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

JUN 22 2001

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

Dear Ms. Ferguson-Southard:

The U. S. Environmental Protection Agency (EPA) Region III has reviewed the report "Total Maximum Daily Loads (TMDLs) of Nitrogen, Phosphorus, and Biochemical Oxygen Demand (BOD) for the Lower Wicomico River, Wicomico County, Maryland," which was submitted by the Maryland Department of the Environment (MDE) for final EPA review and action on December 22, 2000. EPA has delayed final action on this TMDL report in order to provide the City of Salisbury with additional time to conduct a more detailed review of the proposed TMDL. EPA, with concurrence from MDE, granted the City of Salisbury an additional 30 days for such review. A letter dated May 17, 2001 from MDE to EPA documented the additional discussion between the city and state on the proposed TMDLs. This same letter reaffirmed the original TMDL submittal for EPA's consideration and approval. EPA concurs with MDE's position and, pursuant to 40 CFR Section 130.7(d), approves the Lower Wicomico River TMDLs as originally submitted by Maryland on December 22, 2000.

The definition of Load Allocation (LA) at 40 CFR Section 130.2(g) states, in part, that "Load allocations are best estimates of the loading [from nonpoint sources], which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading." Further, a wasteload allocation (WLA), according to 40 CFR Section 130.2(h), is "The portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution." In addition, a TMDL is defined at 40 CFR Section 130.2(i) as "The sum of the individual WLAs for point sources and LAs for nonpoint sources and natural background."

The supporting documentation provided with the TMDL report, specifically the Technical Memorandum, provides one allocation scenario with individual point and nonpoint source allocations. EPA relied upon this information, as well as the additional information resulting from the extended discussions with the City of Salisbury, in reviewing and approving the TMDL submittal and in preparing EPA's Decision Rationale. EPA expects for future TMDLs that the Technical Memorandum will be included in any public notice of the TMDLs.

EPA has determined that the TMDLs and technical memorandum are consistent with the regulations and requirements of 40 CFR Section 130 (see the enclosed Decision Rationale). Pursuant to 40 CFR Sections 130.6 and 130.7(d)(2), the TMDLs and supporting documentation, including the Technical Memorandum, should be incorporated into Maryland's current water quality management plan.

EPA has authority to object to issuance of a National Pollutant Discharge Elimination System (NPDES) permit that is inconsistent with any WLAs established for a point source. If an NPDES permit is issued with an effluent limitation that is not consistent with the WLA contained in the approved TMDL and Technical Memorandum, it is expected that Maryland will document this inconsistency in the permit fact sheet, as discussed in EPA's Decision Rationale.

In addition, we are aware that these TMDLs are under appeal at the state level. If the outcome of this on-going appeal includes a modification to the TMDL, Maryland must submit the modifications, along with the justification, to EPA for review and approval.

If you have any questions or concerns, please contact Mr. Thomas Henry at (215) 814-5752, or me at (215) 814-5732.

Sincerely,

Rebecca W. Hanmer

Rebecca W. Hanmer, Director
Water Protection Division

Enclosure

Decision Rationale
Total Maximum Daily Load of
Nitrogen, Phosphorus, and Biochemical Oxygen Demand for
Lower Wicomico River

I. Introduction

This document will set forth the Environmental Protection Agency's (EPA) rationale for approving the Nitrogen, Phosphorus, and Biochemical Oxygen Demand (BOD) Total Maximum Daily Loads (TMDLs) for the Lower Wicomico River submitted for final Agency review on December 27, 2000. The EPA's approval is based on the TMDL report, associated Technical Memorandum, and other information provided by Maryland. The EPA review determined if the TMDLs meet the following eight regulatory conditions pursuant to 40 CFR §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) The TMDLs have been subject to public participation.
8) There is reasonable assurance that the TMDLs can be met.

