UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029
8/23/2002

Ms. Denise Ferguson-Southard
Assistant Secretary
Maryland Department of the Environment
2500 Broening Highway
Baltimore, Maryland 21224

Dear Ms. Southard:

The U.S. Environmental Protection Agency (EPA), Region III, is pleased to approve the report entitled, "Total Maximum Daily Loads [TMDLs] of Carbonaceous Biochemical Oxygen Demand (CBOD) and Nitrogenous Biochemical Oxygen Demand (NBOD) for Antietam Creek, Washington County, Maryland," submitted to the EPA by the Maryland Department of Environment (MDE) by letter dated December 27, 2001 and received January 8, 2002. Additional information in response to EPA's comments was received on March 20, 2002. The TMDLs were established and submitted in accordance with Section 303(d)(1)(c) and (2) of the Clean Water Act. The TMDLs were established to address impairment of water quality as identified in Maryland's 1996 and 1998 Section 303(d) lists. Maryland identified the impairment for this water quality-limited waterbody based on nutrients, suspended sediments, and low dissolved oxygen (DO) levels. The TMDLs contained in MDE's report only address dissolved oxygen, whereas the other impairments are to be addressed at a later date.

In accordance with Federal regulations found at 40 CFR §130.7, a TMDL must: 1) be designed to meet water quality standards; 2) include, as appropriate, both wasteload allocations (WLAs) from point sources and load allocations from non-point 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 any uncertainties in the relationship between pollutant loads and in-stream water quality; 7) include reasonable assurance that the TMDL can be met; and 8) be subject to public participation. The enclosure to this letter describes how the Antietam Creek TMDL and supporting documentation satisfies each of these requirements. The supporting documentation provided with the TMDL report, specifically the Technical Memorandum, provides one allocation scenario each for CBOD and NBOD including WLAs for five point sources.

EPA recognizes that recent water quality data from Antietam Creek included in Maryland's report indicate that the dissolved oxygen standard is being met. EPA concurs with Maryland's conclusion in its report that future violations of the dissolved oxygen standard could occur if CBOD or NBOD are allowed to increase in Antietam Creek beyond the amount specified in the report. Thus, EPA considers Antietam Creek to be threatened with respect to dissolved oxygen, and consequently, Antietam Creek should remain listed as a water quality limited segment and require the establishment of a corresponding TMDL, pursuant to 40 CFR §§130.7(b)(5)(i) and (c)(1).

Following the approval of this TMDL, MDE shall incorporate it into the State's Water Quality Management Plan pursuant to 40 CFR §130.7(d)(2). Also, any new or revised National Pollutant Discharge Elimination System (NPDES) permits with applicable effluent limits must be consistent

with the TMDLs wasteload allocation pursuant to 40 CFR §122.44(d)(1)(vii)(B)(2). If an NPDES permit is issued with an effluent limitation that does not reflect the wasteload allocation contained in the approved TMDL and Technical Memorandum, it is expected that Maryland will document this change in the permit Fact Sheet, as discussed in USEPA's Decision Rationale.

If you have any questions or concerns, please call me or contact Thomas Henry, the TMDL Program Manager, at (215) 814-5752.

Sincerely,

/S/

Jon M. Capacasa, Acting Director
Water Protection Division

Enclosure

cc: Dr. James George, MDE
Mr. Robin Grove, MDE

Decision Rationale

Total Maximum Daily Loads of Carbonaceous and Nitrogenous Biochemical Oxygen Demand to Antietam Creek, Washington County, Maryland

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those water bodies 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, that may be discharged to a water quality-limited water body.

This document sets forth the United States Environmental Protection Agency's (USEPA) rationale for approving the TMDLs for carbonaceous and biochemical oxygen demand (CBOD and NBOD, respectively) in the Antietam Creek watershed. The TMDLs were established to address impairments of water quality, based on low dissolved oxygen (DO) levels as identified in Maryland's 1996 and 1998 Section 303(d) lists. The Maryland Department of the Environment (MDE) submitted the *Total Maximum Daily Loads of Carbonaceous Biochemical Oxygen Demand (CBOD) and Nitrogenous Biochemical Oxygen Demand (NBOD) for Antietam Creek, Washington County, Maryland*, dated December 21, 2001, to USEPA for final review on December 27, 2001. Follow-up information was received on March 20, 2002. Antietam Creek was first identified on Maryland's 1996 Section 303(d) list for nutrients and suspended sediments. Nutrients, if necessary, and suspended sediments will be addressed separately by MDE at a later date.

