UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029
9/20/2007

Dr. Richard Eskin, Director
Technical and Regulatory Services Administration
Maryland Department of the Environment
1800 Washington Boulevard, Suite 450
Baltimore, MD 21230-1718

Dear Dr. Eskin:

The U.S. Environmental Protection Agency (EPA), Region III, is pleased to approve the *Total Maximum Daily Loads of Fecal Bacteria for the Non-Tidal Georges Creek Basin in Garrett and Allegany Counties, Maryland*. The TMDL Report was submitted by the Maryland Department of the Environment's (MDE) letter dated August 10, 2006, to EPA for review and approval. The TMDL was developed and submitted in accordance with sections 303(d)(1)(c) and (2) of the Clean Water Act to address impairments of water quality as identified in Maryland's Section 303(d) list of impaired waters. MDE identified the Georges Creek Basin as impaired by fecal bacteria.

In accordance with Federal regulations at 40 CFR §130.7, a TMDL must comply with the following requirements: (1) be designed to attain and maintain the applicable water quality standards; (2) include a total allowable loading and as appropriate, wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources; (3) consider the impacts of background pollutant contributions; (4) take critical stream conditions into account (the conditions when water quality is most likely to be violated); (5) consider seasonal variations; (6) include a margin of safety (which accounts for uncertainties in the relationship between pollutant loads and instream water quality); and (7) be subject to public participation. The non-tidal fecal bacteria TMDLs for the Georges Creek Watershed satisfied each of these requirements. In addition, the non-tidal fecal bacteria TMDLs considered reasonable assurance that the allocations assigned to the nonpoint sources can be reasonably met. A copy of EPA's Decision Rationale for approval of these TMDLs is included with this letter.

As you know, all new or revised National Pollutant Discharge Elimination System permits must be consistent with the TMDL WLA pursuant to 40 CFR §122.44 (d)(1)(vii)(B). Please submit all such permits to EPA for review as per EPA's letter dated October 1, 1998.

If you have any questions or comments concerning this letter, please do not hesitate to contact Mr. Thomas Henry, TMDL Program Manager, at (215) 814-5752 or Mr. Kuo-Liang Lai at (215) 814-5473.

Sincerely,

Signed

Jon M. Capacasa, Director
Water Protection Division

Enclosure

cc: Nauth Panday, MDE-TARSA
Melissa Chatham, MDE-TARSA

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

Decision Rationale
Total Maximum Daily Loads of Fecal Bacteria for the Non-Tidal Georges Creek Basin in Garrett and Allegany Counties, Maryland

Signed

Jon M. Capacasa, Director
Water Protection Division

Date : *9/20/2007*

Decision Rationale

Total Maximum Daily Loads of Fecal Bacteria
for the Non-Tidal Georges Creek Basin
in Garrett and Allegany Counties, Maryland

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those waterbodies identified as impaired by the state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety (MOS), that may be discharged to a water quality-limited waterbody.

This document sets forth the U.S. Environmental Protection Agency's (EPA) rationale for approving the TMDLs for fecal bacteria in the Georges Creek Watershed. The TMDLs were established to address water quality impairments caused by bacteria as identified in Maryland's 2002 section 303(d) list of impaired waters. The Maryland Department of the Environment (MDE), submitted[1] the *Total Maximum Daily Loads of Fecal Bacteria for the Non-Tidal Georges Creek Basin in Garrett and Allegany Counties, Maryland*, dated July 2006 (TMDL Report), to EPA for final review, which was received on August 16, 2006. The Georges Creek Non-Tidal Watershed (02-14-10-04) was first identified on Maryland's 1996 section 303(d) list as impaired by sediments, with low pH added to the 1998 and 2002 section 303(d) lists. Bacteria (fecal coliform) and impacts to biological communities were added to the 2002 section 303(d) list. The TMDLs described in this document were developed to address fecal bacteria non-tidal water quality impairments.

EPA's rationale is based on the TMDL Report and information contained in the computer files provided to EPA by MDE. EPA's review determined that the TMDLs meet the following seven regulatory requirements pursuant to 40 CFR Part 130.

1. The TMDLs are designed to implement applicable water quality standards.
2. The TMDLs include a total allowable load as well as individual wasteload allocations (WLAs) and load allocations (LAs).
3. The TMDLs consider the impacts of background pollutant contributions.
4. The TMDLs consider critical environmental conditions.
5. The TMDLs consider seasonal environmental variations.
6. The TMDLs include a MOS.
7. The TMDLs have been subject to public participation.

In addition, these TMDLs considered reasonable assurance that the TMDL allocations assigned to nonpoint sources can be reasonably met.

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[1] By letter dated August 10, 2006.

II. Summary

There is one National Pollutant Discharge Elimination System (NPDES) permitted source (MD0060071) within the watershed. MDE provided adequate land use and instream bacteria data in the TMDL report and allocated the TMDL loads to specific sources. The TMDL shown in Table 1 requires up to and including 98 percent reduction from existing or baseline conditions.

Table 1 – Georges Creek Watershed Non-Tidal TMDL Summary

Subwatershed	Baseline	TMDL	WLA-PS[2]	WLA-CSO[3]	LA[4]
	Billions MPN[1]/day *E. coli*				
GEO0143	4,298.7	95.7	0.0	0	95.7
GEO0111sub	151.9	62.0	0.0	0	62.0
GEO0065sub	352.7	63.8	0.0	0	63.8
GEO0009sub	12,519.5	258.1	0.7	0	257.4
TOTAL	17,322.8	479.7	0.7	0	478.9

[1] MPN = Most Probable Number
[2] WLA-PS = Wasteload Allocation for non MS4 systems (municipal or industrial)
[3] WLA-CSO = Wasteload Allocation for Combined Sewer Overflow
[4] LA = Load Allocation

The TMDL is a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standards. The TMDL is a scientifically-based strategy which considers current and foreseeable conditions, the best available data, and accounts for uncertainty with the inclusion of a "margin of safety" value. For this TMDL, the MOS was incorporated as a conservative assumption used in the TMDL analysis. The loading capacity of the stream was estimated based upon a reduced (more stringent) water quality criterion concentration. The *E.coli* water quality criterion concentration was reduced by 5%, from 126 *E. coli* MPN/100ml to 119.7 *E. coli* MPN/100 ml.

III. Background

The Georges Creek Watershed comprises approximately 75 square miles (47,694 acres) with approximately 80% of the drainage area within Allegany County, Maryland, and the remaining 20% within Garrett County, Maryland (Figure 1). The headwaters of Georges Creek begin in Frostburg, Maryland. The mainstem of Georges Creek flows southwest until its confluence with the North Branch Potomac River below the town of Westport, Maryland.

The Georges Creek Basin lies in the Appalachian Plateaus Province, draining to the North Branch Potomac River. The Georges Creek Watershed lies predominantly in the Dekalb soil series. A small portion of the watershed in the southeastern region lies in the Hazelton soil series. Dekalb soils are well drained, loamy soils (with rapid permeability and internal drainage). Hazelton soils are also well drained, loamy soils (but with moderately rapid permeability and rapid internal drainage).

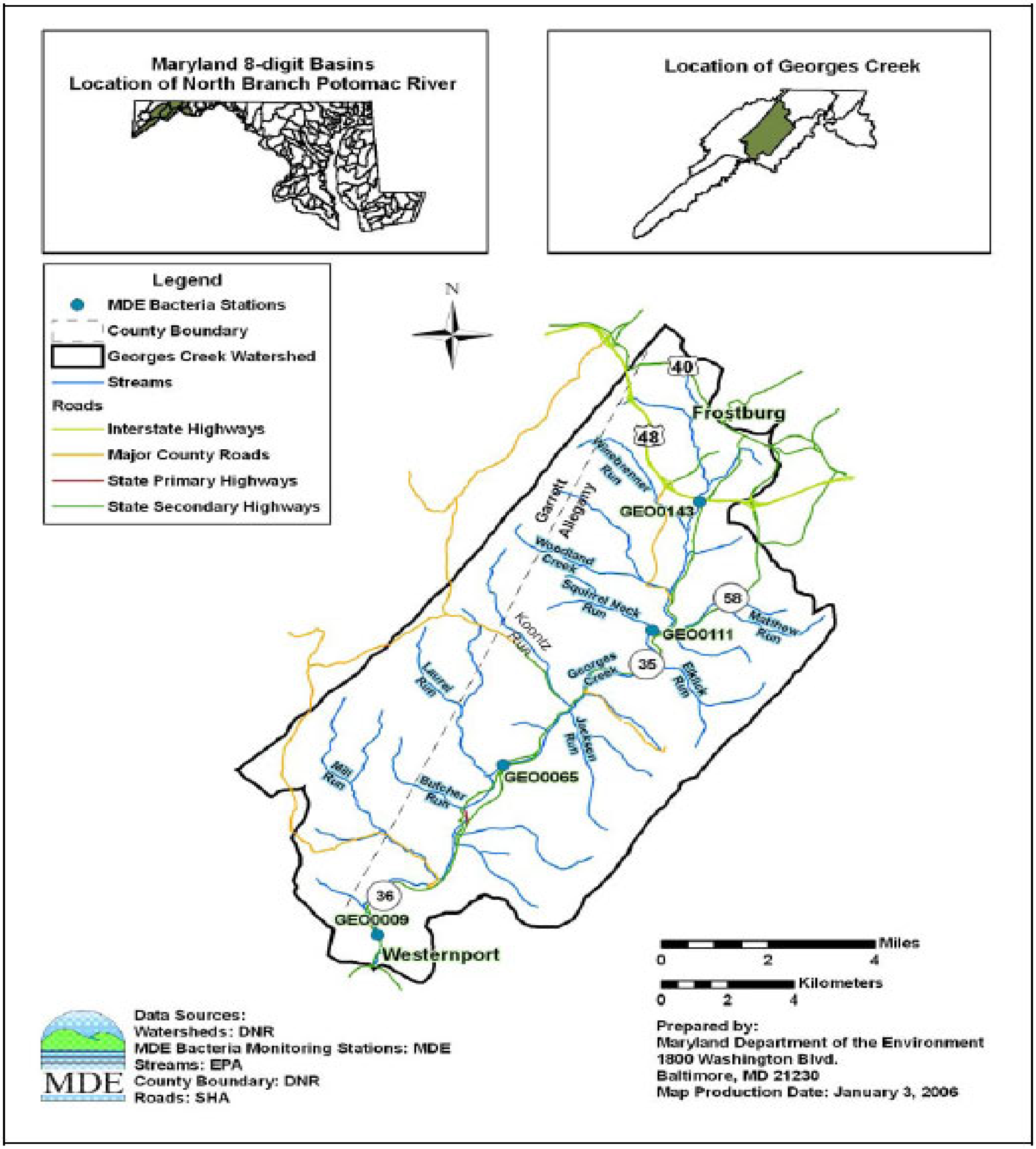
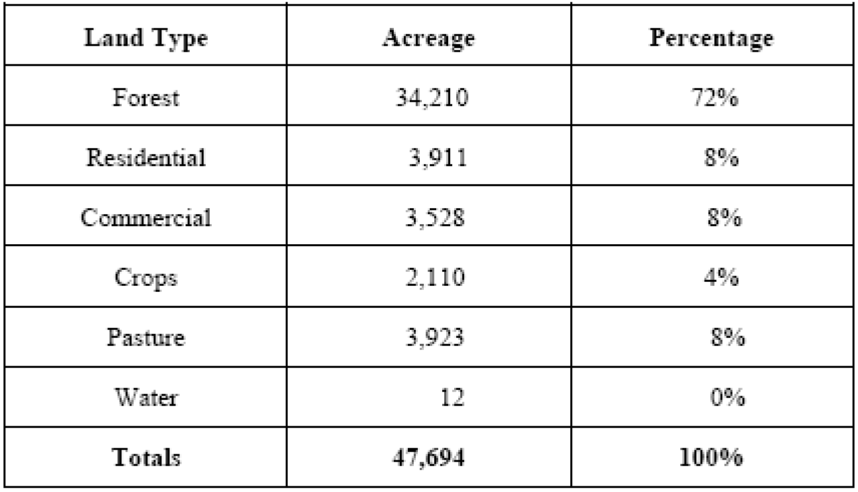