The Technical Memorandum, *Significant Nutrient and Biochemical Oxygen Demand Point Sources and Nonpoint Sources in the Lower Wicomico River Watershed*, submitted by the Maryland Department of the Environment (MDE), specifically allocated nutrients and BOD to two point sources as well as nitrogen and phosphorus to each of four separate land use/source categories (direct atmospheric deposition to the water surface was not considered a "land use" source). Each land use or source was allocated some percentage of the total allowed nutrient load originating from nonpoint sources. Current nonpoint source load estimates were based on the Chesapeake Bay Model Phase IV Year 2000 loading coefficients, which considers natural background, loads from septic tanks, as well as baseflow contributions. Likewise, the load allocations to each land use also considered natural background, septic tanks and baseflow. Each land use Load allocations represents yearly allowable loads of nitrogen and phosphorus. In the low-flow scenario, specific nonpoint source allocations to different land uses could not be provided by MDE. MDE also allocated nitrogen, phosphorus, and BOD to the Fruitland Wastewater Treatment Plant (WWTP) and the Salisbury WWTP. The current loads of nitrogen, phosphorus, and BOD were determined using effluent concentrations and flows reported in 1998 Discharge Monitoring Reports (DMRs). Table 1 summarizes the TMDLs for the Lower Wicomico River as determined by MDE.

Table 1, Summary of Nitrogen, Phosphorus, and BOD TMDLs[1]

Flow Regime (Period)	Parameter	TMDL	WLA[2]	LA[3]	MOS[4]
Low-flow (May 1 - Oct. 31)	Nitrogen (lbs/month)	22,900	16,038	6,535	327
	Phosphorus (lbs/month)	5,764	5,604	152	8
	BOD (lbs/month)	80,104	68,755	10,808	541
Average-flow	Nitrogen (lbs/year)	1,266,530	409,130	832,460	24,940
	Phosphorus (lbs/year)	103,480	68,190	33,850	1,440

[1] The load allocations for low-flow represent flows developed using a United States Geological Survey regression analysis and 1998 base-flow field data taken in the Lower Wicomico River
[2] WLA = Waste Load Allocation
[3] LA = Load Allocation
[4] MOS = Margin of Safety

II. Summary

The Lower Wicomico River[1] is approximately 18.8 miles in length, from its confluence with Ellis Bay and Monie Bay to the upper reaches of the headwaters. The mouth of Lower Wicomico River is bound by the Ellis Bay Wildlife Management Area on the North and by Monie Bay on the South. The Lower Wicomico River watershed has an area of approximately 108,074 acres. The dominant land uses in the watershed are mixed agriculture (23,819 acres or 21.4%), forest (60,792 acres or 54.6%), and urban (23,464 acres or 21.1%).[2]

In response to the requirements of Section 303(d) of the Clean Water Act (CWA), MDE listed the Lower Wicomico River on its 1996 Section 303(d) list of impaired waterbodies under Basin Segment 02130301 for nutrients due to signs of eutrophication in the form of excessive algal blooms and low dissolved oxygen (DO) concentrations. A eutrophic system typically contains an undesirable abundance of plant growth, particularly phytoplankton (photosynthetic microscopic organisms (algae)), periphyton (attached benthic algae), and macrophytes (large vascular rooted aquatic plants)[3]. These impairments interfere with the designated uses[4] of Lower Wicomico River by disrupting the aesthetics of the river and causing harm to inhabited aquatic communities. MDE listed nutrients, both

[1] The Lower Wicomico River watershed, part of the Lower Eastern Shore Tributary Strategy Basin, is located in Wicomico County and Somerset County. It is contained within sub-basin 02-13-03 (Nanticoke River Area).

[2] This information is based on the 1997 Maryland Office of Planning land cover data and 1997 Farm Service Agency (FSA) information..

[3] Protocol for Developing Nutrient TMDLs. First Edition. November 1999. EPA 841-B-99-007.

[4] The designated uses of Lower Wicomico River are Use I (Water Contact Recreation and Protection of Aquatic Life) above the ferry crossing at Whitehaven and Use II (Shellfish Harvesting) below Whitehaven See Code of Maryland Regulations 26.08.02.

nitrogen and phosphorus, from nonpoint and natural sources as the causes and sources of the impairments, respectively. MDE also found that elevated BOD levels were causing impairments. The Lower Wicomico River was given low priority on the 1996 Section 303(d) list. Section 303(d) of the CWA and its implementing regulations require a TMDL to be developed for those waterbodies identified as impaired by the state where technology-based and other required controls will not provide for attainment of water quality standards. The TMDLs submitted by Maryland are designed to address acceptable levels of nutrients (nitrogen and phosphorus) and BOD in order to ensure that water quality standards are maintained. These levels of nitrogen, phosphorus, and BOD will provide for the control of eutrophication and algal blooms (measured through a surrogate indicator known as chlorophyll-a) and ensure that the instantaneous water quality criterion of 5.0 mg/L for DO is attained.

