UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

JUN 2 1 2009

Mr. Charles Martin, Watershed Program Manager
Virginia Department of Environmental Quality
629 E. Main Street
P.O. Box 1105
Richmond, Virginia 23218

Dear Mr. Martin:

The U.S. Environmental Protection Agency (EPA) has reviewed your request to amend the Total Maximum Daily Load (TMDL) and Load Allocations (LAs) for fecal coliform bacteria in the Lower Piankatank River (Shellfish Growing Area 34), located in Middlesex and Gloucester Counties, Virginia. As indicated in your letter, the original TMDL, approved by EPA on November 15, 2005, contained incorrect Biological Source Tracking (BST) information for three sources in the TMDL study area. This resulted in incorrect baseline loads, load allocations, and percent reductions for Cobbs Creek (Condemnation Area 170), Wilton Creek (Condemnation Area 126) and Healy Creek (Condemnation Area 129).

To correct these errors, the Virginia Department of Environmental Quality (VADEQ) has provided revised baseline loads, load allocations, and percent reductions for each of these condemnation areas. These changes will not change the overall value of the TMDLs and will not cause water quality violations. EPA finds this to be a reasonable proposal, and approves the requested modifications to the TMDL.

If you have any questions or comments concerning this letter, please do not hesitate to call me, or contact Greg Voigt at 215-814-5737.

Sincerely,

Larry Merrill, Acting Associate Director
Office of Standards, Assessment and TMDLs

JUL 2 4 2009

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
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July 14, 2009

Mr. Greg Voigt
US EPA Region III TMDL Coordinator
USEPA REGION 3 – 3WP12
1650 Arch Street
Philadelphia, PA 19103-2029

RE: Total Maximum Daily Load modifications for the wasteload allocation in the Shellfish Areas Listed Due to Bacterial Contamination – Lower Piankatank River (Cobbs Creek), Growing Area 34, located in Middlesex and Gloucester Counties, Virginia.

Dear Mr. Voigt,

The purpose of this letter is to request a modification to the load allocation for the Total Maximum Daily Load (TMDL) Report for Shellfish Areas Listed Due to Bacterial Contamination – Piankatank River, Lower, approved by EPA on 11/15/2005.

DEQ staff transposed Biological Source Tracking (BST) source percentages for three sources in Condemnation Area 170, Cobbs Creek, which resulted in incorrect BST Allocation Percentage of Total Load, Current Load, Load Allocation and Reduction Needed percent for Cobbs Creek Condemnation Area 170. Additional rounding errors occurred in Current Loads and Load Allocations, resulting in Reduction Needed percent changes for Condemnation Areas 126, Wilton Creek, and 129, Healy Creek. The corrections to the TMDL report for Condemnation Areas 126, 129, and 170 in Growing Area 34 are attached.

Updating the "Reduction based upon 90TH PERCENTILE Standard Growing Area 34: Piankatank River, Lower Watershed" and associated tables in the Total Maximum Daily Load (TMDL) Report for Shellfish Areas Listed Due to Bacterial Contamination – Piankatank River, Lower in accordance with this request will not cause a water quality violation because these are only percent changes in BST sources with no change to the total TMDL.

Permit Details

There are no point source permittees in Condemnation Areas 126, 129 and 170.

TMDL Revisions

The following tables from Total Maximum Daily Load (TMDL) Report for Shellfish Areas Listed Due to Bacterial Contamination – Piankatank River, Lower were corrected as follows:

P vi - Executive Summary Table "Reduction based upon 90TH PERCENTILE Standard Growing Area 34: Piankatank River, Lower Watershed," changes to BST Allocation Percentage of Total Load, Current Load, Load Allocation and Reduction Needed percent for Cobbs Creek Condemnation Area 170. Additional rounding errors occurred in Current Loads and Load Allocations, resulting in Reduction Needed percent changes for Condemnation Areas 126, Wilton Creek, and 129, Healy Creek.

P 19 - Table 4.2, changes to Livestock, Wildlife and Human percentages for Condemnation Area 170, Cobbs Creek.

