UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029
11/15/2006

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) is pleased to approve the Total Maximum Daily Load (TMDL) for nitrogen and phosphorus in the Upper and Middle Chester River Watershed, Kent and Queen Anne's Counties, Maryland. The TMDL Report was received from the Maryland Department of the Environment (MDE) by EPA on April 13, 2006 for review and approval. This TMDL was established 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. The Upper Chester River (02-13-05-10) was first identified on Maryland's 1996 Section 303(d) list of water quality-limited segments as impaired by nutrients and sediments with listings of bacteria and biological impacts, suspended sediments and methylmercury. The Middle Chester River (02-13-05-09) was first identified on Maryland's 1996 Section 303(d) list of water quality-limited segments as impaired by bacteria and biological impacts, suspended sediments and PCBs. The bacteria, biological, sediment, methylmercury, and PCB impairments will be addressed by MDE at a future date.

In accordance with Federal regulations at 40 CFR §130.7, a TMDL must comply with the following requirements: (1) be designed to attain and maintain the applicable water quality standards, (2) include a total allowable loading and as appropriate, wasteload allocations (WLAs) for point sources and load allocations 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 in-stream 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 and phosphorus TMDLs for the Upper and Middle Chester River watersheds satisfies 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 do not hesitate to contact Mr. Thomas Henry at (215) 814-5752.

Sincerely,

Signed

Jon M. Capacasa, Director
Water Protection Division

Enclosure

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

4/4/07
Errata: 1. The average annual TMDL applies for the whole year and the daily loads for nitrogen and phosphorus are as shown in the April 4, 2007, errata to the Decision Rationale.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029
4/4/2007

Decision Rationale
Total Maximum Daily Loads for Upper and Middle Chester Rivers for Nitrogen and Phosphorus in Kent and Queen Anne's Counties, Maryland

Signed

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Jon M. Capacasa, Director
Water Protection Division

Date: ___11/15/2006_____

4/4/07

Errata: 1. The average annual TMDL applies for the whole year and the daily loads for nitrogen and phosphorus are as shown in the tables below.

Table 1 presents a summary of the TMDLs as determined by MDE.

Table 1 - Summary of Phosphorus and Nitrogen TMDLs for the Upper Chester River					
Flow Regime Period	Parameter	TMDL	WLA[1]	LA[2]	MOS[3]
Growing Season (May 1 -October 31)	Nitrogen (lbs/day)	1341	65	1219	57
	Phosphorus (lbs/day)	47	7	37	2
Average Annual[**]	Nitrogen (lbs/day)	1684	73	1538	73
	Phosphorus (lbs/day)	94	10	80	4

Table 2 - Summary of Phosphorus and Nitrogen TMDLs for the Middle Chester River					
Flow Regime Period	Parameter	TMDL	WLA[1]	LA[2]	MOS[3]
Growing Season (May 1 -October 31)	Nitrogen (lbs/day)	631	105	503	24
	Phosphorus (lbs/day)	27	12	14	1
Average Annual[**]	Nitrogen (lbs/day)	755	130	596	29
	Phosphorus (lbs/day)	46	17	28	1

[1] WLA = Waste Load Allocation

[2] LA = Load Allocation

[3] MOS = Margin of Safety

2. There are incorrect references to MDE's instantaneous dissolved oxygen (DO) standards:

a. They occur in Section II (p. 3) and Section III (p. 4 and 5) of the decision rationale document.

b. The references to instantaneous DO concentrations/standards should be compatible with Table 3, p. 16 of the TMDL document.

3. In Section II (3rd paragraph on p. 4) of the decision rationale, it notes that 1997 was chosen as the modeling year "since it was the only year which was representative of the average annual flow and loads." More accurately, it was chosen primarily because the Tributary Strategies scenario (Version 6) used as the TMDL scenario was available only until the end of 1997;

4. Section III (1) of the decision rationale, p. 6, top paragraph:

a. Regarding the 'nuisance' status of algal blooms evidenced by [chl*a*] exceeding a threshold, language should indicate that instantaneous concentrations and at all times and a 30-day rolling averages of 100 µg/l and 50 µg/l, respectively were determined per Thomann and Mueller (1987), not the Algal Bloom Expert Panel.