MDE developed these TMDLs to address the excessive nutrient enrichment that Lower Wicomico River is currently experiencing. These TMDLs are designed to satisfy the water quality standards and designated uses of Lower Wicomico River for nutrients. Impairments in the remainder of the Nanticoke River watershed are not addressed by these TMDLs. In addition, impairments due to suspended sediments are not addressed by these TMDLs.

In order to address the impairments of Lower Wicomico River from the Section 303(d) list, MDE believes it is necessary to control excessive nutrient input to the system. Nitrogen, phosphorus and BOD are factors which exert influence on not only the concentrations of DO in a waterbody but also biomass (typically characterized as algae or phytoplankton and measured as chlorophyll-a for modeling purposes). Figure 1 (taken from EPA 823-B-97-002, page 2-14) illustrates the interrelationship of major kinetic processes for BOD, DO, and nutrient analysis.

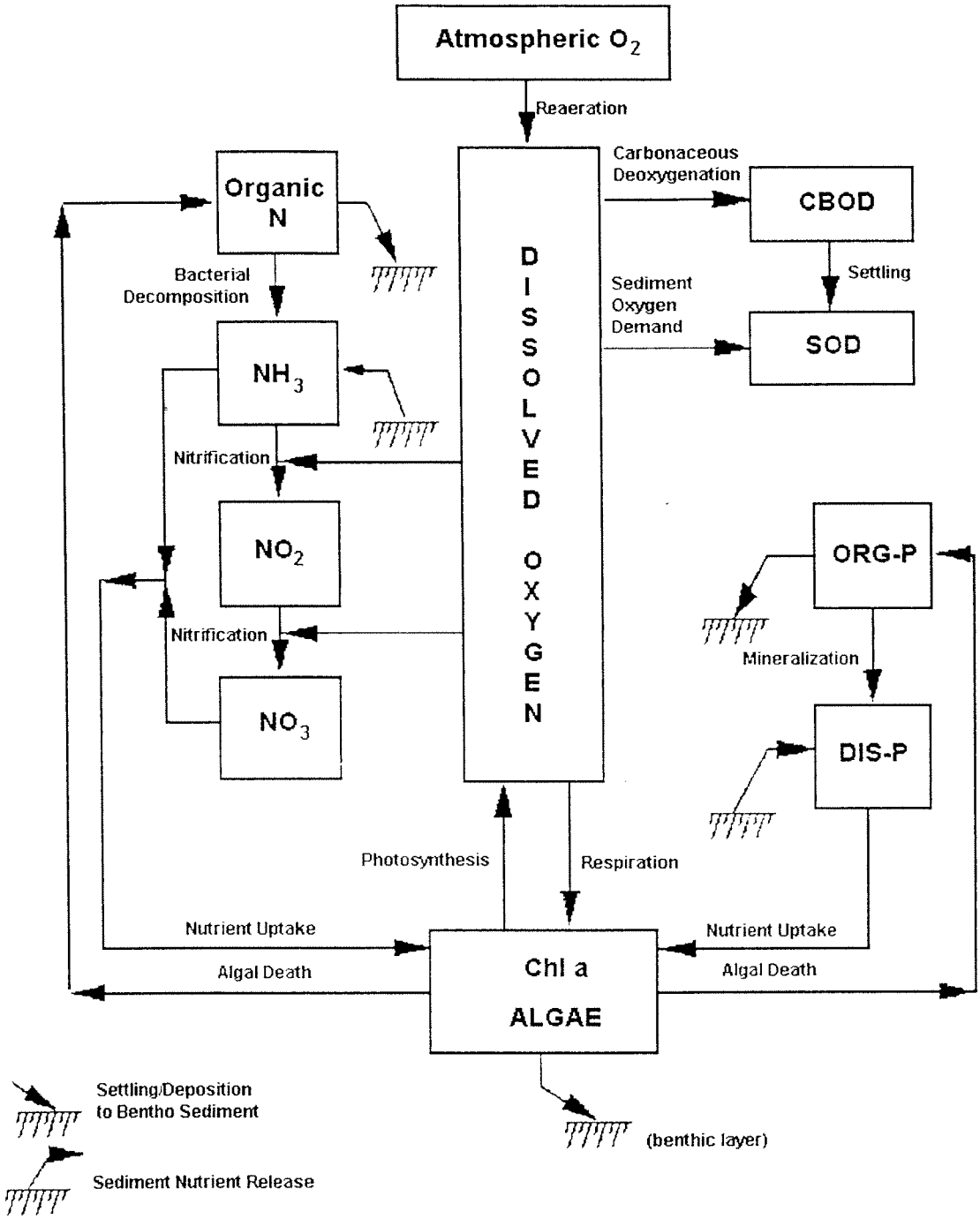

Figure 1

Nutrient enrichment and subsequent algal growth are a concern in rivers and streams because of their effect on DO concentrations. Growing plants provide a net addition of DO to the stream on an average daily basis, yet respiration can cause low DO levels at night that can affect the survival of less tolerant fish species. Also, if environmental conditions cause a die-off of either microscopic or macroscopic plants, the decay of biomass can cause severe oxygen depressions. Therefore, excessive plant growth

can affect a stream's ability to meet both average daily and instantaneous DO standards[5]. In addition, excessive nutrients lead to an overabundance of aquatic plant growth.

MDE uses the WASP5[6] model to evaluate the link between nutrient loadings, algal growth, and DO. This evaluation is based on representing current conditions within the Lower Wicomico River system and determining the necessary reductions in nutrient loadings from various sources to achieve and maintain water quality standards. WASP5 is a general-purpose modeling system for assessing the fate and transport of conventional and toxic pollutants in surface waterbodies (Ambrose, 1987)[7]. The model can be applied in one, two, or three dimensions and includes two sub-models (EUTRO5 and TOXI5) to investigate water quality/eutrophication and toxics impairments. EUTRO5 can simulate the transport and transformation of eight state variables including DO, carbonaceous BOD, phytoplankton carbon and chlorophyll-a, ammonia, nitrate, organic nitrogen, organic phosphorus, and orthophosphate. WASP5 has been