

Comment Response Document for the Nutrient and Biochemical Oxygen Demand TMDLs for the Manokin River, Somerset County, MD

Introduction

The Maryland Department of the Environment (MDE) has conducted a public review of the proposed Total Maximum Daily Loads (TMDLs) to limit Nutrients and Biochemical Oxygen Demand loadings to the Manokin River. The public comment period was open from March 15, 2000 through April 12, 2000. MDE received four sets of written comments.

Below is a list of commenters, their affiliation, and the date they submitted comments. In the pages that follow, comments are summarized in conjunction with MDE's responses.

List of Commenters

Author	Affiliation	Date
Max Chambers	FLOMAX Enterprise	3/22/00
Earl C. Ludy	Somerset County Sanitary District	4/11/00
Cy Jones	Maryland Association of Municipal Wastewater Agencies	4/12/00
James Stuhltrager, Susan Mack and James Pew	Widener University Environmental and Natural Resources Law Clinic, on behalf of the Sierra Club and the American Littoral Society; Earthjustice Legal Foundation on behalf of the Chesapeake Bay Foundation	4/12/00

Comments and Responses

1. One commenter questioned the use of kinetic coefficients cited from literature values, and the sufficiency of the water quality data used to calibrate the water quality model. One commenter also questioned whether or not filter feeders are accounted for in the TMDL analysis. The commenter's general concern is that if the maximum allowable nutrient loads are set too low, insufficient nutrients will remain to support phytoplankton growth upon which filter feeders depend as a food source.

Response: MDE collected water quality samples throughout the Manokin River system for three high-flow periods and three low-flow periods in 1998. Some parameters, such as sediment nutrient fluxes, sediment oxygen demand, particle settling velocities, and various other kinetic coefficients were not measured during those surveys. Rather, it is a widely

accepted practice to use literature information to determine target values of these parameters and adjust them within ranges found in nature as part of the modeling process. This is consistent with federal guidance that stipulates TMDLs are to be developed using the best readily available data and analytical tools.

The WASP5.1 water quality model used for this analysis does not directly simulate filter feeder interactions. However, WASP5.1 is widely accepted as a sufficient tool for the assessment of eutrophication problems in estuarine systems in the manner used for the present analysis. The issues concerning filter feeders have been considered by MDE, but are beyond the current scope of this analysis. The Department is currently investigating revisions of the State water quality criterion for nutrients, and is considering this issue within that context. The commenter is invited to participate in that process.

2. One commenter questioned the description of the term “eutrophication” (excess nutrient enrichment) provided by the Department, in which excess algae blooms are cited as an indication of excess nutrient enrichment. The commenter cites cases in which zebra mussels remove algae, but leave nutrient levels very high, as a justification that recurrent seasonal algal blooms do not constitute a valid criterion for determining a system is eutrophic.

Response: While the widely-reported phenomenon involving zebra mussels is true, it does not follow that nuisance algal blooms are not an indication of eutrophic conditions. The science of measuring the trophic status of a waterbody is inexact; however, very credible scientists have developed methods that typically consider nutrient concentrations, chlorophyll *a*, and water clarity in gauging the trophic status (Robert Carlson, 1977 – Carlson Trophic Index; Fred Lee, 1981; Thomann, 1987).

3. One commenter notes that detailed sources of phosphorus are not provided, with specific concern about non-point sources (NPS) of phosphorus due to the geology of the region.

Response: Federal guidance stipulates that TMDLs are to be developed using the best readily available data, provided that data is sufficient to conduct a reasonable assessment. The subject TMDL analyses used both field data and estimated average annual loads from the EPA Chesapeake Bay watershed model. The effects of geological factors are accounted for in both the observed data, and the EPA watershed model. The baseline NPS loads for the low-flow and average annual flow cases are sufficient starting points from which to judge the necessary reductions needed to meet maximum allowable load allocation. (See the response to Comment # 11 regarding sub-allocations of non-point sources).