4. Section III (6) of the decision rationale. P. 9, regarding Margin of Safety:

a. The decision rationale incorrectly states that the explicit MOS is "5% of the urban stormwater load." It should read, "5% of the agricultural load."

b. EPA mentions conservative assumptions serving as additional implicit MOS; MDE does not invoke an implicit MOS in the TMDL document.

[**] The average annual TMDL applies for the whole year not the time period (November 1 – April 30) specified in the previous decision rationale document. As a result, the daily loads for Nitrogen and Phosphorus are revised.

[**] The average annual TMDL applies for the whole year not the time period (November 1 – April 30) specified in the previous decision rationale document. As a result, the daily loads for Nitrogen and Phosphorus are revised.

Decision Rationale

Total Maximum Daily Loads for Upper and Middle Chester Rivers for Nitrogen and Phosphorus in Kent and Queen Anne's Counties, MD

I. Introduction

This document will set forth the Environmental Protection Agency's (EPA) rationale for approving the Total Maximum Daily Loads (TMDLs) of Nitrogen and Phosphorus to the Upper and Middle Chester Rivers during low flow conditions (May – October) and average annual flow conditions, submitted for final Agency review and approval on April 13, 2006. The EPA's rationale is based on the TMDL, Technical Memoranda, and other information provided in the submittal document to determine if the TMDL meets the following 8 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 Nonpoint Sources in the Upper and Middle Chester River Watershed*, submitted by the Maryland Department of the Environment (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). Each land use or source is allocated some percentage of the total allowed nutrient load originating from nonpoint sources. The load allocations to each land use also consider natural background. Land use load allocations represent either yearly or growing season allowable loads of nitrogen and phosphorus.

The Technical Memorandum, *Significant Nutrient Point Sources in the Upper and Middle Chester River Watershed*, submitted by MDE specifically allocates nitrogen and phosphorus to sources permitted under the National Pollutant Discharge Elimination System (NPDES) and to urban land use loads in the watershed. This includes waste water treatment plants and stormwater discharges from each county. Allocations to the point sources were based on its permitted flow, while the allocations to the stormwater discharges were based on the Hydrological Simulation Program Fortran (HSPF) model of the watershed for 1997. The stormwater nutrient loads account for contributions from urban land.

Table 1 presents a summary of the TMDLs as determined by MDE.

Table 1 - Summary of Phosphorus and Nitrogen TMDLs for the Upper Chester River					
Flow Regime Period	Parameter	TMDL	WLA[1]	LA[2]	MOS[3]
Growing Season (May 1 -October 31)	Nitrogen (lbs/day)	1341	65	1219	57
	Phosphorus (lbs/day)	47	7	37	2
Average Annual (November 1 – April 30)	Nitrogen (lbs/day)	3396	146	3103	146
	Phosphorus (lbs/day)	190	21	161	8

Table 2 - Summary of Phosphorus and Nitrogen TMDLs for the Middle Chester River					
Flow Regime Period	Parameter	TMDL	WLA[1]	LA[2]	MOS[3]
Growing Season (May 1 -October 31)	Nitrogen (lbs/day)	631	105	503	24
	Phosphorus (lbs/day)	27	12	14	1
Average Annual (November 1 – April 30)	Nitrogen (lbs/day)	1522	263	1201	58
	Phosphorus (lbs/day)	92	34	56	3

[1] WLA = Waste Load Allocation
[2] LA = Load Allocation
[3] MOS = Margin of Safety

From this point forward, all references in this approval rationale are found in Maryland's TMDL Report, *Total Maximum Daily Loads of Nitrogen and Phosphorus for the Upper and Middle Chester River Kent and Queen Anne's Counties, Maryland*.