USEPA's rationale is based on MDE's TMDL Report and information contained the Appendix to the report. USEPA's review determined that the TMDLs meet the following eight 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 waste load allocations and load allocations.
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 margin of safety.
7) There is reasonable assurance that the TMDLs can be met.
8) The TMDLs have been subject to public participation.

There are five point sources in this watershed. The Technical Memorandum, *Significant CBOD and NBOD Point and Nonpoint Sources in Antietam Creek Watershed*, specifically allocates BOD loads to these point sources. Maryland provided adequate land use and loading data in the TMDL report, but did not distribute the nonpoint source load allocation to specific land use categories in the TMDL report. Since the load allocations were calculated based on low flow conditions only, the load allocations assumed no runoff loads due to rainfall. The load

allocations for nonpoint sources were based on in-stream tributary concentrations of CBOD and NBOD. Further, a combined point and nonpoint source allocation was determined for the load contribution from Pennsylvania at the Maryland/Pennsylvania boundary of Antietam Creek. These gross load allocations are presented in Tables 1 and 2. Nonpoint source loading rates represent a cumulative impact from all sources, including naturally occurring and human-induced sources.

Table 1- BOD Point and Nonpoint Source Load Allocations by State for Low Flow, May 1 through October 31

State	Nonpoint Sources, lb/month		Point Sources, lb/month	
	CBOD	NBOD	CBOD	NBOD
Maryland	30,799	22,340	65,073	84,967
Pennsylvania	11,465[1]	7,913	-	-

1 Value represents combined point and nonpoint source BOD load contributions from PA at MD/PA boundary line

Table 2 - BOD Point and Nonpoint Source Future Allocations and Margin of Safety

State	Future Allocation				Margin of Safety			
	Nonpoint Sources, lb/month		Point Sources, lb/month		Nonpoint Sources, lb/month		Point Sources, lb/month	
	CBOD	NBOD	CBOD	NBOD	CBOD	NBOD	CBOD	NBOD
Maryland	10,136	6,104	11,955	9,528	1,540	1,117	2,480	3,155
Pennsylvania	1,165	2,948	-	-	573	396	-	-

The sum of the allocations shown in Tables 1 and 2 above (i.e. load allocations from nonpoint sources, wasteload allocations from point sources, future allocations, and margin of safety) constitutes TMDLs of *135,186 lb/month for CBOD* and *138,468 lb/month for NBOD.*

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. Conditions, available data and the understanding of the natural processes can change more than anticipated by the margin of safety. The option is always available to refine the TMDL for re-submittal to USEPA for approval.

Summary

Antietam Creek originates in Pennsylvania and empties into the Potomac River in Maryland. Thirty-seven miles of the 54-mile length Creek occur in Maryland. The Antietam Creek

watershed has an area of approximately 284 square miles, of which 181 square miles are located in Maryland. Figure 1 shows the location of Antietam Creek. The land uses in the total watershed consist of agricultural (58%), forest (19%), and urban areas (13%).[1]

[1] This information is based on Maryland Office of Planning land cover data and EPA land cover data, as contained in MDE's TMDL report (December 2001).