previously applied in a number of regulatory and water quality management applications and is an appropriate linkage evaluation tool for the Lower Wicomico River. Based on this analysis, MDE has determined that the levels of nutrient input to the Lower Wicomico River specified by the TMDLs will ensure that water quality standards are achieved by controlling algae blooms and maintaining the DO water quality criterion. See Table 1 for a summary of the allowable loads.

III. Discussion of Regulatory Conditions

The EPA finds that Maryland has provided sufficient information to meet all of the eight basic requirements for establishing nitrogen, phosphorus, and BOD TMDLs for the Lower Wicomico River. EPA therefore approves the TMDLs, Technical Memorandum, and supporting documentation for nitrogen, phosphorus, and BOD in the Lower Wicomico River. 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.

MDE has indicated that algal blooms and low DO concentrations due to excessive nutrient input have caused violations of the water quality standards and designated uses applicable to the Lower Wicomico River. As previously mentioned, the designated use of Lower Wicomico River is Use I. The DO water quality criterion to support this use indicates that DO concentrations may not be less than 5 mg/L at any time. While Maryland does not have numeric water quality criteria for nitrogen and phosphorus, Maryland interprets its General Water Quality Criteria to provide numerical objectives for nitrogen and phosphorus which will support the DO water quality

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[5] Technical guidance Manual for Developing Total Maximum Daily Loads, Book 2: Streams and Rivers, Part 1: Biochemical Oxygen Demand/Dissolved Oxygen and Nutrients/Eutrophication. Section 4.2.1.2. March 1997. EPA 823-B-097-002.

[6] Ambrose, R.B., T.A. Wool, and J.L. Martin. 1993. The water quality simulation program, WASP5 version 5.10. Part A: Model documentation. U.S. EPA, ORD, ERL, Athens, GA.

[7] Compendium of Tools for Watershed Assessment and TMDL Development. May 1997. EPA 841-B-97-006.

criterion as well as a surrogate indicator (chlorophyll-a)[8] to determine acceptable algae levels in the Lower Wicomico River. Chlorophyll-a is desirable as an indicator because algae are either the direct (e.g., nuisance algal blooms) or indirect (e.g., high/low DO and pH and high turbidity) cause of most problems related to excessive nutrient enrichment[9]. The WASP5 model used by Maryland will help to determine those nutrient levels and compliance with the DO criterion and chlorophyll-a levels.