P 23 – Table 5.3, changes to BST Allocation Percentage of Total Load, Current Load, Load Allocation and Reduction Needed percent for Cobbs Creek Condemnation Area 170. Additional rounding errors occurred in Current Loads and Load Allocations, resulting in Reduction Needed percent changes for Condemnation Areas 126, Wilton Creek, and 129, Healy Creek.

P 26 – text correction unrelated to load allocation tables: "This report represents the culmination of that effort for the bacterial impairments in the Lower Piankatank River watershed."

These changes are included in the attached modified pages. No Waste Load Allocations are involved in this modification. Because this involved changes in Allowable Loads, DEQ provided public notice and a 30-day comment period on the TMDL modification. One comment was received and addressed. The comment and response are also attached.

In accordance with EPA's August 2003 letter to VADEQ, VADEQ hereby requests EPA approval of the proposed modification. If you or your staff has any questions, please contact me at (804) 698-4462.

Sincerely,

Charles H. Martin
Environmental Program Manager
Watershed Programs

Attachments
Replacement page(s)

cc: Jack Frye, VADCR
Sandra Mueller, VADEQ
Margaret Smigo, PRO TMDL coordinator
File CO

OCT 23 2008

October 16, 2008

Margaret Smigo
Department of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060

Dear Ms Smigo:

Comment on
Lower Piankatank River Shellfish TMDL

Thank you for the opportunity to comment on the re-opened Piankatank River, Lower Watershed Total Maximum Daily Load Report (Report). While some of my comments are general in nature, I will focus on the Cobbs Creek portion of the Report as that is where I live.

The executive Summary of the Report lists 6 processes used in developing a shellfish water TMDL. My comments focus on the second process listed: "Potential sources of fecal bacteria loading within the contributing watershed are identified." In order to develop a successful Implementation Plan, the potential sources that contribute to the problem need to be delineated as closely as possible.

The project design for developing the Report and implementation was flawed and therefore the Report is not the useful tool it should be that will lead to an Implementation Plan that will correct the fecal bacteria problem in Cobbs Creek. The "contributing watershed" called for in second process was not used to develop the Report. The watershed used to develop the potential sources of fecal bacteria was the shellfish watershed of the Piankatank River, Lower found in Mathews County not just the Cobbs Creek watershed. My rough estimate is that Cobbs Creek watershed occupies only 60 percent of the shellfish watershed. This approach was not used in non-tidal areas of Virginia. I reviewed the TMDL for the Naked Creek watershed in Augusta County where I previously lived and that study was done only on the watershed of Naked Creek.

The use of the shellfish watershed has introduced large errors into the estimates of animal and septic system found in the Cobbs Creek watershed. Let's take cattle as an example. The estimated number of cattle in the Report is 30. The Shoreline Sanitation Survey found "20 cows with direct access to an unnamed cove on the Piankatank River". So the people who walked the area found 20 cows and the CATTLE WERE NOT IN THE COBBS CREEK WATERSHED. The cows were approximately one-half mile east of the Cobbs Creek watershed. There are no cows in the Cobbs Creek watershed. Why have the people walk the watershed if the report writers are going to use computer estimates and ignore the finding of the field people?

The Shoreline Sanitation Survey reported no horses and no pigs but they did identify 1500 chickens that were not included in the Report. But not including the chickens is a good thing because they are not in the Cobbs Creek Watershed. Storm water from the chicken houses flow into a culvert that passes under Rt. 3 and flows into the Piankatank River upstream from the Rt. 3 bridge. There are one or two homeowners that have small flocks of chickens within the Cobbs Creek watershed. One would have to assume that all of the animal populations listed under Cobbs Creek are inflated and therefore not very useful in defining the contributing sources of fecal bacteria into Cobbs Creek. My condo is on the creek and I usually see no more than a dozen mallard ducks in the summer and about the same number of diving ducks in the winter. Geese seldom are present in the creek, except when we planted new grass, but are present in limited number grazing in the fields. Muskrats are a contributing factor as I have trapped 50 of them from our property over the last four years. Cruising boats anchor in Cobbs Creek and may also be as source of fecal bacteria.