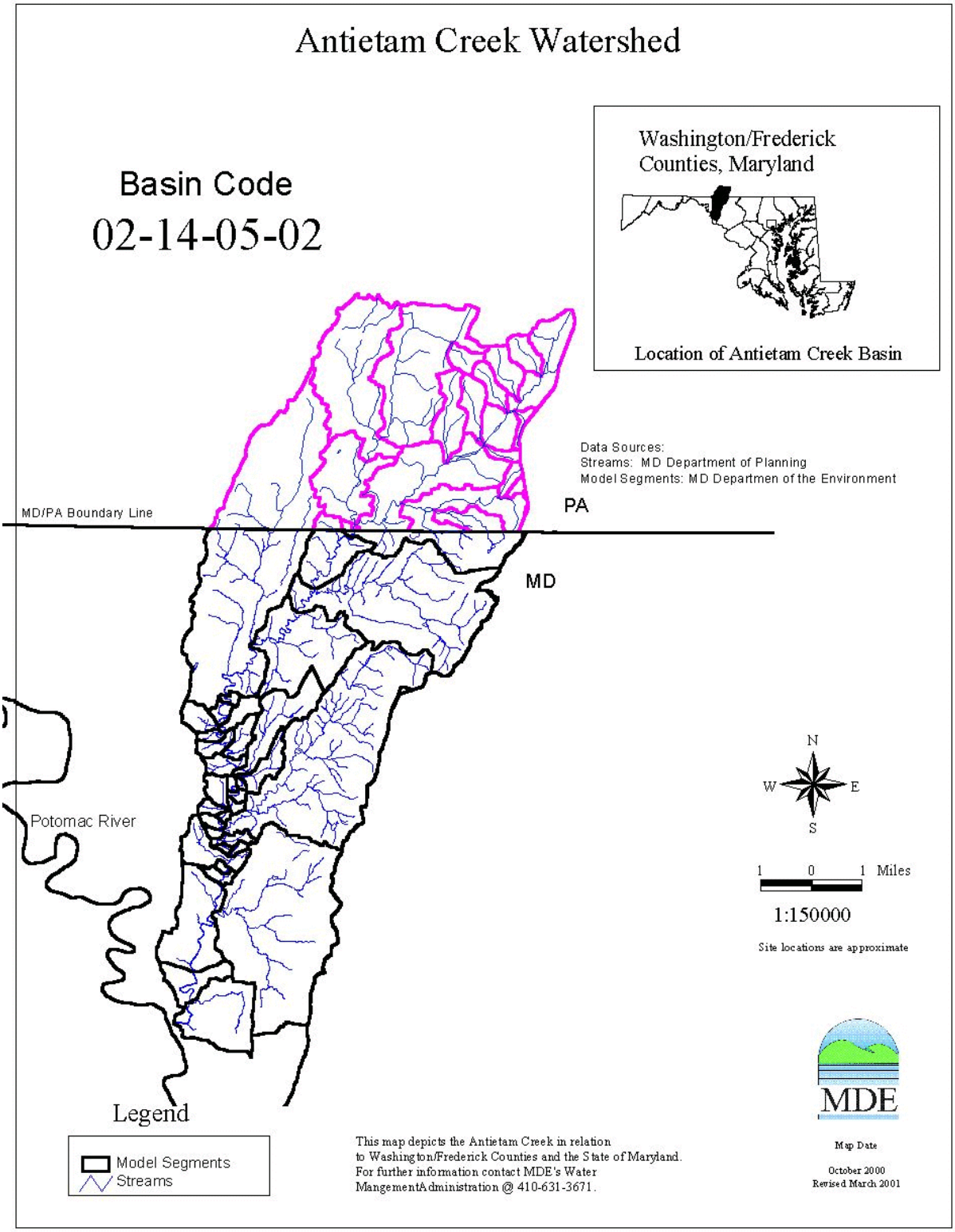

Figure 1: Location Map of the Antietam Creek Drainage Basin within Maryland

In response to the requirements of Section 303(d) of the Clean Water Act (CWA), MDE listed Antietam Creek on the 1996 Section 303(d) list of impaired waterbodies, as impaired by nutrients, suspended sediments, and low dissolved oxygen. Excessive inputs of nutrients (nitrogen and phosphorus) can lead to over-enrichment and eutrophication of the waterbody. The nutrients act like fertilizer leading to excessive growth of aquatic plants, which eventually die and decompose, leading to bacterial consumption of dissolved oxygen (DO) and DO concentrations below what is necessary to support the designated use.

MDE developed these TMDLs to address the historically low levels of DO experienced in Antietam Creek and the anticipated low levels of DO if BOD loadings were to increase in the future. Recent sampling data from Antietam Creek indicate that water quality standards for DO are currently being met. Thus, these TMDLs are designed to satisfy and maintain the water quality standards and designated uses of Antietam Creek for DO. Impairments due to suspended sediments and nutrients are not addressed by these TMDLs. MDE will develop a nutrient TMDL if the results of future sampling for chlorophyll-a (a surrogate indicator of excess nutrients and eutrophication) confirm Maryland's initial presumption of nutrient impairment.

In order to address the dissolved oxygen impairments of Antietam Creek from the Section 303(d) list, MDE believes it is necessary to control NBOD and CBOD loadings to the system. Nitrogenous BOD and carbonaceous BOD are among the factors that exert influence on concentrations of DO, as shown in Figure 2 below. Figure 2 (taken from EPA 823-B-97-002, page 2-14) illustrates the interrelationship of major kinetic processes for BOD, DO, and nutrient analysis.