Figure 1 - Location Map of the Georges Creek Basin (TMDL Report, Figure 2.1.1)

The 2002 Maryland Department of Planning (MDP) land use/land cover data shows that the watershed is characterized as primarily forested. The land use percentage distribution for Georges Creek Basin is shown in Table 2, and spatial distributions for each land use are shown in Figure 2.

Table 2 - Land Use Area and Percentages in Georges Creek Basin
(TMDL Report, Table 2.1.1)



Land Type	Acreage	Percentage
Forest	34,210	72%
Residential	3,911	8%
Commercial	3,528	8%
Crops	2,110	4%
Pasture	3,923	8%
Water	12	0%
Totals	**47,694**	**100%**

MDE estimated the total population in the Georges Creek Watershed to be 13,603 people, based on a weighted average from the Geographic Information System (GIS) 2000 Census Block and the 2002 MDP land use cover that includes the Georges Creek Watershed.

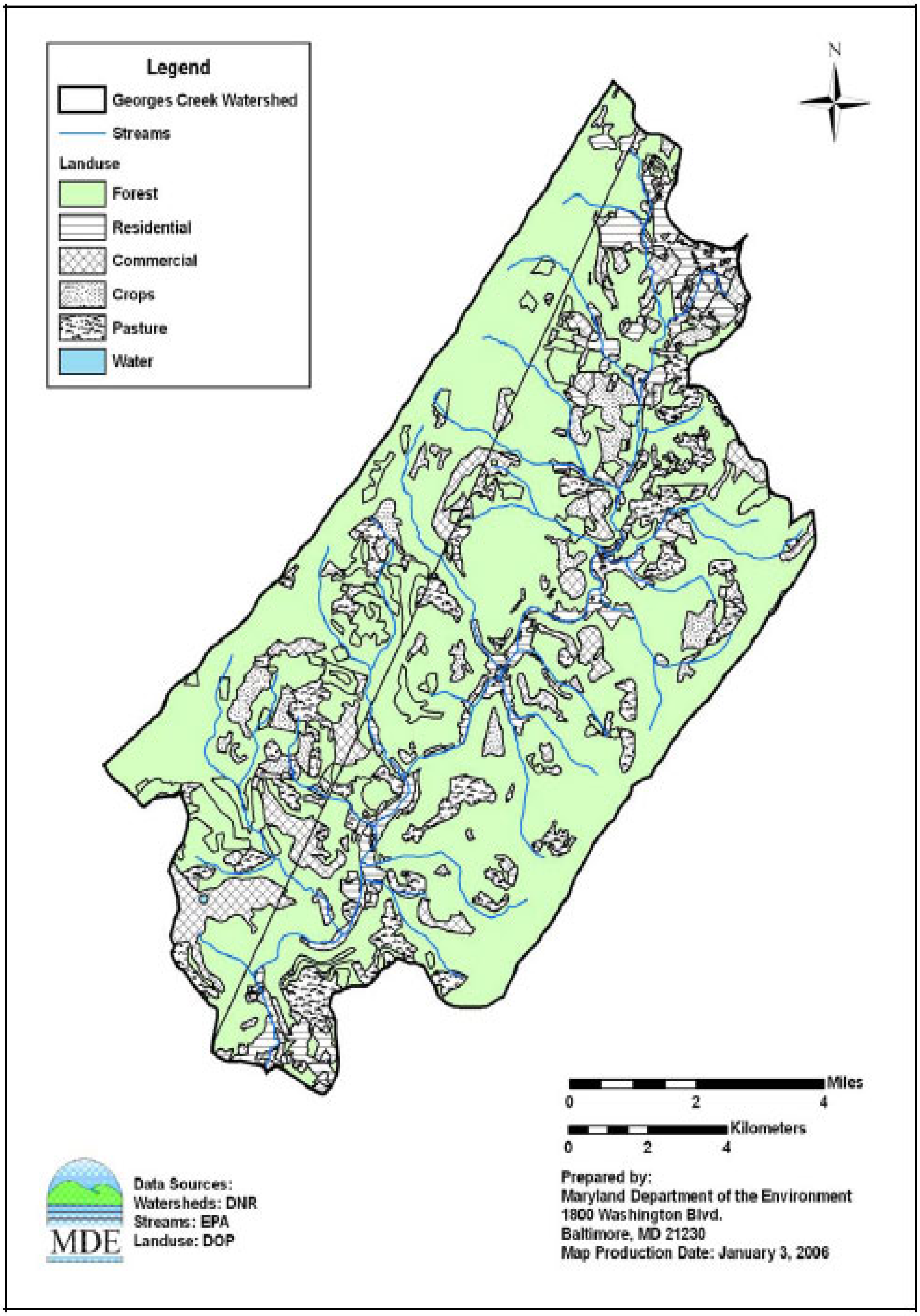


Figure 2 - Land Use of the Georges Creek Watershed (TMDL Report, Figure 2.1.3).

IV. Computational Procedure

The length of Georges Creek within Maryland is non-tidal or free flowing. MDE developed the method described below to determine non-tidal TMDLs.

General

In addition to the TMDL Report provided during the public notice period, MDE provided EPA with computer files in Microsoft Excel® for review. MDE's procedure uses a variation of the load-duration curve method which is also used by several states and by EPA. MDE uses stream flow data from United States Geological Survey (USGS) gages and sampling data to determine the bacteria load reductions necessary to meet water quality standards. MDE then uses bacteria source tracking (BST) results to allocate the TMDL loads to various sources (i.e., domestic animals, human sources, livestock, and wildlife).

The load-duration curve method uses sampling data combined with a long-term stream flow record, frequently from a USGS gaging station, to provide insight into the flow condition under which exceedances of the water quality standard occur. Exceedances that occur under low-flow conditions are generally attributed to loads delivered directly to the stream such as straight pipes, sanitary sewer overflows, livestock with access to the stream, and wildlife. Exceedances that occur under high-flow conditions are typically attributed to loads that are delivered to the stream in stormwater runoff. A flow-duration curve is shown in Figure 3 below. The flow duration interval shown across the bottom is the percent of time that a given flow is exceeded. For example, flows at the gaging station exceed 1,500 cubic feet per second (cfs) 10 percent of the time.[2]

The flow-duration curve is converted to a load-duration curve by multiplying the flow by the bacteria count and the appropriate unit conversion factor (100 ml to cubic feet). An example load-duration curve is shown in Figure 4.

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[2] *TMDL Development From the "Bottom Up" – Part III: Duration Curves and Wet-Weather Assessment,*2003, Bruce Cleland.

