UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029
12/19/2005

Dr. Richard Eskin, Ph. D., Director
Technical and Regulatory Services Administration
Maryland Department of the Environment
1800 Washington Boulevard, Suite 540
Baltimore, MD 21230

Dear Dr. Eskin:

The U. S. Environmental Protection Agency (EPA) Region III is pleased to approve the Total Maximum Daily Load (TMDL) Report for nitrogen, phosphorus, and biochemical oxygen demand (BOD) for Breton Bay, St. Mary's County, Maryland. The TMDL Report was submitted to EPA for review and approval on June 15, 2005. The TMDL was developed and submitted in accordance with Section 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. Breton Bay (basin number 02-14-01-04) was first identified on Maryland's 1996 Section 303(d) list for nutrients, suspended sediments, and biological impairments. The TMDLs described in this document were developed to address localized water quality impairments identified within the watershed, specifically nutrient and BOD stressors in Breton Bay. The suspended sediment and biological impairments in the Breton Bay Watershed will be addressed by Maryland in a separate document.

In accordance with Federal regulations at 40 CFR §130.7, a TMDL must comply with the following requirements: (1) 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 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), (7) consider reasonable assurance that the TMDL can be met, and (8) be subject to public participation. The enclosure to this letter describes how the nitrogen, phosphorus, and BOD TMDLs for the Breton Bay watershed satisfy each of these requirements.

Following the approval of this TMDL, Maryland shall incorporate the TMDL into the Water Quality Management Plan pursuant to 40 CFR § 130.7(d)(2). 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 contact Mr. Thomas Henry, TMDL Program Manager, at (215) 814-5752.

Sincerely,

Signed

Jon M. Capacasa, Director
Water Protection Division

Enclosure

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

Decision Rationale

Total Maximum Daily Loads for Breton Bay for Nitrogen, Phosphorus, and Biochemical Oxygen Demand

In St. Mary's County, Maryland

Signed

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Jon M. Capacasa, Director
Water Protection Division

Date: *12/19/2005*

Decision Rationale

Total Maximum Daily Loads of Nitrogen, Phosphorus, and Biochemical Oxygen Demand for Breton Bay, St. Mary's 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 (MOS), that may be discharged to a water quality-limited water body.

This document sets forth the U. S. Environmental Protection Agency's (EPA) rationale for approving the TMDLs for nitrogen, phosphorus, and biochemical oxygen demand (BOD) in the Breton Bay watershed during low flow (growing season) conditions (May–October) and average annual flow conditions. The TMDL was established to address impairments of water quality, caused by nutrients as identified in Maryland's 1996 Section 303(d) list. The Maryland Department of the Environment (MDE), submitted the *Total Maximum Daily Loads of Nitrogen, Phosphorous, and Biochemical Oxygen Demand (BOD) for Breton Bay in St. Mary's County, Maryland*, dated June 2005, to EPA for final review on June 15, 2005. Breton Bay (basin number 02-14-01-04) was first identified on Maryland's 1996 Section 303(d) list for nutrients, suspended sediments, and evidence of biological impacts. The TMDLs described in this document were developed to address localized water quality impairments identified within the watershed, specifically nutrient and BOD stressors in Breton Bay. The suspended sediment and biological impairments will be addressed at a later date by MDE in a separate TMDL document.

EPA's rationale is based on the TMDL, Technical Memorandums, and other information provided in the submittal document. EPA'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 (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.
8) There is reasonable assurance that the TMDLs can be met.

The Technical Memorandum, *Significant Nutrient Nonpoint Sources in the Breton Bay Watershed*, submitted by the MDE, specifically allocates nitrogen and phosphorus to each of three separate land use/source categories including mixed agriculture, forest and other herbaceous land, and atmospheric deposition. Each land use or source is allocated some percentage of the total allowed nutrient load originating from nonpoint sources. Nonpoint

sources were given a gross allocation for BOD. Current nonpoint source load estimates were based on the Chesapeake Bay Model loading coefficients and Chesapeake Bay Program nutrient loading rates assuming Best Management Practice implementation at levels consistent with the current progress of Maryland's Tributary Strategy to account for atmospheric deposition, agriculture, and forestland. Each land use LA represents yearly allowable loads of nitrogen, phosphorous, and BOD. BOD allocations include loads allocated for urban stormwater.