The presence of aquatic plants in a waterbody can have a profound effect on the DO resources and the variability of the DO throughout a day or from day to day[10]. This is due to the photosynthetic and respiration processes of aquatic plants which can cause large diurnal variations in DO that are harmful to fish. Photosynthesis is the process by which plants utilize solar energy to convert simple inorganic nutrients into more complex organic molecules[11]. Due to the need for solar energy, photosynthesis only occurs during daylight hours and is represented by the following simplified equation (proceeds from left to right):

$$\underset{(Carbon\ Dioxide)}{6CO_2} + \underset{(Water)}{6H_2O} \leftrightarrow \underset{(Sugar)}{C_6H_{12}O_6} + \underset{(Oxygen)}{6O_2}$$

In this reaction, photosynthesis is the conversion of carbon dioxide and water into sugar and oxygen such that there is a net gain of DO in the waterbody. Conversely, respiration and decomposition operate the process in reverse and convert sugar and oxygen into carbon dioxide and water resulting in a net loss of DO in the waterbody. Respiration and decomposition occur at all times and are not dependent on solar energy. Waterbodies exhibiting typical diurnal variations of DO experience the daily maximum in mid-afternoon during which photosynthesis is the dominant mechanism and the daily minimum in the predawn hours during which respiration and decomposition have the greatest effect on DO and photosynthesis is not occurring. In order to ensure that the DO concentration of 5 mg/L is met at all times, MDE calculates both the daily average DO concentrations and the minimum diurnal DO concentrations as a result of photosynthesis and respiration of phytoplankton using the WASP5 model.

In addition to the negative effects on DO, an overabundance of aquatic plant growth adversely impacts the aesthetic and recreational uses of a waterbody by decreasing water clarity and forming unsightly floating algae blooms which also hinder navigation. MDE utilizes

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[8] Chlorophyll-a is typically used as a measure of algal biomass in natural waters because most algae have chlorophyll as the primary pigment for carbon fixation (EPA 823-B-97-002).

[9] Supra, footnote 3

[10] Principles of Surface Water Quality Modeling and Control. Robert V. Thomann., and J.A. Mueller. 1987. Page 283.

[11] Surface Water-Quality Modeling. Steven C. Chapra. 1997. Page 347.

chlorophyll-a, a surrogate indicator for algal biomass[12], to evaluate the link between nutrient loadings and aquatic plant levels necessary to support the designated uses of Lower Wicomico River. Again, using their General Water Quality Criteria, MDE establishes a numeric chlorophyll-a goal of 50 µg/L. This level is based on the goals/strategies recommended by the Algal Bloom Expert Panel to prevent the occurrence of algal blooms similar to those experienced in the Potomac Estuary in 1983[13]. Specifically, the panel believed that nuisance conditions from algal blooms occurred when chlorophyll-a concentrations exceeded 100 µg/l. Similar to the nutrient-DO evaluation, MDE uses the WASP5 model to determine acceptable levels of loadings of nutrients to achieve a chlorophyll-a concentration of 50 µg/l.

EPA finds that the TMDLs for nitrogen, phosphorus, and BOD will ensure that the designated use and water quality criteria for the Lower Wicomico River are 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 excessive algal growth in the Lower Wicomico River 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 is susceptible to algal blooms and low DO concentrations. In order to control the algal activity and its impacts on water quality, particularly with respect to DO levels, Maryland has established individual TMDLs for nitrogen, phosphorus, and BOD that are applicable from May 1 through October 31. Maryland presented these as monthly 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 average annual TMDLs are being established to protect water quality in the Lower Wicomico River and loading limits on average annual loads contribute to water quality problems observed in the low flow critical season. The average annual TMDLs were presented by Maryland as yearly loads.

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

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[12] Biomass is defined as the amount, or weight, of a species, or group of biological organisms, within a specific volume or area of an ecosystem (EPA 823-B-97-002).

[13] Thomann, R.V., N.J. Jaworski, S.W. Nixon, H.W. Paerl, and J. Taft. March 14, 1985. Algal Bloom Expert Panel. The 1983 Algal Bloom in the Potomac Estuary. Prepared for the Potomac Strategy State/EPA Management Committee.

nonpoint sources set forth below and in the Technical Memorandum provided with the TMDLs, the TMDLs for nitrogen, phosphorus, and BOD for Lower Wicomico River are consistent with Section 130.2(i). Pursuant to 40 CFR 130.6 and 130.7(d)(2), these TMDLs and the Technical Memorandum and supporting documentation, should be incorporated into Maryland's current water quality management plan. See Table 1 for a summary of the allowable loads.