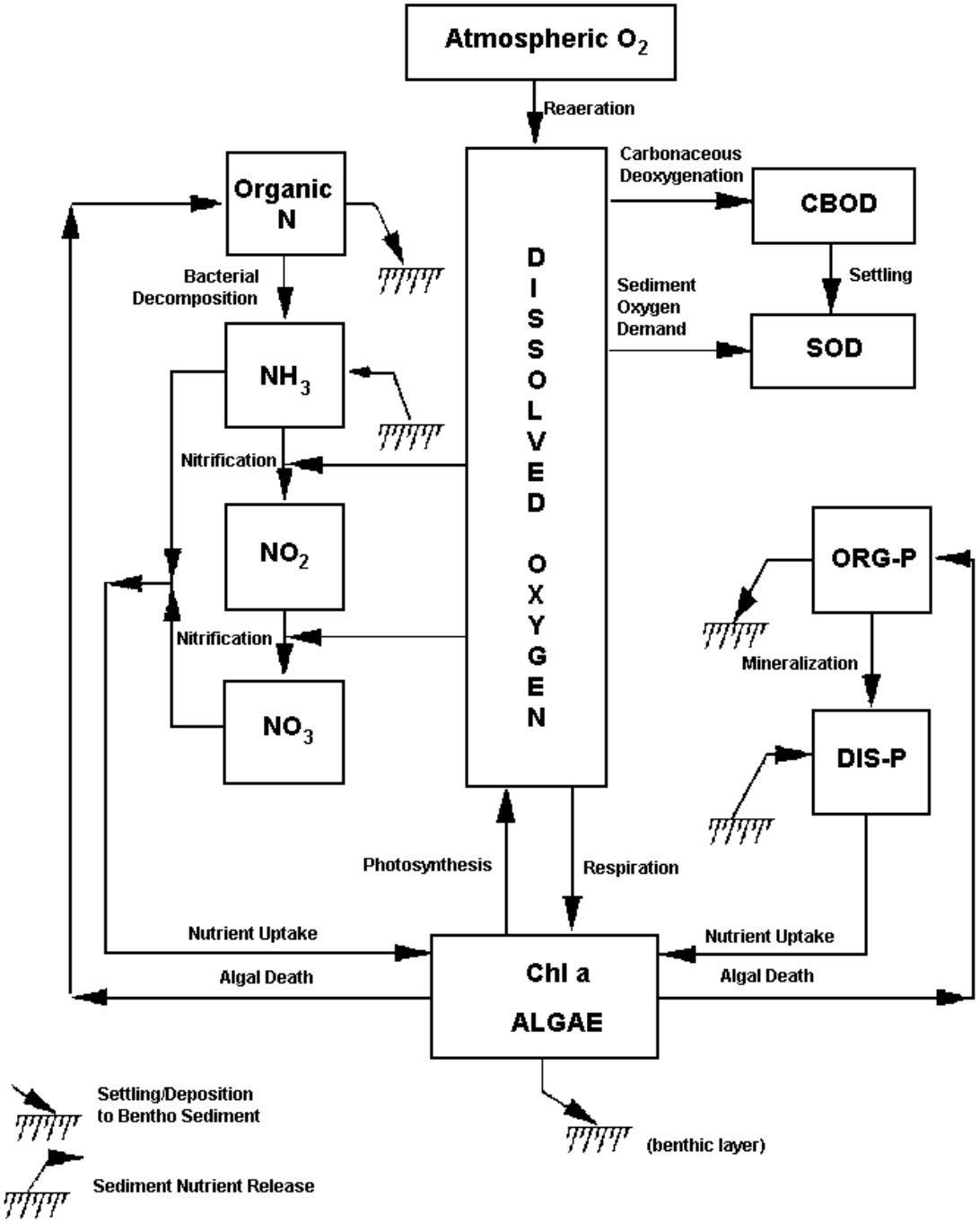

Figure 2 - Illustration of the interrelationship of major kinetic processes for BOD, DO, and nutrient analysis

MDE used an in-house calibrated computer model developed for Antietam Creek. The model prepares input data and runs a free-flowing stream model based on the Streeter-Phelps equation. The Streeter-Phelps equation is a widely accepted model for simulating the effects of point and nonpoint sources of BOD and oxygen on dissolved oxygen concentrations in a waterbody.

The model analysis is based on representing current wasteload allocations for CBOD and NBOD loadings by existing permitted point sources (i.e., wastewater treatment plants (WWTPs)) to Antietam Creek as well as current background conditions, and determining the incremental loadings of CBOD and NBOD that will maintain water quality standards for DO. The Streeter-Phelps spreadsheet model is able to project net CBOD, NBOD and DO values in each segment of the stream that is modeled.