The Technical Memorandum, *Nutrient Point Sources in the Breton Bay Watershed*, submitted by MDE specifically allocates nitrogen, phosphorus, and BOD to sources permitted under the National Pollutant Discharge Elimination System (NPDES) in the watershed. This includes waste water treatment plants and municipal separate stormwater discharges. There is one wastewater treatment plant (WWTP), the Leonardtown WWTP, contributing nutrient loads to Breton Bay. WLAs to this municipal point source were based on its approved water and sewage plan discharge flow. Municipal stormwater discharge is under the jurisdiction of St. Mary's County. Annual WLAs have been made for these stormwater discharges based on the 2002 Maryland Office of Planning land use data and nutrient loading coefficients from the Chesapeake Bay Model. The stormwater nutrient loads account for contributions from urban land. Sufficient data are not available to assign WLAs to the stormwater discharges during the growing season due to the difficulty in separating the source of origin. The BOD allocation for average annual flow for urban stormwater is inclusive with other nonpoint sources and described in the technical memorandum for nonpoint sources.

Tables 1 and 2 present the summary of TMDLs as determined by MDE for the low flow (growing season) and average annual conditions, respectively.

Table 1- BOD, Nitrogen and Phosphorus TMDLs Summary for Low Flow (Growing Season), May 1 through October 31

Parameter	Rate	TMDL	Waste Load Allocation[1]	Load Allocation	Margin of Safety[2]
BOD	lbs/growing season	11,838	10,206	1,548	84
Nitrogen	lbs/growing season	4,746	4,086	630	30
Phosphorus	lbs/growing season	342	306	30	6

1. Point source growing season allocation is designated for Leonardtown WWTP only.
2. 5% of loads from all non-WWTP sources (including urban stormwater, agriculture, and air deposition).

Table 2 - BOD, Nitrogen, and Phosphorous TMDLs Summary for Average Annual Flow, November 1 through April 30

Parameter	Rate	TMDL	Waste Load Allocation	Load Allocation	Margin of Safety
BOD *	lbs/year	244,219	31,050	202,520	10,649 ##
Nitrogen	lbs/year	187,195	62,580 **	119,902	4,713 #
Phosphorus	lbs/year	11,627	4,019 **	7,265	343 #

* Due to the difficulty of source separation, the BOD allocation for urban stormwater in average annual TMDL is included in the nonpoint source allocation.
** The urban stormwater nitrogen and phosphorus allocation for average annual TMDL is included in point source allocation.
# 5% of annual agriculture load.
5% of loads from all non-WWTP sources.

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 EPA for approval.

II. Summary

From this point forward, some references in this decision rationale are found in the TMDL Report, *Total Maximum Daily Loads of Nitrogen, Phosphorus, Biochemical Oxygen Demand (BOD) for Breton Bay in St. Mary's County, Maryland*.

The Breton Bay Watershed[1] encompasses over 55 square miles of land on Maryland's coastal plain between the Potomac and Patuxent Rivers. Breton Bay is 6.5 miles long and drains 35,418 acres. Figure 1 of the TMDL Report shows the location of Breton Bay. Figures 2 and 3 of the TMDL Report show the land uses in the Breton Bay Watershed. The land uses in the watershed consist of forest and other herbaceous vegetation (19,899 acres or 56%), mixed agriculture (8,293 acres or 23%), urban (6,600 acres or 19%) and water (626 acres or 2%)[2]. The estimated baseline annual nutrient loadings for Breton Bay Watershed are 266,317 lbs for total nitrogen and 19,866 lbs for total phosphorus.

[1] The Breton Bay watershed is located within St. Mary's County, Maryland and is part of the Lower Potomac Tributary Strategy Basin.

[2] This information is based on 2002 Maryland Department of Planning land cover data.

The pollutants of concern for the Breton Bay TMDLs are the amount of BOD and nutrients entering the system that results in the low dissolved oxygen (DO) and high chlorophyll-*a* concentrations observed in Breton Bay during the growing season. The Leonardtown WWTP, discharges into Town Run, a tributary of Breton Bay about 5.0 miles from the mouth. The facility has a NPDES permit to discharge 0.68 million gallons per day (MGD) treated domestic wastewater into the Breton Bay Watershed, with effluent quality limits of 30 milligrams per liter (mg/L) BOD_5, 2 mg/L total phosphorus, 8 mg/L total nitrogen, and 5 mg/L DO. The Leonardtown WWTP is the only significant point source in the Breton Bay Watershed.

