration, or conservation planning that addresses water resources. Groups seeking organizational development funding such as watershed awareness can apply for up to $2,000; specific projects such as watershed assessments, restoration planning, project designs or implementation can apply for up to $5,000. Projects must be completed within two years.

Transportation Equity Act for the 21st Century Funding Programs – The Transportation Equity Act for the 21st Century (TEA-21) funds numerous transportation programs (Surface Transportation Program (STP), National Highway System, etc.) to improve the nation's transportation infrastructure, enhance economic growth, and protect the environment. States may spend up to 20 percent of the STP dollars used on certain projects to rehabilitate existing transportation facilities for environmental restoration and pollution abatement projects, including the construction of stormwater treatment systems. Additionally, each state sets aside 10 percent of STP funds for transportation enhancement projects, which can include acquisition of conservation and scenic easements and the mitigation of highway stormwater runoff water quality, as well as scenic beautification, pedestrian and bicycle trails, archaeological planning, and historic preservation. These varied project types can be used to protect source water areas during construction of transportation corridors. FY05 funding for the Surface Transportation Program in Virginia amounted to $114 million.

Clean Water State Revolving Fund – USEPA awards grants to states to capitalize their Clean Water State Revolving Funds (CWSRFs). The states, through the CWSRF, make loans for high-priority water quality activities. As loan recipients make payments back into the fund, money is available for new loans to be issued to other recipients. Eligible projects include point source, nonpoint source, and estuary protection projects. Point source projects typically include building wastewater treatment facilities; combined sewer overflow and sanitary sewer overflow correction; urban stormwater control; and water quality aspects of landfill projects. Nonpoint

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

Virginia Aquatic Resource Trust Fund (VARTF) – The Virginia Wetlands Restoration Trust Fund was established as a cooperative partnership between The Nature Conservancy and the Corps-Norfolk District in a Memorandum of Understanding (August, 1995). The fund is utilized when other on-site or off-site compensation alternatives are determined to be impracticable. VADEQ approved the use of the fund on December 19, 2001 as an acceptable form of compensatory mitigation for impacts to state waters, including wetlands, permitted under Virginia Water Protection individual and general permits. An amendment to the 1995 Memorandum of Understanding was made in December 2003. Among other things, the amendment changed the name of the fund to the Virginia Aquatic Resources Trust Fund and allowed for stream restoration contributions to be made.

Open Space Lands Preservation Trust Fund – Farmland, forest land, and open space land are important to our heritage in Virginia. These lands are under increasing pressure from urban development in parts of the Commonwealth. The 1997 Virginia General Assembly created a new fund (Va. Code Sections 10.1801-2) to assist landowners with the costs of conveying conservation easements and the purchase of all or part of the value of the easements. The fund is operated by the Virginia Outdoors Foundation. Conservation easements preserve farmland, forestland, and natural and recreational areas by restricting intensive uses, such as development and mining, which would alter the conservation values of the land. An easement is a voluntary legal agreement between a landowner and a public body or conservation group in which the parties agree to protect the open-space and natural resource values of the land. Each easement is tailored to reflect the conservation values of the property and is recorded in the local courthouse as a permanent part of the property records. Easements do not grant public access to a landowner's property. Costs that the fund may reimburse include legal costs, appraisal and other costs, and all or part of the easement's value. To be eligible, the easement must be perpetual in duration.

Southern Rivers Conservation – Through the Southern Rivers Conservation Initiative, the National Fish and Wildlife Foundation supports projects to restore and enhance riparian and riverine habitat in twelve southeastern states (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV). The initiative funds projects that fall into the following three categories: (1) Stream Restoration (Restore Our Southern Rivers), (2) Freshwater Mussel Conservation (projects that support the National Strategy for Mussel Conservation), and (3) Southeastern Imperiled Fishes Management (projects that support the Southeastern Imperiled Fishes Management Plan). In addition, projects should demonstrate community-based approaches to environmental stewardship, benefit water quality, demonstrate partnerships with others, involve specific on-the-ground activities, demonstrate landscape- or ecosystem-level approaches that complement other existing or planned restoration efforts in the watershed, and have a landowner and/or public education component. Program is temporarily on hold.

Virginia Agricultural BMP Cost-Share Program – The Virginia Agricultural Best Management Practices (BMPs) Cost-Share Program provides funds to help install conservation practices that

protect water and make farms more productive. Funding availability varies by Soil and Water Conservation District (SWCD). The state provides SWCDs with funds to target areas with known water quality needs. Areas with the greatest need receive the greatest funding. The cost-share program supports using various practices in conservation planning to treat animal waste, cropland, pastureland and forested land. Some are paid for at a straight per-acre rate. Others are cost-shared on a percentage basis up to 75 percent. In some cases, USDA also pays a percentage. In fact, the cost-share program's practices can often be funded by a combination of state and federal funds, reducing the landowner's expense to less than 30 percent of the total cost. Cost-share funds are also available for approved innovative BMP demonstration projects intended to improve water quality.

CREP – Conservation Reserve Enhancement Program – The Conservation Reserve Enhancement Program (CREP) is a voluntary land retirement program that helps agricultural producers protect environmentally sensitive land, decrease erosion, restore wildlife habitat, and safeguard ground and surface water. CREP is an offshoot of the country's largest private-lands environmental improvement program -- the Conservation Reserve Program (CRP). Like CRP, CREP is administered by USDA's Farm Service Agency (FSA). CREP addresses high-priority conservation issues of both local and national significance, such as impacts to water supplies, loss of critical habitat for threatened and endangered wildlife species, soil erosion, and reduced habitat for fish populations such as salmon. CREP is a community-based, results-oriented effort centered around local participation and leadership. Like CRP, CREP contracts require a 10- to 15-year commitment to keep lands out of agricultural production. A federal annual rental rate, including an FSA state committee-determined maintenance incentive payment, is offered, plus cost-share of up to 50 percent of the eligible costs to install the practice.

Environmental Quality Incentives Program – The USDA Natural Resources Conservation Service's Environmental Quality Incentives Program (EQIP) was established to provide a voluntary conservation program for farmers and ranchers to address significant natural resource needs and objectives. Nationally, it provides technical, financial, and educational assistance; sixty percent of it is targeted to livestock-related natural resource concerns and the rest to more general conservation priorities.

Landowner Incentive Program (Non-Tribal) – The U.S. Fish and Wildlife Service's Landowner Incentive Program (LIP) grant program provides competitive matching grants to states, territories, and the District of Columbia to establish or supplement landowner incentive programs. These programs provide technical and financial assistance to private landowners for projects that protect and restore habitats of listed species or species determined to be at-risk. LIP projects will likely involve activities such as the restoration of marginal farmlands to wetlands, the removal of exotic plants to restore natural prairies, a change in grazing practices and fencing to enhance important riparian habitats, instream structural improvements to benefit aquatic species, road closures to protect habitats and reduce harassment of wildlife, and acquisition of conservation easements. Although not directly eligible for these grants, third parties such as nonprofit organizations may benefit from these funds by working directly with their states to see if either grants or partnering opportunities are available.

11.0 References

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APPENDIX A

Steering, Working Group, and Public Meeting Summaries

MEETING SUMMARY

TMDL IMPLEMENTATION PLANNING FOR ABRAMS AND OPEQUON CREEKS FIRST STEERING COMMITTEE MEETING MAY 11, 2005

NOTE: The Next Steering Committee Meeting will be a combination public meeting and working group meeting from 7 – 9 p.m. at Shenandoah University on June 13, 2005.

Background

The first Steering Committee meeting to develop an Implementation Plan (IP) for five Total Maximum Daily Loads (TMDLs) in the Abrams and Opequon Creek watershed in the City of Winchester and Frederick and Clarke Counties was held May 11, 2005. The meeting was led by the IP Resources Team from Virginia Tech, West Virginia University, and the Institute for Environmental Negotiation (IEN) at the University of Virginia, with agency support from the Department of Environmental Quality (DEQ) and the Department of Conservation and Recreation (DCR). Brian Benham of Virginia Tech welcomed participants before turning the meeting facilitation over to Frank Dukes of IEN.

The purpose of the meeting was to develop a strategy for completing the IP. The meeting had four specific goals:

a) understand the IP purpose and goals;
b) set the Steering Committee schedule;
c) determine how the Planning Team, Steering Committee, and stakeholder Working Groups will work together; and
d) discuss preparations for the mandated public meeting.

At the outset of the meeting, clarification was requested about the scope of the IP. Dr. Brent of DEQ responded that the IP is intended to cover both the Abrams and Opequon watersheds and specifically address the bacteria and sediment impairments for both streams. Two of the TMDLs address benthic impairment in segments of the Abrams and Lower Opequon Creeks. The other three TMDLs address bacteria impairments in segments of the Abrams, Upper and Lower Opequon Creeks.

The IP Process and Goals

Dr. Brent clarified the process for obtaining state water quality goals by developing this IP. The TMDL study that has already been completed revealed the level of reductions in pollutants needed to make the water clean. The IP specifies the types and level of activities needed to attain those levels. The IP will take between nine months to a year to develop. The community and agency staff will then start to take actions to make water quality improvements, monitoring along the way to assess the progress towards reaching the goals for clean water.

Jason Ericson of DCR described how they work with local groups to implement plans and provide technical assistance. DCR has completed five IPs that are being implemented and is developing nine other IPs elsewhere in the state. Pilot projects started in 2001 are showing that Best Management Practices (BMPs) can produce water quality improvements. In some cases, the pilot projects are getting water quality results faster than expected. In other cases, the pilot projects have a long way to go to meet the water quality standards. Experience from these pilot projects will be incorporated into the IP process for the Abrams and Opequon Watershed.

A Steering Committee member asked about the time frame for the IP and whether this was related to the use of Section 319 funding requirements or the state cost-share program requirements. Mr. Ericson speculated that ten year IP contract is related to the state's program only. He strongly recommended that the Committee discuss funding alternatives because the Section 319 money might not be available forever. The CREP program (a tree planting program) is an example of another funding resource for stream fencing.

The Steering Committee Schedule

Brian Benham proposed the following timeline for developing the IP:

June 13 2005	First public meeting
June– Sept 2005	Working groups and Steering Committee meet as needed
Dec 2005	Complete draft IP plan
Jan 2006	Final public meeting, followed by 30 day comment period
Feb 2006	Begin implementation

The first public meeting will be held on June 13 at Shenandoah University. DEQ has submitted a notice to the Virginia Register announcing the meeting. The announcement will appear on May 30. The announcement itself satisfies legal and programmatic requirements, but does not do much to arouse local interest and attendance. Additional strategies will be needed to promote the meeting locally.

The Steering Committee members decided that in addition to standard requirements for a public meeting for TMDL IP's, the first public meeting would introduce the IP process, specify duties of the Steering Committee and Working Groups, gather information from attendees, and invite attendees to participate in the Working Groups.

How the Planning Team, Steering Committee, and Working Groups Will Work Together

Steering Committee

The Resource Team invited all those attending this planning meeting to participate at the Steering Committee level. A description of the Steering Committee responsibilities was proposed for review (see end of summary) and the follow additions were suggested:

- The Steering Committee needs to understand and help explain/promote the TMDL program and IP process.
- The Steering Committee should help develop local informational and promotional materials that set the stage for why the IP process is important and why citizens should care.

- The Steering Committee should organize an outreach strategy before the public meeting.
- The Steering Committee needs to help identify potential working group members.
- The Steering Committee will define milestone to measure project success.

Although it was decided that anyone committed to participating in the IP development process is invited to serve on the Steering Committee, widespread representation is important. A member inquired about the absence of landowner representatives in the planning meeting. The local SWCD coordinator explained that the Farm Bureau was contacted but no response was received. All supported additional efforts to recruit more rural and urban landowners. Bob Carpenter from Valley Farm Credit agreed to serve as a rural landowner liaison for now.

Working Groups

The Resource Team introduced the idea of Working Groups that will explore and expand the toolbox of implementation actions or BMPs appropriate for their sector. They will discuss, analyze, and evaluate all available actions and prioritize which actions local constituents are most willing to support.

The first Working Group categories proposed by the Resource Team were Agriculture, Urban/Residential, Environmental, Commercial, and Public/Government. It was then determined that the Environmental, Commercial, and Public/Government interests cut across all sectors. Committee members want stakeholders to interact with those who have different interests. Public official and members of the various watershed associations should be integrated into, not separated out of, the Working Groups. These interests do not want to be off by themselves but working along side other members of their constituents. The public/government participants will help the Working Groups determine what works and does not work. Commercial interests should not be subdivided, unless considering adaptive reuse and infill.

The question of whether associated universities should work as technical consultants or operate like another working group was discussed. The Steering Committee ultimately decided that it is important to differentiate between stakeholders and those providing resource assistance. The universities should therefore serve as resources, not as a separate working group. The Working groups will uncover implementation concepts and ideas on to be considered and the university and agency staff will assist the groups with technical, policy and funding questions.

The participants ultimately decided to establish two broad working groups under the headings of Urban and Rural/Agriculture and have environmental, governmental, public officials, and commercial and educational interests represented on each Working Group. The Rural/Agriculture Working Group needs to identify both rural agricultural and rural residential members, including subdivisions and farmettes. If the Working Groups get too big and unwieldy, then they are free to subdivide. The Working Groups themselves can decide how they want to organize their process.

During the meeting, the Steering Committee members signed up for the Working Groups that they would help to assist.

Implementation Plan

Development Process

The proposed IP process includes a series of sessions. Each meeting will start with a Steering Committee meeting, breakout into Working Groups meetings, then end with a joint meeting between the Working Groups and Steering Committee. The Working Groups can set their own schedule to meet outside the joint meetings to collect the information needed to fulfill their responsibilities. Jason Ericson of DCR suggested that there are typically three to four meetings for each working group. The recommendations go to the Steering Committee who decides which ideas are the most beneficial.

The first public meeting on June 13 is an opportunity to expand awareness and ask for participation in the IP process by soliciting citizens to become part of Working Groups. There will be a brief organizational meeting of the Working Groups after the public meeting.

A participant asked how the Working Groups would be monitored and kept on track in order to fulfill the designated responsibilities. The Resource Team will provide a clear definition of what the Working Group is meant to address and produce and the Steering Committee will regularly receive input from the Working Groups. The Planning Team wants to empower the Working Groups to think of new things that have not been considered or attempted yet. The state funding agencies offered that they are willing to go outside the box to fund new protection strategies.

Frank Dukes of IEN asked meeting participants to establish ground rules for future meeting. The only ground rule suggested at this time is to refrain from using cell phones inside the meeting room. Participants requested that meeting summaries be sent electronically, that the Resource Team bring copies of handouts (agenda, meeting summary, etc) to the meetings, and that a working lunch is preferred to use time most efficiently.

Measures of Success

A question about what goals are reasonable to establish was posed. Responses echoed the importance of general buy-in to practices that will improve water quality and the adoption of these practices into policies and existing rules and regulations. Other participants feel that the greatest success comes from implementing practices to improve water quality without more regulations. While voluntary compliance is ideal, some believe that actions should be required, if the community will not do them voluntarily.

A member pointed out that there needs to be a realistic evaluation and if progress is not made towards the goals, adjustments should be made to the proposed actions. Success was defined through the identification of partnerships and opportunities to bring resources to the watershed to monitor, identify water quality threats, and to expand education efforts. Another suggested measure of success comes from creating partnerships that bring about a new perspective and cultural shift where all residents see themselves as influential watershed stewards.

Preparations for the June 13 Public Meeting

Steering Committee duties before the public meeting involve being familiar with the TMDL program and IP process, reviewing a copy of an established IP, and helping with marketing and recruitment. Committee member ideas for attracting participants to the meeting included:

- Mail post cards to community organizations
- Attend community group meetings to explain the IP purpose and process.
- Arrange for the public meeting announcement to be posted on the city and county website
- Announce the program through the local radio station (WINC) and public television station

The Resources Team will be responsible for creating a description of the Urban and Rural/Agricultural Working Groups that includes a purpose and goals statement. The Planning Team should also provide examples of what other working groups have produced in the past and present an outline of the IP process.