The model uses the background and point source (i.e., WWTP) loadings of CBOD and NBOD as DO sags and simulates oxygen addition through atmospheric reaeration and photosynthesis. The model simulates an equilibrium state of the water body, which in this case, considered low flow conditions since problems with DO are expected to occur only at low-flow conditions. The critical conditions were determined to be summer conditions during which low-flows and high-temperatures occur. The TMDL was calculated for 7Q10 conditions, which represent the seven-day consecutive lowest flow expected to occur every ten years

The Streeter-Phelps equation has been previously and widely applied in a number of regulatory and water quality management applications and is an appropriate evaluation tool for the Antietam Creek. Based on this analysis, MDE has determined that the levels of CBOD and NBOD input to the Antietam Creek specified by the TMDLs will ensure that water quality standards are achieved by maintaining the DO water quality criterion. See Tables 1 and 2 for a summary of the allowable loads.

The spatial domain of the Antietam Creek model includes the Maryland portion of the Creek, a 37-mile stretch that extends from the Maryland/Pennsylvania boundary to the confluence of Antietam Creek with the Potomac River. Thirty-seven model segments represent this modeling domain. Concentrations of relevant water quality parameters were measured during summer surveys in 1996 and 1997 at several stations. A diagram of the model segmentation is presented in Appendix A of MDE's TMDL report.

III. Discussion of Regulatory Conditions

The EPA finds that Maryland has provided sufficient information to meet all of the eight basic requirements for establishing NBOD and CBOD TMDLs for Antietam Creek. EPA therefore approves the TMDLs and supporting documentation for Antietam Creek. The EPA's approval is outlined according to the regulatory requirements listed below.

1) The TMDL is designed to implement the applicable water quality standards.

The designated use of Antietam Creek is Use IV-P: recreational trout waters and public water supply. The in-stream DO water quality criterion to support this use is a minimum

of 5 milligrams per liter (mg/L) at any time. Based on water quality data collected in Antietam Creek during 1996 and 1997, the DO water quality standard is currently being met. However, increased loadings of CBOD and NBOD beyond the current allowable point source loadings and current background conditions in Antietam Creek could lead to a violation of the DO water quality standard. The Streeter-Phelps computer model used by Maryland determines the allowable incremental loadings of CBOD and NBOD that will likely maintain compliance with Maryland's DO standard.

Two other factors: sediment oxygen demand (SOD) and algal growth due to excessive nutrients, are also part of the oxygen balance and may impact the DO levels in a waterbody. SOD was discounted as a factor in Antietam Creek since it is a free-flowing stream and frequent scouring during storm events usually prevents long-term accumulation of organic materials whose decay primarily comprises the SOD. Algae affect the oxygen balance through the production of oxygen during photosynthesis and consumption of oxygen by respiration. Evidence of undesirable levels of algae is normally supported by large diurnal variations in DO concentrations. The available data for dissolved oxygen and nutrients (i.e., total nitrogen, total phosphorus) do not support algae as a significant factor affecting DO concentration in Antietam Creek; thus, algae was discounted as a factor during the DO modeling of Antietam Creek.

EPA finds that the TMDLs for CBOD and NBOD will provide for the designated use and water quality criteria for the Antietam Creek to be met and maintained.

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

Total Allowable Loads

The critical season for low DO concentrations in Antietam Creek has been identified by Maryland as the summer months. During these months, flow in the channel is reduced resulting in slower moving, warmer water which has less dilution potential and decreased capacity for dissolved gases and is therefore susceptible to low DO concentrations. In order to maintain water quality with respect to DO levels, Maryland has established individual TMDLs for NBOD and CBOD that are applicable from May 1 through October 31. Maryland presented these as monthly mass loads to be consistent with the monthly concentration limits that are required by National Pollutant Discharge Elimination System (NPDES) permits. Expressing the TMDLs as monthly loads is consistent with federal regulations at 40 CFR 130.2(i), which state that TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure.

The 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 wasteload allocations for point sources and the land-based load allocations for nonpoint sources set forth below, the TMDLs for NBOD and CBOD for Antietam Creek are consistent with Section 130.2(i). Pursuant to 40 CFR 130.6 and 130.7(d)(2), these TMDLs and supporting documentation, should be incorporated into Maryland's current water quality management plan. See Tables 1and 2 for a summary of the allowable loads.

Waste Load Allocation

EPA regulations require that an approvable TMDL include individual waste load allocations for each point source. The Maryland portion of the watershed that drains to Antietam Creek has five "significant" permitted point source discharges of BOD. Maryland's TMDL report for Antietam Creek did not include individual waste load allocations for these five point sources; however, the Technical Memorandum did provide waste load allocations for the low flow TMDL, which is presented in Table 3 below. Maryland estimated that the combined BOD loadings from the other seven wastewater treatment plants in the Maryland portion of the Antietam Creek watershed comprise 10 percent of the total point source load; these sources were thus included in the tributary loads during the modeling and TMDL development.