In response to the requirements of Section 303(d) of the CWA, MDE listed Breton Bay on the 1996 Section 303(d) list of impaired waterbodies under basin number 02-14-01-04 as impaired by nutrients due to signs of eutrophication (expressed as high chlorophyll–*a* levels), suspended sediments, and evidence of impacts to biological communities. Eutrophication is the over-enrichment of aquatic systems by excessive inputs of nutrients (nitrogen and phosphorus) and BOD. The nutrients act like fertilizer leading to excessive growth of aquatic plants, which eventually die and decompose, leading to bacterial consumption of DO and DO concentrations below what is necessary to support the designated use. MDE developed these TMDLs to address the excessive nutrient enrichment that the Breton Bay is currently experiencing. This TMDL is designed to satisfy the water quality standards and designated uses of Breton Bay only for nutrients. The suspended sediments and biological impairments will be addressed by MDE at a later date.

In order to address the impairments of Breton Bay 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.

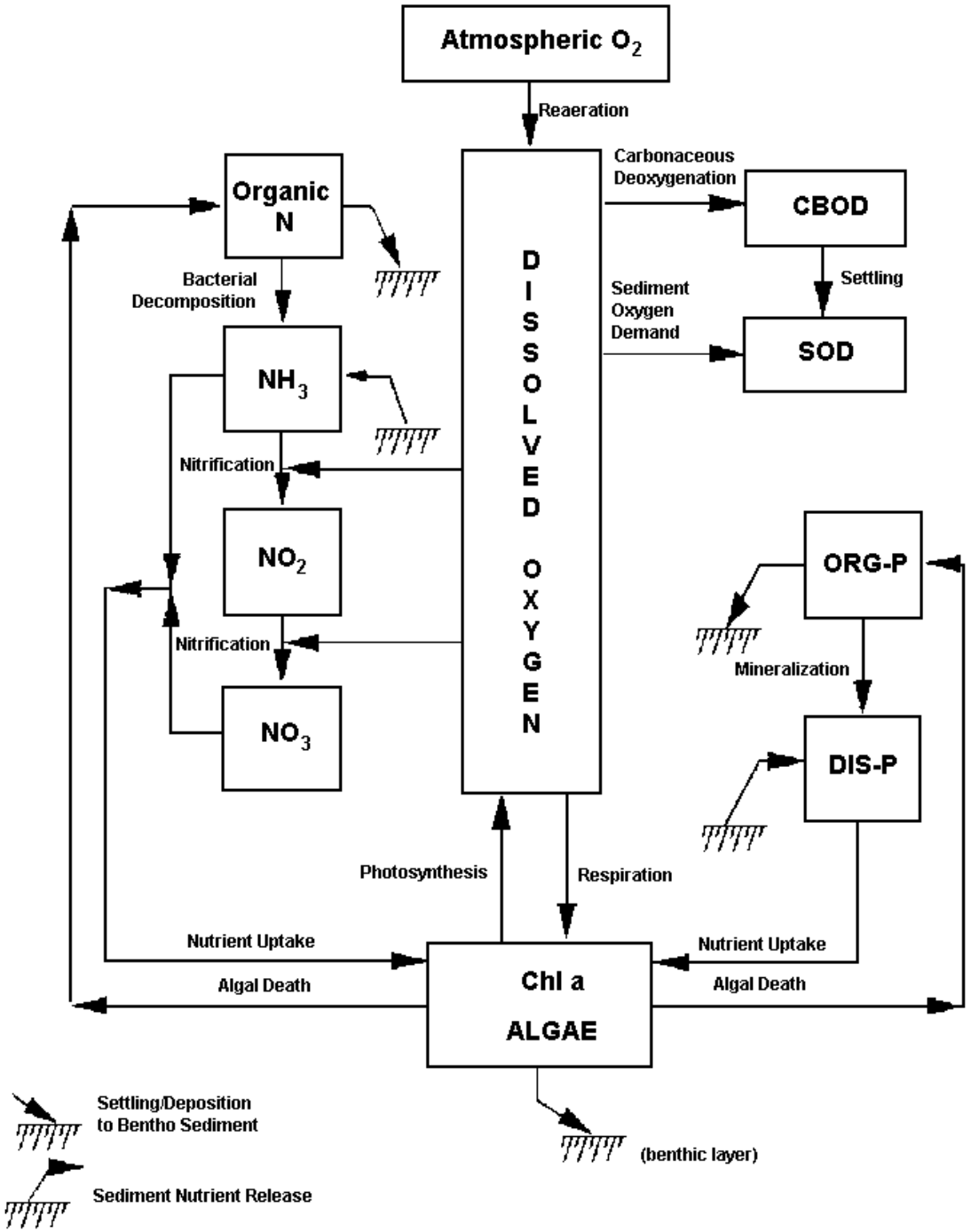

Figure 1. Illustration of the interrelationship of major kinetic processes for BOD, DO, and nutrient analysis.

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[3]. In addition, excessive nutrients lead to an overabundance of aquatic plant growth.

MDE uses the Water Quality Analysis Simulation Program version 5.1 (WASP 5.1)[4] model to evaluate the link between nutrient loadings, algal growth, and DO. This water quality simulation program provides a generalized framework for modeling contaminant fate and transport in surface waters and is based on the finite-segment approach (Di Toro *et al.,* 1983). WASP5.1 is supported and distributed by U.S. EPA's Center for Exposure Assessment Modeling in Athens, Georgia (Ambrose *et al.*, 1993).

The model analysis is based on representing current conditions within Breton Bay and determining the necessary reductions in nutrient loadings from various sources to achieve and maintain water quality standards. WASP 5.1 is a general-purpose modeling system for assessing the fate and transport of conventional and toxic pollutants in surface waterbodies (Ambrose, 1987)[5]. 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 toxic 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.

The WASP 5.1 model was implemented in a steady-state mode. This mode of using WASP 5.1 simulates constant flow, and average water body volume over the tidal cycle. The tidal mixing is accounted for using dispersion coefficients, which quantify the exchange of conservative substances between WASP 5.1 model segments. The model simulates an equilibrium state of the water body, which in this case, considered low flow and average annual flow conditions, described in more detail below.

WASP5.1 has been previously applied in a number of regulatory and water quality management applications and is an appropriate linkage evaluation tool for Breton Bay. Based on this analysis, MDE has determined that the levels of nutrient input to Breton Bay specified by the