The next Steering Committee (SC) meeting will follow the public meeting on June 13. Joint SC/Working Group meetings were also scheduled for July 7, August 17, and September 15.

Summary of Post-Meeting Focus Group Discussion
(Prepared by Tanya Borisova of West Virginia University)

In preparation for a forthcoming survey of Opequon watershed residents, which will focus on their valuation of possible TMDL creek clean-up results, a focus group study (discussion) was conducted by Dr. Alan Collins (Division of Resource Management, West Virginia University) with members of the Steering Committee. Committee members shared their experiences with the Creek, expressed their ratings of the current state of the Creek, described existing limitations for Creek use, and portrayed possible changes in the Creek and its tributaries due to TMDL implementation. Ways to cover TMDL implementation costs, as well as questions that should be included in the survey were also discussed.

Committee members used the Creek mostly for fishing and canoeing. Their rating of the Creek state ranged from 2 to 5 (using a scale from 1 - extremely poor - to 10 - excellent). The committee members also noted that the quality of the stream varies, with some parts of the Creek (say, between Routes 522 and 50) being in very good conditions, while other parts (say, the stretch from the point of confluence with Abrams Creek to the WV border - Lower Opequon) being in a much worse state. Sediment (silt) is named as the major pollutant. Following TMDL implementation, Committee members expect more human use of the Creek, less land erosion, and more permanent land protection covers (such as riparian buffers). The members also expect that the restored Opequon watershed will contribute to the quality of life in local communities. There were suggestions to pay the costs of TMDL implementation using 319 funds, grants, and funds from a variety of existing programs, mostly in the form of cost-share between government and land-owners. Finally, for the survey questions, the participants suggested differentiating between agricultural and urban landowners (since they will need to take different actions to improve the quality of the Creek, and since agricultural land-owners may be more aware of the impact of their practices on the state of the Creek). The Committee also suggested asking survey respondents about what could be done to improve the Creek, and what they would personally be

willing to do. Finally, the Committee discussed the use of the survey as a means to educate people about TMDL implementation and pollution problems in the watershed.

MEETING SUMMARY

TMDL IMPLEMENTATION PLANNING FOR ABRAMS AND OPEQUON CREEKS PUBLIC MEETING

Shenandoah University, Hester Auditorium, Henkel Hall
Winchester, Virginia
June 13, 2005

Prepared by the
Institute for Environmental Negotiation, University of Virginia

Background

The first public meeting to discuss the development of an Implementation Plan (IP) for five Total Maximum Daily Loads (TMDLs) in the Abrams and Opequon Creek watershed in the City of Winchester and Frederick and Clarke Counties was held on June 13, 2005. The IP Resources Team members from Virginia Tech, West Virginia University, and the Institute for Environmental Negotiation (IEN) at the University of Virginia led the meeting with agency support from the Department of Environmental Quality (DEQ) and the Department of Conservation and Recreation (DCR). The purpose of this first public meeting was to expand awareness and ask for public participation in the IP process by soliciting citizens to become part of either the Urban or Rural Working Group. The goals of the meeting were to:

- Provide a basic introduction to the process of implementing TMDL plans;
- Engage the community through the steering committee and the working groups; and
- Explain the roles and responsibilities for each group and the commitment needed for a successful process.

The local Project Coordinator, Jim Lawrence, welcomed participants and introduced the members of the Resource Team:

- Brian Benham and Mary Leigh Wolfe, Virginia Tech
- Gerard D'Souza and Tatiana Borisova, West Virginia University
- Frank Dukes and Casey Williams, University of Virginia
- Robert Brent, Dept. of Environmental Quality (DEQ)
- Jason Ericson and Nesha Mizel, Dept. of Conservation and Recreation (DCR)

Mr. Lawrence worked with the staff from DEQ and DCR to publicize the meeting and encourage citizens to attend. An estimated 65 people attended the meeting. Over 1100 mailings were sent to residents of the City of Winchester and Frederick and Clarke Counties including riparian landowners on Abrams and Opequon Creeks. Advance articles were published in the Northern Virginia Daily and Winchester Star. Public service announcements were made on two local radio stations. The meeting was also promoted on Winchester Community Television and

through an 18-minute interview aired on Winchester Cable Talk. Meeting flyers were posted in public places along with larger outdoor signs in highly visible areas throughout the watershed. Email announcements were also sent to individuals and organizations and posted on web sites and electronic newsletters. The public informational meeting commenced and concluded as a general session in the Hester Auditorium and included time in between for working groups to meet separately to review job responsibilities and get organized. The meeting began with presentations from the DEQ Regional TMDL Coordinator, Dr. Brent, and from the Resource Team leader, Dr. Benham from Virginia Tech. The presenters fielded questions from the audience during both presentations.

Presentation on the TMDL Program by Robert Brent, DEQ

Dr. Brent provided background information on the status of water quality in the Opequon Creek watershed and explained what the State does when streams are impaired. Abrams and Opequon Creeks are listed as impaired (or "dirty") waters due to high levels of bacteria and sediment. More than 10% of the water quality monitoring samples taken in these streams exceeded the bacteria or sediment limits set by the State for primary contact recreation. These streams also do not support a healthy diverse community of aquatic life due to the excess sediment. After reviewing the reasons why too much bacteria or sediment makes streams unhealthy, Dr. Brent identified the sources of bacteria and sediment in the Abrams Creek and Opequon Creek watersheds. Mr. Brent also presented slides showing the necessary levels of reduction of bacteria and sediment to achieve State water quality standards. Questions about the sources of pollution:

- Specific questions were asked about potential sources of pollution from the sewage collection systems that runs parallel to Abrams Creek. A citizen reported that parts of the pipes are exposed but not necessarily broken. The Resource Team explained that if the system is designed to flow directly to the sewage treatment plant, it should not get into the stream until after it is treated unless there is a break in a pipe. There were no known leaks in the system when the stream was last assessed.
- When Dr. Brent asked the meeting participants to speculate why the percentage of bacteria detected in the watershed decreases in the downstream direction, they accurately concluded that discharges from the wastewater treatment operation were diluting the upstream bacteria populations. He explained that bacteria monitoring information for the sewage treatment plant on Route 7 is collected daily and submitted to DEQ on a monthly basis. The information is part of the public record and available to anyone by request. If the sewage treatment plant does not meet the State's standards, then the facility would be out of compliance with their discharge permit and could be subject to enforcement actions that may require certain actions or impose financial penalties.
- There was some confusion in the audience over the difference between point and nonpoint sources of pollution and the different approaches to managing point and nonpoint pollution. Point sources were defined as readily identifiable inputs where waste is discharged to the water from a pipe or drain. Most industrial wastes are discharged to rivers and the sea in this way. With few exceptions, most point source waste discharges are controlled by DEQ or the Environmental Protection Agency through discharge permits issued under the National Pollutant Discharge Elimination System. The permit for each outfall (or pipe) specifies the quality and quantity of the waste permitted to be discharged

to the water at a particular location. One citizen felt that the shortcomings In the point source permit process are not captured in the TMDL program, which lead him to question the value and meaningfulness of the meeting. Questions about the estimation of source allocation and pollutant reductions:

- Citizens asked several questions about the proportions of various sources of bacteria and how the percentages for each stream segment were generated. Dr. Brent explained that the numbers are based on the presence of various land uses, human and wildlife populations, and point sources. These factors are integrated into a computer modeling analysis to produce estimations of the source.
- A resident challenged why the model call for zero reduction in the number of cattle in the lower Opequon stream and insisted that he sees cattle in this section of the stream on a regular basis. The Resource Team responded that cattle in the stream only constitutes a small source of pollutants when compared to other sources in the stream, so reductions in this area, while important, are not of primary importance. It is best to focus primary efforts on the largest pollution sources.
- A citizen asked for clarification of the percentage of sediment originating from agricultural land and asked the Resource Team to substantiate how they derived the given calculations. Resource Team members reinforced the complexity of the model used to determine the source allocations. A complete explanation of the source allocations requires going back to the model and reviewing the computations.
- Dr. Benham responded to a question from the audience about how the estimated values considered future population growth by clarifying that the model was designed to incorporate the projected rate of growth in the area for the next 25 years. Land use changes were also projected over time in the model. Dr. Benham and Dr. Brent emphasized that the figures presented represent a best educated guess based on the simulation model. The numbers are not fixed but provide reduction targets. The best way to determine how well the estimations reflect the reductions goals is through continual monitoring. The Resource Team stressed that an IP is a living document that will incorporate additional data and become more accurate over time.

Presentation on the Implementation Planning Process – Brian Benham, Virginia Tech

Dr. Benham articulated the importance of community participation in the process of creating an Implementation Plan (IP) for the TMDLs on the Abrams and Opequon Creeks. The development of an IP should be a cooperative endeavor that attains consensus among all stakeholders. All stakeholders will have the opportunity to get involved through a Working Group and/or the Steering Committee. Dr. Benham then distinguished between the various opportunities to get involved:

- Public meetings: Informational meetings that provide a forum for public comment.
- Steering Committee: Advisory group that directs the overall process and reviews output from Working Groups.
- Working Groups: Groups of stakeholders that identify their primary interest in the watershed into one of the following two categories:
    - Rural Areas Working Group: Agriculture/Rural Residential
    - Urban Areas Working Group: Commercial/Urban Residential

Developing an IP involves identifying appropriate Best Management Practices (BMPs) that address pollution problems. It is important to analyze the costs and benefits of various BMPs, consider potential sources of funding for the BMPs, and assess which strategies will most likely receive stakeholder support. An IP helps a locality to attract the funding needed to implement BMPs.

The Resource Team is looking for assistance from the Working Groups to determine which BMPs will be most successful, the resources that stakeholders will need to implement those BMPs, and other activities happening in the watershed that should be coordinated with the development of the IP. Once the most desirable BMPs are determined, the Resource Team will help to determine the cost of implementation and develop public educational strategies. The overall schedule for the development of the IP was presented:

- June 2005: First public meeting
- June – September 2005: Working Groups and Steering Committee meet as needed
- December 2005: Complete draft Opequon Creek TMDL IP
- January 2005: Final public meeting
- February 2006: Begin implementation
-

Questions about the program and process

A citizen asked why the community should participate in the creation of an IP instead of the Board of Supervisors or the City Council. He felt that this effort should qualify as a fundamental responsibility of the Planning Commission. Why does the community have to find funding and why is this not covered by tax dollars? The Resource Team explained that this program is currently a grass roots effort. These actions are voluntary, incentives based on stakeholder buy-in and community engagement. If this voluntary, community designed program does not achieve necessary pollution reduction levels, federal and state environmental protection agencies could decide to mandate stricter regulations on communities in the future. Input from the Working Groups and monitoring results will influence the IP to make it more effective over time. The IP is an evolving, interactive, and consensus-building process that adheres to the principles of adaptive implementation.

Working Group Meetings

Following the introductory general session, participants chose to attend a brief, introductory and organizational meeting for either the Rural Areas or Urban Areas Working Group. These submeetings commenced with introductions of the stakeholders present, then launched into a review of the roles and responsibilities for the Working Group. In order to accomplish the designated tasks, the Working Groups discussed other stakeholder interests that were missing from the room and needed to be represented. The responsibility for recruiting representatives from missing sectors will rest with the Steering Committee. Each Working Groups briefly reviewed implementation ideas suitable for their focus area and discussed resources currently available and needed to evaluate pollution problems and potential solutions. The Resource Group requested ideas and information requests to incorporate into future meetings. Finally, the groups wrapped up with a discussion about future meetings, and decided that meeting at night were best. Subsequent evening meetings were scheduled on:

- July 7, 2005
- August 4, 2005

Summary of the Discussion from the Rural Areas Working Group (prepared by Nesha Mizel)

The Rural Areas Working Group decided that the Board of Supervisors should have representation at the meetings. Some community members believed that this would be difficult to achieve due to a pro-growth policy that had been adopted by the board. Members of the working group agreed that more effective communication with the board was necessary, and that future plan map that had been drafted by the board for the county). Jim Lawrence suggested that the Public Works Department should participate in the meetings as well, and he encouraged all community members to talk with individuals on the Board of Supervisors. Mr. Lawrence specifically suggested Lynda Tyler, Barbara Van Osten and Gene Fisher as good contacts. The Department of Health was also mentioned as an important player in the implementation process due to their role in regulation of septic systems. The group then discussed the role that both large and small landowners will play in the implementation process. Group members concurred that the cooperation of large landowners was essential to the success of the implementation process, and cited the failure at Holman's Creek as a good example of lack of participation by large landowners in the watershed. Application of fertilizer to lawns by smaller landowners was also identified as an important contribution to water pollution by nutrients. Jim Lawrence mentioned the City of Winchester's requirements to develop a water protection plan under the National Pollutant Discharge Elimination System Phase II permitting. The program includes establishment of a stormwater management ordinance, public education and public participation in such efforts as illicit discharge detection and elimination through stream walks and clean ups. These programs could be part of a public involvement and education initiative in the entire watershed. The storm water management requirements developed by the City to improve water quality could be a starting point for strategies to consider with the IP. Aerial photos were also cited as an excellent way to assess land use and possible pollution sources in the watershed. Group members agreed that they would like more information on sources of pollution in the watershed, including contributions of pollution from smaller tributaries of Abrams and Opequon Creeks. The group was interested in county records of failing septic systems and information on successful implementation of conservation practices in other watersheds. Several group members cited specific areas of concern in the watershed including large amounts of stormflow from Buffalo Lick Run in Opequon Creek, which may be the result of increasing amounts of impervious surface due to rapid development. Citizens also raised concern about a pipeline that was laid along Opequon Creek, which appears to be causing major channel erosion. It was suggested that GIS should be used to map the pipeline, and that the Frederick County Sanitation Authority should be invited to the next meeting to provide additional information about the pipeline.

Summary of the Discussion from the Urban Areas Working Group

The Urban Areas Working Group decided that representatives from all industries with discharge permits needed to be involved. Representatives from the commercial sector, especially big box stores and commercial centers that involve large expanses of paved parking, were also mentioned as important stakeholders and resources in this process. The group also lacks someone

affiliated with the Department of Game and Inland Fisheries, the Department of Parks and Recreation, a public or private golf course, the development or construction industry, or the Chamber of Commerce. Reasons were given to justify the importance of each of these players. Historical societies and other organizations, such as the Izaak Walton League, the Potomac Conservancy, and neighborhood church and civic groups, can also play a large role in land preservation, maintenance, and stewardship.

Several group members repeatedly mentioned the need for a more extensive and organized environmental education strategy. This could include a scorecard for citizens to score the water usage in their home and the stormwater runoff from their property. One participant mentioned that the Soil and Water Conservation District has presentations on urban environmental issues to offer any group, club, or event. Educational outreach is also imperative for proper septic tank maintenance, which group members agreed is one of the most challenging sources of pollution to control.

Group members requested assistance from the Resource Group in determining how to calculate rates of runoff related to individual landowners. More information on the current infrastructure, roads, land uses, parcel identification, location and age of septic systems, and pollution problems in the watershed in the form of maps would also enable the group to better study the problems and recommend desirable solutions.

Presentations from the development or commercial management community on the challenges of integrating BMPs or Low Impact Development (LID) techniques into their projects would help the group consider ways to improve incentives for more environmentally sensitive land use practices. Information about the purpose, scope, and resources of the MS4 program (NPDES Phase II stormwater permit) would also improve the value of the group's input. A central project Web site that contained a copy of the TMDL study, maps, monitoring data, and a list of other resources would be helpful. Finally, the group reinforced the importance of continued outreach to the media and to recruit involvement from decision-makers.

Wrap up

The meeting concluded with a brief and final general session intended to answer questions on the process, discuss what information and assistance the Working Groups need, review what the Resource Group can provide, and clarify the next steps.

- One citizen asked who is responsible for drafting the IP. Dr. Benham explained that Virginia Tech is responsible for drafting the plan with input from the Steering Committee. Once the draft plan is created from input from the Steering Committee, the plan is open for a 30-day public comment period. The plan will then be revised before it goes to the State for approval.
- Another citizen asked what happens if someone does not agree with the most popular opinion among the Steering Committee. Anyone can offer individual opinions during the public comment period. A minority report could also be drafted to explain why some citizens do not agree with aspects of the proposed IP.