Table 3 - Summary of NBOD and CBOD Waste Load Allocations

WWTP Facility	**NPDES Permit Number**	**NBOD Load** ***lbs / month***	**Future Total Allocation** ***lbs / month***	**CBOD Load** ***lbs / month***	**Future Total Allocation** ***lbs / month***
Hagerstown Fiber L.P.	MD0066974	2,302	3,022	7,506	9,855

Hagerstown Water Pollution Control Facility	MD0021776	36,829	37,476	36,029	39,422
Funkstown	MD0020362	4,316	4,316	1,689	1,689
Maryland Correctional Institute	MD0023057	36,829	43,521	18,014	23,653
Antietam	MD0062308	4,604	6,045	1,801	2,365

It is necessary to distinguish between current permitted loading, the WLA determined through the TMDL process, and actual loading. Current permitted loading refers to the maximum allowable loading as designated by NPDES permit for each facility prior to the TMDL process. The WLA represents the allowable point source pollutant load necessary to achieve water quality standards as determined by the TMDL process. The actual loading represents the amount of pollutant loading that a facility is discharging. This load must not exceed the permitted load specified in the NPDES permit. However, it is very likely that actual loading is less than both the current permitted load and wasteload allocation such that pollutant loadings from particular facilities may not be impacted by the TMDL process. Conversely, permit limits may need to be adjusted to reflect the wasteload allocation determined in the TMDL process. Thus, while a facility may not be required to take action to reduce pollutant loadings, the NPDES permit limits may need to be revised in order to reflect findings from the TMDL process

Waste load allocations for the Pennsylvania portion of Antietam Creek were not attributed to individual sources in Pennsylvania. Total NBOD and CBOD load allocations, as shown in Tables 1 and 2, were established based on 1996-1997 water quality data from summer stream surveys in Antietam Creek at the Maryland / Pennsylvania border. These total load allocations represent the combined point and nonpoint sources attributed to the length of Antietam Creek that resides in Pennsylvania. These load allocations are subject to review by the Commonwealth of Pennsylvania.

Load Allocation

In this model, BOD loadings due to nonpoint sources were represented by water quality data in Antietam Creek at the Pennsylvania boundary and at the downstream tributaries: Little Antietam Creek (north), Beaver Creek, and Little Antietam Creek (south). These loadings account for all human and natural sources. Maryland included a gross load allocation for low-flow TMDLs, which are presented in Tables 1 and 2. According to federal regulations at 40 CFR 130.2(g), load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Since Maryland used observed in-stream data, loads could not be broken down into land uses. Moreover, a breakdown by land use cannot be determined for nonpoint source loads during a low flow scenario. Land use data, however, was provided in Maryland's TMDL report.

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Table 4 - Summary of average flow load allocations for Nitrogen and Phosphorus

Parameter	"Existing"[1] Nonpoint Source Load (lbs/year)	Load Allocation (lbs/year)	Reduction needed (%)
Nitrogen	51,486	34,918	32
Phosphorus	2,047	1,386	32

[1] Based on1999 observed field data. Reflects what is considered as current conditions.

Table 5 - Summary of low-flow load allocations for Nitrogen and Phosphorus

Parameter	"Existing"[1] Nonpoint Source Load (lbs/month)	Load Allocation (lbs/month)	Reduction needed (%)
Nitrogen	505	349	31
Phosphorus	45	31	31

[1] Based on1999 observed field data. Reflects what is considered as current conditions.

The TMDL report states a 40% reduction for average flow loads. These load reductions are based on reductions in controllable loads. The load reductions shown in Tables 5 and 6 are total load reductions and does not take in to account whether the land use loads are controllable or not controllable.

Allocations Scenarios

EPA realizes that the above total loads for nitrogen and phosphorus is one allocation scenario. As implementation of the established TMDLs proceed or more detailed information becomes available, Maryland may be able to break out the loads into land uses and find other combinations of land use allocations that are feasible and/or cost effective. Any subsequent changes, however, in the TMDLs must conform to gross waste load and load allocations and must ensure that the biological, chemical, and physical integrity of the waterbody is preserved.