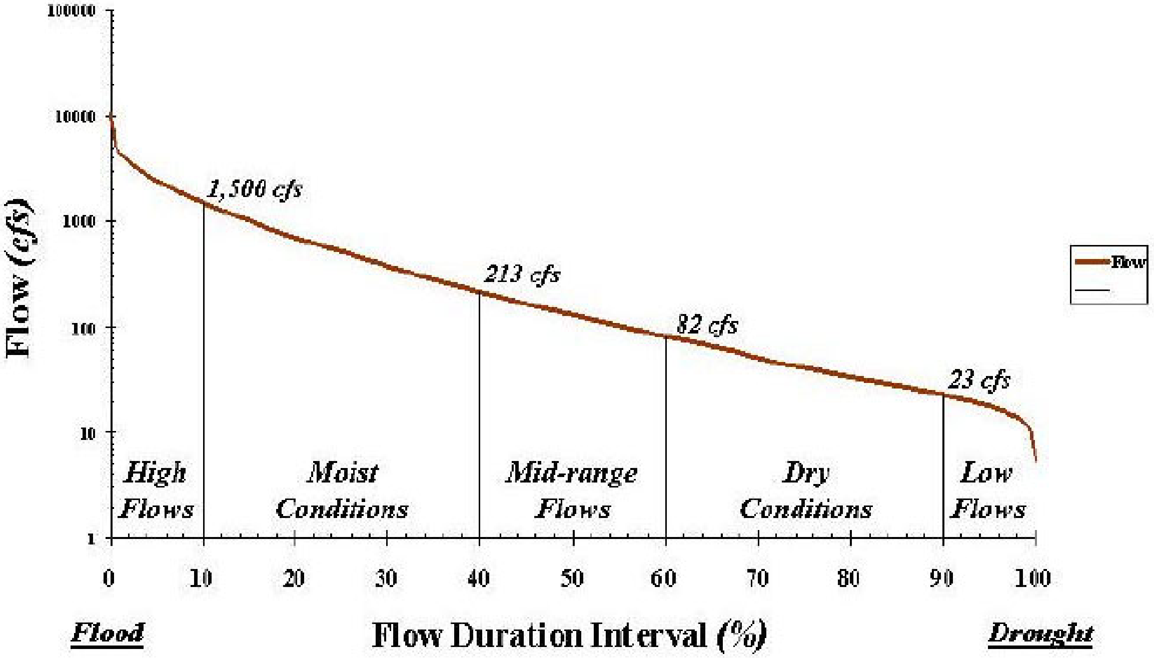


Figure 3 – Example Flow-Duration Curve

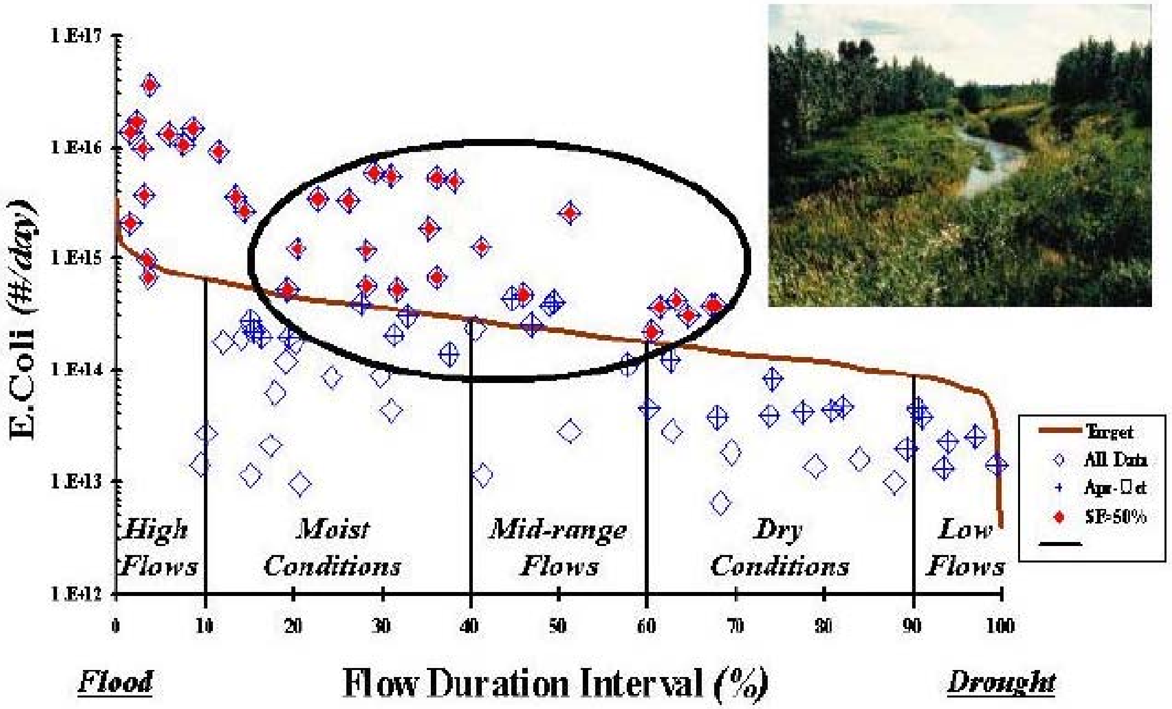


Figure 4 - Example Load-Duration Curve

Frequently the target load shown in Figure 4 is based on the single-sample maximum value from the state's water quality standards. The required load reduction at all flows is equal to the difference between the target load and a line parallel to the target load line which passes through the highest sample value. However, MDE's water quality standards do not contain a single-sample maximum number and, therefore, modified the above procedure.

Georges Creek Basin Computational Method

In order for EPA to conduct a thorough review of MDE's method, MDE provided EPA with Microsoft Excel® files and, therefore, the following description of MDE's computational method refers to information not necessarily contained in the TMDL Report.

In addition to four bacteria monitoring stations, there is one USGS gaging station located within the Georges Creek Watershed which was used to estimate surface flow in Georges Creek.

The analysis to define daily flow duration intervals (flow regions, strata) includes the bacteria monitoring data. Bacteria (enterococci or *E. coli*) monitoring data are "placed" within the regions (stratum) based on the daily flow duration percentile of the date of sampling. An example plot of the Georges Creek *E. coli* monitoring data with corresponding flow frequency for the annual average and seasonal conditions from the TMDL Report, Appendix B, is shown below.

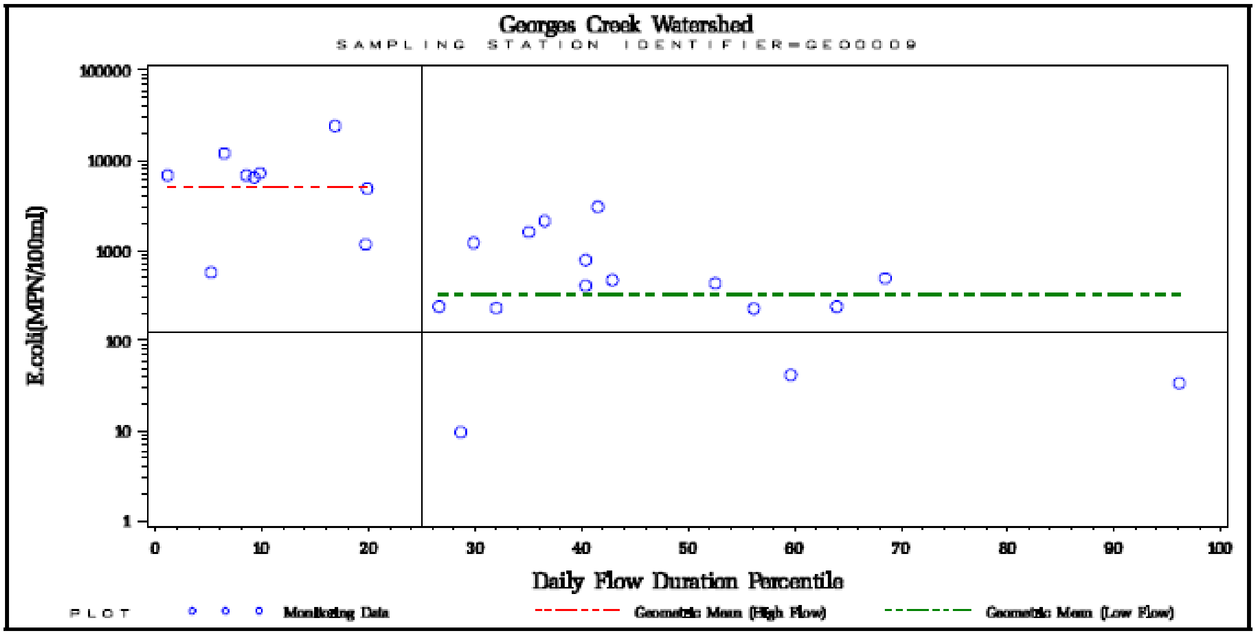
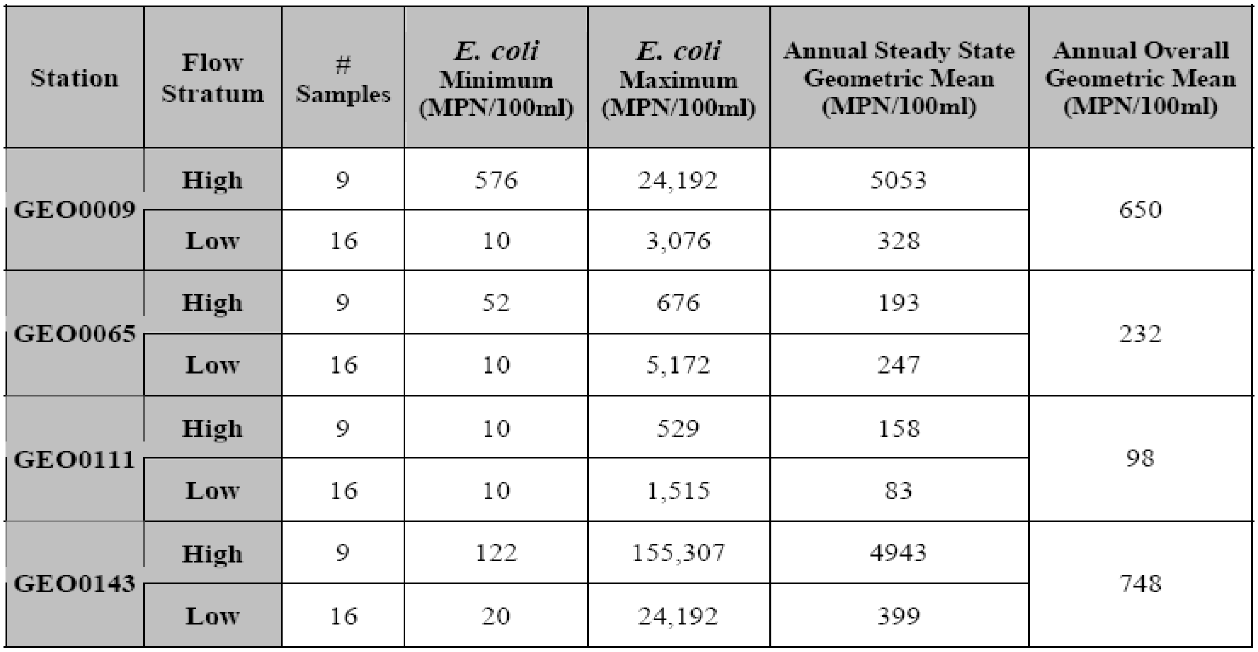


Figure 5 – *E. coli* Concentration vs. Flow Duration for Georges Creek Monitoring Station GEO0009 (TMDL Report, Appendix B, Figure B-2)

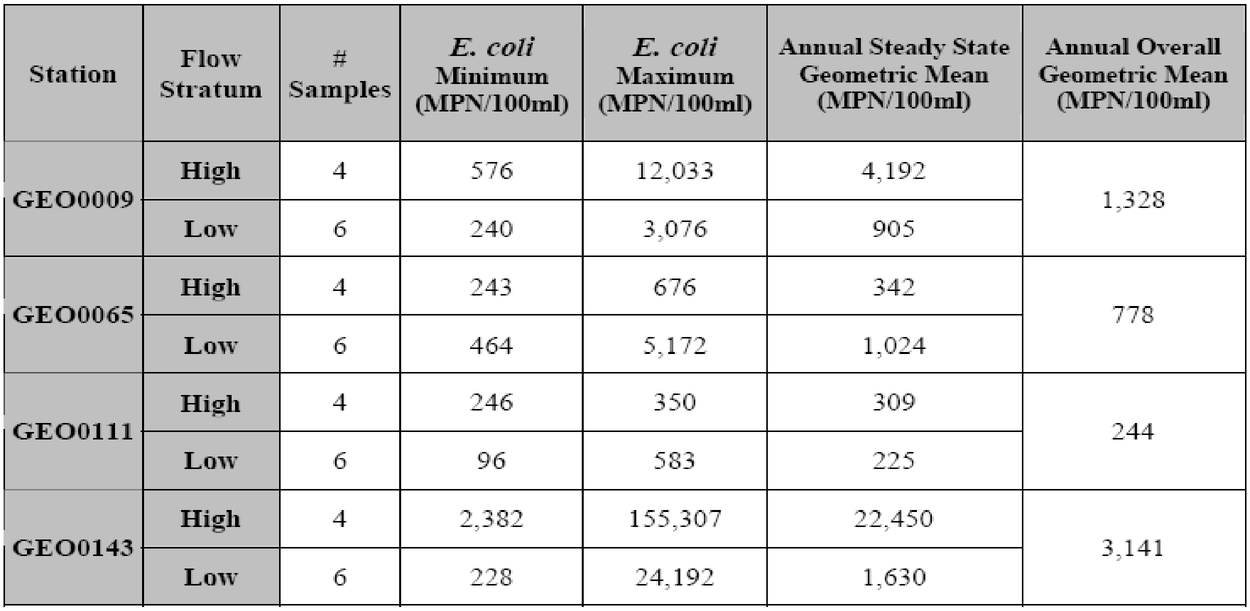
The resulting existing geometric means for high-flow and low-flow are shown as dashed horizontal lines in Figure 5. The representative geometric mean for the station is equal to 0.25 times the $\log_{10}$ high-flow geometric mean plus 0.75 times the $\log_{10}$ low-flow geometric mean changed back into a geometric mean. The high-flow, low-flow, and representative geometric mean are shown in Table 3 below. Note that geometric means in the table exceed the 126 MPN/100ml criterion for *E. coli*.