4. One commenter cites the average annual loads of nitrogen and phosphorus used as estimates of base-line conditions, and asserts that, without knowing the quantity of water involved, the loads by themselves are insufficient to determine the water’s chemical composition (nutrient concentrations).

Response: The TMDL documentation (Appendix A) provides nutrient concentration information for simulated average annual flow conditions, for both the base-line scenario, and

the maximum allowable load scenario. These data are provided for each segment of the model. In addition, observed nutrient data for high flow conditions are documented.

5. One comment addressed the water quality characterization, questioning the validity of quantitative chlorophyll *a* goals based on observations in the Potomac River estuary (Thomann, 1987). Another questioned whether the chl *a* goal would be used for permitting.

Response: MDE’s long-standing chlorophyll *a* thresholds are well established, and accepted by EPA for use in regulatory decision making. The Thomann studies in the Potomac River are cited by U.S. EPA guidance (1999) on the development of nutrient TMDLs. One of the goals of the Manokin River TMDL is to reduce peak chlorophyll *a* levels to below 50 µg/l. NPDES permits will be developed in a manner consistent with this TMDL endpoint. See also the response to Comment #2, regarding the use of chlorophyll *a* to assess water quality.

6. One commenter asserts that the non-point sources contribute a significant part of the loading, but do not seem to be required to share in the reductions needed to attain the TMDL goal. The commenter suggests that the TMDL allocations place an inordinate burden on the Princess Anne Waste Water Treatment Plant (WWTP) in a manner contrary to an approved sewer plan flow of 1.26 million gallons per day (mgd), which may affect future development in the Manokin watershed.

Response: Significant, equitable non-point source limits are clearly provided for in the TMDL documentation. The commenter's assertion in regard to the State-approved sewer plan flow of 1.26 mgd is correct and is consistent with plans for upgrading the Princess Anne WWTP, a great part of which is being funded by the State. The TMDL and waste load allocations have been adjusted upward as summarized in the following table, which is consistent with future growth expectations. An evaluation of the projected water quality response to these adjustments indicates no change, that is, the maximum chlorophyll *a* remains at 50 µg/l, and the minimum DO remains at 5.0 mg/l. It was also determined that, except for infrequent instances suggested in observed data, phosphorus does not limit algal growth. Present limits on phosphorus will continue to apply in NPDES permits; however, a TMDL for phosphorus is not being quantified at this time.

Summary of Adjustments to the Draft TMDL

	Draft TMDL	Final TMDL	NPS	Draft Point Source	Final Point Source	MOS
	Average Annual TMDL (lb/yr)					
TN	349,780	353,680	301,890	38,830	42,730	9,060
	Low-Flow TMDL (lb/month)					
BOD	4,210	4,420	980	3,180	3,390	50
TN	1,530	1,610	260	1,260	1,340	10

The reason the water quality is not projected to change is because the concentrations of nitrogen and BOD remain constant and there is no place in the waterbody system where the concentrations of these substances build up. The situation is most easily envisioned as a slightly larger river of the same water quality. One potential concern, which has been considered, is the relation of the nitrogen controls to the Chesapeake Bay goals. The limited pertinence of this concern can be placed in perspective in two ways. First, the adjustment of the average annual nitrogen TMDL represents a one-percent change. Second, the seasonal nitrogen concentration limit of 3.0 mg/l, that was assumed in the TMDL analysis for the Princess Anne and Eastern Correctional Institute WWTPs, compares favorably with the typical nitrogen limit of 8.0 mg/l associated with the current Chesapeake Bay Agreement nutrient goals. That is, these WWTPs will be providing more beneficial nitrogen treatment than the norm with regard to Chesapeake Bay goals.