II. Summary

In response to the requirements of Section 303(d) of the Clean Water Act (CWA), MDE listed the Upper and Middle Chester Rivers on the 1996 § 303(d) list of impaired waterbodies as impaired by nutrients due to signs of eutrophication in the form excessive algae levels. The TMDLs submitted by Maryland are designed to address acceptable levels of nitrogen and phosphorus, and a minimum concentration of Dissolved Oxygen of 5.0 mg/L. These levels of nitrogen and phosphorus will provide for the control of eutrophication and algae 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.

The Upper Chester River was also identified on the § 303(d) list as being impaired by bacteria (fecal coliform), impact to biological communities, suspended sediments, and methylmercury. The Middle Chester River was identified on the § 303(d) list as being impaired by bacteria (fecal coliform), impact to biological communities, suspended sediments, and PCBs. The impairments due to these contaminants will be addressed in separate analyses by MDE.

The TMDLs for nitrogen and phosphorus were developed using a time-variable, three-dimensional water quality eutrophication model package that includes a water quality model, Corps of Engineers Water Quality-Integrated Compartment Model (CE-QUAL-ICM) as the analysis tool to link the nutrients source loadings to the DO criteria and the chlorophyll-*a* goal, and the hydrodynamic model, Curvilinear Hydrodynamic in Three Dimensions (CH3D). This evaluation is based on representing current conditions within the Upper and Middle Chester River systems and determining the necessary reductions in nutrient loadings from various sources to achieve and maintain water quality standards.

The water quality model was calibrated to reproduce observed water quality characteristics for 1997-1999 conditions. The model calibration establishes an analysis tool that may be used to assess a range of scenarios for differing flow and nutrient loading conditions. Observed conditions in the streams in 1997 were used to determine the baseline condition scenario. The single year (1997) was chosen rather than the 3-year span (1997-1999) since it was the only year which was representative of the average annual flow and loads. The urban-stormwater concentrations and the nonpoint source nutrient concentrations for the calibration and baseline scenarios were estimated from the HSPF model of the Chester River Basin Watershed.

The nitrogen and phosphorus TMDLs are presented as growing seasonal loads in pounds per growing season because they were developed to meet TMDL endpoints under a range of conditions observed throughout the year. The average annual nitrogen and phosphorus TMDLs were presented in pounds/year. The seasonal and average annual TMDLs are presented in Tables 1 and 2.

III. Discussion of Regulatory Conditions

EPA finds that Maryland has provided sufficient information to meet all of the 8 basic requirements for establishing nitrogen and phosphorus TMDLs for the Upper and Middle Chester Rivers. EPA therefore approves the TMDLs, Technical Memorandum, and supporting documentation for nitrogen and phosphorus in the Upper and Middle Chester Rivers. 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 the Upper and Middle Chester Rivers. The designated uses of the Upper and Middle Chester Rivers are Use II: Tidal Waters: Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting. 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 criterion as well as a surrogate indicator (chlorophyll-*a*)[1] to determine acceptable algae levels in the Upper and Middle Chester Rivers. Chlorophyll-*a* are 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[2]. The CE-QUAL-ICM model package 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[3]. 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[4]. 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. The targeted DO level of 5 mg/L is specified criteria for Use I waters set forth in COMAR 28.08.02.

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

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[1] 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).

[2] Supra, footnote 3

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

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

utilizes chlorophyll-*a*, a surrogate indicator for algal biomass[5], to evaluate the link between nutrient loadings and aquatic plant levels necessary to support the designated uses of the Upper and Middle Chester Rivers. 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[6]. Specifically, the panel believed that nuisance conditions from algal blooms occurred when chlorophyll-*a* concentrations exceeded 100 µg/L.

EPA believes that the TMDLs for phosphorus and nitrogen will ensure that the designated use and water quality criteria for the Upper and Middle Chester Rivers 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 Upper and Middle Chester Rivers 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 and phosphorus that are applicable from May 1 through October 31. See Section 4.5 for further discussion. The TMDLs and allocations are presented as mass loading rates of pounds per growing season for seasonal loads (May 1 - October 31) and as pounds per year for the average annual load (November 1 – April 30). Expressing TMDLs as seasonal and annual mass loading rates 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 growing season and average annual nitrogen and phosphorus TMDLs are presented in Tables 1 and 2.