Not focusing on just the Cobbs Creek watershed has resulted in wasted time, money and effort. The Shoreline Sanitation Survey, which covered the shellfish watershed, identified a total of 22 polluting and potentially polluting sites within the watershed. Only six of these sites are within the Cobbs Creek watershed. Two of the six sites were polluting and they were rechecked soon after the defects were found and they were found to be in compliance. The Naked Creek TMDL report referenced a Holmans Creek Watershed study where the field people made a more concentrated study of the septic systems and they found over 30 percent of all septic systems checked in the watershed were either failing or not functioning at all. It would have been better for the field people to have more closely studied the septic systems in the Cobbs Creek watershed instead of walking the fields not in the Cobbs Creek watershed.

Since we know that the Animal Populations and Septic Systems data is inflated and not realistic, the BST test becomes more important. The BST data for Cobbs Creek is quite variable and the number of samples taken was one-third less than the other two watersheds included in the report. The average of the limited and variable data may not give us an accurate base to work from either. I looked at two years worth of rainfall data for the area and rainfall did not correlate well with the elevated fecal bacteria findings.

Simply put: I think that the protocol used to develop the Report has added confusion to the problem instead of clarity and that it will be most difficult for a successful Implementation Plan to be written that will eliminate the contributing sources for fecal bacteria and that the waters of Cobbs Creek will no longer be condemned. I am interested in having the problem solved so that I can eat the oysters growing in my oyster floats.

Lewis Garrett

Lewis Garrett
86 Hudgins Point Lane
Cobbs Creek, VA 23035
804-725-9809

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

L. Preston Bryant, Jr.
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David K. Paylor
Director

Gerard Seeley, Jr.
Regional Director

October 31, 2008

Mr. Lewis Garrett
86 Hudgins Point Lane
Cobbs Creek, VA 23035

Dear Mr. Garrett,

Thank you very much for your comment and emails regarding typographical errors in the Piankatank River Shellfish TMDL. This letter is in response to your comment, dated October 16, 2008. We have corrected the errors you identified and will submit corrected data and tables to the U.S.E.P.A. Your comment and this response will be added to the information sent to the U.S.E.P.A.

You expressed concern that "the contributing watershed …was not used to develop the Report," related to the fact that the Dept. of Environmental Quality (DEQ) used the combined watersheds for Wilton, Healy, Cores, Moore and Cobbs Creeks, including Warehouse Cove and associated Lower Piankatank River acreage. You stated a preference that only the Cobbs Creek watershed should be used to characterize the bacterial problem in Cobbs Creek. DEQ agrees that it would have been an improvement to use the land use and drainage areas of each creek to assess those individual waterbodies. However it is not possible for DEQ to assess each Virginia Dept. of Health – Division of Shellfish Sanitation (VDH-DSS) condemned and DEQ impaired waterbody individually, because there are hundreds to assess before May 2010, which is the court–decreed deadline for completing most of these assessments. Therefore DEQ decided to combine adjacent impaired waterbodies in these reports to increase the likelihood of finishing before the legal deadline.

You stated the belief that "the animal population estimates for Cobbs Creek were inflated." We wish that we had had the animal population information provided in your comment during the development of the TMDL report. Fortunately DEQ uses more than just the animal estimates to determine the bacterial reductions for implementation planning of watershed improvements, the next step in the TMDL process. DEQ also uses the BST data and strongly considers land use to propose bacterial reductions. The fecal coliform levels in all three of Cobbs, Wilton and Healy Creeks were such that the same maximum percentage reductions (99 – 100%) of human, livestock and pet will probably be necessary to lower the bacteria levels to approach the water quality standard. The data predicts that wildlife bacterial sources may be high enough in each individual creek that elimination of the man-made sources may not be enough to attain the standard. Thus the relative accuracy of animal population estimates did not appear to significantly lessen the bacterial reductions needed.

DEQ disagrees that "not focusing on just the Cobbs Creek watershed has resulted in wasted time, money and effort." The report indicated that major reductions in man-made bacterial sources are necessary in each of Cobbs, Wilton and Healy Creeks in the Lower Piankatank River watershed to begin to return the fecal coliform levels to the water quality standard. This determination provided the information needed to move to the next phase of the TMDL process, the implementation planning for where to concentrate resources to improve the water quality. There will be several opportunities for public participation in this process, including providing information on location of animal populations. DEQ will add your contact information to our mailing list for future announcements of the implementation planning meetings, and we hope you will be able to attend.