Table 3 - Existing/Baseline Conditions (TMDL Report, Table 2.3.3)
Annual Steady State Geometric Mean by Stratum per Subwatershed



Station	Flow Stratum	# Samples	*E. coli* Minimum (MPN/100ml)	*E. coli* Maximum (MPN/100ml)	Annual Steady State Geometric Mean (MPN/100ml)	Annual Overall Geometric Mean (MPN/100ml)
GEO0009	High	9	576	24,192	5053	650
	Low	16	10	3,076	328	
GEO0065	High	9	52	676	193	232
	Low	16	10	5,172	247	
GEO0111	High	9	10	529	158	98
	Low	16	10	1,515	83	
GEO0143	High	9	122	155,307	4943	748
	Low	16	20	24,192	399	

Table 4 - Existing Seasonal Period Steady State Geometric Mean by Stratum per Subwatershed (TMDL Report, Table 2.3.4)

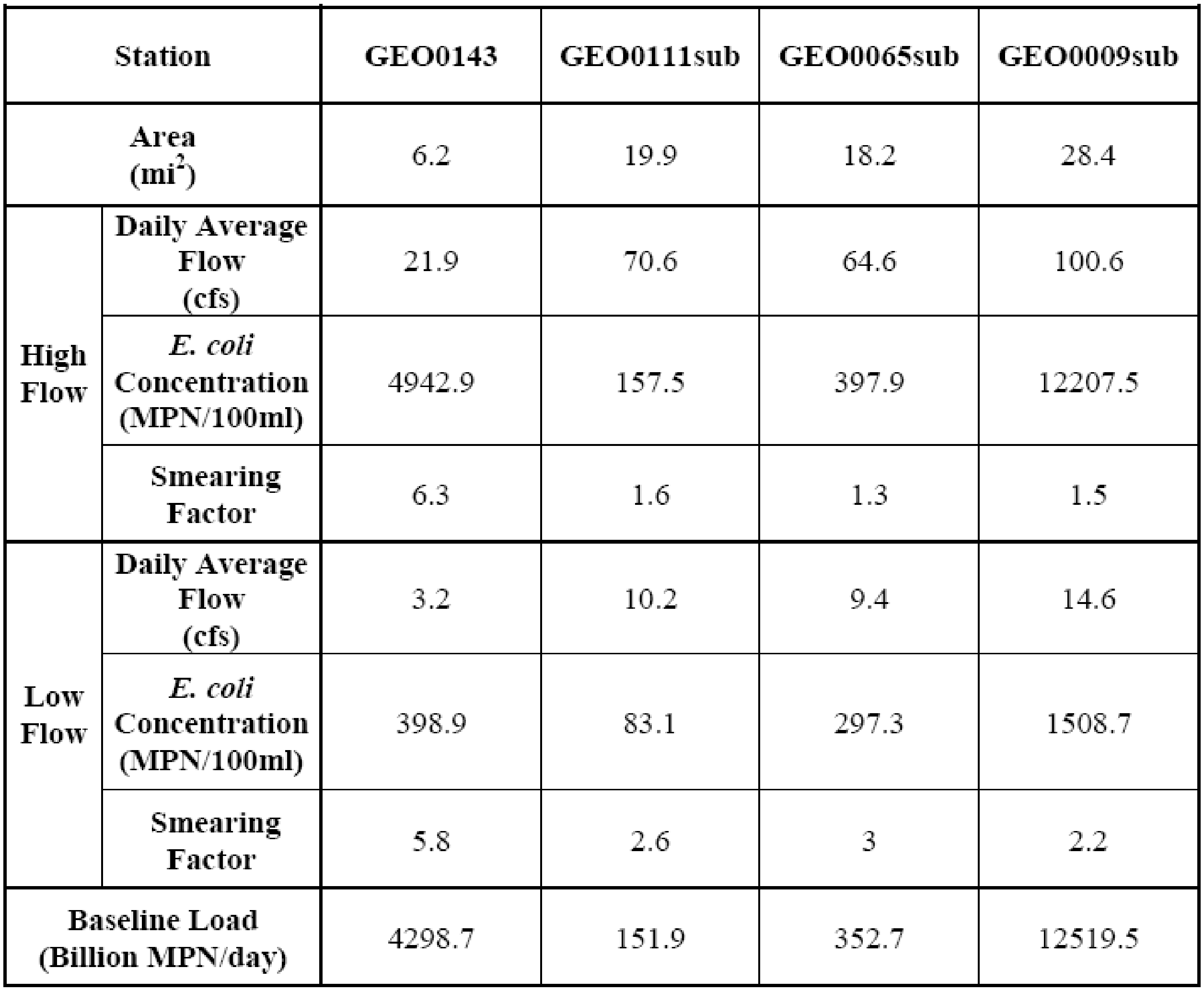


Station	Flow Stratum	# Samples	*E. coli* Minimum (MPN/100ml)	*E. coli* Maximum (MPN/100ml)	Annual Steady State Geometric Mean (MPN/100ml)	Annual Overall Geometric Mean (MPN/100ml)
GEO0009	High	4	576	12,033	4,192	1,328
	Low	6	240	3,076	905	
GEO0065	High	4	243	676	342	778
	Low	6	464	5,172	1,024	
GEO0111	High	4	246	350	309	244
	Low	6	96	583	225	
GEO0143	High	4	2,382	155,307	22,450	3,141
	Low	6	228	24,192	1,630	

The seasonal period, in Table 4 above, uses only data from May 1 through September 30, a critical period for the recreational use.

Using the average flow for the high-flow and low-flow regimes, and the high-flow and low-flow regime bacteria concentrations, the baseline loads were estimated as explained in Section 4.3 and shown in Table 4.3.1 of the TMDL Report. Table 4.3.1 is shown below as Table 5.

Table 5 - Baseline Load Calculations (TMDL Report, Table 4.3.1)



Station		GEO0143	GEO0111sub	GEO0065sub	GEO0009sub
Area (mi^2)		6.2	19.9	18.2	28.4
High Flow	**Daily Average Flow (cfs)**	21.9	70.6	64.6	100.6
	E. coli **Concentration (MPN/100ml)**	4942.9	157.5	397.9	12207.5
	Smearing Factor	6.3	1.6	1.3	1.5
Low Flow	**Daily Average Flow (cfs)**	3.2	10.2	9.4	14.6
	E. coli **Concentration (MPN/100ml)**	398.9	83.1	297.3	1508.7
	Smearing Factor	5.8	2.6	3	2.2
Baseline Load (Billion MPN/day)		4298.7	151.9	352.7	12519.5

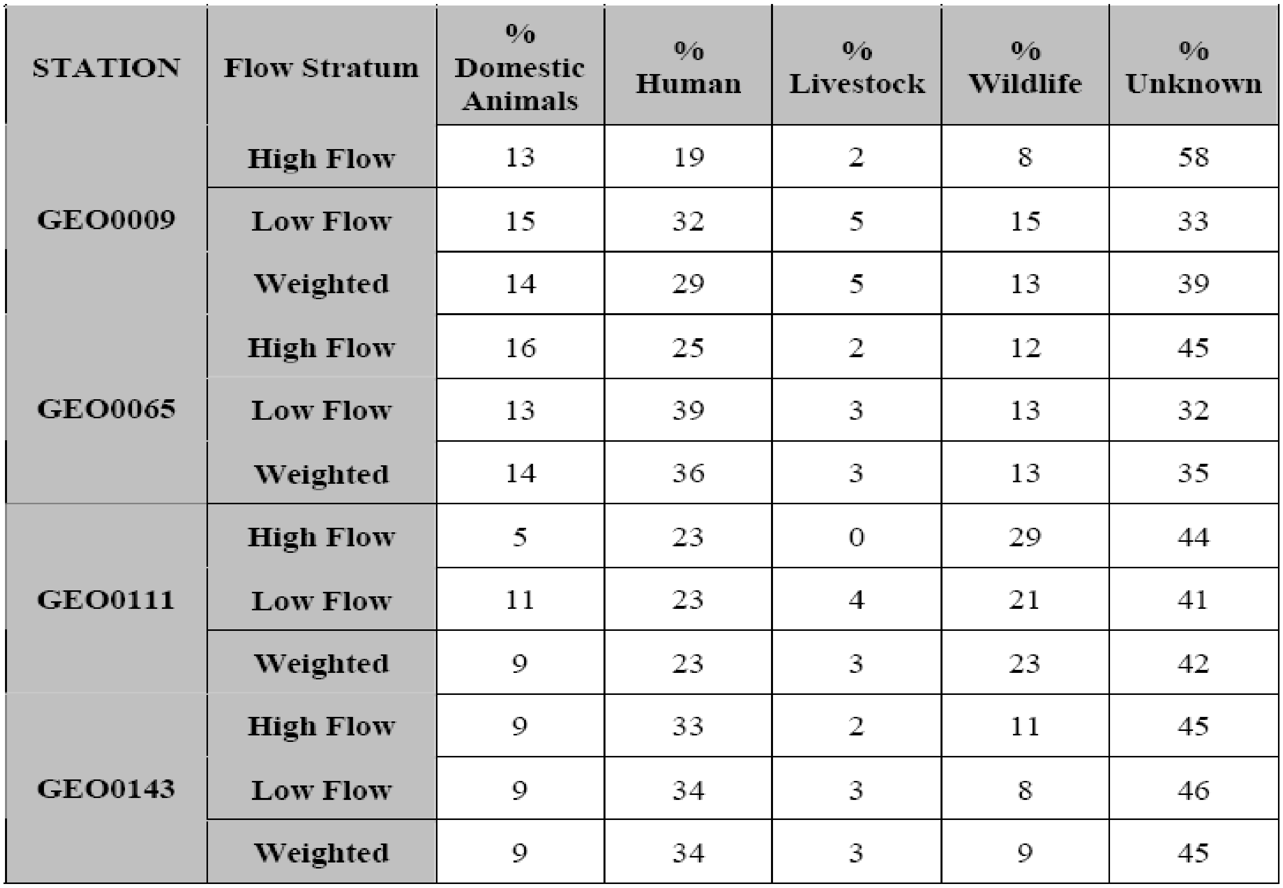
In order to analyze the flow record for periods that might produce higher overall geometric means and loads (critical conditions) and to account for seasonality, each day of the flow record was assigned to either the high-flow or low-flow regime. MDE used a rolling one-year period to find a year with the most high-flow days and a year with the most low-flow days, and examined each year’s swimming season to find the one with the most high-flow days and most low-flow days.