Waste Load Allocations

EPA regulations require that an approvable TMDL include individual wasteload allocations for each point source. Maryland's TMDL report for the Lower Wicomico River did not include an individual waste load allocation for each of the two point sources (Fruitland WWTP -NPDES permit # MD0052990 and Salisbury WWTP -NPDES permit # MD0021571) for nitrogen, phosphorus, and BOD. However, the Technical Memorandum did provide wasteload allocation scenarios, which are presented in Tables 2 and 3.

Table 2 - Summary of low-flow WLAs for Nitrogen, Phosphorus, and BOD

Facility	NPDES permit #	Parameter	Current permit Loading[1] (lbs/month)	WLA (lbs/month)	Reduction needed (%)
Fruitland WWTP[2]	MD0052990	Nitrogen	4,565	2,002	56
		Phosphorus	507	500	1
		BOD	12,681	7,506	41
Salisbury WWTP[3]	MD0021571	Nitrogen	63,644	14,036	78
		Phosphorus	5,167	5,104	1
		BOD	129,350	61,249	53

[1] The current point source loadings assume maximum approved water and sewer plan flow and appropriate parameter concentrations expected to occur at that flow. For Fruitland WWTP, the current loading was based on design flow of 1.0 mgd, a nitrogen concentration of 18 mg/L, a phosphorus concentration of 2.0 mg/L, and a BOD_5 concentration of 30 mg/L. For Salisbury WWTP, the current loading was based on design flow of 10.2 mgd, a nitrogen concentration of 25 mg/L, a phosphorus concentration of 2.0 mg/L, and a BOD_5 concentration of 30 mg/L.

[2] WLA loading based on a design flow of 1.0 mgd and a nitrogen concentration of 8.0 mg/L, a phosphorus concentration of 2.0 mg/L, and a BOD_5 concentration of 30 mg/L.

[3] WLA based on a design flow of 10.2 mgd and a nitrogen concentration of 5.5 mg/L, a phosphorus concentration of 2.0 mg/L, and a BOD_5 concentration of 24 mg/L.

Table 3 - Summary of average annual flow WLAs for Nitrogen and Phosphorus

Facility	NPDES permit #	Parameter	Current permit Loading[1] (lbs/year)	WLA (lbs/year)	Reduction needed (%)
Fruitland WWTP[2]	MD0052990	Nitrogen	54,780	36,530	33
		Phosphorus	6,079	6,090	----
Salisbury WWTP[3]	MD0021571	Nitrogen	763,725	372,600	51
		Phosphorus	62,000	62,100	-----

[1] The current point source loadings assume maximum approved water and sewer plan flow and appropriate parameter concentrations expected to occur at that flow. For Fruitland WWTP, the current loading was based on design flow of 1.0 mgd, a nitrogen concentration of 18 mg/L and a phosphorus concentration of 2.0 mg/L. For Salisbury WWTP, the current loading was based on design flow of 10.2 mgd, a nitrogen concentration of 25 mg/L and a phosphorus concentration of 2.0 mg/L.

[2] WLA loading based on a design flow of 1.0 mgd and a nitrogen concentration of 12.0 mg/L and a phosphorus concentration of 2.0 mg/L.

[3] WLA based on a design flow of 10.2 mgd, a nitrogen concentration of 12 mg/L and a phosphorus concentration of 2.0 mg/L.

The point source loads used to represent the expected current conditions assumed maximum approved water and sewer plan flows. The wasteload allocations of the TMDLs represent point source loads which will provide compliance with the pertinent water quality standards. The low-flow monthly wasteload allocation values are most applicable from May 1 to October 31. The average annual and low-flow TMDL analyses were accomplished using nonpoint source loads which are based on 1998 field survey data from the Lower Wicomico River.

It is necessary to distinguish between current permitted loading, the wasteload allocation determined through the TMDL process, and actual loading. Current permitted loading refers to the allowable loading as designated by NPDES permit for each facility prior to the TMDL process. The wasteload allocation 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 may need to be revised in order to reflect findings from the TMDL process.

Load Allocations

Maryland provided adequate land use and loading data in the TMDL report, but did not distribute the total load allocation to specific land use categories in the TMDL report. Maryland included a gross load allocation for the low-flow and average-flow TMDLs. These gross load allocations were presented in Table 1. 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. Wherever possible natural and nonpoint source loads should be distinguished. MDE uses the Chesapeake Bay Program model Phase IV loading coefficients (Year 2000 scenario) which are land use specific and include natural background contributions, atmospheric deposition (to land and/or water), and baseflow contributions.