A quick evaluation conducted at the end of the meeting revealed that participants felt that more extensive outreach and advertisement for the meeting was needed, including flyers in neighborhoods and signs at intersections. One participant suggested that it would be helpful for the presenter or facilitator to repeat questions from the audience to ensure that all participants can hear and understand the question. The majority of the audience concurred that future meetings should be limited to no more than two hours.

MEETING SUMMARY

TMDL IMPLEMENTATION PLANNING FOR ABRAMS AND OPEQUON CREEKS WORKING GROUPS MEETING

Shenandoah University, Hester Auditorium, Henkel Hall
Winchester, Virginia
July 7, 2005

Background

An Abrams/Opequon TMDL Implementation Plan (IP) Working Groups meeting was held on July 7, 2005 at Shenandoah University. The IP Resource Team led the meeting, with members from Virginia Tech, West Virginia University, and the Institute for Environmental Negotiation (IEN) at the University of Virginia, and with agency support from the Department of Environmental Quality (DEQ) and the Department of Conservation and Recreation (DCR). Local leadership is provided by The Opequon Watershed, Inc. The meeting began and ended as one general session in the Hester Auditorium, but most of the meeting time was dedicated to simultaneous working sessions with members of the Urban and Rural Working Groups. The goals of the meeting were to:

- Review the purpose and process of the IP;
- Update existing maps with respect to land use and bacteria and sediment sources; Identify locations of known or suspected water quality problems due to bacteria and sediment;
- Identify best management practices and other approaches for reducing sources of bacteria and sediment; and
- Solicit feedback on planned stakeholder survey on perceptions about improving water quality in Abrams and Opequon Creeks.

Frank Dukes from the Institute for Environmental Negotiation facilitated the meeting. Dr. Dukes opened the meeting by welcoming participants, reviewing the agenda, and introducing the members of the Resource Team.

The Resource Team leader, Brian Benham from Virginia Tech, then provided an update on the IP process. Presentations on questions offered by participants at the June 13 public meeting followed. Mike Phillips, a TMDL Technician for the Shenandoah Valley Soil and Water Conservation District (SWCD), shared experiences and lessons learned working with the agricultural communities to execute the North River TMDL IP, which is located in Rockingham County. Mr. Phillips has achieved success working with the Mennonite community, which does not accept public funds, through voluntary Best Management Practices (BMPs). He highlighted ways of building a good relationship with the community and using the TMDL IP to improve water quality. There was a question from the audience about which streams in the Shenandoah Valley have seen the greatest improvement in water quality in the last five years as a result of the development of a TMDL IP. In Rockingham County, Muddy Creek, Mill Creek, Dry River, and North River have experienced the greatest improvements.

Dale Lehnig from Winchester's Department of Public Utilities reviewed the National Pollutant Discharge Elimination System (NPDES) Permitting Program and local Stormwater Program for Municipal Separate Storm Sewer Systems (MS4). The IP will coordinate with the NPDES and MS4 programs to address watershed issues. For additional information about the NPDES program, including program requirements such as MS4s, the schedule for implementation, and a progress report on implementation activities to date, please refer to the enclosed copy of the presentation slides.

Ms. Lehnig also provided an update on the progress of the Phase Two program for the city, saying the implementation plan extends until 2008. The city has an erosion and sediment control ordinance in place and is currently working to develop a stormwater management ordinance, including completing the mapping of all stormwater inlets and outfalls. The program also contains public education and participation components that address homeowner best management practices including lawn care, disposal of household chemicals and pet waste, storm sewer stenciling and stream walks focused on illicit discharge detection. Both presenters fielded questions from the audience during their presentations.

The Working Groups breakout sessions provided an opportunity for participants to give direct feedback to the Resource Team about potential sources of problems and appropriate solutions to impairments in the TMDL study area. Brian Benham and Mary Leigh Wolfe presented maps and graphic displays of land use and bacteria and sediment sources. One of the maps indicated the age of houses and the numbers of houses that are not connected to the public water system. These houses have their own septic sewer systems. It is more likely that older septic systems will fail. Group members used numbered and color coded dots to indicate the general location of potential problems and solutions on the maps and submitted a corresponding description of the problems/solutions in writing.

Wrap Up and Closing

All participants then reconvened in a general session to discuss the breakout sessions and review the next steps of the IP process. Dr. Benham and Dr. Wolfe acknowledged that the maps used in the working group sessions needed additional reference markers, such as an overlay of roads. In the future, it would be helpful to let participants locate where they live on the maps so that they can learn their watershed address and better relate to the issues and potential solutions. They plan to insert aerial photographs under the maps next time. They will also have a broader sweep of solutions to consider for the next meeting on August 4.

One participant requested to see a remote heat sensory image from a satellite flyover of deer and geese population. He claimed that problems from wildlife far exceed problems from agriculture. Robert Brent of DEQ noted that one option would be to approach. The U.S. Department of Agriculture Wildlife Services Division, which has a program to help manage or eliminate wildlife problems. A participant representing Shenandoah University and the Frederick County Board of Supervisors called the idea unfeasible because of the negative publicity that it could create. Another Shenandoah University representative in the audience noted the success of the Urban Archery program and others in the meeting agreed that this wildlife management strategy should be incorporated into the IP.

The meeting concluded with participants providing feedback to Alan Collins from West Virginia University about a planned stakeholder survey on perceptions about improving water quality in the Opequon Watershed.

The next meeting was scheduled for August 4, from 7-9 p.m., again at Henkel Hall at Shenandoah University.

MEETING SUMMARY

TMDL IMPLEMENTATION PLANNING FOR ABRAMS AND OPEQUON CREEKS WORKING GROUPS MEETING

Shenandoah University, Hester Auditorium, Henkel Hall
Winchester, Virginia
August 4, 2005

Background

The third Abrams/Opequon TMDL Implementation Plan (IP) Working Groups meeting was held on August 4, 2005 at Shenandoah University. The IP Resource Team led the meeting, with members from Virginia Tech, West Virginia University, and the Institute for Environmental Negotiation (IEN) at the University of Virginia, and with agency support from the Department of Environmental Quality (DEQ) and the Department of Conservation and Recreation (DCR). The Opequon Watershed, Inc provides local leadership. The meeting opened as a general session in the Hester Auditorium then divided into working sessions with members of the Urban and Rural Working Groups. The goals of the meeting were to:

- Review Best Management Practice (BMP) categories and types;
- Examine revised maps of land use and sources of bacteria and sediment pollutants;
- Identify BMPs and other approaches for reducing sources of bacteria and sediment in the Opequon watershed;
- Discuss the feasibility of the various BMPs, implementation strategies and resources; and
- Identify potential sites for specific BMPs.

Frank Dukes from the Institute for Environmental Negotiation facilitated the meeting. Dr. Dukes opened the meeting by welcoming participants and reviewing the meeting goals, agenda, and ground rules. Participants expressed satisfaction when asked about the quantity and quality of information distributed by email and through the online forum at www.tmdl.net.

General Session Presentations

Following a brief update on the IP process and direction from project leader, Brian Benham, Mary Leigh Wolfe, from Virginia Tech, launched a 30-minute presentation on water quality management strategies by explaining the presentation handouts: *Definitions of BMP Categories and Types* and a *Comparison Chart of Sediment and Bacteria BMPs*. The presentation illustrated practices and techniques that are available for preventing or reducing pollution due to sediment and bacteria. Dr. Wolfe highlighted the advantages and tradeoffs between the general categories of strategies – ordinances/regulations, educational programs, structural practices, and vegetative practices. She explained how Low Impact Development (LID) provides alternatives to conventional development in new and existing developments.

Questions and comments about the management strategies:

- A participant asked how often the infiltration and filtering practices described get clogged with debris. Dr. Wolfe emphasized that these practices need to be properly designed, operated, and maintained to operate successfully.
- Dr. Wolfe confirmed that various practices could be combined to suit specific site needs. Practices should consider the amount of impervious area involved, but generally, the more vegetation involved, the better.
- A participant inquired if the practices presented are more expensive to developers. While they can be more expensive, it is important to look at the total cost and savings over time. The IP will consider how to make the proposed strategies economically feasible.

After responding to questions about management strategies, Mary Leigh Wolfe emphasized that the IP will include a monitoring plan to assess the effects of pollution management strategies on water quality. Citizen participation will be an important component of the monitoring plan. Dr. Wolfe introduced James Beckley, a water quality liaison from DEQ, to describe the state's new Coliscan® Easygel™ Monitoring Program. With the financial assistance from DEQ's TMDL division, DEQ is seeking citizen volunteers to help monitor watersheds listed as impaired for bacteria. DEQ is providing an easy to use bacteria media called Coliscan® Easygel™ to help identify E. coli bacteria levels in stream samples. The citizen-collected data will help identify areas in the TMDL watershed needing improvement and rate the progress of the TMDL IP.

DEQ will provide enough Coliscan® Easygel™ media to test for 10 sample locations on a monthly basis, pipettes and collection bottles to collect the samples, one incubator, one cooler to transport samples, and training on how to perform sampling and counting of bacteria results. DEQ is looking for citizen volunteers to dedicate between 4-10 hours of time one day per month to collect and analyze ten samples and electronically submit (E-mail) results of the sampling on a quarterly basis using a DEQ provided form. Karen Andersen, from Friends of the Shenandoah River, has volunteered her lab to process the samples, but volunteers are needed to collect the samples.

Questions and comments about the Coliscan® Easygel™ Program:

- A participant inquired when trainings would be conducted. A workshop will be scheduled sometime between August 22 and September 9, 2005. The training will take about three hours to complete and will most likely start in the late morning or early afternoon sometime between Monday and Friday. Announcements will be sent as soon as a date is determined.
- There was a question about the location of monitoring sites. Monitoring sites have not been selected yet and DEQ would like site suggestions from residents. Citizens should contact Jim Lawrence at jiml@crosslink.net or Karen Andersen at kanderse@su.edu for more information on how to get involved.
- A citizen wanted to know the locations of DEQ's existing monitoring sites. DEQ is currently monitoring 4 sites in the watershed. Robert Brent from DEQ and Karen Andersen decided to meet after the meeting to talk about ways to coordinate agency and volunteer monitoring locations and efforts.
- Another participant asked why this program does not include monitoring nutrients, such as nitrates and phosphates, at the same time. The money from this program is to assess E. Coli,

but these resources could be combined with other monitoring techniques to track the progress of BMPs. By using a comprehensive approach, both the local community and DEQ will learn more about the watershed conditions and obtain data to improve the TMDL process by learning what methods are working in the watershed. This could potentially accelerate the TMDL process thereby cleaning up the water body at a faster rate and at a lower cost.

- Participants noted that the greatest challenge of previous monitoring efforts was recruiting the number of people to collect the samples needed. Any future monitoring programs should make the most of volunteer availability by coordinating data collection techniques.

Jim Lawrence also mentioned the opportunity to collaborate on a biological monitoring program with West Virginia. A training event is tentatively scheduled for August 13, 2005 that will include macroinvertebrate sampling, analysis, and survey of problem and potential restoration sites along the creek. An effort is underway to work with the Friends of the Shenandoah River, The Opequon Watershed, Inc., the Izaak Walton League (in WV and VA), Virginia's DEQ and the WV Department of Environmental Protection to establish a comprehensive monitoring program for the entire watershed. A Level I certification training for the Save Our Streams Biomonitoring methodology is tentatively planned for October. Citizens from both states are encouraged to attend both the Biomonitoring workshop and the Coliscan® Easygel™ training. More information will be provided as soon as the schedules are finalized.

The Working Group break out sessions provided an opportunity for participants to give direct feedback to the Resource Team about potential solutions to impairments in the TMDL study area. Brian Benham and Mary Leigh Wolfe reviewed maps and graphical displays of the land use and sources of degradation. The Working Groups referred to these maps when discussing solutions relevant and feasible in the urban or rural areas of the watershed. Participants were also asked to consider strategies, challenges, and potential resources available for implementation.

Summary of the Rural Working Group Discussion

The Rural Working Group session began with a discussion of possible BMPs for a large loafing lot, which is part of a livestock auction facility in the watershed. Residents suggested that the property needs a covered manure storage facility since manure is currently stored in uncovered piles. While the installation of vegetative buffers was determined to be an appropriate BMP for the operation, the construction of a covered facility or "hoop barn" with a concrete floor was undesirable because of the increased chance of cattle breaking legs on the concrete pad. The possibility was raised of classifying the livestock auction as a point source to make people more aware of its impact and to provide greater monitoring and control. A nutrient management plan should be developed for the auction. Another suggestion was to develop education programs to be held during livestock auctions to raise landowner awareness of possible BMP options, possibly facilitated by farmers (peer to peer).

New residential development on rural lands was an issue of concern. Group members identified the need for better erosion and sediment control in the county, in addition to education for developers and landowners. More consistent ordinances among the jurisdictions were identified as a critical factor in reducing sediment pollution generated by new development.

Ordinances could be passed to facilitate the application of residues/establishment of vegetation in a timely manner following construction. Ordinances might also be appropriate to reduce land stripping, possibly through tree protection. It was noted that ordinances do not apply to large tracks zoned RA (Rural Areas) until after the zoning process has occurred; a loophole exists where clearing for development takes place prior to the rezoning process. Phased disturbance (clearing smaller sections of land sequentially rather than entire tracks at once) was discussed as a solution to concerns about soil being left bare for extended periods of time between development phases. The group concurred that education for developers could help to remediate this problem. Education programs should include good lawn care practices, application of residues/establishment of vegetation on disturbed lands in a timely manner following construction, and low impact development (LID) practices. Another suggestion was to get involved in the development of the Rural Area Planning process currently underway.

Failing septic systems were discussed as a source of bacteria in the watersheds. Group members discussed the need for financial assistance for septic system repair/replacement. Cost share funds through EPA 319 grants were mentioned as a source of assistance. There is an opportunity to increase public awareness of cost share money available to repair failing systems. Cost share incentive programs could be created to retrofit systems with access ports to make pump out procedures more streamlined. An amnesty period should be provided during which people can report failing septic systems without incurring fines. The integration of maintenance fees with property taxes could increase awareness of septic system maintenance requirements. Landowners could be required to submit a septic system pumping receipt along with property tax payment. Identification and mapping of straight pipes, sinkholes, wells and septic systems was proposed as a way to identify failing septic systems and protect groundwater/drinking water quality. Berkley, West Virginia was cited as an example where aerial photography was used to locate failing systems. Funding for the project was provided by a grant from the EPA. Additional strategies suggested included: providing educational programs to inform homeowners of proper septic system maintenance; target specific high-risk areas of the county (possibly older houses or those located near karst features) for money to repair failing systems; and fix leaky sinks and toilets which can cause system failure.

Participants recognized the need to exclude cattle from streams and for financial assistance to repair fences damaged by floods (including programs that offer 100% cost share). Members of the Resource Team cited a new DCR BMP that includes cost share for fencing repairs (Practice # WP-2T). Farmers need to be informed of cost share money available for the repair of stream fencing damaged during flooding. Peer education programs (farmer to farmer), including farmer success stories focusing on the benefits, was recommended as a primary means of increasing stream fencing in the watershed. Another possible education opportunity is to get Trout Unlimited to sell stream fencing as a tool to improve water quality for fishing. It was suggested that property taxes could be reduced or a tax credit could be provided for those areas taken out of agricultural production through fencing; participants noted that the taxes might not be high enough for this to be beneficial. An additional suggestion was to explore a phased approach to stream fencing, installing off-stream water sources and shade areas first to encourage cattle to stay out of the stream; fence areas where stream is most desirable and easily accessed by cows first. More awareness of the CREP (Conservation Reserve Enhancement Program) is needed. One group member mentioned that farmers would not want to plant trees in riparian

buffers due to the hazards that they could pose if uprooted during high flow events.

Conservation tillage and minimum till were also mentioned as cost-effective BMPs for cropland. A farmer in the group estimated that currently about 90% of cropland in the watershed was under conservation tillage. Cover crops are not widely used, and biosolids are being applied in some areas. Educational programs would be beneficial to inform farmers of the benefits of using cover crops. It was noted that biosolids are being applied in some areas of the watershed. It was recommended that biosolids application programs be more closely monitored and that education programs be provided on proper biosolids application techniques. Consistent regulations with regard to biosolids application among counties would also be beneficial.