Table 6 - Critical Time Periods (TMDL Report, Table 4.4.1)

Hydrological Condition		Averaging Period	Water Quality Data Used	Fraction High Flow	Fraction Low Flow	Condition Period
Annual	High flow	365 days	All	0.56	0.44	Jan 1997 - Jan 1998
	Low flow	365 days	All	0.06	0.94	May 1995 - May 1996
Seasonal	High flow	May 1st – Sept 30th	May 1st – Sept 30th	0.46	0.54	May 2003 - Sep 2003
	Low flow	May 1st – Sept 30th	May 1st – Sept 30th	0.00	1.00	May 2002 - Sep 2002

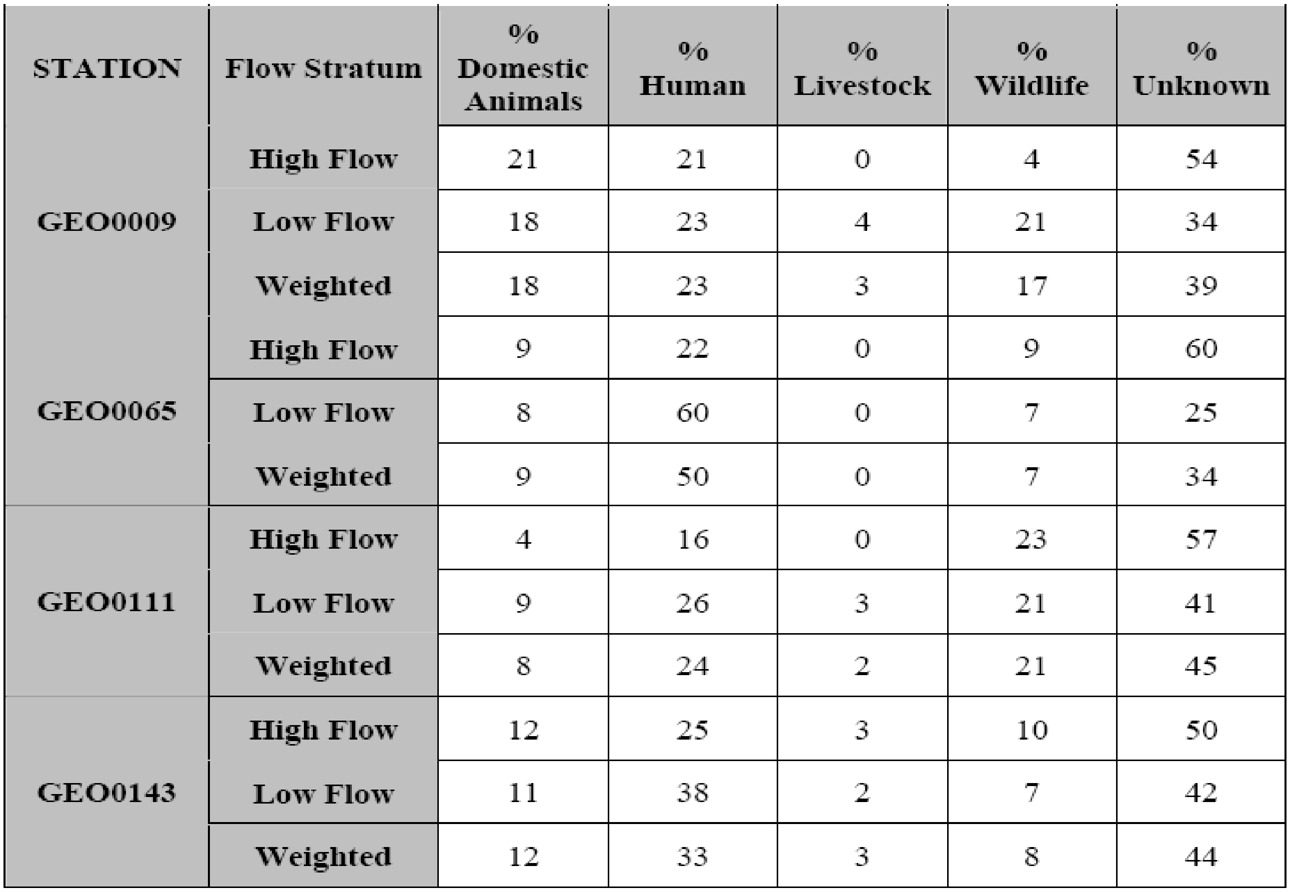
Bacteria source tracking (BST) was used to identify the relative contribution of the various sources to the instream water samples. The TMDL Report, Appendix C, is the Salisbury University, Department of Biological Sciences and Environmental Health Services, BST report, *Identifying Sources of Fecal Pollution in the Georges Creek Watershed, Maryland.* Enterococci isolates were obtained from known sources, which included human, dog, cow, beaver, deer, coyote, rabbit, fox, and goose. For purposes of the TMDL, the sources were separated into domestic animals, human, livestock, and wildlife. A fifth classification of “unknown” results from the analysis when the source could not be identified. The source percentage for each sample is shown in TMDL Report, Appendix C, Table C-8, Percentage of Sources per Station per Date.

Table 7 - Distribution of Fecal Bacteria Source Loads in the Georges Creek Basin for the Annual Condition (TMDL Report, Table 2.4.4)



STATION	Flow Stratum	% Domestic Animals	% Human	% Livestock	% Wildlife	% Unknown
GEO0009	High Flow	13	19	2	8	58
	Low Flow	15	32	5	15	33
	Weighted	14	29	5	13	39
GEO0065	High Flow	16	25	2	12	45
	Low Flow	13	39	3	13	32
	Weighted	14	36	3	13	35
GEO0111	High Flow	5	23	0	29	44
	Low Flow	11	23	4	21	41
	Weighted	9	23	3	23	42
GEO0143	High Flow	9	33	2	11	45
	Low Flow	9	34	3	8	46
	Weighted	9	34	3	9	45

Table 8 - Distribution of Fecal Bacteria Source Loads in the Georges Creek Basin for the Seasonal Period May 1 - September 30 (TMDL Report, Table 2.4.5)



STATION	Flow Stratum	% Domestic Animals	% Human	% Livestock	% Wildlife	% Unknown
GEO0009	High Flow	21	21	0	4	54
	Low Flow	18	23	4	21	34
	Weighted	18	23	3	17	39
GEO0065	High Flow	9	22	0	9	60
	Low Flow	8	60	0	7	25
	Weighted	9	50	0	7	34
GEO0111	High Flow	4	16	0	23	57
	Low Flow	9	26	3	21	41
	Weighted	8	24	2	21	45
GEO0143	High Flow	12	25	3	10	50
	Low Flow	11	38	2	7	42
	Weighted	12	33	3	8	44

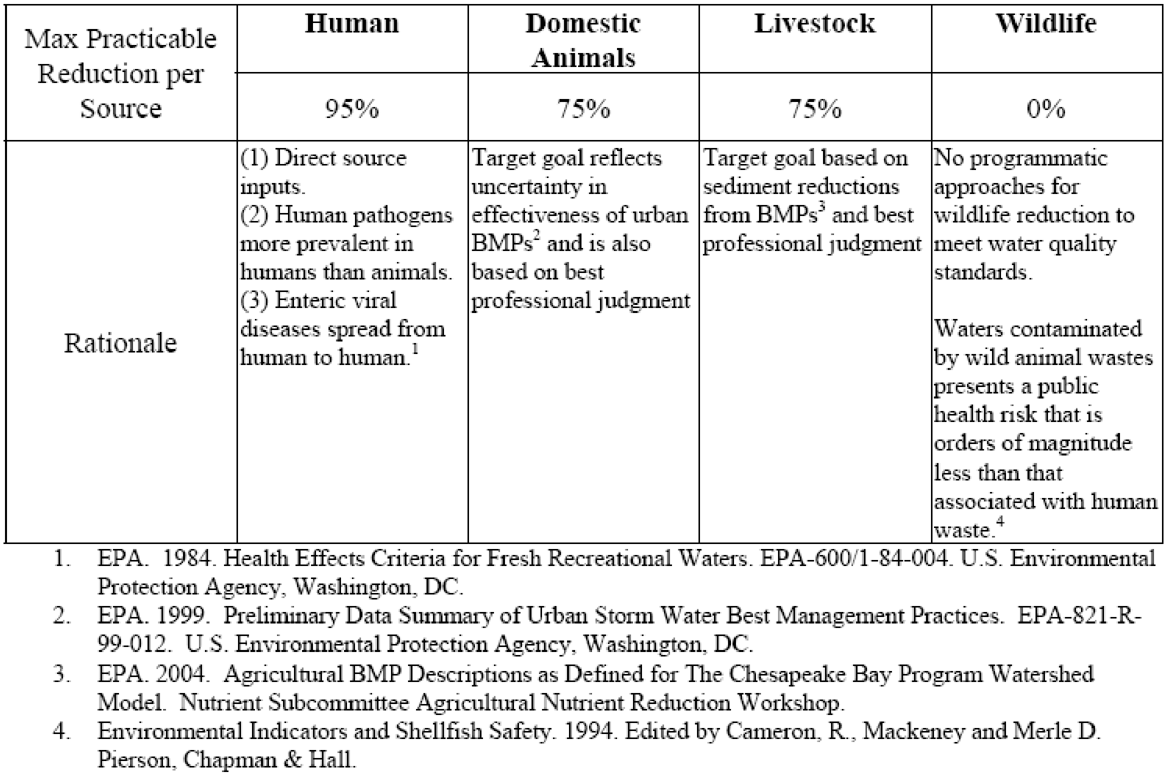
The target reduction for each condition is the reduction necessary in the geometric mean from Table 3 to meet the criterion. In determining the initial reduction scenario, two additional factors were considered -- risk and practicability.

Bacteria from human sources are presumed to present a larger risk to humans than bacteria from other sources, and bacteria from wildlife presents the lowest risk to humans. TMDL Report, Section 4.7, Practicable Reduction Targets, page 41, identified the assumed risk factors shown in Table 9 below. Table 10, Maximum Practical Reduction Targets, shown below, identifies the practicable reductions and the rationale for selecting them.