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[3] 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.

[4] 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.

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

TMDLs will ensure that water quality standards are achieved by controlling algae blooms and maintaining the DO water quality criterion. See Tables 1 and 2 of this Decision Rationale for a summary of the allowable loads.

The spatial domain of the Breton Bay model extends from the mouth of Breton Bay for about 6.3 miles towards the confluence of McIntosh Run. Seven WASP 5.1 model segments represent this modeling domain. Concentrations of relevant water quality parameters, observed in 2001, serve as the model's upstream and downstream boundaries. A diagram of the WASP 5.1 model segmentation is presented in Figure 8 of the TMDL Report.

III. Discussion of Regulatory Conditions

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 Breton Bay watershed. EPA therefore approves the TMDLs, Technical Memorandums, and supporting documentation for nitrogen, phosphorus, and BOD in the Breton Bay Watershed. 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 due to excessive nutrient input have caused violations of the water quality standards and designated uses applicable to Breton Bay. The designated use of Breton Bay is Use II – shellfish harvesting waters. The DO water quality criterion to support this use indicates that DO concentrations may not be less than 5.0 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 criterion as well as a surrogate indicator (chlorophyll-*a*)[6] to determine acceptable algae levels in Breton Bay. 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[7]. The WASP 5.1 model used by Maryland was used 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[8]. 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

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[6] 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).

[7] Supra, footnote 3

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

solar energy to convert simple inorganic nutrients into more complex organic molecules[9]. 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):

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

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 minimum DO concentrations 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 WASP 5.1 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 chlorophyll-*a*, a surrogate indicator for algal biomass[10], to evaluate the link between nutrient loadings and aquatic plant levels necessary to support the designated uses of Breton Bay. Again, using their General Water Quality Criteria, MDE established 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[11]. 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 WASP 5.1 model to determine acceptable levels of loadings of nutrients to achieve a maximum chlorophyll-*a* concentration of 50 µg/L.