Maryland also recognized that nutrients may reach the river in significant amounts during higher flow periods. The average annual flow TMDL analysis investigates critical conditions in dry years and/or very wet years. The year 1997 was chosen to estimate the TMDLs and accounts for seasonality and critical conditions. The TMDLs for nitrogen and phosphorus are presented in Tables 1 and 2.

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[5] 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).

[6] 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.

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 and urban sources and LAs for nonpoint sources set forth below and in the Technical Memorandums provided with the TMDLs, the TMDLs for nitrogen and phosphorus are consistent with § 130.2(i).

Waste Load Allocations

The Upper Chester River Watershed has two permitted point sources, the Millington (MD0020435) Waste Water Treatment Plant (WWTP) and the Sudlersville (MD0020559) WWTP. The Middle Chester River Watershed has four permitted point sources, Worton-Butlertown (MD0060585) WWTP, Kennedyville (MD0052671) WWTP, Chestertown Foods, Inc., (MD0002232) and Chestertown (MD0020010) WWTP. All six permitted facilities were given an allocation. For some of the facilities, allocations changed according to the season and facility discharge volumes.

Stormwater runoff from urban land uses are also assigned a WLA (see CFR § 130.2). The stormwater allocation is represented as a gross allotment due to the limitation of available data and information specific to outfalls. Urban stormwater concentrations for the model calibration and baseline scenario were estimated from the HSPF model using observed data from 1997-1999. The Technical Memorandum, *Nutrient Point Sources in the Upper and Middle Chester River Watersheds*, submitted by MDE specifically allocates nitrogen and phosphorus to sources permitted under the NPDES permit program in the watershed. This includes waste water treatment plants and urban stormwater discharges.

Load Allocations

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. As discussed earlier, the nonpoint source nutrient concentrations for the calibration and baseline scenarios were estimated from the HSPF model of the Upper and Middle Chester Rivers Watershed, using observed data collected from 1997-1999. The Technical Memorandum, *Significant Nutrient Nonpoint Sources in the Upper and Middle Chester River Watersheds*, submitted by the Maryland Department of the Environment (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 and phosphorus to specific land uses is one allocation scenario. 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 Memorandum for Nitrogen and Phosphorus for the Upper and Middle Chester Rivers are consistent with the regulations and requirements of 40 CFR § 130.

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 1997 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.

In terms of the average annual flow TMDL analysis, the HSPF model considers; 1) variability in the precipitation patterns estimated from existing National Oceanic and Atmospheric Administration meterological stations, 2) hydrologic response of land area estimated for a simplified set of landuses in the basin, and 3) agricultural information estimated from the Maryland Department of Planning (MDP) and land use data, the 1997 agricultural census data and the Farm Service Agency (FSA). This effectively considers natural background, loads from septic tanks, as well as base flow 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 the Upper and Middle Chester Rivers 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.[7] Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that result in attaining and maintaining the water quality criterion and have 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 1997-1999 field data and current knowledge regarding eutrophication, Maryland identified the period of May 1 through October 31 as the critical period. The

[7] 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.

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 Upper and Middle Chester 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 CE-QUAL-ICM 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, and so utilized the data from 1997 that included both wet and dry periods. MDE has developed an annual TMDL based on average flow conditions during which the TMDL will be met.

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, seasonal 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[8]. Consistent with our discussion regarding critical conditions, the CE-QUAL-ICM 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 allocation, or TMDL.

For both the low-flow and the average annual flow, the TMDL analysis for both nitrogen and phosphorus, MDE states that it explicitly allocates 5% of the urban stormwater load 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. The high-flow analysis was run under the assumption that summer water temperatures and summer solar radiation would be experienced by the Upper and Middle Chester Rivers. These conditions are unlikely given that high-flow analyses are typically done during winter and spring months of the year.

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

7) The TMDLs have been subject to public participation.

The TMDLs of nitrogen and phosphorus to the Upper and Middle Chester River were open for public comment from February 10, 2006 through March 13, 2006. One set of comments were received by MDE. The comments were provided along with MDE's response document with 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 (BNR) 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 permitted dischargers 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 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. 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.