It was noted that an interbasin transfer exists in the watershed. The City of Winchester withdraws 7 - 8 million gallons a day for the North Fork of the Shenandoah River in Warren County and discharges a portion of that into the Opequon. The impacts of the altered flow regime on water quality also need to be considered.

Summary of the Urban Working Group Discussion

The Urban Working Group session began with a discussion of the sources of excess sediment in the streams. After requesting clarification of the reductions needed in stream sediment loads, participants expressed the need for more effective ordinances and consistent enforcement of ordinances to reduce sediment pollution. One group member suggested that the older, downtown urban areas are more stabilized than the new, commercial areas, and that management strategies should focus on retrofitting the large impervious surfaces surrounding recently developed sites first.

As in the Rural Working Group, members voiced concerns about the requirements for phased development and erosion control measures. All concurred that more awareness between city and county staff, elected officials, and developers about the causes, consequences, and controls of sediment pollution is needed to improve the development requirements. Members cited the lack of public understanding, public participation in public meetings, and political will as impediments to ordinance revision, and identified the need for better organization of "grass-roots" educational efforts, particularly directed towards elected officials. The Lord Fairfax Soil and Water Conservation District mentioned that they plan to provide speakers and PowerPoint presentation on various water conservation issues and solutions to decision-makers and civic groups in the near future.

The group proposed additional public education programs about stormwater and pet waste management on private lands. Rain barrels should be encouraged and subsidized. Rainstore™ Infiltration beds were suggested, but they might not be suitable in areas with karst landscape. A map identifying the location of the karst geology would help to identify the appropriate location for certain BMPs and potential problems between drinking wells and septic systems.

A representative from the city explained that they are considering a stormwater utility fee that could provide an incentive for landowners to reduce runoff and provide a source of funds for management strategies. Participants also wanted to know more information from the

city about the street sweeping program and verify that debris collected is deposited in the landfill.

Developers are beginning to shift the responsibility of maintaining stormwater retention facilities to homeowner associations, who are often unprepared to deal with unforeseen difficulties. The city and counties need to redefine specifications to allow for new management practices. A participant mentioned Stafford County, Virginia, as an example of a jurisdiction that manages all of its stormwater through Low Impact Development (LID) techniques. A member of the group suggested that the state agencies should expand the suite of LID practices endorsed at the local and county level. It should be noted that the state has an LID Work Group that is focused on creating a stormwater handbook with recommendations for additional BMPs. The Northern Shenandoah Valley Regional Commission is also working on guidance for appropriate LID practices for the area's soil types and karst geology.

Participants also made suggestions about the location of structural and vegetative practices. The idea of restoring the Town Run cement channel back to a meandering natural state was eventually discouraged due to the estimated costs involved, the steep streambank slopes, and increased risk of floods. Practices to reduce the amount of water flowing into the stream were proposed instead, such as stabilizing the channel upstream of Glen Burnie, reestablishing the streambank vegetation and floodplain to create a naturalized area to address water quality and quantity issues at Whittier Park, and changing the plans to install a concrete channel above Stewart with a natural channel.

Wrap Up

All participants reconvened in a general session to hear an update on the water quality survey from Gerard D'Souza of West Virginia University. Frank Dukes then presented the next steps of the process. The suggestions collected from all Working Groups discussion will be incorporated into the draft IP and presented to the Steering Committee on September 15, 2005. The Steering Committee will identify additional information and issues needing attention. All Working Group participants will be notified when the draft is complete and are welcome to join the Steering Committee review or submit comments independently.

The next Steering Committee meeting is scheduled for September 15, 2005, 12 – 2 pm, at the Timbrook Safety Center.

MEETING SUMMARY

TMDL IMPLEMENTATION PLANNING FOR ABRAMS AND OPEQUON CREEKS STEERING COMMITTE MEETING

Timbrook Public Safety Building
Winchester, Virginia
September 15, 2005

Background

The Steering Committee for the Abrams/Opequon TMDL Implementation Plan (IP) met on September 15, 2005 at the Timbrook Public Safety Building. The Steering Committee is a diverse body of watershed stakeholders who are volunteering their time to help guide the IP development process. Steering Committee membership is open to anyone in the watershed. The purpose of the Steering Committee is to review, filter, and prioritize the information collected from previous public input sessions.

The IP Resource Team led the meeting, with members from Virginia Tech, West Virginia University, and the Institute for Environmental Negotiation (IEN) at the University of Virginia, and with agency support from the Department of Environmental Quality (DEQ) and the Department of Conservation and Recreation (DCR). The Opequon Watershed, Inc provides local leadership. Box lunches were provided for the working lunch session. The goals of the meeting were to:

- Update the Steering Committee on the status of the IP;
- Present the Steering Committee with a summary of the previous public meetings;
- Get assistance from the Steering Committee on prioritizing IP practices and target locations for those practices; and to
- Collect input from the Steering Committee on a matrix of information about potential IP practices, including suggestions on sources of missing information.

Brian Benham from Virginia Tech opened the meeting, welcomed participants, and clarified the importance of the Steering Committee. Frank Dukes from the Institute for Environmental Negotiation served as the facilitator. After reviewing the meeting goals, agenda, and handouts, Frank kicked off the meeting by having participants introduce themselves and their association or interest in the TMDL IP.

Update on the Implementation Plan

Mary Leigh Wolfe from Virginia Tech reviewed the structure and results of the three public Working Group meetings conducted in summer 2005. She provided an update on the status of the IP's working draft, highlighting the sections most derived from the community's involvement. The current draft of the IP includes 12 categories of "problems" identified by the

Working Groups, and potential ways to address those problems. Mary Leigh presented a matrix designed to help analyze problems and solutions and asked the Steering Committee to help identify sources of the missing information. Once the matrix is refined with input from the Steering Committee, Virginia Tech will calculate the pollution reductions associated with each action. The full copy of the draft IP will be available to Steering Committee for review as soon as all of the sections have been updated.

General questions and concerns about the Implementation Plan

- A participant asked where we are in terms of the timeline for completing the IP? The IP needs to be finalized in January.
- A participant expressed concern about the lack of on-the-ground survey information for the properties adjacent to Abrams and Opequon creeks. These data would help to provide important information about what needs to be done where and where we need the practices the most. He believes that aerial photos can provide information about the nature of the agricultural lands and the presence of livestock, but walking the streams is an important step to developing a clear understanding of the potential sources of pollutants.
    - Another participant explained the challenges she encountered trying to drive along Town Run going west from Shenandoah University. It is not possible to access the stream once it disappears behind private property. Also, she found it difficult to determine the inlet and outlet around the hospital.
    - In response, Jim Lawrence explained that he and Dale Lehnig from the Winchester Department of Public Utilities have discussed doing an assessment of Upper Town Run with the Center for Watershed Protection to determine what should be improved and how.
    - Dale also commented that stream walks are part of the National Pollutant Discharge Elimination System (NPDES) permits, and that a bill is currently being considered by the Virginia House of Delegates that would give cities the ability to access private property for stream assessment purposes.

- A participant asked when the latest data on the watershed conditions were collected and if the IP will update this. Mary Leigh listed the types of land use data already collected, and clarified that the IP will target particular areas of the watershed and land uses, not individual landowners. Brian explained that the IP is a framework rather than a prescription of exactly what practices should happen where. Robert Brent from DEQ reinforced that the IP cannot be prescriptive because, in reality, it depends on volunteer citizen involvement. Mary Leigh reiterated that the success of the IP would be based on the overall improvement of water quality conditions. The IP does not presently include a strategy to measure the success of individual implementation actions.
- A citizen insisted again that a survey of the entire watershed would still be important and helpful. Another participant agreed that expanding monitoring efforts should be a priority in the IP in order to determine the location and the extent of problems. Monitoring could help to target the most efficient use of BMPs to make any available money go further. Another participant stressed feelings that this information is important in establishing a base model of existing conditions in order to assess the success of the implementation strategies.

- Mary Leigh explained that the Steering Committee could add stream assessments as another action in the IP, but the group will need to decide who will perform the work and how it will be funded.
- All participants agreed that the IP should include a field assessment action step to provide the basis for seeking money for additional studies.
- If citizens want on-the-ground assessment details, then Virginia Tech is looking for partners able to provide the needed services in-kind or for reduced costs. Virginia Tech is interested in the long-term quality of the watershed, but that issue is separate from the IP. Virginia Tech plans to pursue funding sources so that they can continue to stay involved through activities beyond the IP.
- Jim reminded the group that the new comprehensive monitoring effort between VA and WV is a key factor in establishing baseline data. Resources should help to reinforce the momentum of this program already underway.
- A participant asked if the local high school students could perform the monitoring activities. Jim informed the group that some Frederick County schools are already involved and that a few teachers and students are registered for some of the upcoming training sessions. Jim stressed the need to be realistic about the challenges in the local community. An inventory on private land might threaten residents and deter them from participating in the implementation strategies.
- A participant wondered how the Comprehensive Plans for the city and counties factor into the matrix and the IP. Another participant asked if the Resource Team has information about BMPs that have already been installed in the watershed. Brian confirmed that the Resource Team has collected all available information and that the projected land use changes are incorporated into the IP.
- A participant asked if the increasing amount of impervious surface will counteract the benefits created through the installation of BMPs. Brian explained that future projections of impervious surface have been considered, but that these increases should be addressed in the development strategies. State Erosion and Sediment Control law requires new developments over 1 acre to establish a stormwater management plan in order to receive a pre-construction permit. The group was unsure if a post development permit was also required, but information collected after the meeting confirmed that a follow up inspection or permit is not required after the completion of a construction project. However, a post construction stormwater ordinance is being developed to comply with the MS4 guidelines for the City of Winchester.
- A participant asked about developing an approach for individual landowners that explains the process and invites them to participate. Brian cited an example from another IP in which TMDL Technicians for the local Soil and Water Conservation District (SWCD) are tasked to approach landowners to address these issues in a personalized way. He noted that we also need other tactics to reach the people that do not attend public meetings.
- Finally, Matt Benson from West Virginia University provided an update on the West Virginia survey to watershed residents. The surveys have been sent out and two newspaper articles have been published. The survey intends to estimate the benefits from improved water quality and TMDL implementation. The goal of the survey is to associate a dollar value with the benefits of the IP and to water quality in general so that the cost of the implementation actions can be compared to the benefits. More information about the survey

and methodology, is available at the following website:
http://www.caf.wvu.edu/resm/faculty/borisova/OpequonProject.htm

Discussion about the Implementation Planning Matrix

After addressing all of the Steering Committee questions and concerns, the Resource Team directed participants into a focused discussion about the IP matrix. The group approached one problem category at a time and spent significant time reviewing and revising the list of solutions proposed for each category. While the group ran out of time to discuss some of the source information missing in the matrix, the Steering Committee did conduct an informal vote to determine priority levels for most of the suggested actions. The matrix that was evaluated at the meeting is available through the TMDL IP online forum at http://tmdl.bse.vt.edu. The matrix will be updated and then posted on the forum. A note will be sent to the steering committee when the updated matrix is posted.

A participant suggested adding the creation of limited or hardened stream crossings as an action item under the category, "Livestock access to streams". Another participant suggested changing the action, "Livestock exclusion" to Livestock fencing". Someone in the group explained that cost share is available to landowners that install an alternative water supply and fencing together, but not to those that establish the practices separately. Others reminded the group that citizens could complain to the Department of Agriculture according the Agricultural Stewardship Act if they think a landowner is polluting a waterway. The Department of Agriculture is supposed to investigate the problem and assist the landowner in fixing the problem. If the landowner does not remedy the problem, they are supposed to face a fine. Others in the group felts that this program has limited staff and inconsistent enforcement however.

It was debated if education should be a separate implementation category or an element of all the practices. Someone suggested adding both a category for general education and a specific action under each problem. A participant asked how the effectiveness of education would be measured and felt that the IP should focus on practices that have measurable results. Another person felt that an economic assessment of the watershed's ecological services should be included within the general education category.

A participant suggested that providing 100 percent cost share for the installation of BMPs would provide a more effective incentive than additional land use taxation reductions. There is already a 25 percent tax credit for BMP installation not covered by cost share. A participant asked how the IP would address fertilizer. While farms have nutrient management plans, residents need more assistance managing the lawn application of fertilizer.

A participant asked for clarification about the potential stormwater utility fee for the City of Winchester. The fee would be standard and based on a typical sized lot for residents and variable for businesses depending on the amount of impervious surface involved. Installations of BMPs or LID could result in the reduction of the fee.

A citizen acknowledged the need to revise development regulations so that they do not require large amounts of paving. An ordinance change would require approval from the Board of

Supervisors, which would create an opportunity to educate the board about Low-Impact Development (LID) techniques. There was also a recommendation to incorporate an ordinance or mandate requiring regular maintenance of septic systems. This could be integrated into community plans to promote community-based septic systems instead of individual systems.

Next Steps

The Steering Committee was asked if they thought that the Resource Team should convene more meetings with the Working Groups to collect more action ideas for the IP. The Steering Committee disagreed and felt that they should take responsibility for working with the Resource Team to refine the existing list of actions since the Working Group members had been invited to participate. When asked what information they needed from the Resource Team, the Steering Committee requested to have an actual copy of the IP that they could react to and a list of potential funding sources to consider and build on. Virginia Tech agreed that they would update the remaining sections of the IP, quantify what they can for now, and post it to the online forum: http://tmdl.bse.vt.edu.

The next meeting was scheduled for Nov. 15, 2005, from 12 – 2, at the Timbrook Public Safety Center.

MEETING SUMMARY

TMDL IMPLEMENTATION PLAN DEVELOPMENT FOR ABRAMS AND OPEQUON CREEKS STEERING COMMITTEE MEETING

Timbrook Public Safety Building
Winchester, Virginia
November 15, 2005

Background

The Steering Committee for the Abrams/Opequon TMDL Implementation Plan (IP) met on November 15, 2005 at the Timbrook Public Safety Building. The Steering Committee is a diverse body of watershed stakeholders who are volunteering their time to help guide the IP development process. Steering Committee participation is open to anyone in the watershed. The roles of the Steering Committee members are to listen to the local community and incorporate their ideas and concerns into the Steering Committee's discussions, serve as local ambassadors and information sources for their own constituency groups and the whole community, learn about the TMDL program and related issues, and develop and evaluate ideas and proposals for the IP.

The IP Resource Team (listed at the end of this summary) led the meeting. Box lunches were provided for the working lunch session. The goals of the meeting were to:

- Introduce preliminary results of the WVU survey of watershed residents
- Update participants on the status of the Implementation Plan
- Identify priorities of strategies in the planning matrix not covered in previous meeting
- Identify next steps and set a meeting date to review the Implementation Plan draft

Brian Benham from Virginia Tech welcomed participants and clarified the schedule, which was modified to allow the WVU researchers to present their findings first, followed by discussion of practices in the planning matrix. Frank Dukes from the Institute for Environmental Negotiation served as the facilitator. Frank asked participants to introduce themselves and their association or interest in the TMDL IP. Brian then explained the purpose of the planning matrix and the importance of Steering Committee input.

Review of West Virginia University's Preliminary Survey Results

Alan Collins and Tatiana Borisova from WVU first gave some background on the survey project. The survey is concerned with the water quality of the Opequon and Abrams Creeks and how much water quality improvement is worth to watershed residents in West Virginia and Virginia. One result from the survey will be the respondents' willingness to pay to clean up the Creek.

The first survey was mailed to 2300 households in Virginia on September 2nd with a reminder post card sent on October 11th. As of November 11th, a total of 222 surveys were mailed back to WVU. The researchers were expecting about a 10-15% response rate, but Virginia's has stayed around 9.7% while surveys are still trickling in. The end of November is the cut-off date. The response rate in West Virginia has been higher than in Virginia, possibly in recognition of the state university's efforts. Alan provided synopses of the Virginia General Public results and Riparian Landowner survey results and a list of comments respondents have included on the surveys.