Sincerely,

Mark Alling
TMDL Manager,
Piedmont Regional Office
DEQ

List of Tables

Total Maximum Daily Load Executive Summary

Total Maximum Daily Load Process

Management of water quality is a process intended to protect waters for a variety of uses. The first step in the process is the identification of desired uses for each waterbody. There are typically a number of physical, chemical and/or biological conditions that must exist in a waterbody to allow for a desired use to exist. In Virginia, most inshore tidal waters are identified as potential shellfish growing waters. In order to support shellfish propagation without risk to human consumers, shellfish waters must have very low levels of pathogenic organisms. Virginia, as most other states, uses fecal coliforms (FC) as an indicator of the potential presence of pathogenic organisms. To maintain the use of a waterbody for direct shellfish harvesting, the goal is to ensure the concentration of fecal coliforms entering the waterbody does not exceed a "safe" level. The safe level is set as the standard against which water quality monitoring samples are checked.

When water quality monitoring detects levels of fecal coliforms above allowable, "safe" levels, managers must identify the potential sources and plan to control them. The prescribed method for figuring out what must be controlled to attain the water quality standard is the calculation of a total maximum daily load (TMDL). The TMDL is the amount of fecal coliforms that may be introduced by each potential source without exceeding the water quality standard for fecal coliforms in shellfish growing waters.

The process of developing a shellfish water TMDL may be generalized in the following manner:

1. Water quality monitoring data are used to determine if the bacterial standard for shellfish have been violated;
2. Potential sources of fecal bacteria loading within the contributing watershed are identified;
3. The necessary reductions in fecal bacteria pollutant load to achieve the water quality standard are determined;
4. The TMDL study is presented to the public to garner comment;
5. An implementation strategy to reduce fecal bacteria loads is written into a plan and subsequently implemented;
6. Water quality monitoring data are used to determine if the bacterial standard is being met for shellfish waters.

Different approaches can be used to determine the sources of fecal pollution in a waterbody. Two distinctly different approaches are watershed modeling and bacterial source tracking (BST). Watershed modeling begins on the land, identifying potential sources based on information about conditions in the watershed (e.g. numbers of residents, estimated wildlife populations, estimated of livestock, etc.). BST begins in the water, identifying sources of fecal coliforms, specifically the dominant fecal coliform *Escherichia coli*, to shellfish waters based on either genetic or phenotypic characteristics of the coliforms. Virginia's Department of Environmental Quality has decided to utilize BST, and specifically to use a method called antibiotic resistance analysis (ARA). This method assumes that fecal bacteria found in four sources: humans, wildlife, livestock, and domestic animals analysis in a process called bacterial source tracking. These samples were compared to a reference library of fecal samples from known sources. The resulting data were used to assign portions of the load within the watershed to wildlife, humans, pets or livestock. The results of this analysis indicated that the primary source of fecal coliforms is wildlife with livestock as secondary contributors. The presence of a large signature attributable to one component is sufficient to establish potential directions for remediation under a future implementation plan.

Load Allocation Scenarios

The next step in the TMDL process was to determine the appropriate water quality standard to be applied. This was set as the 90th percentile standard because the data established that the 90th percentile required the greater reduction. Calculated results of the model for each segment were used to establish the existing load in the system. The load necessary to meet water quality standards was calculated in a similar fashion using the water quality standard criterion in place of the ambient water quality value. The difference between these two numbers represents the necessary level of reduction in each segment.

Finally the results of the BST developed for each segment were used to partition the load allocation that would meet water quality standards according to source. The results of the model, the BST source partitioning and the reductions necessary for each segment are shown below.