Table 9 - Relative Risk Factors

	Human	Domestic Animal	Livestock	Wildlife
Relative Risk to Humans	5	3	3	1

Table 10 - Maximum Practical Reduction Targets (TMDL Report, Table 4.7.2)

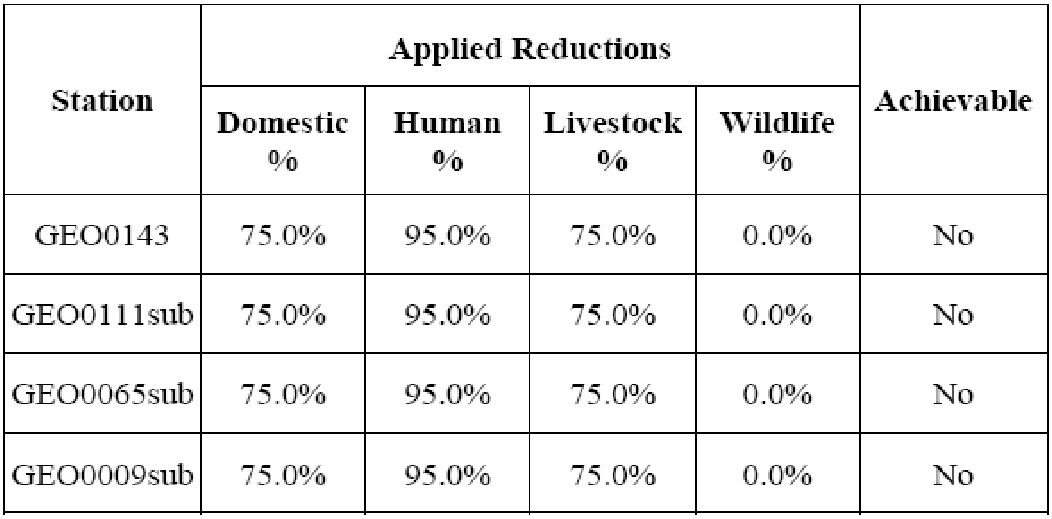


Max Practicable Reduction per Source	**Human**	**Domestic Animals**	**Livestock**	**Wildlife**
	95%	75%	75%	0%
Rationale	(1) Direct source inputs. (2) Human pathogens more prevalent in humans than animals. (3) Enteric viral diseases spread from human to human.[1]	Target goal reflects uncertainty in effectiveness of urban BMPs[2] and is also based on best professional judgment	Target goal based on sediment reductions from BMPs[3] and best professional judgment	No programmatic approaches for wildlife reduction to meet water quality standards. Waters contaminated by wild animal wastes presents a public health risk that is orders of magnitude less than that associated with human waste.[4]

1. EPA. 1984. Health Effects Criteria for Fresh Recreational Waters. EPA-600/1-84-004. U.S. Environmental Protection Agency, Washington, DC.
2. EPA. 1999. Preliminary Data Summary of Urban Storm Water Best Management Practices. EPA-821-R-99-012. U.S. Environmental Protection Agency, Washington, DC.
3. EPA. 2004. Agricultural BMP Descriptions as Defined for The Chesapeake Bay Program Watershed Model. Nutrient Subcommittee Agricultural Nutrient Reduction Workshop.
4. Environmental Indicators and Shellfish Safety. 1994. Edited by Cameron, R., Mackeney and Merle D. Pierson, Chapman & Hall.

The required reductions were determined by analyzing each of the above critical time periods (Table 6) individually for each sub-watershed, together with the results of the BST analysis, to minimize the final risk. First, the reductions were not allowed to exceed the practicable reductions in the above table. The water quality criterion for *E. coli* could not be achieved.

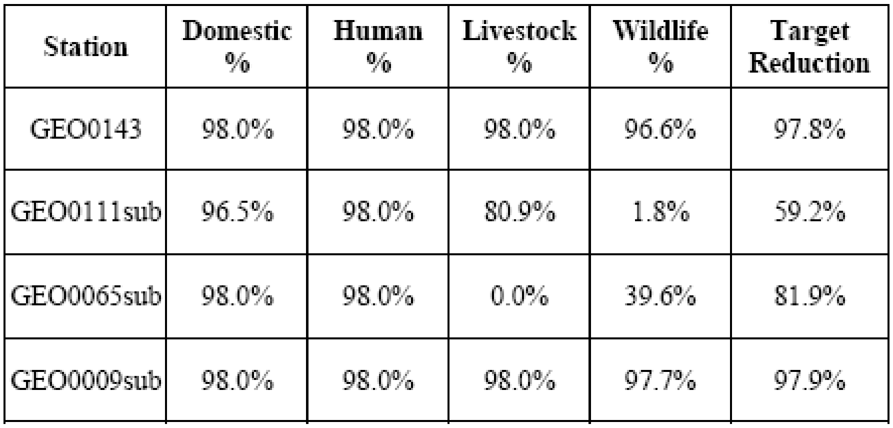
Table 11 - Practical Reductions Results (TMDL Report, Table 4.7.3)



Station	**Applied Reductions**				**Achievable**
	Domestic %	**Human %**	**Livestock %**	**Wildlife %**	
GEO0143	75.0%	95.0%	75.0%	0.0%	No
GEO0111sub	75.0%	95.0%	75.0%	0.0%	No
GEO0065sub	75.0%	95.0%	75.0%	0.0%	No
GEO0009sub	75.0%	95.0%	75.0%	0.0%	No

Next, the analysis was performed allowing greater reductions for each fecal bacteria source until the water quality criterion for *E. coli* was achieved.

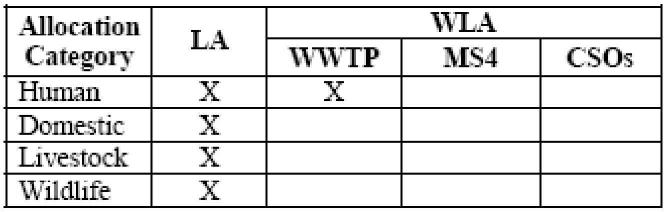
Table 12 - Required Reductions to Achieve Water Quality Criterion Up to 98% Reductions (TMDL Report, Table 4.7.4)



Station	Domestic %	Human %	Livestock %	Wildlife %	Target Reduction
GEO0143	98.0%	98.0%	98.0%	96.6%	97.8%
GEO0111sub	96.5%	98.0%	80.9%	1.8%	59.2%
GEO0065sub	98.0%	98.0%	0.0%	39.6%	81.9%
GEO0009sub	98.0%	98.0%	98.0%	97.7%	97.9%

The TMDL load is then divided into WLA-WWTP, WLA-MS4, CSO, and LA portions. MDE developed allocation rules summarized in Table 13 below. The “unknown” BST source category is deleted and the other categories increased.

Table 13 - Source Contributions for TMDL Allocations (TMDL Report, Table 4.8.1)



Allocation Category	LA	WLA		
		WWTP	MS4	CSOs
Human	X	X		
Domestic	X			
Livestock	X			
Wildlife	X			

The load reduction scenario results in a load allocation that will achieve water quality standards. The state reserves the right to revise these allocations provided such allocations are consistent with the achievement of water quality standards.

For the human sources, the nonpoint source contribution (LA) in subwatersheds with WWTPs is estimated by subtracting the WWTP load from the final human load. All three jurisdictions with CSOs permitted to discharge into the Georges Creek have developed their Long Term Control Plans (LTCPs) and CSOs are expected to be eliminated by the dates stated in the LTCPs. The final human load is assigned to either LA and/or WWTP.

No MS4 permits exist for the Georges Creek watershed; therefore, pet allocation is assigned to LA. Wildlife and livestock are also assigned to the LA.

V. Discussion of Regulatory Conditions

EPA finds that Maryland has provided sufficient information to meet all of the seven basic requirements for establishing bacteria TMDLs for Georges Creek. Therefore, EPA approves the TMDLs for the Georges Creek Watershed. EPA's approval is outlined according to the regulatory requirements listed below.

1. The TMDLs are designed to implement the applicable water quality standards.

The Maryland water quality standards Surface Water Use Designation for this watershed includes Use I – P (Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply) for the mainstem of Georges Creek, and Use I (Water Contact Recreation and Protection of Aquatic Life) for all of its tributaries (COMAR 26.08.02.08R(b)).

The standards for bacteria used for Use I – P waters – Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply – are contained in COMAR 26.08.02.03-3. For waters not designated natural bathing areas the applicable criteria from Table 1, COMAR 26.08.02.03-3.A.(1)(a) are as follows:

Table 14 - Water Quality Criteria

Indicator	**Steady State Geometric Mean Indicator Density**
Freshwater	
E. coli	126 MPN[1]/100ml
Enterococci	33 MPN/100ml
Marine Water	
Enterococci	35 MPN/100ml

[1]MPN - Most Probable Number

The standards do not specify either a minimum number of samples required for the geometric mean or time frame such as the commonly used 30-day period. However, the *2006 List of Impaired Surface Waters [303(d) List] and Integrated Assessment of Water Quality In Maryland*, dated April 2006, Section B.3.2.1.3.1, Recreational Waters, contains MDE's interpretation of how bacteria data will be used for assessing waters for general recreational use. A steady state geometric mean will be calculated with available data where there are at least five representative sampling events. The data shall be from samples collected during steady state conditions and during the beach season (Memorial Day through Labor Day) to be representative of the critical condition. Furthermore, according to Section B.3.2.1.3.2, Beaches, "(t)he single sample maximum criteria applies only to beaches and is to be used for closure decisions based on short-term exceedances of the geometric mean portion of the standard." Since warm temperatures can occur early in May and last until the end of September or early October, a longer seasonal period than the official beach season (Memorial Day through Labor Day) was used for the water quality assessment, as a conservative assumption in the analysis.

In 1986, EPA published "Ambient Water Quality Criteria for Bacteria" whereby three indicator organisms, fecal coliform, *E. coli* and Enterococci, were assessed to determine their correlation with swimming-associated illnesses. Fecal coliform are a subgroup of total coliform bacteria and *E. coli* are a subgroup of fecal coliform. Enterococci are a subgroup of bacteria in the fecal streptococcus group. Fecal coliform, *E. coli* and Enterococci can all be classified as fecal bacteria. The statistical analysis found that the highest correlation to gastrointestinal illness was linked to elevated levels of *E. coli* and Enterococci in fresh water (Enterococci in salt water), leading EPA to propose that States use *E. coli* or Enterococci as pathogen indicators. Maryland has adopted the EPA recommended bacterial indicators, *E. coli* and Enterococcus. Although the criteria numbers are different, the risk to the recreational bathers at the criteria levels are the same.

Estimation of annual and seasonal conditions loads in the Georges Creek TMDL was determined by assessing monitoring data for all stations located in the Georges Creek Watershed over a sufficient temporal span (at least one year).

EPA finds that the TMDLs for bacteria will ensure that the designated use and water quality criteria for Georges Creek are met and maintained.

2. The TMDLs include a total allowable load as well as individual wasteload allocations and load allocations.

The TMDL is expressed as MPN per day and is based on meeting the instream long-term geometric mean of *E. coli* bacteria. EPA's regulations at 40 CFR §130.2(i), also define "total maximum daily load (TMDL)" as the "sum of individual wasteload allocations for point sources and load allocations for nonpoint sources and natural background." As the total loads provided by Maryland equal the sum of the individual WLAs for point sources and the land-based LAs for nonpoint sources set forth below, the TMDLs for fecal bacteria for the Georges Creek are consistent with §130.2(i).