EPA finds that the TMDLs for phosphorus, nitrogen, and BOD will ensure that the designated use and water quality criteria for the Breton Bay are met and maintained.

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

[10] 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).

[11] 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.

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 Breton Bay 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 low flow (growing season) 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 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 Breton Bay since loading limits on average annual loads contribute to water quality problems observed in the low flow critical season (growing season). The average annual TMDLs were presented by Maryland as yearly loads.

Maryland also presented daily average TMDLs. On average, the low flow (growing season) TMDLs will result in loads of approximately 26 lbs/day of nitrogen, 2 lbs/day of phosphorus and 66 lbs/day of BOD. The average annual flow TMDLs will result in loads of approximately 513 lbs/day of nitrogen, 32 lbs/day of phosphorus and 669 lbs/day of BOD.

EPA's regulations at 40 CFR § 130.2(i), define "total maximum daily loads (TMDLs)" as the "sum of individual WLAs for point sources and LAs 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 and in the Technical Memorandums provided with the TMDLs, the TMDLs for nitrogen, phosphorus, and BOD are consistent with 40 CFR § 130.2(i). Pursuant to 40 CFR § 130.6 and § 130.7(d)(2), these TMDLs, the Technical Memorandums, and supporting documentation, should be incorporated into Maryland's current water quality management plan. Tables 1 and 2 of this decision rationale present the summary of allowable loads.

Waste Load Allocations

EPA regulations require that an approved TMDL include individual waste load allocations for each point source. The Leonardtown WWTP is the only point source in the Breton Bay Watershed. The facility is permitted through NPDES to discharge a maximum flow of 0.68 MGD treated domestic wastewater into Town Run, a tributary of Breton Bay, with effluent quality limits of 30 mg/L BOD_5, 2 mg/L total phosphorus, assumed 8 mg/L total nitrogen and 5 mg/L DO. Point source baseline loads were based on the current WWTP maximum permitted loads.

For the low flow (growing season) condition, allocations have been made to the Leonardtown WWTP based on its maximum permitted discharge flow and 4 mg/L nitrogen, 0.3 mg/L phosphorus and 15 mg/L BOD_5 in the effluent. For the average annual flow condition, Leonardtown WWTP will maintain its effluent at the level of 6 mg/L nitrogen (excluding the growing season period), 0.3 mg/L phosphorus and 15 mg/L BOD_5. Point source allocation is described further in the technical memorandum entitled "*Nutrient Point Sources in the Breton Bay Watershed"* and Appendix A.

Municipal stormwater discharge is under the jurisdiction of St. Mary's County. Annual WLAs have been made for these stormwater discharges based on the 2002 Maryland Office of Planning land use data and nutrient loading coefficients from the Chesapeake Bay Model. The stormwater nutrient loads account for contributions from urban land and are assigned a WLA (see 40 CFR § 130.2). The stormwater allocation is represented as a gross allotment due to the limitation of available data. A total reduction of 30% from baseline nitrogen and phosphorus is assigned to urban stormwater loads for annual average flow conditions. The Technical Memorandum, *Significant Nutrient Point Sources in the Breton Bay Watershed*, submitted by MDE specifically allocates nitrogen and phosphorus to urban lands that will be included in a future NPDES permit for the watershed. Sufficient data are not available to assign WLAs to the stormwater discharges during the growing season. Due to the difficulty in separating the source of origin, the BOD allocation for average annual flow for urban stormwater is inclusive with other nonpoint sources and described in the technical memorandum for nonpoint sources.

Load Allocations

Maryland provided adequate land use and loading data in the TMDL Report, but did not distribute the total LA to specific land use categories in the TMDL Report. Maryland included a gross LA for the low-flow (growing season) and average-flow TMDLs. According to Federal regulations at 40 CFR § 130.2(g), LAs 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.

For the low flow (growing season) and annual average flow conditions, the tributary loads of nitrogen, phosphorus and BOD allocations for all non-WWTP sources (including agriculture, air deposition and forest as nonpoint source loads and urban stormwater runoffs classified as point source load) represent 30% reductions from the baseline scenario. The baseline scenario loads were calculated through observed nutrient concentrations from the Breton Bay water quality survey conducted during the growing seasons of 2001 and 2002. These loads, based on observed concentrations, account for both "natural" and human-induced components. The Technical Memorandum, *Significant Nutrient Nonpoint Sources in the Breton Bay Watershed*, submitted by the MDE, specifically allocates nitrogen and phosphorus to each of three separate land use/source categories (atmospheric deposition of nitrogen or phosphorus to the water surface is included in the loads attributed to mixed agriculture, forest and other herbaceous, and urban land uses).