Reduction based upon 90TH PERCENTILE Standard
Growing Area 34: Piankatank River, Lower Watershed

Condemnation Area	Source	BST Allocation % of Total Load	Current Load MPN/ day	Load Allocation MPN/ day	Reduction Needed
126 Wilton Creek	Livestock	24%	2.71E+11	2.71E+09	99%
	Wildlife	49%	5.54E+11	1.39E+11	75%
	Human	22%	2.49E+11	0.00E+00	100%
	Pets	5%	5.65E+10	5.65E+08	99%
	Total	100%	1.13E+12	1.42E+11	87%
129 Healy Creek	Livestock	21%	7.75E+10	7.75E+08	99%
	Wildlife	58%	2.14E+11	4.50E+10	79%
	Human	14%	5.17E+10	0.00E+00	100%
	Pets	7%	2.58E+10	2.58E+08	99%
	Total	100%	3.69E+11	4.60E+10	88%
170 Cobbs Creek	Livestock	19%	2.30E+10	2.30E+08	99%
	Wildlife	51%	6.17E+10	4.59E+10	26%
	Human	28%	3.39E+10	0.00E+00	100%
	Pets	2%	2.62E+09	2.62E+07	99%
	Total	100.00%	1.21E+11	4.62E+10	62%

will all differ in their reactions to antibiotics. Thus, when samples of fecal bacteria collected in the water quality monitoring program are exposed to specific antibiotics the pattern of responses allows matching similarities to the response patterns of bacteria from known sources which have been accumulated in a "source library". Through this analysis investigators also estimate the relative proportion of the fecal bacteria derived from each of the four general source classes and assumes this proportion reflects the relative contribution from the watershed..

The resulting estimates of the amount of fecal coliform pollution coming from each type of source can then be used to allocate reductions necessary to meet the water quality standard for shellfish growing waters. Identifying and agreeing on the means to achieve these reductions represent the TMDL implementation plan.

Continued water quality monitoring will tell whether the efforts to control sources of fecal coliforms in the watershed have succeeded.

Fecal Coliform Impairment

This document details the development of bacterial TMDLs for three segments in the Lower Piankatank River watershed in Middlesex and Mathews Counties, Virginia. The three condemned areas in the watershed are condemnation number 126: portions of Wilton Creek, 129 portions of Healy Creek and condemnation number 170: Cobbs Creek. The applicable state standard specifies that the number of fecal coliform bacteria shall not exceed a maximum allowable level of geometric mean of 14 most probable number (3-tube MPN) per 100 milliliters (ml) and a 90th percentile geometric mean value of 49 MPN/100ml. (Virginia Water Quality Standard 9-VAC 25-260-5). In development of this TMDL, the 90th percentile 49 MPN/100 ml was used, since it represented the more stringent standard.

Sources of Fecal Coliform

Potential sources of fecal coliform consist primarily of non-point source contributions, as there are no permitted point source discharges in the watershed. Non-point sources include wildlife; livestock; land application of bio-solids; recreational vessel discharges; failed, malfunctioning, or non-operational septic systems, and uncontrolled discharges (straight pipes conveying gray water from kitchen and laundry areas of private homes, etc.).

Water Quality Modeling

A steady state tidal prism model was used for this TMDL study because the character of the waterbodies to be modeled is relatively simple from a hydrologic perspective: for example, small in area and volume with a single, unrestricted connection to receiving waters. This approach uses the volume of the waterbody and adjusts for tidal flushing, freshwater inflow and bacterial decay in order to establish the existing and allocation conditions.

Determination of Existing Loadings

To assist in partitioning the loads from the diverse sources within the watershed, water quality samples of fecal coliform bacteria were collected for one year and evaluated using an antibiotic resistance

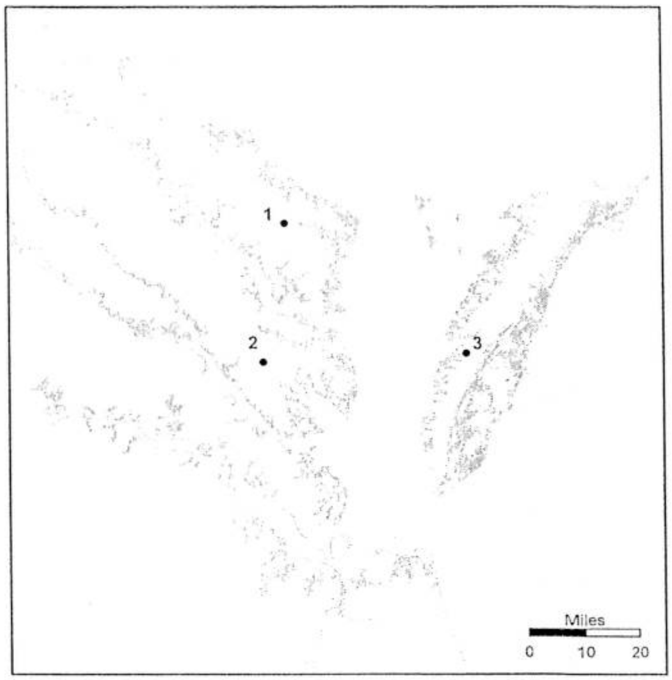
did not flow out of the embayment on the previous ebb tide (m^3 per tidal cycle)
Q_b = the quantity of mixed water that leaves the embayment on the ebb tide that did not enter the embayment on the previous flood tide (m^3 per tidal cycle)
V = the mean volume of the embayment (m^3) and
Cf = the unit conversion factor.