7. Several commenters requested an extension of the comment period.

MDE recognizes the importance of public participation in the development of TMDLs, and goes beyond the minimum regulatory requirements to promote public involvement. In MDE's written materials and oral presentations, staff clearly solicit the proactive participation of anyone who wants to be involved in the technical aspects of the TMDL development process. In the present case, MDE has conducted numerous general briefings on Maryland's Eastern Shore. MDE also conducted a formal data solicitation process during the summer of 1999, which involved direct mailings, and three public meetings. The time-frame for conducting and completing the TMDL analysis for the Manokin River was specifically referenced at all of those meetings. The time-frame was also posted on MDE's TMDL web site, was provided in materials handed out at a meeting last December to which all local governments were invited, and was enclosed in follow-up correspondence for that meeting.

In addition to giving ample advanced notice of the TMDL development schedule, and opportunity for interested stakeholders to engage the process, MDE conducted the required public notice of the draft TMDL. As part of the formal public review process, MDE conducted a direct mailing to interested parties, including the organizations requesting the extension. In view of the substantial public efforts described above, and the willingness of MDE to consider proposing changes to the TMDL based on findings of future independent reviews, MDE has denied the requests to extend the comment period.

8. Several commenters indicate that there are large uncertainties in the analysis. One commenter argues that the uncertainty would suggest the TMDL limits are too tight, and another commenter suggests that the 3% margin of safety (MOS) seems too small to account for the effects of non-point source pollution during low-flow. The later commenter asks that the Department clarify how these values were calculated.

Response: TMDLs are required to include an MOS to account for uncertainties in a manner that is conservative toward protecting the environment. There are no strict guidelines or methodologies provided by the EPA for selecting an MOS, except to suggest that an MOS may be an explicit value held aside, or conservative assumptions built into the analysis. The

margins of safety proposed in this TMDL analysis are based on other TMDLs approved by the EPA, and were adopted in consideration of built-in conservative assumptions of the analysis. The MOSs for the TMDLs were selected with the understanding that the analysis, and MOS, may be revised in the future as better information becomes available. In response to the specific comment about the low-flow case, the explicit MOS was 5% (not 3% as cited by the commenter). The explicit MOS is computed as a percentage of the NPS load allocation, and rounded to a reasonable value.

9. One commenter questions the monthly and yearly limits proposed in the TMDL documentation, saying that failure to propose a *daily* load is inconsistent with the Clean Water Act.

Response: The Code of federal Regulations (40 CFR 130.2(i)) states that “TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure.” No explicit time period is required. EPA acknowledges this in the recent preamble to their proposed TMDL regulations published in the Federal Register, August 23, 1999 (Volume 64, Number 162)] page 46031. Nevertheless, in order to assist the reader in understanding the magnitude of the loads involved, the TMDL value is also shown as an average daily load.

10. One commenter questioned the technical methods used to arrive at an estimate of the annual TMDLs. They question the use of average flows and loads for setting the annual TMDL threshold, arguing that non-point source (NPS) loads are routinely higher during flow events that exceed average flow. They contend that the method underestimates the average annual TMDL.

Response: The Department developed the annual average TMDL using the best readily available data and analytical tool. To that end the Department collected sufficient data to apply the WASP 5.1 model in a steady-state mode. The steady-state model accounts for sediment oxygen demand (SOD) and sediment nutrient fluxes (See response to Comment 12). The nutrient fluxes and SOD reflect the carry-over effects of past large loading events, the remaining loads from those events being washed down stream beyond the spatial domain of the present analysis. During high flow events, the river system is typically well aerated and well flushed such that symptoms of excess nutrient loads are typically not apparent until flows subside. Thus, within the confines of the steady state WASP model, the analysis is designed to address the primary concern of the commenter.