As noted above, Maryland did not provide a breakdown of the load allocations in the TMDL report; however, such a breakdown for average annual flow was provided in the Technical Memorandum. The TMDLs are based on nitrogen and phosphorus loading from the four land uses/sources within the watershed. The average annual allocations are represented as estimated year 2000 loads, accounting for the TMDLs previously developed for Johnson Pond, Tony Tank Lake, and Wicomico Creek. The specific load allocations for the TMDLs during average flow are presented in Tables 4 and 5.

Table 4 - Summary of Load Allocations for Nitrogen (average flow)

Land Use Category	% Land Use	Watershed Area (acres)	% Nonpoint source current load	Nonpoint source current load (lbs/yr)	% Nonpoint source TMDL load	Nonpoint source TMDL load (lbs/yr)	% reduction needed
Mixed Agriculture	21.4	23,819	34.7	302,316	34.7	288,600	5
Forest/other Herbaceous	54.6	60,792	25.3	220,421	25.3	210,260	5
Urban	21.1	23,464	36.7	319,741	36.7	305,350	5
Atmospheric Deposition[1]	2.9	3,260	3.4	29,622	3.4	28,250	5
Total	100	111,335	100	872,099	100	832,460	-----

[1] The atmospheric deposition load is attributable to deposition only to surface water, atmospheric deposition to land surfaces is included in the loads attributed to mixed agriculture, forest and other herbaceous, and urban land uses.

Table 5 - Summary of Load Allocations for Phosphorus (average flow)

Land Use Category	% Land Use	Watershed Area (acres)	% Nonpoint source current load	Nonpoint source current load (lbs/yr)	% nonpoint source TMDL load	Nonpoint source TMDL load (lbs/yr)	% reduction needed
Mixed Agriculture	21.4	23,819	56.2	26,847	56.2	19,020	29
Forest/other Herbaceous	54.6	60,792	15.3	7,309	15.3	5,170	29
Urban	21.1	23,464	24.7	11,799	24.7	8,360	29
Atmospheric Deposition[1]	2.9	3,260	3.8	1,815	3.8	1,300	28
Total	100	111,335	100	47,770	100	33,850	-----

[1] The atmospheric deposition load is attributable to deposition only to surface water, atmospheric deposition to land surfaces is included in the loads attributed mixed agriculture, forest and other herbaceous, and urban land uses.

A breakdown by land use cannot be determined for nonpoint source loads during low flow. These nonpoint source loads, which were based on observed concentrations, account for "natural" and human-induced components. Table 6 presents the gross load allocations for low flow.

Table 6 - Summary of low-flow load allocations for Nitrogen, Phosphorus, and BOD

Parameter	"Existing"[1] Nonpoint Source Load (lbs/month)	LA (lbs/month)	Reduction needed (%)
Nitrogen	8,226	6,535	21
Phosphorus	188	152	19
BOD	14,475	10,808	25

[1] Based on1998 observed field data. Reflects what is considered as current conditions.

Allocations Scenarios

EPA realizes that the above breakouts of the total loads for nitrogen, phosphorus, and BOD to the point sources and nonpoint sources is one allocation scenario. As implementation of the established TMDLs proceed, Maryland may find that other combinations of point and nonpoint source allocations are more feasible and/or cost effective. However, any subsequent changes 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.

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 EPA. EPA 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 Lower Wicomico River, any deviation from the wasteload allocations set forth in the Technical Memorandum 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, EPA 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 and the Technical Memorandum for Nitrogen, Phosphorus, and BOD for Lower Wicomico River 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, including the Technical Memorandum, 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 TMDL analysis, Maryland used 1998 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.

In terms of the high-flow TMDL analysis, Chesapeake Bay Model Phase IV loading coefficients (Year 2000 scenario) were used which effectively consider natural background, loads from septic tanks, as well as baseflow contributions.

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 Lower Wicomico River 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.[14] 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.

Based on the 1998 field data and current knowledge regarding eutrophication, Maryland identified the months of July, August, and September as the critical period. The specific conditions that describe this critical period are reduced flows in the stream (low-flow), higher concentrations of nutrients, and warmer water temperatures. These conditions combine to create favorable conditions for algal growth and wide fluctuations in DO concentrations which lead to violations of the designated uses and water quality criteria of the Lower Wicomico River. Furthermore, the data showed that chlorophyll-a levels were of concern and DO concentrations are violating the water quality criteria. The low-flow TMDL analysis using the WASP5 model adequately considers those critical conditions.