Q_b and Q_0 are estimated based on the steady state condition as follows:

$$Q_b = Q_0 + Q_f$$

$$Q_0 = \beta Q_T$$

where β is an exchange ratio and Q_T is the total ocean water entering the bay on the flood tide, which is calculated based on tidal range. The dominant tide in this region is the lunar semi-diurnal (M_2) tide with a tidal period of 12.42 hours. Therefore, the M_2 tide is used for the representative tidal cycle. In general, the exchange ratio varies from 0.3 to 0.7, based on the previous model tests in Virginia coastal embayments (Kuo et al., 1998; Shen et al., 2002). A mean value of 0.5 was used for the exchange ratio. Q_f is mean freshwater discharge during the tidal cycle. The estimated mean flow, Q_f.. is 4.3 cfs, 1.5 cfs and 1.8 cfs for Wilton Creek, Healy Creek and Cobbs Creek, respectively. The stream flow used for Q_f was based on a ratio of the drainage area of the subject watershed as compared to the drainage area and the stream flows measured by the U.S. Geological Survey for one of the three gauging stations; Great Wicomico, Ware River and Nassawaddox Creek. The Great Wicomico was used for this study. The selection of gauging station for use in the model is determined by the proximity of the station to the TMDL study area.



Map Number	USGS gaging station	Stream Name
1	01661800	Great Wicomico River
2	01670000	Ware River
3	01844800	Nassawaddox Creek

5.2 The TMDL Calculation

To meet the water quality standards for both geometric mean and 90th percentile criteria, TMDLs for the impaired segments in the watershed are defined for the geometric mean load and the 90th percentile load. The TMDL for the geometric mean essentially represents the allowable average limit and the TMDL for the 90th percentile is the allowable upper limit. If observed data were available for more than one monitoring station in a condemned area, the volume-weighted values for each condemned area were used to represent the embayment concentration.

Table 4.2 Non-point Source Load Distribution using BST
Growing area 34: Piankatank River, Lower

Condemnation Area	Livestock	Wildlife	Human	Pet
126 Wilton Creek	24%	49%	22%	5%
129 Healy Creek	21%	58%	14%	7%
170 Cobbs Creek	19%	51%	28%	2%

5.0 TMDL Development

5.1 Steady-State Modeling Approach

Bay and coastal waters are subject to the action of the tides. The ebb and flood of the tide serves to move water between locations exchanging and mixing with other water. The tide and amount of freshwater discharge into the embayment are the dominant influences on the transport of fecal coliform. The TMDL is calculated using the steady-state tidal prism model. Compared to the volumetric method (EPA Shellfish Workshop, 2002), the steady-state tidal prism model incorporates the influences of tidally induced transport, freshwater input, and removal of fecal coliform via decay. The model assumes that the embayment is well mixed, and freshwater input, tidal range, and the first-order decay of fecal coliform are all constant. A detailed description of the model is presented in Appendix B, and a summary is presented below.

The steady-state tidal prism model calculates fecal coliform load using equation one:

$$L = [C(Q_b + kV) - Q_0 C_0] \times Cf \qquad (1)$$

where:
L = fecal coliform load (counts per day)
C = mean fecal coliform concentration (MPN /100ml) of embayment
k = the fecal coliform removal/decay rate (per day)
C_0 = the fecal coliform concentration (MPN/100ml) at the ocean boundary
Q_0 = the quantity of water that enters the embayment on the flood tide through the ocean boundary that

5.3.1 Development of Wasteload Allocations

There are no permitted point source discharges in the watershed. No waste load is considered in this TMDL.