The WASP modeling framework can be used to develop time-variable models of specific waterbodies. To do so requires significantly more water quality data, watershed data and modeling resources than when WASP is used to develop a steady-state model. Given that the TMDL can be refined if the NPS allocation proves insufficient, it is the judgement of the Department that the application of a time-variable model would entail an unacceptable delay of environmental management decisions. This judgement is consistent with a key consensus finding advocated by the TMDL Federal Advisory Committee (FACA), a very diverse stakeholder group that advised EPA on a wide array of TMDL issues (EPA, July 1998). Specifically, the TMDL FACA advised that "In cases of uncertainty, an iterative approach to

TMDL development and implementation will assure progress toward water quality standards attainment." This FACA recommendation is based on the practical recognition that states have limited resources with which to conduct a large number of TMDL analyses within a limited time frame. This is supported in practice by EPA's approval of similar TMDLs based on the same analytical method used for the subject TMDLs.

It is important to note that the critical design elements of the wastewater treatment plants (WWTPs) are driven by results of the low-flow TMDL, rather than the average annual TMDL (i.e., ability to meet minimum concentrations during critical conditions). This is not brought into question by the comment, which concerns the average annual TMDL.

11. Several comments were received regarding the specific allocations of non-point source (NPS) loads and implementation of controls to meet the NPS goals. Specific comments were received about the feasibility of achieving the non-point source reduction goals for the low-flow TMDL, and noted that the section of the report on assurance of implementation made no explicit reference to NPS BOD.

Response: The allocations expressed in a TMDL are intended to serve as an outline of viable means for implementing the TMDL. MDE's rationale for not including a detailed implementation plan within the TMDL documentation is to allow for a separate, thorough process, involving the appropriate stakeholders. MDE considers implementation issues during the TMDL development process, and establishes allocations at a level of detail that meet the intent of the law and meet the expectations of stakeholders to be involved in the future process of conceiving detailed TMDL implementation plans. Thus, rather than risk the appearance of imposing a detailed implementation plan from the top down, during the relatively short time-frame available for conducting the TMDL analysis, the Department's current approach preserves the many future options for implementing the TMDL goals.

In regard to the allocation of the allowable NPS load among individual sources, MDE considers such sub-allocations to be a detailed implementation issue, which is beyond the scope of this TMDL, as discussed above. A technical memorandum, entitled *Significant Nutrient Point Sources and Non-point Sources in the Manokin River Watershed*, describes viable individual allocations to each land use category and is intended to facilitate future stakeholder dialogue on implementation planning.

MDE considers the issue of whether or not it is feasible to achieve the TMDL goals when developing TMDL allocations. MDE is obligated to establish TMDLs, even for extreme cases in which it is not feasible to achieve the stated goals. In such cases, it was envisioned by the people who crafted the federal Clean Water Act that the TMDL analysis would serve to provide feed back information to the process of refining the water quality standards. That is, it was envisioned that the detailed TMDL analysis might determine that a particular water quality goal is infeasible, thereby providing guidance for refining the water quality standards. In the Manokin River, it appears to be feasible to meet standards; however, it is likely to take

many years for the effects of NPS controls to be reflected in changes to the base-flow

(groundwater) concentrations related to the low-flow TMDL.

In regard to the comment about BOD, the same types of NPS controls that affect nutrients can control BOD. It was an oversight on the part of the Department to omit explicit reference to BOD in the section on assurance of implementation. This has been rectified and will be included in the final TMDL documentation.

12. One commenter questioned whether sediment oxygen demand and nutrient fluxes associated with sediments deposited during higher flows are addressed in the analysis.

Response: Although the time-variable deposition of sediments due to changes in stream flow was not simulated explicitly, the steady-state application of the model used for this TMDL analysis did account for bottom sediment chemistry. The roles of bottom sediments, including the effects of prior sedimentation, were addressed in two ways in this TMDL analysis. First, baseline bottom chemistry was estimated on the basis of research literature and knowledge of the characteristics of the subject waterbody, which accounted for previously deposited sediments. Second, an estimation was made of the change in bottom chemistry that occurs as a result of changes in nitrogen concentrations, which affect the concentration of chlorophyll *a* and organic nitrogen and therefore the amount of organic matter settling to the bottom sediments.