Highlights of the general public survey results included:

- Trash is identified as a large problem in the watershed.
- The West Virginia portion of the Opequon is stocked with trout and used for more recreation purposes, so people are aware of the aquatic life.
- More respondents from West Virginia than from Virginia believe that the water quality has gotten worse in the past few years.
- The general public is largely unaware of the TMDL process.
- 70% of respondents support a financial contribution in the form of a tax to clean up the Opequon and Abrams (higher percentage in WV than VA). The median amount respondents were willing to pay annually was $50.
- The respondents indicate a higher level of trust in watershed organizations and university scientists than in local government to make decisions about what should be done to clean up Abrams and Opequon Creeks.

Alan acknowledged that extrapolating the results of a survey from a small response percentage to a large population must be done with care. He was then asked if there are plans to present the WV and VA results side by side, not combined, to help isolate the strategies that will be most effective in each state. He responded that the researchers will be doing that as well as determining if the two populations can be combined.

The riparian landowner survey had a higher response rate, 35% (63 completed and returned of 177 mailed), than the general public survey. Stream pollution was the biggest water quality concern of riparian landowners. When asked what stream improvement project landowners would put in with their own money, tree planting and conservation easements were the most popular. When posed the same question but with the option of government cost-share assistance, stream bank restoration and tree planting were the most popular. For both questions, however, the highest percentage response was "none of the above". The mean value of the highest level of annual taxes respondents would be willing to pay to clean up the creek was $78.49. When asked why they would not be willing to pay to improve water quality in the Opequon, almost half of the landowners replied that they could not afford higher taxes (48%).

A question was raised about the first general public survey and whether a 9% response rate is representative of the whole population. Alan responded that the survey would miss those who don't care at all about the Creek, and also the population with lower education levels.

Frank then began a short discussion by asking Alan to identify a key finding that was striking to the research team. Alan thought that a lot of importance was attached to trash clean-

ups by the general public, even though trash perhaps didn't have a direct link with water quality or reaching the TMDL. But these events do increase awareness and involvement which is needed to solve the problem. He also noted the trust issues that respondents had with local government.

One Steering Committee member responded that education is the key. There's a wealth of experience in the local watershed groups and they are highly trusted by the public. So, the next step is to do something, plan an action or event, to get people involved and then educate them incrementally as to the conditions and remedies to improve water quality. The TMDL is too complex to serve as the sole rallying point (at this time) for both public and private involvement.

The question was raised whether the Opequon is used for drinking water. Alan responded that while the Opequon is not used for drinking water, it is a tributary to the Potomac, which is used for drinking water supply.

Prioritizing the Matrix

Frank opened the discussion about priorities in the matrix, and voting on whether a practice was of high importance or low importance to be included in the TMDL Implementation Plan. He instructed the group to move quickly through the voting and leave discussion about lead agencies for later. Voting was based on the importance of the practice, whether it was likely to be implemented, and whether there were areas available to implement the practice.

- A member asked whether bioretention and limiting impervious surfaces were part of the city's MS4 permit. Brian's answer was no.
- After a few people confessed confusion, Brian clarified that street-sweeping would include quantifying the amount of sediment and the IP would include those reductions.
- A question was raised about why developers were included in the educational Erosion and Sediment programs proposed. Mary Leigh responded that they were lumped together in the last working group meeting, but that the Steering Committee could separate them and vote separately for home/land owners. This could be an issue to be revisited.
- Nesha clarified the Citizen Watch Group for E&S and gave an example of the Northern Virginia Planning Commission's program. Jim also stated that consistent Erosion and Sediment ordinances are needed across jurisdictions, which requires further attention.
- A member explained that the establishment of vegetation is already a law and so should be crossed out of the matrix, but questions were raised about the enforcement of these laws.
- A member asked what exactly is meant by applying the E&S ordinances to lands zoned as Rural Area so that ordinances apply when development takes place prior to re-zoning process. Another member explained that it didn't seem like development waited until the rezoning process to begin clearing land. Someone wondered whether that was already illegal, and Jim explained that landowners could clear trees before being rezoned, and would not have to adhere to the percentage requirements for protection.
- A member stated that phased disturbance during development wasn't a problem anymore and that educational programs would not make developers care. Contradictory opinions

were expressed as to the need for education of the Board of Supervisors. The committee voted to remove the practice from the list.

- Several members asked what cost-share was available for failing septic systems. Brian explained that if this option is included in an Implementation Plan, there could be funds available through DCR and the Dept. of Health for cost-share.
- Brian clarified the discussion as a whole and said that these ideas, which came from the working groups, will be refined and transferred into prose in the Implementation Plan. The purpose of the meeting discussion was to get an idea about what is important and applicable.
- Clarification was asked for on the state's septic system cost-share practices, and Nesha responded that it was tied to the money from DCR that was mentioned earlier, but they weren't all the same and shouldn't be lumped together. Mary Leigh asked the group to think about what's effective here because it may be different in other places, and also about the target audience in the watershed.
- A comment was made that houses could not be connected to the sewer system unless located in the Public Service area. A member noted that the connection fee was $18,000 and increasing. Brian then asked whether the intended audience for septic tank pump out cost-share practice (i.e. those who can not economically afford to pump out their systems) would be reached. One member responded that everyone would take advantage of the program, while another asked whether the IP could target low income households. It is important to note here that some of the state's septic system cost-share practices are means tested, or based on household income.
- In discussing problem #12 in the matrix, Brian clarified that exfiltration is leakage through pipe walls. A member responded that the sewer authority is already taking care of the problem. Mary Leigh clarified that this was meant to encourage integration of all the different practices together. Brian added that the MS4 permit requires mapping, tracking, and fixing problems through that program. Jim asked the group whether they wanted to address inflow and infiltration in the IP at all, and a member asked for clarification first on whether these practices are included in the MS4 for Winchester. Jim's answer was yes, but not in the county. Brian added that part of the MS4 was to map illicit discharges.
- Mary Leigh explained the two additional practices that came up at the last Steering Committee meeting: an inventory of the whole watershed for the integration of these programs and the development of a monitoring program.
- A member asked about the pet waste practices, and Mary Leigh explained that, at its last meeting, the Steering Committee voted that these practices are high priority.

Identifying the Lead Agency for each Practice

Mary Leigh began discussion of the next section of the matrix by explaining the purpose of the lead agency or organization – who would take responsibility for the implementation of the groups of practices. Brian added that the Steering Committee could be the lead; it isn't necessary to be a pre-defined group.

- A member asked whether the whole project could be coordinated by one group, or whether segments would be defined. Mary Leigh responded that no one would be coordinating the whole project, just the segments and groups of practices.
- The comment arose that a few people thought it was important to have one person or group to act as the coordinator for the project in its entirety. Mary Leigh asked who would be best to do this, since there was such diversity of practices (agriculture and urban, etc.). Nesha commented that other groups had received grant money to employ someone to coordinate the implementation plan.
- A representative from the Lord Fairfax Soil and Water Conservation District (LFSWCD) explained that they had coordinated other IPs but with the help of a local citizen committee.
- A member commented that the City and County need to be responsible and take the lead since they create and enforce the laws.
- A member asked if there was money for other organizations, such as Virginia Tech and UVA and WVU to participate. Mary Leigh answered that no, there wasn't but they can help to look for grant money together as part of the whole group. The member responded that money was needed for various things and worried there wouldn't be enough for everything.
- Frank redirected the discussion and asked if the group did indeed want one group to coordinate the implementation effort. The response was affirmative. Brian asked if there was a local watershed organization that could act as an umbrella group for this, since residents had a good sense of trust with them. A member commented that there was no political will in Frederick County and to aim for the local government's involvement is not realistic. Another member mentioned that the local governments are already involved in the Water Resources Policy Committee of the Northern Shenandoah Valley Regional Commission, which suggests that local planning commission involvement is possible.
    - A member commented that the City/County would plead lack of knowledge for agricultural practices, so a new committee would be helpful, but the decision makers have to be involved.
    - The opinion was voiced that long-term partnerships were worrisome and volunteers can't be relied on for the complex expertise needed for the implementation of these practices. So, a new committee is needed with all parties represented.
    - Jim expressed agreement with many of the above comments, and suggested The Opequon Watershed, Inc could serve as the local coordinating entity. He acknowledged their capacity issues, but highlighted the need for a strong tie to local government including staff and local officials. In order to build trust and partnerships, the coordinating committee would need to include city and county governments.
    - A member asked if there would be funding for a full-time coordinator like at Holman's Creek. The response was possibly, but nothing is certain.
    - A member raised the idea of a county-wide watershed committee that would take on all of the TMDLs and be composed of government and watershed representatives. A representative from LFSWCD echoed this sentiment, and added that Shenandoah County, with help from the LFSWCD, coordinated a watershed Committee with representatives from all TMDL watersheds.

- It was decided that a new steering/coordinating committee for the implementation of the IP would be considered; the committee must include decision-makers from local governments.

The Steering Committee then identified several ongoing programs that could help with the implementation of different practices.

- MS4 program
- Virginia Tributary Strategies
- Lord Fairfax Soil & Water Conservation District
- Virginia Cooperative Extension
- Frederick-Winchester Service Authority
- Frederick County Sanitation Authority
- Virginia Department of Health
- Virginia Department of Conservation & Recreation
- Virginia Department of Environmental Quality
- Virginia Department of Housing and Community Development
- Virginia Department of Forestry
- Other Land trusts and programs for land protection
- Farm Service Administration
- Natural Resources Conservation Service
- US Geological Survey
- Valley Conservation Council
- The Opequon Watershed
- Potomac Conservancy
- Friends of the Shenandoah River
- Northern Shenandoah Valley Regional Commission-Water Resources Policy Committee

During this conversation, a member asked if DEQ had teeth to enforce implementation. Tara responded that although the TMDL is mandatory according to Federal law, and the development of an Implementation Plan is legislated at the state level, the implementation of the IP is not.

Another member commented that several studies have been completed in the North Fork about minimum flows, while someone else added that the USGS has completed several studies on the West Virginia side of the border about the hydrology of the karst topography. Another participant mentioned the workshop that took place at the National Conservation Training Center about growing a community on karst.

Next Steps

Mary Leigh stated that Virginia Tech would continue to put the practices and recommendations into writing and assured the Steering Committee that they would have a complete draft of the Implementation Plan ready to discuss a couple weeks before the next meeting, which is planned for noon-2 on Tuesday, January 24, 2006 at the Timbrook Public Safety Building.

MEETING SUMMARY

TMDL IMPLEMENTATION PLANNING FOR ABRAMS AND OPEQUON CREEKS STEERING COMMITTEE MEETING

Timbrook Public Safety Building
Winchester, Virginia
January 24, 2006

Background

The Steering Committee for the Abrams and Opequon TMDL Implementation Plan (IP) met on January 24, 2006 at the Timbrook Public Safety Building to discuss how to advance the status of the IP. The goals of the meeting were to:

- Update the Steering Committee on the overall status of the draft IP;
- Review the latest information about benthic impairment TMDLs on Abrams and Lower Opequon Creeks;
- Discuss suggested measures to correct bacteria impairments;
- Determine next steps and refine the membership, roles, and responsibilities of the TMDL IP Action Committee.

The IP Resource Team (listed at the end of the summary) led the meeting. While box lunches were consumed, Frank Dukes from the Institute for Environmental Negotiation opened the meeting, welcomed participants, and reviewed the meeting goals and agenda. Frank then asked participants to introduce themselves and their association or interest in the TMDL IP.

General Updates

Brian Benham from Virginia Tech enthusiastically explained a proposal that will be submitted to the National Fish and Wildlife Program to investigate effective strategies for reducing nutrient loads from the Opequon Creek Watershed. The project establishes new partnerships between authorities and organizations in Virginia and West Virginia. If funded, the project will:

1. Evaluate nutrient-reduction performance and cost effectiveness of innovative Best Management Practices (BMPs);
2. Develop, implement, and evaluate strategies to overcome barriers to adoption of selected BMPs;
3. Develop model implementation protocols for the Frederick-Winchester Service Authority (FWSA) under the water-quality trading framework that focus on the multiple sources (point and nonpoint) under the jurisdiction's control; and
4. Develop a comprehensive nutrient-reduction strategy for the Opequon Creek watershed.

On behalf of DEQ and DCR, Tara Sieber and Nesha Mizel invited Steering Committee members to attend and encourage others to attend the 2006 Valley Region TMDL Implementation Workshop on Friday, February 24, 2006, at the Frontier Cultural Museum in Staunton, VA. Specifically focused on Valley issues, this workshop is designed to bring together community groups, Conservation District employees, and interested residents from watersheds that have been, will be, or are currently involved in the TMDL Implementation process. There is no cost for the all day workshop and lunch will be provided. For more information, please contact Tara Sieber at tlsieber@deq.virginia.gov or Nesha Mizel at Nesha.Mizel@dcr.virginia.gov.

Jim Lawrence announced that the Service Authority, Virginia DEQ, The Opequon Watershed Inc., The Friends of the Shenandoah River, and VA Tech are moving ahead on the establishment of a comprehensive monitoring program for the Opequon and its major tributaries. The program involves both chemical and bacteria (including coliscan) monitoring and is funded by the Service Authority and DEQ. Citizen volunteers are needed to collect samples from 18 monitoring sites. Friends of the Shenandoah River will provide the lab analysis and monitor training. Trainings will be scheduled in February and March. Anyone interested should contact Jim Lawrence at 540-667-0761 or Karen Andersen at 540-665-1265 for more information.

Benthic Impairment Update

Brian Benham provided a Power Point presentation to review the process used to determine the sources of sediment in the watershed and explain why and how the sediment model for the watershed has been revised. Virginia Tech recently identified and corrected a coding error in the sediment model. This model correction decreased the original estimate of sediment caused by channel erosion. The actual management practices included in the IP will not change, but it will be easier to achieve the load reduction required. The model correction did not affect estimates of the sediment loads from other sources in the watershed.

The target load of sediment from channel erosion has been revised based on the corrected model. To determine the new target load, the Resource Team multiplied the revised estimate of sediment from channel erosion by the percent load reduction decided in the approved TMDL. Implementation strategies to reduce the amount of sediment will address the revised target load. The recalculated overall sediment reduction needed in Abrams Creek is now 21 percent and 16 percent in the Lower Opequon Creek. These values represent the amount of sediment reduction needed to restore the benthic community.

A participant asked how the percent reduction was determined. Brian explained that a reference watershed was used to determine the typical sediment load generated under natural, undisturbed conditions. This reference sediment load was then compared to the sediment load in the Abrams and Lower Opequon Creeks. The difference provides an estimate of the reduction needed to allow the benthic community to recover. Robert Brent from DEQ added that phased implementation and future monitoring would reveal when the management strategies meet the goal of a restored benthic community. Attaining that water quality goal could eventually require either more or less than the estimated percent reduction in sediment.

When someone asked for a clarification of channel erosion, Brian explained channel erosion to be the wearing away of streambed sediments, which is affected by the flow of water. Urbanized areas have more impervious surfaces, and runoff from these surfaces increases stream flow volumes and the potential for channel erosion.

A participant asked if the Resource Team is considering the expansion of Parkins Mill and increased development throughout the watershed. Brian confirmed that the model considers sediment loads for all permitted discharges, and Robert corroborated that the revised TMDL includes the projected growth figures for the newly approved permits for Parkins Mill. Brian reminded the group that the model accounts for projected land use changes in the watershed, including gradually increasing sediment loads from urban sources and decreasing loads from agricultural sources.

Another member of the Steering Committee asked about any efforts to connect the reduction loads to the Tributary Strategies. The participant explained that the Tributary Strategies for the Potomac River call for an 18 percent reduction in sediment load, and since the Abrams and Opequon Creeks drain into the Potomac, the two programs should work together. Brian and Robert clarified that the two programs operate on different scales. The Tributary Strategy considers the overall Potomac Basin as part of the Chesapeake Bay watershed, while the TMDLs are more specific. TMDLs typically call for more stringent measures, and these measures will help the Tributary Strategy program to achieve its goals.