5.4 Consideration of Critical Conditions and Seasonal Variation

EPA regulations at 40 CFR 130.7 (c)(1) require TMDLs to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of the waterbody is protected during times when they are most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards. The current loading to the waterbody was determined using a long-term record of water quality monitoring (observation) data. The period of record for the data was 1995 to 2002. The resulting estimate is quite robust.

A comparison of the geometric mean values and the 90^{th} percentile values against the water quality criteria will determine which represents the more critical condition or higher percent reduction. If the geometric mean values dictate the higher reduction, this suggests that, on average, water sample counts are consistently high with limited variation around the mean. If the 90^{th} percentile criterion requires a higher reduction, this suggests an occurrence of the high fecal coliform due to the variation of hydrological conditions. For this study, the 90^{th} percentile criterion is the most critical condition. Thus, the final load reductions determined using the 90^{th} percentile represent the most stringent conditions and it is the reductions based on these bacterial loadings that will yield attainment of the water quality standard. Seasonal variations involve changes in surface runoff, stream flow, and water quality as a result of hydrologic and climatologic patterns. Variations due to changes in the hydrologic cycle as well as temporal variability in fecal coliform sources, such as migrating duck and goose populations are accounted for by the use of the long-term data record to estimate the current load.

5.5. Margin of Safety

A Margin of Safety (MOS) is required as part of a TMDL in recognition of uncertainties in the understanding and simulation of water quality in natural systems. For example, knowledge is incomplete regarding the exact nature and magnitude of pollutant loads from various sources and the specific impacts of those pollutants on the chemical and biological quality of complex, natural water bodies. The MOS is intended to account for such uncertainties in a manner that is conservative from the standpoint of environmental protection.

A sensitivity analysis of the model parameters indicates that fecal coliform decay rate is the most sensitive of model parameters. The decay rate is a lumped parameter that includes die-off due to temperature, salinity, and light. It also includes the influence of re-suspension and other factors. The value of the decay rate varies from between 0.3 and 3.0 in salt water (Thomann and Mueller, 1987). A value of 0.35 per day was used in the TMDL calculation consistent with other regulatory programs.

Table 5.3 Reduction and Allocation Based Upon 90th Percentile Standard: Growing Area 34

Condemnation Area	Source	BST Allocation % of Total Load	Current Load MPN/ day	Load Allocation MPN/ day	Reduction Needed
126 Wilton Creek	Livestock	24%	2.71E+11	2.71E+09	99%
	Wildlife	49%	5.54E+11	1.39E+11	75%
	Human	22%	2.49E+11	0.00E+00	100%
	Pets	5%	5.65E+10	5.65E+08	99%
	Total	100%	1.13E+12	1.42E+11	87%
129 Healy Creek	Livestock	21%	7.75E+10	7.75E+08	99%
	Wildlife	58%	2.14E+11	4.50E+10	79%
	Human	14%	5.17E+10	0.00E+00	100%
	Pets	7%	2.58E+10	2.58E+08	99%
	Total	100%	3.69E+11	4.60E+10	88%
170 Cobbs Creek	Livestock	19%	2.30E+10	2.30E+08	99%
	Wildlife	51%	6.17E+10	4.59E+10	26%
	Human	28%	3.39E+10	0.00E+00	100%
	Pets	2%	2.62E+09	2.62E+07	99%
	Total	100.00%	1.21E+11	4.62E+10	62%

The TMDL seeks to eliminate 100% of the human derived fecal component regardless of the allowable load determined through the load allocation process. Human derived fecal coliforms are a serious concern in the estuarine environment and discharge of human waste is precluded by state and federal law. According to the preceding analysis, reduction of the controllable loads; human, livestock and pets, will not result in achievement of the water quality standard for condemned areas 126, 129 or 170. Absent any other sources, the reduction is allocated to wildlife. Through an iterative implementation of actions to reduce the controllable loads, subsequent monitoring may indicate that further reductions are not necessary, or that revisions in implementation strategies may be appropriate. Continued violations may result in the process of Use Attainment Analysis, UAA, for the waterbody (see Chapter 6 for a discussion of UAA). The allocations presented demonstrate how the TMDLs could be implemented to achieve water quality standards; however, the state reserves the right to allocate differently, as long as consistency with the achievement of water quality standards is maintained.