The WLAs are assigned to a permitted point source. For the human sources, the nonpoint source contribution (LA) in subwatersheds with WWTPs is estimated by subtracting the WWTP load from the final human load. All three jurisdictions with CSOs (Table 17) permitted to discharge into the Georges Creek have developed their Long Term Control Plans (LTCPs) and CSOs are expected to be eliminated by the dates stated in the LTCPs. The final human load is assigned to either LA and/or WWTP. No MS4 permits exist for the Georges Creek watershed; therefore, pet allocation is assigned to LA. Wildlife and livestock are also assigned to the LA.

Table 15 (also Table 1) – Georges Creek Bacteria Non-Tidal TMDL Summary

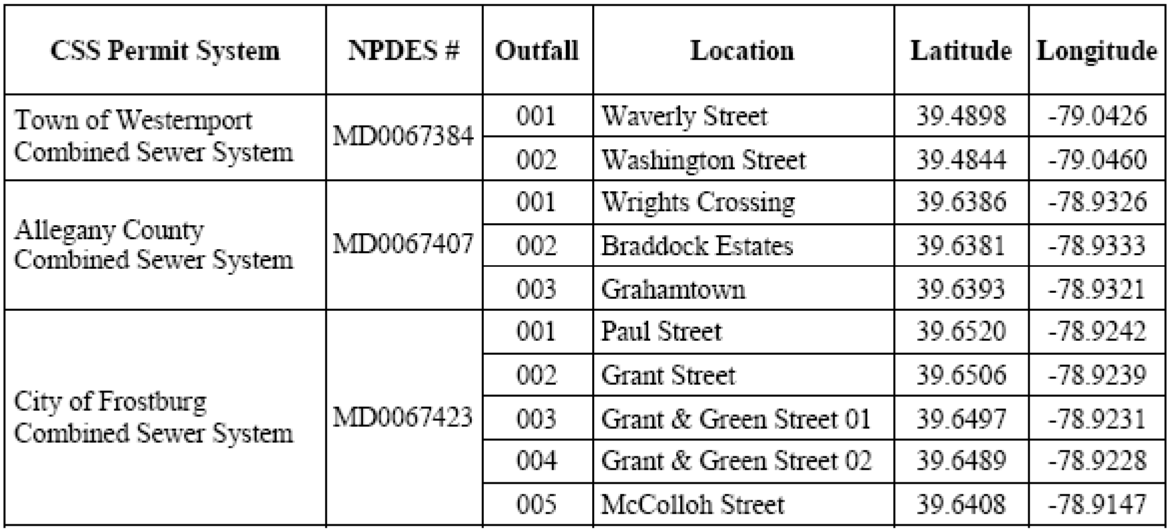
Subwatershed	Baseline	TMDL	WLA-PS[2]	WLA-CSO[3]	LA[4]
	Billions MPN[1]/day *E. coli*				
GEO0143	4,298.7	95.7	0.0	0	95.7
GEO0111sub	151.9	62.0	0.0	0	62.0
GEO0065sub	352.7	63.8	0.0	0	63.8
GEO0009sub	12,519.5	258.1	0.7	0	257.4
TOTAL	17,322.8	479.7	0.7	0	478.9

[1] MPN = Most Probable Number
[2] WLA-PS = Wasteload Allocation for non MS4 systems (municipal or industrial)
[3] WLA-CSO = Wasteload Allocation for Combined Sewer Overflow
[4] LA = Load Allocation

Table 16 - NPDES Permitted Facility with WLA

Permittee/ Allocation	**Permit Number**	**Location**	**WLA-PS MPN /Day**
Georges Creek WWTP	MD0060071	Allegany	1.87E+07

Table 17 – Locations of Combined Sewer Overflows in Georges Creek Watershed (TMDL Report, Table 2.4.3)



CSS Permit System	NPDES #	Outfall	Location	Latitude	Longitude
Town of Westernport Combined Sewer System	MD0067384	001	Waverly Street	39.4898	-79.0426
		002	Washington Street	39.4844	-79.0460
Allegany County Combined Sewer System	MD0067407	001	Wrights Crossing	39.6386	-78.9326
		002	Braddock Estates	39.6381	-78.9333
		003	Grahamtown	39.6393	-78.9321
City of Frostburg Combined Sewer System	MD0067423	001	Paul Street	39.6520	-78.9242
		002	Grant Street	39.6506	-78.9239
		003	Grant & Green Street 01	39.6497	-78.9231
		004	Grant & Green Street 02	39.6489	-78.9228
		005	McColloh Street	39.6408	-78.9147

EPA realizes that the bacteria allocations shown in Table 15 is one allocation scenario designed to meet instream water quality standards. As implementation of the established TMDLs proceed or more detailed information becomes available, Maryland may find other combinations of dividing the TMDL loads between WLA-PS and LA allocations that are feasible and/or cost effective. Any subsequent changes, however, must ensure that the instream water quality standards are met.

Based on the foregoing, EPA has determined that the Georges Creek TMDLs for fecal bacteria are consistent with the regulations and requirements of 40 CFR Section 130.

3. The TMDLs consider the impacts of background pollutant contributions.

Maryland's Georges Creek Watershed is comprised of four distinct subwatersheds. While the monitoring data used in developing the TMDL is from instream sampling which integrates the effects of all loads, the effects of the upstream subwatersheds are considered on the downstream subwatersheds. A decay factor and estimated time of travel was used to estimate the effect of the upstream subwatersheds on the downstream subwatersheds.

4. The TMDLs consider critical environmental conditions.

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 Georges Creek's water quality is protected at all times.

MDE's water quality standards do not specify a time period for which the geometric mean is calculated. For the designated recreational use, the critical period for exposure is the summer months during the swimming season. To identify critical periods resulting from flow and rainfall conditions, MDE developed a procedure to examine the 15-year flow record for critical high and low-flow periods of one year and for seasonal (May 1 to September 30) conditions. MDE's 2006 Section 303(d) listing methodology identifies the swimming period as Memorial Day to Labor Day, however, MDE used May through September because May and September may be warm and swimming may occur. The corresponding critical period dates are shown in the TMDL Report Table 4.4.1 and Table 6 of this document.

5. The TMDLs consider seasonal environmental variations.

Seasonal variations involve changes in stream flow as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flow normally occurs during the colder period of winter and in early spring from snow melt and spring rain, while low-flow typically occurs during warmer summer and early fall drought periods[3]. MDE's statistical method analyzed flows in Georges Creek by dividing them into high and low-flow regimes and calculated geometric mean bacteria concentrations for each regime in order to evaluate seasonal differences.

6. The TMDLs include a margin of safety.

A MOS is required as part of a TMDL in recognition of many 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

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[3] Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2, Part 1, Section 2.33, (EPA 823-B-97-002, 1997)

waterbodies. The MOS is intended to account for such uncertainties in a manner that is conservative from the standpoint of environmental protection.

Based on EPA guidance, the MOS can be achieved through two approaches.[4] One approach is to reserve a portion of the loading capacity as a separate term in the TMDL. The second approach is to incorporate the MOS as conservative assumptions used in the TMDL analysis.

For this TMDL, the MOS was incorporated as conservative assumptions used in the TMDL analysis. The loading capacity of the stream was estimated based upon a reduced (more stringent) water quality criterion concentration. The *E.coli* water quality criterion concentration was reduced by 5%, from 126 *E. coli* MPN/100ml to 119.7 *E. coli* MPN/100 ml.

7. The TMDLs have been subject to public participation.

MDE conducted a public review of the proposed TMDL of Fecal Bacteria for Georges Creek. The public comment period was open from June 23, 2006 through July 24, 2006. MDE received no written comments.

VI. Discussion of Reasonable Assurance

In addition to the seven outlined elements above, there is a reasonable assurance that the TMDLs can be met. According to 40 CFR §122.44(d)(1)(vii)(B), the effluent limitations for an NPDES permit must be consistent with the assumptions and requirements of any available WLA for the discharge which is prepared by the state and approved by EPA. Therefore, any WLAs will be implemented through the NPDES permit process. Based on the point source permitting information, there is one NPDES point source facility, Georges Creek WWTP, with a permit regulating the discharge of fecal bacteria directly into the Georges Creek Watershed. Also note there are three permitted combined sewer systems (CSSs) which monitor CSO discharges to the main branch and tributaries of Georges Creek. Although the two Westernport Permit System CSOs are within the Georges Creek Watershed, both are located downstream of the area covered by this TMDL analysis. CSOs are not given a WLA within the TMDLs for Georges Creek.

In Georges Creek Watershed, MDE's analysis indicates that required reductions to meet the water quality criteria are extremely large and are not feasible by implementing cost-effective and reasonable best management practices (BMP) to nonpoint sources. Therefore, MDE intends to implement an iterative approach that addresses those sources with the largest impact on water quality and human health risk, with consideration given to ease of implementation and cost.

Maryland has several well established programs that will be drawn upon such as the NPDES permit limits that will be based on the TMDL loadings, MDE's Managing for Results work plan, and MDE procedures adopted to assure that future evaluations are conducted for all established TMDLs.