Dale Lehnig from the Winchester Department of Public Utilities briefly reviewed how the City's MS4 (Stormwater Program for Municipal Separate Storm Sewer Systems) program coordinates with the TMDL IP. All stormwater management plans will be revised to incorporate the implementation management strategies and everyone permitted will be required to comply with the IP requirements. The extent of the MS4 Program in Frederick County only applies to areas under VDOT jurisdiction.

Bacteria Impairment Update

Mary Leigh Wolfe introduced information on management strategies addressing the bacteria impairments in the watershed. She presented two scenarios and asked the group for feedback to help guide development of additional scenarios. Various scenarios are evaluated based on cost and effectiveness in reducing the violation rate of the TMDL bacteria standards. Based on the drainage of the watershed, strategies should be established in the Abrams and Upper Opequon Creeks before installing corrective measure in the Lower Opequon Creek.

Mary Leigh clarified the goal of generating various scenarios that achieve different levels of bacteria violation rates and quantifying which practices are most cost effective. The TMDL IP actually has two phases. Phase I will work to achieve the 10.5 percent bacteria violation rate needed to remove a stream from the impaired waters list. Phase II will target a zero percent violation rate, the ultimate TMDL water quality standard.

Scenario 1 for Abrams Creek involves removing all cattle from the creek and repairing or replacing half of the failing septic systems (approximately 22 systems). This scenario generates a

12 percent violation rate. Another possible scenario is to establish more sewer connections. The group discussed how this would involve coordination between three different agencies: the Frederick County Sanitation Authority, the City of Winchester Department of Public Utilities and the Frederick-Winchester Service Authority. Virginia Tech wants to conduct further analysis of potential areas that can be connected to the sewer and compare this cost to that of the septic systems repairs. Cost estimates were presented for septic system repairs, but not for septic system pump outs or making sewer connections. Karen Anderson informed the group that the average cost for a pump out in the area is $225 to $275, even when trying to get a group rate.

A Steering Committee member asked how Virginia Tech determined the number of failing systems. Mary Leigh explained how the estimate is based on the ages of the systems. The septic industry has approximations of failure rates for systems of various ages. Not surprisingly, the oldest systems have the highest failure rate. Lack of maintenance was discussed as being the greatest cause of system failure.

Community programs that offer free septic system pump outs provide localities the opportunity to inspect systems and perform necessary repairs. A program of this sort in effect in the Holman's Creek watershed successfully identifies whether and where septic leakages are occurring. Nesha Mizel announced that DCR offers a cost-share program for up to $250 in pump out operations. The Steering Committee talked about how regularly scheduled pump outs actually save homeowners money because they prevent the need for premature replacement down the road.

The Implementation Action Committee will be responsible for determining how to monitor and measure the actual amount of septic failure. A participant noted that the first step should be accurate identification of septic system locations and proposed a few techniques used to locate systems. Others acknowledged the need to evaluate the area's geology when considering the location of future systems.

Nesha Mizel of DCR provided examples of how other communities are monitoring septic systems. Holman's Creek has a residential coordinator, managed by Lord Fairfax Conservation District, who handles residential outreach and monitors the operations performed by the pump out contractor. In another area covered by an IP, the Health Department is responsible for monitoring septic systems. If staff is available, conservation districts typically supervise the agricultural component of an IP, and the Health Department is responsible for the residential component.

A member of the Steering Committee asked about expanding educational efforts to people new to septic systems. Tara described how some groups distribute "Welcome Wagon" informational materials through local realtors. The Soil and Water Conservation Districts also have similar materials available. A participant voiced concern about how much educational efforts influence behavior. Another member suggested establishing a regular renewal permit that requires residences to pump out or show proof of a pump out every 5 years or when paying property taxes. The Resource Team agreed to include these ideas in the public recommendations section of the IP, but cannot guarantee which management responses will occur. County, City and agency officials will help to determine what approaches are taken.

Mary Leigh then reviewed scenario 2, which involves the same actions as scenario 1 with the added assumption that the MS4 Program will provide a 96 percent reduction in bacteria loading (as determined in the bacteria TMDL). More research is needed to determine the combination of practices required to achieve this 96 percent reduction. Virginia Tech will work with Dale Lehnig to evaluate the City's potential MS4 strategies.

The primary sources of bacteria in the watershed are pets and wildlife. Mary Leigh asked the Steering Committee for feedback on realistic and acceptable ways to reduce these sources of bacteria. Ideas previously presented by the Steering Committee include educational programs about pet waste, wildlife reduction, and structural techniques to detain runoff.

Nesha mentioned that pet waste pick up bags available at "Doggie Duty" stations in public parks in the City of Harrisonburg are proving to be popular and effective. Another participant suggested establishing a "Doggie Watch" program. Karen Andersen reminded the group that resolving the goose overpopulation problem at Shenandoah University, possibly through the USDA wildlife nuisance program, would greatly reduce the nutrient loading from wildlife. Finally, the Steering Committee discussed the importance of considering which corrective measures provide the longest impact in addition to short-term affordability and effectiveness.

TMDL IP Action Committee

Frank reintroduced an idea that emerged in a previous Steering Committee meeting about establishing an Action Committee to carryout practices defined in the IP. He presented two draft documents for review: one suggesting a list of possible members that might serve on this group and the other outlining possible roles and responsibilities of the members. Frank asked the Steering Committee for any reactions to the set of goals listed. Language was suggested to clarify that the group will evaluate progress and recommend changes "through a water quality monitoring program". A copy of the possible membership and roles and responsibilities documents are included at the end of the meeting summary.

A Steering Committee member asked who would be responsible for the administrative and financial responsibilities. In Holman's Creek, a committee supervises a staff from the Conservation District that handles the administrative and financial responsibilities of fulfilling the IP. Mary Leigh suggested that, because the Opequon watershed is complex with several types of land uses and stakeholders, it might not be possible for this group to directly manage implementation; rather, it could provide an advisory and coordination role. The Steering Committee continued to discuss the question of who would be held responsible for fulfilling the implementation actions.

Nesha clarified that the Opequon situation is different from Holman's Creek, where a large grant was used to provide for staff. Jim pointed out that the draft membership list is a snapshot identifying who and what might be available to help the process move forward. A fiscal agent could be designated down the road through a §319 grant (federal funds distributed by the Department of Conservation and Recreation) and supervised by the Action Committee. Jim

summarized previous thoughts that member organizations would send a liaison to this committee and the chair position could rotate on the regular basis. Participant expressed the need to gather a group of people that "hold the purse strings and have the passion" to carryout the implementation.

A participant suggested coordinating with the Northern Shenandoah Valley Regional Commission's Water Resources Policy Committee, a group focused on integrating water quality management in the Shenandoah Valley. It might make sense to structure the Action Committee, which would be focused on water quality, as an autonomous group under this existing regional committee that already includes representatives from all local governments.

Another participant noted that the Water Resources Policy Committees exists for planning purposes and the Action Committee would be focused on implementation, which requires more direct involvement from the local governments. Another participant, however, suggested that working under the regional Water Policy Committee would help in obtaining the resources and information needed to assist with implementation. This structure provides an opportunity to connect local governments and organizations with university research. The regional commission could be the conduit for money and scientific information between universities and local governments, like with the Shen Air Program. This also provides the opportunity to leverage local interests with state and federal resources.

A participant noted that it is important to establish authority to have some sort of accountability. Although authority is not designated yet, the Action Committee, if formed with the right people, could be a vehicle to establishing authority. Execution of the IP will evolve over time as opportunities arise, and the Action Committee should be flexible so that it can evolve as well. Although the IP does not mandate an Implementation Action Committee, the Steering Committee decided that it does need a coordinating body. Frank proposed forming a work group to develop a few proposals to bring back to the next Steering Committee meeting. Anyone interested in this discussion should contact Jim at jiml@crosslink.net or 540-667-0761.

Participants asked for examples on how other groups are executing implementation plans within or outside of the state. The Resource Team revealed that there are not many other examples and that the Abrams and Opequon TMDL IP could establish a model for the others.

Next Steps

Another Steering Committee meeting is needed to review the revised the benthic portion of the IP and additional scenarios. Virginia Tech will continue analyzing models to quantify the value of various management strategies so that the Steering Committee can make informed decisions about the most cost effective practices to pursue at the next meeting.

Steering Committee

The Steering Committee is a diverse body of watershed stakeholders who are volunteering their time to help guide the IP development process. Stakeholder input is essential to creating a realistic clean up plan to meet the TMDL pollution reduction goals for Abrams and

Opequon Creeks. Steering Committee membership is open to anyone in the watershed. The purpose of the Steering Committee is to review and refine public input on the IP.

TMDL IMPLEMENTATION PLANNING FOR

ABRAMS AND OPEQUON CREEKS

ACTION COMMITTEE ROLES AND DUTIES

DRAFT FOR REVIEW BY MEMBERS – FOR JAN 24, 2005

The Abrams/Opequon TMDL Action Committee includes representatives from local government, state government, the private sector, citizen groups, and academia. The purpose of the Action Committee is to oversee actions to improve water quality developed during the Abrams/Opequon TMDL Implementation Plan. Specific goals include:

- Identify and designate water quality responsibilities as they pertain to the Abrams/Opequon TMDL Implementation Plan including, but not limited to:
    - Promotion and installation of agricultural BMPs
    - Public education regarding septic system maintenance
    - Incorporation of water quality-based stormwater BMPs (LID) into planning and development
    - Promotion and installation of urban BMPs including LID and erosion and sediment control practices

- Help the many parties with water quality responsibilities in the Abrams/Opequon watershed communicate with one another on a regular basis about their individual and joint activities;

- Help the parties having water quality responsibilities coordinate activities as appropriate, including grant proposals, projects;

- Provide accountability to local and state government by periodically providing information about implementation actions;

- Through monitoring, evaluate progress and recommend changes to ensure water quality improvement consistent with the goals of the Implementation Plan.

RECOMMENDATIONS FOR ABRAMS AND OPEQUON TMDL IMPLEMENTATION COMMITTEE

Agency/Organization	Position
Lord Fairfax SWCD	District Administrator
Lord Fairfax SWCD	Conservation Specialist
NRCS	District Conservationist
VA Cooperative Extension	Extension Agent
City of Winchester: Engineering Dept.	City Engineer
City of Winchester: Planning and Zoning	Director or Planner I
City of Winchester: Public Works	Director of Environmental Maintenance
	City Arborist
City of Winchester-Parks & Rec	Designated Representative
City of Winchester	Common Council Representative
Frederick/Winchester Health Dept.	Environmental Health Specialist
Frederick County Planning and Dev.	Senior Planner
Frederick County Planning Commission	Designated Representative
Frederick County-Public Works	Director or Engineer
Frederick County Easement Authority	Designated Representative
Frederick County- Parks & Rec	Designated Representative
Town of Stephens City	Designated Representative
Frederick County BOS	BOS Representative
Clarke County Planning Department	Natural Resource Planner
Clarke County Planning Commission	Designated Representative
Clarke County BOS	BOS Representative
Clarke County Easement Authority	Designated Representative
Northern Shenandoah Valley Regional Com.	Water Resources Policy Committee rep
Winchester Chapter-Izaak Walton League	Designated Representative
Winchester Trout Unlimited	Designated Representative
Shenandoah Valley Battlefields Foundation	Designated Representative
Civil War Preservation Trust	Designated Representative
Valley Conservation Council	Designated Representative
Northern Shenandoah Valley Audubon Society	Designated Representative
Frederick Farm Bureau	Designated Representative
Clarke Farm Bureau	Designated Representative
Frederick County Fruit Growers	Designated Representative
Winchester Green Circle Advisory Committee	Designated Representative
Winchester Joint Council of Garden Clubs	Designated Representative
Shenandoah University	Grounds & Maintenance
Shenandoah University	Environmental Studies Program
Lord Fairfax Community College	Department of Natural Resources
Frederick County Public Schools	Designated Representative
Winchester City Public Schools	Designated Representative
Clarke County public Schools	Designated Representative
Top of VA Building Association	Designated Representative
Community Consensus Coalition	Designated Representative

Industrial Parks Association	Designated Representative
Winchester-Frederick Chamber of Commerce	Designated Representative
Winchester-Frederick Economic Development Com	Designated Representative
Winchester Industrial Development Authority	Designated Representative
Potomac Conservancy	Conservation Program Manager or Asst.
The Opequon Watershed	Board member or designated representative
Friends of the Shenandoah River	Program Director

Recommendations for Abrams and Opequon TMDL Implementation Committee Advisors

Agency/Organization	**Position**
VA Dept. of Environmental Quality	TMDL Specialist
VA Dept. of Conservation and Rec.	TMDL Coordinator
Institute for TMDL Studies (VA Tech)	Director or Research Associate
Institute for Environmental Negotiations (UVA)	Director or Senior Associate
VA Dept. of Forestry	

MEETING SUMMARY
TMDL IMPLEMENTATION PLANNING
FOR ABRAMS AND OPEQUON CREEKS
STEERING COMMITTEE MEETING

Timbrook Public Safety Building
Winchester, Virginia
April 21, 2006

Frank Dukes of the Institute for Environmental Negotiation at the University of Virginia began the meeting at 12.10 pm while participants settled into their lunches and looked over the handouts provided. Frank welcomed folks to the meeting, led the introductions of the participants, and reviewed the agenda.

Updates

Matt Benson from West Virginia University gave an updates on the results of the Contingent Valuation study in the Virginia and West Virginia sides of the Opequon watershed. The total benefits of the Implementation Plan to the residents of the watershed in both states will be between 2 and 2.75 million dollars. This was to be paid for over a five year time period. From the general public and riparian surveys collected, the final value of the Opequon to the Virginia portion of the watershed is between 1.71 and 2.46 million dollars. A participant asked what the percentage of return was, and Matt responded that it was below their assumed rate. The Virginian rate of return was 10%, while West Virginia had a 13% rate of return. The Willingness To Pay was accounted for by using the percentage rate returned and then all non-respondents were assumed to have a lower Willingness To Pay (WTP). It was then asked how WVU got the names and addresses of the landowners in the watershed. Matt replied that they bought the list and conducted a random mailing from there. After a question regarding the graph and chart, Matt explained Contingent Valuation more in depth. He summarized that it estimates demand for improvement and then perceived improvement.

Jim Lawrence of the Winchester Green Circle and The Opequon Watershed, Inc., reminded participants about the Public Meeting for the Implementation Plan on May 10th. It was then learned that the public meeting was to be held on the same night as the Board of Supervisors Meeting. Jim also announced the dates for biomonitoring training hosted by the Isaak Walton League and Save Our Streams and Coliscan training with the Friends of the Shenandoah River. Dale Lehnig from the City of Winchester announced that the City had passed the Water Quality ordinance. Jim also mentioned that a representative from the Virginia Homebuilders Association was in attendance at this meeting.

Review of Draft Implementation Plan

First on the agenda was to review the Draft Implementation Plan (IP) which Mary Leigh reminded everyone is based on the DCR/DEQ Guidance Manual. She reviewed the Table of Contents and what each section contains. Mary Leigh also stressed that while they welcome

feedback on all parts of the draft IP, today's Steering Committee session was focused on specific areas needing more information. These sections were Chapters 6 & 7 regarding the *Implementation Actions* and *Measurable Goals and Milestones*, the "meat of the IP sandwich" as Mary Leigh described it. The committee started at Table 6.2, which was based on the same matrix used before, but with "Type of Practice" on the far right-hand columns. Clarification was asked about the term "primary" as a designation, which Mary Leigh explained described on-the-ground, practical actions. It was also noted that cost-share designation numbers were indeed included in the Implementation Action descriptions. Questions were asked about whether farmers can get information about BMPs, and Mary Leigh explained that NRCS and DCR had some available and they were included in the IP. More questions about the meaning of the "Type of Practice" columns were asked, and Mary Leigh explained that the intent of the policy practice was to make it clear that the Steering Committee wanted something more to be done about the amount of cost share available. Brian added that the intent of the matrix was to be a tool to voice and record what was heard through the process, not necessarily change the process right now. A participant suggested that the steering committee look at how to increase funding, but Brian clarified that the Action Team was to be responsible for these types of duties.