6.0 TMDL Implementation

The goal of the TMDL program is to establish a three-step path that will lead to attainment of water quality standards. The first step in the process is to develop TMDLs that will result in meeting water quality standards. This report represents the culmination of that effort for the bacteria impairments in the Lower Piankatank River watershed. The second step is to develop a TMDL implementation plan. The final step is to implement the TMDL implementation plan, and to monitor water quality to determine if water quality standards are being attained.

Once a TMDL has been approved by EPA, measures must be taken to reduce pollution levels in the waterbody. These measures, which can include the use of better treatment technology and the installation of best management practices (BMPs), are implemented in an iterative process that is described along with specific BMPs in the implementation plan. The process for developing an implementation plan has been described in the recent "TMDL Implementation Plan Guidance Manual", published in July 2003 and available upon request from the DEQ and DCR TMDL project staff or at http://www.deq.state.va.us/tmdl/implans/ipguide.pdf With successful completion of implementation plans, Virginia will be well on the way to restoring impaired waters and enhancing the value of this important resource. Additionally, development of an approved implementation plan will improve a locality's chances for obtaining financial and technical assistance during implementation.

6.1 Staged Implementation

In general, Virginia intends for the required reductions to be implemented in an iterative process that first addresses those sources with the largest impact on water quality. For example, in agricultural areas of the watershed, the most promising management practice is livestock exclusion from waterbodies. This has been shown to be very effective in lowering fecal coliform concentrations in waterbodies, both by reducing the cattle deposits themselves and by providing additional riparian buffers.

Additionally, in both urban and rural areas, reducing the human fecal loading from failing septic systems should be a primary implementation focus because of its health implications. This component could be implemented through education on septic tank pump-outs as well as a septic system repair/replacement program and the use of alternative waste treatment systems. In urban areas, reducing the loading from leaking sewer lines could be accomplished through a sanitary sewer inspection and management program.

The iterative implementation of BMPs in the watershed has several benefits:

1. It enables tracking of water quality improvements following BMP implementation through follow-up monitoring;
2. It provides a measure of quality control, given the uncertainties inherent in computer simulation modeling;
3. It provides a mechanism for developing public support through periodic updates on BMP implementation and water quality improvements;
4. It helps ensure that the most cost effective practices are implemented first; and
5. It allows for the evaluation of the adequacy of the TMDL in achieving water quality standards.

The selected decay rate is a conservative estimate in the TMDL calculation. Therefore, the MOS is implicitly included in the calculation.

5.6 TMDL Summary

To meet the water quality standards for both geometric mean and 90th percentile criteria, TMDLs for Rappahannock River: Lagrange and Robinson Creeks are defined for the geometric mean load and the 90th percentile load. The TMDLs are summarized in the table 5.4 and 5.5.

Table 5.4 TMDL Summary for Three Closures in the Piankatank River, Lower Watershed (geometric mean)

Condemnation Area	Pollutant Identified	TMDL MPN/day	Waste Load Allocation MPN/day	Load Allocation MPN/day	Margin of Safety
126 Wilton Creek	Fecal Coliform	4.05E+10	N/A	4.05E+10	Implicit
129 Healy Creek	Fecal Coliform	1.31E+10	N/A	1.31E+10	Implicit
170 Cobbs Creek	Fecal Coliform	1.43E+10	N/A	1.43E+10	Implicit

Table 5.5 TMDL Summary for Three Closures in the Piankatank River, Lower Watershed (90th percentile)

Condemnation Area	Pollutant Identified	TMDL MPN/day	Waste Load Allocation MPN/day	Load Allocation MPN/day	Margin of Safety
126 Wilton Creek	Fecal Coliform	1.42E+11	N/A	1.42E+11	Implicit
129 Healy Creek	Fecal Coliform	4.60E+10	N/A	4.60E+10	Implicit
170 Cobbs Creek	Fecal Coliform	4.62E+10	N/A	4.62E+10	Implicit