The current TMDLs present that there are no point sources in Still Pond Creek. Federal regulations at 40 CFR 122.44(d)(1)(vii)(B), require that, for an NPDES permit for an individual point source, the effluent limitations must be consistent with the assumptions and requirements of any available wasteload allocation for the discharge prepared by the State and approved by USEPA. USEPA has authority to object to the issuance of an NPDES permit that is inconsistent with wasteload allocations established for that point source. To ensure consistency with these TMDLs, as NPDES permits are issued for the point sources that discharge the pollutants of concern to Still Pond Creek, any deviation from the wasteload allocations set forth in the TMDL report, and described herein for the particular point source must be documented in the permit Fact Sheet and made available for public review along with the proposed draft permit and the Notice of Tentative Decision. The documentation should; 1) demonstrate that the loading change is consistent with the goals of the TMDL and will implement the applicable water quality standards, 2) demonstrate that the changes embrace the assumptions and methodology of these TMDLs and Technical Memorandum, and, 3) describe that portion of the total allowable loading determined in the State's approved TMDL report that remains for other point sources (and future growth where included in the original TMDL) not yet issued a permit under the TMDL. It is also expected that Maryland will provide this Fact Sheet, for review and comment, to each point source included in the TMDL analysis as well as any local and State agency with jurisdiction over land uses for which load allocation changes may be impacted.

In addition, USEPA regulations and program guidance provides for effluent trading. Federal regulations at 40 CFR 130.2 (I) state: "If Best Management Practices (BMPs) or other nonpoint source pollution controls make more stringent load allocations practicable, then wasteload allocations may be made less stringent. Thus, the TMDL process provides for nonpoint source control tradeoffs." The State may trade between point sources and nonpoint sources identified in this TMDL as long as three general conditions are met; 1) the total allowable load to the waterbody is not exceeded, 2) the trading of loads from one source to another continues to properly implement the applicable water quality standards and embraces the assumptions and methodology of these TMDLs and Technical Memorandum, and 3) the trading results in enforceable controls for each source. Final control plans and loads should be identified in publicly available planning document, such as the State's water quality management plan (see 40 CFR 130.6 and 130.7(d)(2). These final plans must be consistent with the goals of the approved TMDLs.

Based on the foregoing, EPA has determined that the TMDLs for nitrogen and phosphorus for Still Pond Creek are consistent with the regulations and requirements of 40 CFR Section 130. Pursuant to 40 CFR 130.6 and 130.7(d)(2), these TMDLs and the supporting documentation, should be incorporated into Maryland's current water quality management plan.

3) The TMDL considers the impacts of background pollutant contributions.

In terms of the low-flow and average-flow TMDL analyses, Maryland used 1999 field data which would adequately consider pollutant contributions from baseflow, which is considered to be most influential during low-flow periods, as well as other nonpoint source contributions such as atmospheric deposition and loads from septic tanks.

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 streamflow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of Still Pond Creek is protected during times when it is 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. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence. In specifying critical conditions in the waterbody, an attempt is made to use a reasonable "worst-case" scenario condition. For example, stream analysis often uses a low-flow (7Q10) design condition as critical because the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

The nutrient TMDL analysis consists of two broad elements, an assessment of low flow loading conditions, and an assessment of annual average loading. The low flow TMDL analysis investigates the critical conditions under which symptoms of eutrophication are typically most acute, that is, in late summer when flows are low, leading to poor flushing of the system, and when sunlight and temperatures are most conducive to excessive algal production.

The water quality model was calibrated to reproduce observed water quality characteristics for both observed low flow and observed high flow conditions. The calibration of the model for these two flow regimes establishes an analysis tool that may be used to assess a range of scenarios with differing flow and nutrient loading conditions. Observed water quality data collected during 1999 was used to support the calibration process, as explained further in the "Nonpoint Source Loadings" section of Appendix A of the TMDL report.

5) The TMDLs consider seasonal environmental variations.

Seasonal variation involve changes in streamflow 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 snowmelt and spring rain, while low flow typically occurs during warmer summer and early fall drought

periods[2]. Consistent with EPA's discussion regarding critical conditions , the WASP5.1 model and TMDL analysis will effectively consider seasonal environmental variations.

6) The TMDLs include a margin of safety.

A margin of safety (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 water bodies. 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 (EPA, April 1991). One approach is to reserve a portion of the loading capacity as a separate term in the

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

TMDL. The second approach is to incorporate the MOS as conservative assumptions used in the TMDL analysis.

In terms of the low-flow TMDL analysis for nitrogen and phosphorus, MDE states that it explicitly allocates 5% of the load allocation value and reserves this for the MOS. In terms of the average-flow TMDL analysis for nitrogen and phosphorus, MDE states that it explicitly allocates 3% of the load allocation value and reserves this for the MOS.