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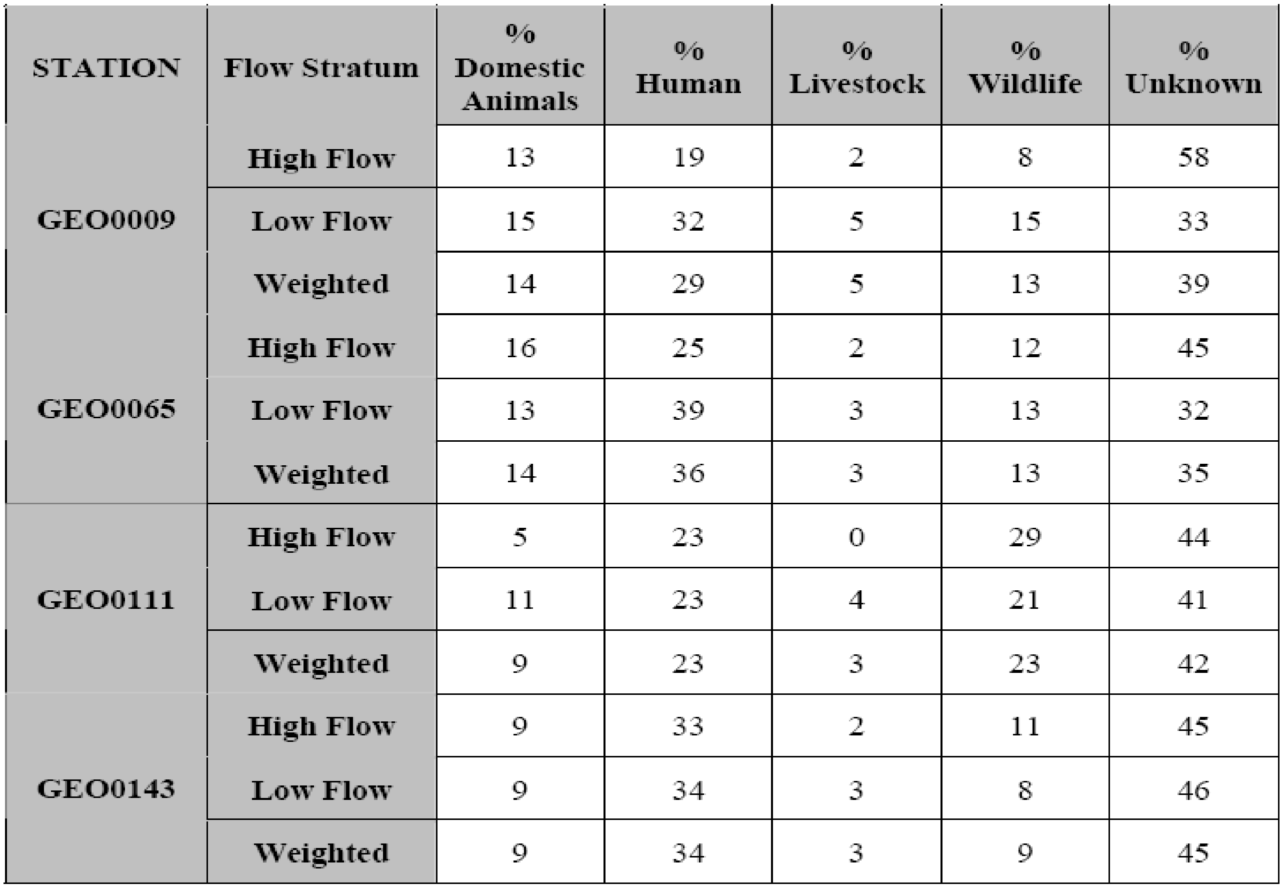
[4] *Guidance for Water Quality-based Decisions: The TMDL Process,* (EPA 440/4-91-001, April 1991)

MDE’s implementation plan is not only based on reductions to total fecal bacteria, it is based on reductions by sources of bacteria. MDE used the results of its BST monitoring from October 2002 through October 2003 to estimate the required reduction in sources of bacteria. MDE does not consider it practical to require wildlife source reductions. MDE identifies the maximum practicable reduction (MPR) per source as:

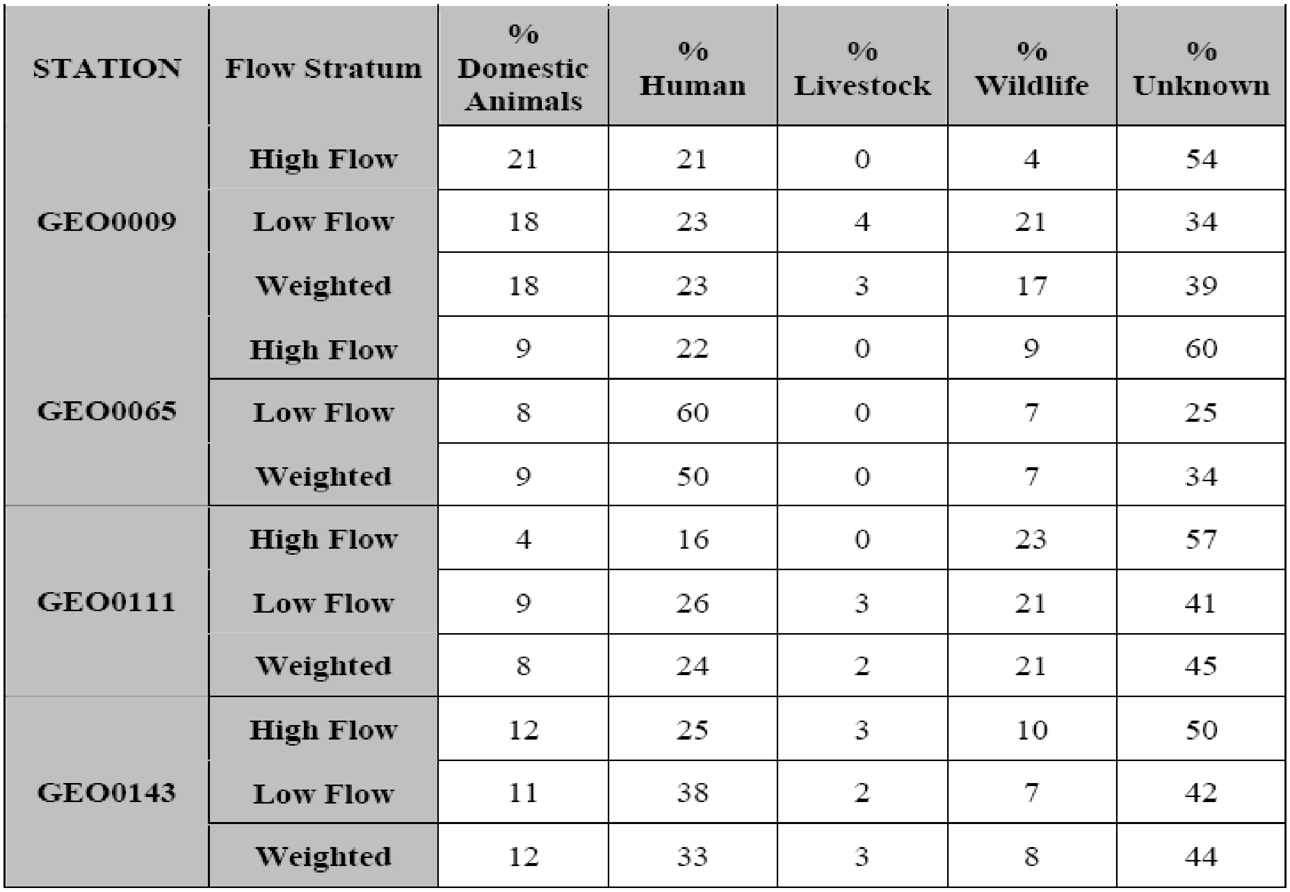
- Human - 95 percent
- Domestic Animal - 75 percent
- Livestock - 75 percent
- Wildlife - 0 percent

Table 18 (also Table 7) – Distribution of Fecal Bacteria Source Loads in the Georges Creek Basin for the Annual Condition
(TMDL Report, Table 2.4.4)



STATION	Flow Stratum	% Domestic Animals	% Human	% Livestock	% Wildlife	% Unknown
GEO0009	High Flow	13	19	2	8	58
	Low Flow	15	32	5	15	33
	Weighted	14	29	5	13	39
GEO0065	High Flow	16	25	2	12	45
	Low Flow	13	39	3	13	32
	Weighted	14	36	3	13	35
GEO0111	High Flow	5	23	0	29	44
	Low Flow	11	23	4	21	41
	Weighted	9	23	3	23	42
GEO0143	High Flow	9	33	2	11	45
	Low Flow	9	34	3	8	46
	Weighted	9	34	3	9	45

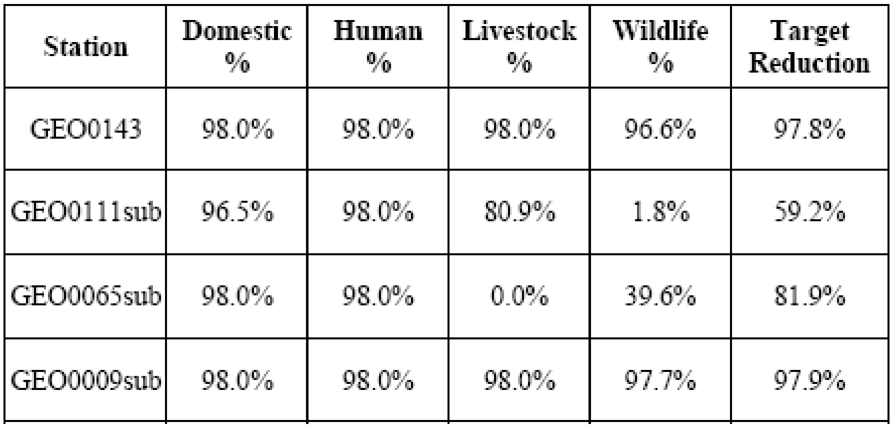
Table 19 (also Table 8) - Distribution of Fecal Bacteria Source Loads in the Georges Creek for the Seasonal Period May 1 - September 30 (TMDL Report, Table 2.4.5)



STATION	Flow Stratum	% Domestic Animals	% Human	% Livestock	% Wildlife	% Unknown
GEO0009	High Flow	21	21	0	4	54
	Low Flow	18	23	4	21	34
	Weighted	18	23	3	17	39
GEO0065	High Flow	9	22	0	9	60
	Low Flow	8	60	0	7	25
	Weighted	9	50	0	7	34
GEO0111	High Flow	4	16	0	23	57
	Low Flow	9	26	3	21	41
	Weighted	8	24	2	21	45
GEO0143	High Flow	12	25	3	10	50
	Low Flow	11	38	2	7	42
	Weighted	12	33	3	8	44

The following reductions (Table 20) are necessary to achieve water quality standards.

Table 20 (also Table 12) – TMDL Reduction Results: Optimization Model up to 98% (TMDL Report, Table 4.7.4)



Station	Domestic %	Human %	Livestock %	Wildlife %	Target Reduction
GEO0143	98.0%	98.0%	98.0%	96.6%	97.8%
GEO0111sub	96.5%	98.0%	80.9%	1.8%	59.2%
GEO0065sub	98.0%	98.0%	0.0%	39.6%	81.9%
GEO0009sub	98.0%	98.0%	98.0%	97.7%	97.9%

The TMDLs specify LAs that will meet the water quality standards. In the practicable reduction targets scenario, no subwatersheds met water quality standards.

To further develop the TMDLs, the constraints were relaxed in all subwatersheds. The maximum allowable reduction was increased to 98% for all sources, including wildlife.

MDE intends for the required reductions to be implemented in an iterative process that first addresses those sources with the largest impact on water quality, with consideration given to ease of implementation and cost. The iterative implementation of BMPs in the watershed has several benefits: tracking of water quality improvements following BMP implementation through follow-up stream monitoring; providing a mechanism for developing public support through periodic updates on BMP implementation; and helping to ensure that the most cost-effective practices are implemented first.

Finally, Maryland has recently adopted a five-year watershed cycling strategy to manage its waters. Pursuant to this strategy, the State is divided into five regions and management activities will cycle through those regions over a five-year period. The cycle begins with intensive monitoring, followed by computer modeling, TMDL development, implementation activities, and follow-up evaluation. This follow-up monitoring will allow Maryland to determine whether the second stage TMDL implementation can be implemented successfully or whether an alternate action should be pursued.