MDE also recognizes that increased nonpoint source loads of nutrients during precipitation events could adversely affect water quality, thus a critical condition itself, despite the fact that the 1998 field data shows that chlorophyll-a levels and DO concentrations were not of concern for the months of February and March.

5) *The TMDLs consider seasonal environmental variations.*

Seasonal variations 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 seasonally low flow

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[14] EPA Memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Water Management Division Directors, August 9, 1999.

typically occurs during the warmer summer and early fall drought periods[15]. Consistent with EPA's discussion regarding critical conditions, the WASP5 model and TMDL analysis will effectively consider seasonal environmental variations.

6) *The TMDLs include a margin of safety.*

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. Margins of safety may be implicit, built into the modeling process, or explicit, taken as a percentage of the wasteload allocation, load allocations, or TMDL.

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

In addition, MDE uses certain conservative assumptions which are implicitly included in the modeling 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.

7) *The TMDLs have been subject to public participation.*

The TMDLs of nitrogen, phosphorus, and BOD to the Lower Wicomico River were open for public comment from November 3, 2000 through December 4, 2000. Only one set of written comments was received by MDE. This was provided along with MDE's response document with the TMDL report.

EPA submitted a copy of these TMDLs to the United States Fish and Wildlife Service (USFWS) on November 13, 2000 and to the United States National Marine Fisheries Service (USNMFS) on November 13, 2000. The EPA did not receive a response from the USFWS or USNMFS on the proposed TMDLs.

EPA delayed action on the final TMDLs in order to allow the City of Salisbury additional time to provide comments on the TMDLs. Salisbury approached the Region requesting a extension to the 30 day period for EPA action on a final TMDL in order to pursue remaining technical issues with the state. Because the issues were significant in terms of potential impacts on the Salisbury wastewater treatment facility, EPA felt it was appropriate to accept the short delay.

During the delay in agency action on these TMDLs, Maryland and the City of Salisbury met on several occasions to discuss the city's issues. These issues were clarified in a letter to the state dated April 5, 2001. The first meeting was held on April 27, 2001. The second meeting was held on May 15, 2001, with the City, Maryland Department of the Environment and the Office of

[15] Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2, Part 1, Section 2.3.3, (EPA 823-B-97-002, 1997).

the Governor. Maryland provided the city opportunity to discuss their technical concerns and to provide documentation to support these concerns. Following the second meeting, Maryland reviewed the information in-house as well as through an outside technical expert. It was concluded by Maryland, and documented in a letter dated May 17, 2001 to EPA, that the original approach used by Maryland is a more appropriate method for establishing TMDLs for the Lower Wicomico River. Therefore, Maryland requested that EPA approve the TMDLs as originally submitted.

The City of Salisbury is undertaking dye studies in the river during the summer of 2001. Maryland has indicated that this information may be used to verify the assumptions the state used with respect to the river's dispersion coefficient, the major concern of the City. If it is found that, based on this new dye study, the coefficients should be adjusted, Maryland has the option of re-visiting the TMDLs at that time.

8) *There is a reasonable assurance that the TMDL 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. Furthermore, EPA has authority to object to issuance of an NPDES permit that is inconsistent with wasteload allocations established for that point source.

Nonpoint source controls to achieve load allocations can be implemented through a number of existing programs, including EPA's Clean Water Action Plan and Maryland's Water Quality Improvement Act of 1998, and the State's Chesapeake Bay Agreement's Tributaries Strategies for Nutrient Reduction.

MDE believes that agricultural ditching, direct loading from animals, and deposition of nutrient-laden sediment from high-flow events are potential nonpoint sources that negatively impact water quality during critical low-flow periods. MDE believes that nonpoint source control mechanisms are necessary to improve water quality during low-flow periods. MDE states that controlling these nonpoint sources will ensure that water quality standards during low-flow periods will be achieved.

In addition, there will be follow-up monitoring within five years as part of Maryland's Watershed Cycling Strategy. This follow-up monitoring will allow Maryland and EPA to determine whether these TMDLs have been implemented successfully.

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]	751	525.8	214.3	10.7
	Phosphorus (lbs/day)[4]	189	183.7	5.0	0.3
	BOD (lbs/day)[4]	2,626	2,254.3	354.4	17.7
Average-flow (Nov. 1 - April 30)	Nitrogen (lbs/day)	3,408	1,120.9	2,280.7	6.7
	Phosphorus (lbs/day)	283	186.8	92.7	3.9

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