Discussion then turned to Table 6.3, which shows primary implementation actions for meeting bacteria and sediments TMDLs in the impaired watersheds. Mary Leigh focused the group on providing feedback on the cost/unit category. Some of these were quantified and some were not. The question was asked about the first action, fencing and alternative water systems, and wondered what SL-6 was. Mary Leigh was able to explain that this was a reference to the cost-share practice of installing the entire practice (stream exclusion fencing and providing a water system in the pasture). DCR's cost-share database lists the average cost for the entire system at about $44,000, while a range could be ten to seventy thousand dollars depending on the size and water system. Mary Leigh reminded everyone that these are just estimates but the Implementation Phase is all about adjustment based on Best available information and monitoring. The question was asked about the estimated cost per stream mile, and Mary Leigh said it was variable. Another participant suggested that since the unit was so erratic, perhaps stream mile would be easier. Mary Leigh asked that they come after the meeting to talk about the issue more in depth.

The topic of Low Impact Development (LID) was broached and a participant wondered where this was on the list of actions. Mary Leigh explained that two practices on the list are considered LID: Infiltration Basins and Rain Gardens. Further clarification was asked about retrofittings and porous/pervious pavers and Mary Leigh said that the two afore mentioned practices were in the retrofit category but the Action Team could be responsible for the introduction of the pavers. A participant wondered if more detail would be beneficial in the IP, and Mary Leigh said they would take this into account.

Riparian Buffers was the next topic on the Implementation Actions. Several comments were made about the estimations of cost. Several supported the comment that the estimations were too low with the price of trees and seeding grass as well as the tubes and labor being so high. Nesha clarified that perhaps tree tubes weren't needed to protect them from deer forage, but a participant added that they needed something to protect the trees from people! Overall, the committee agreed that more trees were needed in urban areas. Frank re-directed the conversation

back to the IP and the matrix, and discussion began on the vegetative cover Implementation Action. Mary Leigh clarified that the average cost for this practice was based on an average of a range of costs. Since no one had comments, the group moved on to loafing lot management, and a participant asked for a definition of exactly what a loafing lot was. Brian explained that when dairy cows were not off to pasture regularly, they were confined in a "loafing lot" which had the potential to hold a great deal of animal waste. A question was asked about the cost of maintenance, and Mary Leigh answered that there is some cost for upkeep.

The next Implementation Action was cover crops, which decreases the amount of runoff of bacteria and sediment from cropland. The cost of the practices was sourced from the DCR BMP database. Several comments were made that this cost ($27/acre) was no longer accurate, and it was probably closer to $40/acre although with labor added, it could be as high $100/acre.

The group discussed the different implementation options available for malfunctioning septic systems. One of these options is to connect to public sewer. In reviewing the costs of sewer connections, one committee member estimated that the availability fee for water and sewer was around $12,400, with $7400 of this cost just for sewer. The connection fee also needs to be accounted for. The committee was unsure of the current connection fee, but was aware that it had recently gone up. It was suggested that the Resource Team check with the staff working on the Holmans Creek TMDL Implementation Project.

The committee also discussed the installation of new septic systems and agreed that a good share of new systems in Frederick County will have to be alternative systems. A representative from the Board of Supervisors explained that an ad hoc committee had recently been formed in Frederick County in order to discuss the possibility of increasing the current 50% reserve requirement for conventional septic systems to 100%. It is anticipated that this would greatly increase the number of alternative systems that would be required in the County. Several committee members suggested that the Resource Team contact Marsh and Legg, a local survey and soil science contractor in order to collect any additional information regarding septic system costs and alternative system numbers in the watershed. The committee suggested that the Health Department would be helpful in providing information regarding the average percentage of failing systems that need to be replaced rather than simply repaired. One committee member asked whether the plan would include a strategy to educated newcomers to the area who do not have previous knowledge of septic system maintenance requirements. Brian and Mary Leigh explained that the technical assistance component of the implementation plan included pay for an individual to conduct education and outreach on such issues as septic system maintenance.

The committee went on to discuss the pet waste education program included in Table 6.3. It was agreed that a 75% reduction rate would be to optimistic, and that a 50% reduction rate was more realistic for the area. One committee member voiced a concern regarding the lake at Shenandoah University. He explained that ducks and geese at the lake are a serious problem, and will remain there as long as the lake remains there. Mary Leigh explained that the implementation plan included a position for someone to vacuum up the waste before it reached the water. It was also suggested that goose hunting season be expanded in order to reduce the population further.

The draft implementation plan calls for a very high number of raingardens and/or bioretention filters. Mary Leigh explained that the ranges that are shown in tables throughout the draft plan show results from calculations done as if only rain gardens or only bioretention filters were installed. She went on to explain that these high numbers could be reduced significantly if we were able to eliminate even more bacteria at the source (e.g. pet waste programs), rather than treating it as it moves close to the stream. The committee agreed that we will not be able to implement all of these practices; however, we are required to show the full suite of practices required to meet the TMDL. If we were to actually implement all of these practices, we would be going far beyond what we need to do in order to get the impaired streams de-listed (<10.5% violation rate). A committee member brought up the additional costs that would be incurred through maintenance of rain gardens and bioretention filters that got clogged with sediment.

The committee moved through the draft plan to Table 6.4, and discussed the estimated costs of raingarden and bioretention filter implementation in Abrams Creek ($22.7 – $37.6 million). Mary Leigh explained that these costs had been shown independently of the other costs in order to illustrate what a huge proportion of the total overall cost that they were, though one committee member said that he found this to be confusing. Brian and Mary Leigh emphasized that fact that if we address sources of bacteria in the watershed first, we should not have such a high requirement for installation of treatment/filtration devices like bioretention filters. During this discussion, one committee member asked whether we knew how the watershed acreage broke down between the City of Winchester and Frederick County. Brain and Mary Leigh agreed that they would be prepared to share this information at the public meeting on May 9.

Mary Leigh reviewed Table 6.5, which showed estimated costs for practices in the Upper Opequon watershed. She explained that there is a greater need for fencing with off stream watering since this watershed has greater agricultural land use. A committee member wanted to know whether we could separate out programs like pet waste for both the City of Winchester and Frederick County. Brian explained that the modeling for the implementation plan was done on a watershed scale, and suggested that the Action Committee could determine how these programs would be administered (i.e. crossing jurisdictional boundaries). One group member explained that she did not think that a pet waste program would be implemented in Frederick County, though maybe in the Urban Development Area within the county.

The committee went on to review Chapter 7 of the draft plan, which breaks down implementation into different phases. Mary Leigh explained to the committee that the goal during Phase I is to get to a <10.5% violation rate, which is what we need in order to take the stream off of the impaired waters list. Costs for Stage I implementation were presented in Table 7.4 of the draft plan. Soon after implementation begins, the Virginia Department of Environmental Quality will be monitoring water quality improvements throughout the watershed. This will allow us to see what kind of progress is being made and where we might need to make some adjustments to the plan. Brian discussed how, in order to meet the Stage I goal of a 10.5% violation rate, we would only need to implement an estimated 10% of the practices that we would need to meet the TMDL (i.e. a 0% violation rate).

One of the committee members suggested that we also look at potential nitrogen and phosphorous reductions that would be accomplished in implementation so that they could be

applied towards meeting our Tributary Strategies goals. Mary Leigh stated that she has nitrogen and phosphorous reductions for practices that may be used to reduce sediment.

After reviewing Stage I goals, a committee member suggested that some goals for fencing be included in this stage (none are currently listed in the draft) since this is something that the local Soil and Water Conservation Districts are already working to implement.

Action Committee Discussion

The steering committee ended the meeting with a brief discussion about plans to form an Action Committee that will coordinate and oversee implementation of the plan. The committee agreed that they needed to be sure to develop a good relationship with City and County government in order for the process to be successful. It was suggested that the Action Committee meet after the first public meeting, and that one of their first tasks could be to lobby for a joint city-county meeting during which Clarke County's role in implementation could also be addressed.

Shenandoah County currently has a water resources policy committee that is discussing the establishment of a specific committee that would manage both Tributary Strategies and TMDL Implementation projects in the county. Focus areas identified for this special sub-committee included: water quality monitoring, education, and implementation of the plan. Several organizations have already expressed an interest in being involved including Friends of the Shenandoah River and the local Soil and Water Conservation District.It was agreed that the Action Committee should communicate with this group and learn from their experiences. Those interested in being a part of the Action Committee's first meeting were asked to email Jim Lawrence. Jim stated that the meeting would probably be during the week of May 15.

It was agreed that it would be most helpful for the Board of Supervisors to have a one-on-one meeting with representatives from the Resource Team in order to be briefed on the final implementation plan rather than attending the public meeting, which is also on their meeting night.

Advertising for the public meeting was discussed, and Tara Sieber agreed to post several signs that DEQ has around town to announce the meeting. The committee also agreed that posting smaller fliers would be helpful. Nesha and Tara agreed to work on the fliers and send them to Jim Lawrence to distribute.

Brian and Mary Leigh closed the meeting by asking the steering committee to let them know if it was okay to have their name listed on the final document.

TMDL IMPLEMENTATION PLAN FOR ABRAMS AND OPEQUON CREEKS
FINAL PUBLIC MEETING

Shenandoah University, Hester Auditorium, Henkel Hall
Winchester, VA
May 10, 2006

Background

The final public meeting for the Abrams and Opequon Creek TMDL Implementation Plan (IP) took place on Wednesday May 10th, 2006. Tara Sieber, from the Department of Environmental Quality, began the meeting by welcoming everyone and introducing the members of the resource team:

Brian Benham and Mary Leigh Wolfe, Virginia Tech
Gerard D'Souza, Alan Collins and Tatiana Borisova, West Virginia University
Frank Dukes and Casey Williams, University of Virginia
Tara Sieber and Robert Brent, Dept. of Environmental Quality (DEQ)
Nesha Mizel and Jason Ericson, Dept. of Conservation and Recreation (DCR)
Jim Lawrence, The Opequon Watershed, Inc.

Tara first thanked all of the members of the Steering Committee and Working groups for volunteering their local knowledge and depth of experience. The purposes of this final meeting were then outlined; to culminate a year's worth of work, to elicit questions and comments, and to confirm the community's support for the plan. Tara then turned the meeting over to Brian and Mary Leigh to review the TMDL process and describe the Implementation Plan itself.

The Clean-up Plan Overview

Brian began the overview by reviewing the background of the Abrams and Opequon Creeks' impairments and TMDLs.

A participant was curious about bacteria concentration and the impact of the sewage treatment plan outfall on percentages. Brian confirmed this is a volume-based standard and so would be affected.

Another question was asked about what exactly a loafing lot was. Brian explained that this was the area associated with dairy farms where cows can feed after milking before going back out to pasture.

Mary Leigh continued the discussion by briefing the participants on the Implementation Plan contents. Several questions and clarifications arose from this discussion.

Should the numbers be the same or double between Upper and Lower Opequon watersheds? Mary Leigh thanked the participant for their attention to detail and promised to check on these numbers.

Does the rural riparian zone treat one or both sides of the stream? Mary Leigh explained that if the buffer covers both sides of the stream, it's counted twice.

What are the units of measure for the proposed practices, especially rain gardens? The costs of the practices are explained in terms of cost per acre treated by the practice. Infiltration is more expensive but more effective and so costs differ.

Does the cost for buffers consider potential acquisition costs of the land? No.

A participant asked about the break down of costs from public versus private funds. There is a summary of funding information provided in Chapter 10.

Are there any elected officials on the Steering Committee? Jim confirmed that there were several members at different meetings, but attendance was inconsistent. A Planning Commissioner with Frederick County attended almost all the meetings.

A participant suggested that the resource team consult with research done by the University of Wisconsin. The scientists there have prepared an extensive cost/benefit analysis of riparian buffers and their implementation strategies.

It was brought to the groups' attention that the projected costs of clean up ($60 Million) are greater than the assessed resource values ($2.5 Million), as calculated by total implementation of all practices versus WVU study. This is true in number comparison, Mary Leigh confirmed, but the costs may not be that high and funding possibilities are extensive.

Won't we need more practices in 11 years than we do after 5 years? Mary Leigh stressed that this plan is based on 25% build out scenarios, and this assumption is built into the BMP calculations and model. The comment was made that this was a conservative estimate.

Several questions were asked about the set-up of the model, such as 'what-if' scenarios, unilateral output versus family of outputs, and whether a sensitivity analysis was performed. Mary Leigh responded that the model was responsive to inputs and a sensitivity test was performed.

Local Implementation

Jim Lawrence from The Opequon Watershed, Inc. was next on the agenda to discuss local implementation steps and the formulation of the Opequon Action Team. Several discussion points arose.

Is there any thought of offering a presentation on the TMDL IP to the Water Resources Policy Committee? Jim agreed that this is an excellent idea.

Wouldn't be helpful if local planners had guidelines for what the plan recommends as new developments are considered? Jim agreed and said that this could be consolidated with the push

for a Natural Resources Advisory Board. Another suggestion would be to work within the Regional Policy Committee to collect examples of what other policy ideas.

Will the monitoring program going to be used to verify the model? Mary Leigh answered that actually the monitoring will be used to gauge progress in implementation and current water quality status.

A participant commented that the value of the benefits seems surprisingly low. Is there a better way to assess their value? Gerard D'Souza from WVU answered that the study actually measured a "willingness to pay" today – an aggregate of the value today - what benefit people would get from improving water quality today for specific benefits.

Clarification was asked on the cost of the infiltration practices, and if studies had compared these to normal curb and gutter practices. Mary Leigh answered that ther have been studies and it is usually cheaper to install and maintain Low Impact Development practices.

Another major benefit is not being measured here, one participant remarked, the downstream benefits that this provides to the Chesapeake Bay. Mary Leigh and Brian responded that the IP document addresses how to connect this effort to other plans and programs.

There is currently not much room for public access to the creek. This prevents citizens from understanding and taking advantage of the benefits of the creek. If we really want to the public to preserve a place, we should really get people to experience the place more often. Trash clean ups can help people experience and understand the creek.

Partial assessment of information about the benefits is not that meaningful. Health, property, perceptions about the quality of life should be included. The participant who brought this issue up was assured that the IP would provide a more complete explanation of the benefits analysis.

The comment was made that science does not mean much to elected officials, who really only care about costs and what they get for those costs.

Conclusion

Tara thanked everyone for coming and encouraged folks to stay involved in the implementation process by commenting on the document, participating on the Action Team, or involving their community groups in the process. As a reminder, there will be a comment document attached to the final plan which will be posted on the DEQ website. To make sure that your comments are included in the official document, please send comments by June 12th to Tara Sieber at VADEQ (tlsieber@deq.virginia.gov or 540.574.7870).

APPENDIX B

Additional Implementation Actions Suggested by Opequon TMDL IP Working Groups

As described in Chapters 5 and 6, working groups identified a number of potential implementation actions that were then evaluated and prioritized by the Steering Committee. The resulting high priority actions identified by the Steering Committee are presented in Table 6.2. Additional implementation actions suggested by the working groups that did not receive a high priority ranking from the steering committee are listed in Table B.1.

Table B.1 Practices identified by the Opequon Implementation Plan Development Working Groups that were identified as low priority by the Steering Committee.

Problem	Implementation Action
Livestock access to streams	Peer education about fencing
	Encourage education about aquatic resources by Trout Unlimited and others
	Reduce property tax or give tax credit for land taken out of production
	Phased approach to stream fencing (reflected in phased implementation)
Agricultural runoff	Rotational grazing system
	Consistent (more protective) regulations across jurisdictions for biosolids
	Monitor biosolids applications
	Educational programs on biosolids application
Increased stormwater runoff	Structural practices for infiltration, detention or retention in the watershed
	Identify curb & gutter demonstration areas for conversion to infiltration
	Conduct awareness/education campaign to reach political leadership and overcome impediments to LID
Erosion and sediment control	Offer E&S educational programs that target homeowners and landowners
	Coordinate a Citizens Watch group
	Promote phased disturbance during development – educational programs for developers
	Get involved in Rural Area Planning process currently underway
Stream channel modifications	Replace armored (concrete-lined) section of Town Run
Failing septic systems	Provide an amnesty period for reporting failing systems without fines
	Identify sources of financial assistance
	Educational program for homeowners (include information about leaky sinks and toilets
	Create cost-share incentive programs to retrofit systems with access ports
Exfiltration from municipal sewer collection system	Integrate with city/county sewer maintenance and rehabilitation programs

APPENDIX C

Glossary

Allocations - best estimates of current and future pollutant loads (both nonpoint and point sources) entering a waterbody. Pollutant load estimates can range from reasonably accurate measurements to gross estimates, depending on the availability of data, and the techniques used for predicting specific loads. (see Load Allocation and Waste Load Allocation)

Allocation Scenario - proposed combination of point source and nonpoint source pollutant loads being considered to meet a water quality goal.