In addition to these explicit set-aside MOS, additional safety factors are built into the TMDL development process. The low-flow analysis sets a goal of 50 µg/l for chlorophyll-a, which MDE believes is conservative given the generally acceptable range of chlorophyll-a values for waters meeting their water quality standards of 50 - 100 µg/l.

In the average flow analysis, conservative assumptions are used and result in an implicit MOS. The average flow analysis was run under the assumption of summer temperature and summer solar radiation. When the water is warmer and more sunlight is present, there will be more algal growth and a higher potential for low dissolved oxygen concentrations. The model was also run under steady-state conditions, for 200 days, assuming continuous average flows and loads. It is unlikely that these flows and loads will actually be seen for such an extended period of time during the summer. The higher temperatures and solar radiation are conservative assumptions that represent a significant implicit margin of safety.

7) There is a reasonable assurance that the TMDLs can be met.

EPA requires that there be a reasonable assurance that the TMDLs can be implemented. Wasteload allocations will be implemented through the NPDES permit process. 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 wasteload allocation for the discharge prepared by the state and approved by EPA. The watershed that drains to Still Pond Creek has no permitted point source discharges of nutrients. Hence, for both the low flow and average annual TMDLs, the entire allocation, except for the margin of safety, is being made to nonpoint sources.

For both TMDLs, Maryland has several well-established programs that will be drawn upon: the Water Quality Improvement Act of 1998 (WQIA), and the EPA-sponsored Clean Water Action Plan of 1998 (CWAP), and the State's Chesapeake Bay Agreement's Tributary Strategies for Nutrient Reduction. Also, Maryland has adopted procedures to assure that future evaluations are conducted for all TMDLs that are established.

It is reasonable to expect that nonpoint source loads can be reduced during low flow conditions. While the low flow loads cannot be partitioned specifically into contributing sources, the sources themselves can be identified. These sources include deposition of nutrients and organic matter to the streambed from higher flow events, septic systems failure and wildlife animal contribution. When these sources are controlled in

combination, it is reasonable to achieve nonpoint source reductions of the magnitude identified by this TMDL allocation.

The potential influence of high-flow events from the Susquehanna River was noted in the *General Setting and Source Assessment* section of this report. The effects of the Susquehanna/Bay are poorly understood, and could be very complex. The implications for nutrient loadings could range from very little (if the fresh-water flushing does not result in a net increase in load) to very significant. The implications for implementation are similarly uncertain. The Susquehanna/Bay could be a significant nutrient source, implying that a lower proportion of the load is from nonpoint sources in the Still Pond Creek basin. In such case, load reductions from the Susquehanna, as part of the Chesapeake Bay Agreement, could have a significant positive effect on the Still Pond Creek water quality. Regardless of the uncertainty, nonpoint source reductions associated with the programs outlined above should be pursued aggressively to address the extensive enrichment of the Bay and Still Pond Creek and to off-set the increasing population pressure.

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 and EPA to determine whether these TMDLs have been implemented successfully.

8) The TMDLs have been subject to public participation.

The MDE has conducted a public review of the TMDL for nitrogen and phosphorus loadings in Still Pond Creek. The public comment period was open from November 15, 2001 to December 14, 2001. MDE received no comments on this TMDL.

On October 4, 2001, EPA initiated informal consultation with the U.S. Fish and Wildlife Service and National Marine Fisheries Service (NMFS) pursuant to Section 7(c) of the Endangered Species Act, regarding certain federal agency actions by EPA Region III regarding Maryland TMDLs. The Region forwarded a Biological Evaluation to the Services on February 8, 2002 regarding our proposed action on Maryland TMDLs. On February 27, 2002, EPA received concurrence from the U.S. Fish and Wildlife Services and on March 1, 2002 EPA received concurrence from the National Marine Fisheries Service that our action is not likely to adversely affect endangered species and their critical habitat.

IV. Additional Information

The following table presents the TMDLs in pounds per day.

Flow Regime (Period)	Parameter	TMDL	WLA[1]	LA[2]	MOS[3]
Low-flow (May 1 - Oct. 31)	Nitrogen (lbs/day)[4]	11.5	0.0	10.9	0.6
	Phosphorus (lbs/day)[4]	0.7	0.0	0.7	0.03
Average-flow (Nov. 1 - April 30)	Nitrogen (lbs/day)	65.6	0.0	47.9	17.7
	Phosphorus (lbs/day)	45.3	0.0	44.0	1.3

[1] WLA = Waste Load Allocation
[2] LA = Load Allocation
[3] MOS = Margin of Safety
[4] 30.5 days per month was used to convert lbs/month to lbs/day