Allocations Scenarios

EPA realizes that the above breakout of the total loads for nitrogen, phosphorus, and BOD to specific land uses is one allocation scenario for low flow (growing season) and annual average flow conditions. As implementation of the established TMDLs proceed or more detailed information becomes available, Maryland may find other combinations of land use allocations that are more 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.

Based on the foregoing, EPA has determined that the TMDL and the Technical Memorandums for nitrogen, phosphorus, and BOD for Breton Bay are consistent with the regulations and requirements of 40 CFR § 130. Pursuant to 40 CFR § 130.6 and § 130.7(d)(2), these TMDLs and the supporting documentation, including the Technical Memorandums, 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 field data for the year 2001 to 2002 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 stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of Breton Bay 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.[12] 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 2001 to 2002 field data and current knowledge regarding eutrophication,

[12] 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.

Maryland identified the period of May 1 through October 31 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 Breton Bay. 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 WASP 5.1 model adequately considers those critical conditions.

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 observed low flow conditions. Calibration of the model for the low flow regime establishes an analysis tool that may be used to assess a range of scenarios with differing flow, BOD, and nutrient loading conditions. Observed water quality data collected during 2001 to 2002, was used to support the calibration process, as explained in Appendix A of the TMDL Report.

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 typically occurs during the warmer summer and early fall drought periods[13]. Consistent with our discussion regarding critical conditions, the WASP 5.1 model and TMDL analysis effectively consider seasonal environmental variations.

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 water bodies. The MOS is intended to account for such uncertainties in a manner that is conservative from the standpoint of environmental protection. A MOS may be implicit, built into the modeling process, or explicit, taken as a percentage of the WLA, LA, or TMDL.

Maryland has adopted a MOS for these TMDLs by using both a more conservative approach in the modeling process as well as a reserved portion from loading capacity. For instance, the average monthly flow from Leonardtown WWTP is 0.41 MGD, around 60 % of the

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

design flow (0.68 MGD) utilized in baseline and scenario simulations in the WASP 5.1 model for Breton Bay. In addition, safety factors are also built into the TMDL development process. In the absence of other factors, a generally acceptable range of peak chlorophyll *a* concentrations is between 50 and 100 μg/l. For the present TMDLs, MDE has elected to use the more conservative peak concentrations of 50 μg/l. In addition, MDE also includes an additional explicit MOS allocation of 5% from all non-WWTP allocations in the low flow (growing season) condition (including urban stormwater, agriculture forest and air deposition) and 5% of agriculture allocation in average annual condition to address the uncertainty of the modeling process. Tables 1 and 2 of this decision rationale include the explicit MOS incorporated into the low flow (growing season) and average annual TMDLs.

7) The TMDLs have been subject to public participation.

The TMDLs of nitrogen, phosphorus, and BOD for the Breton Bay were open for public comment from March 23, 2005 through April 21, 2005. Only one set of written comments were received by MDE. This was provided with MDE's response document for the TMDL report.

8) There is a reasonable assurance that the TMDL can be met.

EPA requires that there be a reasonable assurance that the TMDL can be implemented. MDE has stated that the implementation of nutrient controls will be executed through the Enhanced Nutrient Removal (ENR) strategy and NPDES permits. The ENR strategy builds upon the Biological Nutrient Removal program already in place. It provides cost-share grant funds to local governments to retrofit or upgrade waste water treatment plants to remove a greater portion of nutrients from the discharge. The NPDES permits for the Leonardtown WWTP will include nutrient goals that have been established, and upon completion of the upgrade, the permitee shall make a best effort to meet the load goals.

Nonpoint source controls to achieve LAs can be implemented through a number of existing programs, including Maryland's Clean Water Action Plan and Water Quality Improvement Act of 1998, and the State's Chesapeake Bay Agreement's Tributaries Strategies for Nutrient Reduction. Additionally, Maryland's Water Quality Improvement Act, requires that a comprehensive and enforceable nutrient management plan be developed, approved and implemented for all agricultural lands throughout Maryland.

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.