Ambient water quality - level of water quality constituents collected as part of a routine monitoring program.

Anthropogenic - involving the impact of humans on nature; specifically items or actions induced, caused, or altered by the presence and activities of humans.

Best management practices (BMPs) - reasonable and cost-effective means to reduce the likelihood of pollutants entering a water body. BMPs include riparian buffer strips, filter strips, nutrient management plans, conservation tillage, etc.

Bioassessment - the process of evaluating the algal, benthic macroinvertebrate, and/or fish communities to determine whether a water body supports the state-defined designated use for aquatic life.

Calibration (of a model) - the process of adjusting model parameters within physically reasonable ranges until the resulting predictions give a best possible fit to observed data.

Clean Water Act (CWA) - is commonly used to describe the series of legislative acts that form the foundation for protection of the nation's water resources. Milestones in water quality legislation include the Water Quality Act of 1965; Federal Water Pollution Control Act of 1972 (PL92-500); the Clean Water Act, itself passed in 1977; and the Water Quality Act of 1987. Sections of the CWA address different types of water pollution in different ways. Section 305b and Section 303d of the CWA deal specifically with water quality assessment and TMDL development.

Coliform bacteria - a group of organisms (Colon bacilli) usually found in the digestive tract of all warm-blooded animals and humans. The presence of coliform bacteria in water is an indicator of possible pollution by fecal material and the presence of pathogenic bacteria that can cause diseases such as intestinal infections, dysentery, hepatitis, typhoid fever and cholera. Bacteria quantities are generally reported as colonies or colony forming units (cfu) per 100 milliliters (ml) of sample. (see fecal coliform)

Criteria - elements of water quality standards expressed as constituent concentrations, levels, or narrative statements, representing the quality of water that supports a particular use. When criteria are met, water quality will generally support the designated use.

Delisting - the process by which an impaired waterbody is removed from the Section 303(d) Impaired Waters List. To remove a waterbody from the Section 303(d) list, the state must demonstrate to EPA, using monitoring or other data, that the waterbody is no longer impaired.

Designated use - those uses specified in water quality standards for each water body or segment. All Virginia waters are designated for the following uses: recreational uses, e.g., swimming and boating; the propagation and growth of a balanced, indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources, e.g., fish and shellfish. Taken together, these uses are generally stated as "fishable and swimable." Through the protection of these uses, other uses such as industrial water supply, irrigation and navigation also are protected.

Die-off (of fecal coliform) - reduction in the fecal coliform population due to predation by other bacteria as well as by adverse environmental conditions (e.g.UV radiation, high or low pH, etc.).

Direct nonpoint sources - nonpoint sources that discharge directly into the stream, such as direct deposits of fecal material to streams from livestock and wildlife.

Drainage basin - the land area that drains to, or contributes water to, a particular point, stream, river, lake or, ocean. Drainage basins range in size from a few acres for a small stream, to large areas of the country like the Chesapeake Bay Basin that includes parts of six states. (see watershed)

E. coli (Escherichia coli) - a subgroup of fecal coliform bacteria that are present in the intestinal tracts and feces of warm-blooded animals. E. coli are used as an indicator of the potential presence of pathogens.

Effluent - (1) Something that flows out or forth, (2) Discharged wastewater such as the treated wastes from animal production facilities, industrial facilities, or wastewater treatment plants.

Endpoint - a measurable goal or target. Assessment endpoints and measurement endpoints are

Exceedance - a violation, e.g., of a permit limit or a water quality standard.

Existing Use - the use actually attained in the water body on or after November 28, 1975, whether or not the use is included in the water quality standards.

Failing septic system - septic systems in which the drain field has failed such that effluent (wastewater) that is supposed to percolate into the soil, rises to the surface and ponds on the surface where it can run into streams or rivers and pollute them.

Fate of pollutants - physical, chemical, and biological changes that pollutants experience once in the environment.

Fecal coliform - an organism of the coliform bacteria group originating in the intestinal tract of warm-blooded animals that passes into the environment in feces. Fecal coliform bacteria are often used as an indicator of pathogens in water. Generally reported as colonies or colony forming units (cfu) per 100 milliliters (ml) of water sample.

Geometric mean - the nth root of the product of n values. Mathematically the geometric mean is expressed as:

$$Geometric\ Mean = \sqrt[n]{x_1 \times x_2 \times \ldots x_n}$$

where n is the number of samples, and x1, x2, etc. are the values of some parameter, i.e. E. coli concentrations. Compared to an average or simple mean, the geometric mean lessens the impact of extremely high or low values greater than zero. For example, consider the following set of five E. coli measurements with units of cfu/100ml, 150, 600, 50, 120, 195. A simple mean of these values produces:

$$\text{Simple Mean} = \frac{150+600+50+120+195}{5} = 223 \text{ cfu/100ml}$$

The geometric mean for these measurements would be:

$$Geometric\ Mean = \sqrt[5]{150 \times 600 \times 50 \times 120 \times 195} = 160 \text{ cfu/100ml}$$

Geographic Information System (GIS) - a system of hardware, software, data, people, organizations and institutional arrangements for collecting, storing, analyzing and disseminating information about areas of the earth. An example of a GIS is the use of spatial data for Emergency Services response (E-911). Dispatchers use GIS to locate the caller's house, identify the closest responder, and even determine the shortest route. All these activities are automated using the electronic spatial data in the GIS.

Hydrology - the study of the distribution, properties, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.

Impaired waters - those waters with chronic or recurring monitored violations of the applicable numeric and/or narrative water quality criteria.

Implementation Plan - a document required by Virginia statute (see WQMIRA) detailing the suite of pollution control measures needed to remediate an impaired water body. Once fully implemented, the plan should result in the previously impaired water achieving a "fully supporting" status. (see use support)

Indicator - a qualitative or quantitative surrogate measure that can be used to evaluate the relationship between pollutant sources and their impact on water quality. For example, the number and type of fish in a stream may be indicative of the stream's water quality.

Indicator organism - (1) any organism that by its presence or absence, its frequency, or its vigor indicates a particular property of its surrounding environment. (2) an organism used to indicate the potential presence of other (usually pathogenic) organisms. Indicator organisms are usually associated with the other organisms, but are usually more easily sampled and measured.

Load, Loading, Loading rate - the total amount of material (pollutants) entering a water body from one or multiple sources. Measured as a rate in weight per unit time or per unit area (e.g., pounds/year, pounds/acre).

Load allocation (LA) - the portion of the loading capacity attributed to 1) the existing or future nonpoint sources of pollution, and 2) natural background sources. Wherever possible, nonpoint source loads and natural loads should be distinguished.

Loading capacity (LC) - the greatest amount of pollutant loading a waterbody can receive without violating water quality standards. (see assimilative capacity)

Margin of safety (MOS) - a required component of the TMDL that accounts for the uncertainty in calculations of pollutant loading from point, nonpoint, and background sources.

Mean - the simple mean is the sum of the values in a data set divided by the number of values in the data set.

Micrograms per liter (µg/l) - a measure of concentration, equivalent to parts per billion (ppb). One thousand micrograms per liter is equivalent to 1 milligram per liter.

Model - a system of mathematical expressions that describe both hydrologic and water quality processes. When used for the development of TMDLs, models can estimate the load of a specific pollutant to a water body and make predictions about how the load would change as remediation steps are implemented. Examples of models being used to develop TMDLs in Virginia include HSPF (Hydrological Simulation Program-Fortran) and GWLF (Generalized Watershed Loading Function).

Monitoring - periodic or continuous sampling and measurement to determine the physical, chemical, and biological status of a particular media like air, soil, or water.

Nonpoint source (NPS) pollution - pollution originating from diffuse sources on and above the landscape. Examples include runoff from fields, stormwater runoff from urban landscapes, roadbed erosion in forestry, and atmospheric deposition. Estimates indicate that NPS pollution accounts for more than one-half of the water pollution in the United States today. (contrast with point source pollution)

Numeric criteria - a measurable value determined for the pollutant of concern which, if achieved, is expected to result in the attainment of water quality standards in the listed waterbody.

Pathogen - a disease-causing agent, especially microorganisms such as bacteria, protozoa, and viruses.

Phased approach - under the phased approach, pollutant load reduction management strategies are implemented gradually with the most cost effective best management practices being implemented first. Monitoring continues throughout the implementation process to assess water quality improvement. This approach can be used where great uncertainty exists, either in load estimation or in the effectiveness of a chosen management strategy. (See also Staged Implementation)

Point source pollution - pollutant loads discharged through a discreet conveyance. Point source discharges are generally regulated through the Virginia Pollution Discharge Elimination System (VPDES) permitting procedures. Point sources can also include pollutant loads contributed by tributaries to the main receiving stream or river. During TMDL development, permitted point sources are assigned a waste load allocation for the pollutant in question.

Pollutant - any substance of such character and in such quantities that when it reaches a body of water, it degrades the receiving water, rendering it unfit for some specified designated use. Specifically as defined in Section 502(6) of the CWA a pollutant means dredged spoil, solid

waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water

Pollution - alteration of the physical, biological, chemical, and radiological integrity of water due to human activities any unwanted contaminating property that renders a water supply unfit for its designated use. Specifically as defined in Section 502(19) of the CWA, pollution means the man-made or man-induced alteration of the physical, biological, chemical, and radiological integrity of water.

Public comment period - the time allowed for the public to express its views and concerns regarding action proposed by a state or federal agency.

Reach - a section of a river or stream that generally extends from the confluence of one tributary with another, or sometimes from a tributary to an outlet, lake, or other feature.

Receiving water - creeks, streams, rivers, lakes, estuaries, groundwater formations, or other bodies of water into which surface water and/or treated or untreated waste are discharged.

Riparian - pertaining to the banks of a river, stream, pond, lake, etc., as well as to the plant and animal communities along such bodies of water

Runoff - that part of rainfall or snowmelt that does not infiltrate but flows over the land surface, eventually making its way to a stream, river, lake or an ocean. It can carry pollutants into receiving waters.

Section 305(b) - section of the Clean Water Act that requires states to submit a biennial report in even numbered years to EPA describing the quality of the state's waters. The 305(b) report describes the overall water quality conditions and trends in the state.

Section 303(d) - section of the Clean Water Act that requires states to periodically identify waters that do not or are not expected to meet applicable water quality standards. These waters are identified on the 303(d) Impaired Waters List. A TMDL must be developed for each water on the 303(d) list. If a listed water has multiple impairments (multiple reasons for degraded water quality), a TMDL must be developed for each impairment.

Septic system - an on-site system designed to treat and dispose of domestic sewage. A typical septic system consists of a tank that receives waste from a residence or business and a drain field or subsurface absorption system consisting of a series of percolation lines for the disposal of the liquid effluent. Solids (sludge) that remain after decomposition by bacteria in the tank must be pumped out periodically.

Sewer - a channel or conduit that carries wastewater and storm water runoff from the source to a treatment plant or receiving stream. Sanitary sewers carry household, industrial, and commercial waste. Storm sewers carry runoff from rain or snow. Combined sewers handle both.

Simulation - with respect to water quality, simulation is the use of mathematical models to approximate the behavior of a natural water system in response to a specific set of known inputs or conditions. Once validated, simulation models can be used to predict the response of a natural water system to specific changes to model inputs, i.e. changes in land use.

Staged Implementation - a process that allows for the evaluation of the adequacy of the TMDL in achieving the water quality standard. As stream monitoring continues to occur, staged or phased implementation allows for water quality improvements to be recorded as they are being achieved. It also provides a measure of quality control, and it helps to ensure that the most cost effective practices are implemented first.

Stakeholder - (in this context) any person or organization with a vested interest in TMDL development and implementation in a specific watershed.

Straight pipe - delivers wastewater directly (without treatment) from a building, e.g., house, or milking parlor, to a nearby stream, pond, lake, or river.

Surface water - all water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors directly influenced by surface water.

Technology-based effluent limitations - effluent limitations for permitted point sources calculated from technology-based controls. Technology-based controls include best practicable control technology currently available as defined in the Clean Water Act.

Total Maximum Daily Load (TMDL) - a pollution "budget" that is used to determine the maximum amount of pollution a water body can assimilate without violating water quality standards. The TMDL includes pollution from permitted point sources (Waste Load Allocations, WLAs), and nonpoint and natural background sources (Load Allocations, LAs). In addition to the load allocations, the TMDL includes a margin of safety (MOS). The MOS accounts for any uncertainty associated with estimating the load allocations. Mathematically, a TMDL is written as follows

TMDL = LC = WLAs + LAs + MOS

A TMDL is developed for a specific pollutant and can be expressed in terms of mass per time, toxicity, or other appropriate measures that relate to the water quality standard being violated.

TMDL Implementation Plan - a document required by Virginia statute (see WQMIRA) detailing the suite of pollution control measures needed to remediate an impaired stream segment. The plans are also required to include a schedule of actions, costs, and monitoring. Once implemented, the plan should result in the previously impaired water meeting water quality standards and achieving a "fully supporting" use support status.

Transport of pollutants (in water) - involves two main processes: (1) advection, resulting from the flow of water itself, and (2) dispersion, or transport due to turbulence in the water.

Tributary - a lower order-stream compared to a receiving waterbody. A tributary will be upstream from, and flow into, the receiving waterbody, i.e. the Missouri is a tributary to the Mississippi.

Use Attainability Analysis (UAA) - a structured scientific assessment of the physical, chemical, biological, and economic factors that affect the attainment of a designated use. If a UAA shows that attaining a designated use is not feasible, the state, after considering public opinion, may choose to modify the use to make it less stringent.

Use support - the degree to which a water body will support its designated use. Use support criteria vary depending on the designated use. The degree of use support is reported in the Section 305(b) and Section 303(d) reports. The four use support categories are Fully Supporting, Fully Supporting but Threatened, Partially Supporting, Not Supporting. Waters classified as Partially Supporting or Not Supporting are deemed to be "impaired."

Validation (of a model) - process of determining how well the predictions of a mathematical model describe the actual behavior and physical process under investigation.

WQMIRA - the Water Quality Monitoring, Information, and Restoration Act of 1997. This Virginia statute directs the Virginia Department of Environmental Quality (DEQ) to produce a list of impaired waters and develop TMDLs for these waters. The statute also directs DEQ to develop Implementation Plans for the TMDLs.

Wasteload allocation (WLA) - the portion of a receiving water's loading capacity that is allocated to one of its existing or future permitted point sources of pollution. WLAs constitute a type of water quality-based effluent limitation.

Wastewater treatment - chemical, biological, and mechanical procedures applied to an industrial or municipal discharge or to any other sources of contaminated water to remove, reduce, or neutralize contaminants. Treatment facilities are often referred to by the acronyms STP (sewage treatment plant) or POTW (publicly owned treatment works) or WWTP (waste water treatment plants).

Water quality - the biological, chemical, and physical conditions of a waterbody. It is a measure of a waterbody's ability to support beneficial uses.

Water quality criteria - include general narrative statements that describe good water quality and specific numeric criteria that are based on specific levels of pollutants that, if exceeded, would result in a water body not supporting a desginated use. The numerical and narrative criteria taken together describe water quality necessary to protect designated uses.

Water quality standards - a group of statements that constitute a regulation describing specific water quality requirements. Virginia's water quality standards have the following three components: designated uses, water quality criteria to protect designated uses, and an antidegredation policy.

Watershed - area that drains to, or contributes water to, a particular point, stream, river, lake or ocean. Larger watersheds are also referred to as basins. Watersheds range in size from a few acres for a small stream, to large areas of the country like the Chesapeake Bay Basin that includes parts of six states (see, drainage basin).