To put the Department's choice of using a steady-state model into the proper context, sediment transport and fate processes are rarely simulated for eutrophication problems even when time-variable simulations are conducted. First, the ability to accurately simulate those processes, though improving, is limited. Second, many researchers think that the simulation of those processes for assessing eutrophication does not necessarily improve the analysis results. As an alternative, the simulation of an active sediment layer, which models the evolving sediment chemistry, but not the stream bed sediment movement, is generally the next level of sophistication beyond what was done in the present analysis. This later analytical approach is typically applied in situations where organic matter and nutrients in the bottom sediments accumulate over a long period, and one is interested in assessing the long-term recovery of the system. However, even to conduct this refined analytical approach, which would not simulate stream bed sediment transport, sediment properties must be measured using non-routine methods that would entail significant costs and delay of this and other TMDLs.

Given the questionable benefits of explicitly simulating the stream bed sediment transport in this case, and EPA's approval of this methodology for similar TMDL analyses, the Department elected to conduct the analysis as it did.

13. One commenter noted a number of inconsistencies in the report, specifically with regard to point sources. The main body of the report seems to have an inconsistency in the 1998 baseline point source numbers, in comparison to the TMDL allocations, making it appear that a drastic point source reduction has been made. However, the text of the Appendix A indicates that the point source loads were not reduced. Also, the Westover Goose Creek

WWTP loads appear to be incorrect or to be operating for a limited number of months during the year. Furthermore, the report does not clearly state what the maximum design flows are. In addition, a number of inconsistencies and inaccuracies were noted in the text and data presented. Specifically, English units are interchanged with metric units, NPS load reductions are stated as being a percentage of the "total" load in some places, and a percentage of the "controllable" load in other places.

Response: The commenter is correct in the identification of inconsistencies in the report with regard to point source information. Although the computer model runs for 1998 baseline high flow and low flow conditions were based on the correct point source numbers, incorrect values were reported in Section 2.1 of the draft TMDL documentation. The proper point source loading values for the baseline conditions are 19,270 lbs/yr for total nitrogen. The non-point source loads were stated correctly in the draft document provided for public review. Revision of the point source values have also been reflected in revisions of baseline total average annual nitrogen loads to be 403,790 lbs/yr. (See response to Comment # 6 regarding another refinement with regard to the point source loads, and findings with regard to phosphorus).

The commenter's constructive critique in regard to more clearly pointing out the maximum design flows and concentrations has been noted. These values can be found in the technical memorandum entitled *Significant Nutrient Point and Non-point Sources in the Manokin River Watershed*. Tables 1A-1C provide details of the point source loads used in the low-flow TMDL, which correspond to Scenario 3 in the main document. Table 2A and Table 2B provide details of the point source loads used in the average annual TMDL, which corresponds to Scenario 4 in the main document.

In regard to the Westover Goose Creek WWTP, the discrepancies cited by the commenter were correctly noted. Table 2A and Table 2B in the Technical Memorandum have been updated to reflect the correct values, which were used in the TMDL analysis.

English standard units are used throughout the main document. English units are used in the main document to provide continuity with Maryland's legacy of strong stakeholder involvement in Chesapeake Bay restoration, which have traditionally made use of English units. Metric units are used in Appendix A because all of the input data for the WASP5.1 water quality model are in metric units. Using metric units in Appendix A allows for a more straightforward comparison between the water quality model input and information contained in Appendix A. Footnote 1 on page A2 of Appendix A contains unit conversions to allow for the comparison of numbers in the Main Document to Appendix A.

Non-point source nutrient reductions are correctly identified as reductions to controllable loads in Section 4.3 "Scenario Descriptions" and Section 4.5 "TMDL Allocations." In Section 4.4 "Scenario Results" the draft wording is unclear, and has been refined to reflect the fact that percentages presented in that section are for controllable non-point source nutrient loads.

14. One commenter questions the accuracy of the model calibration and validation plots for tributaries of the Manokin River, and the potential effect on using the model for environmental management decisions. Specifically, the commenter highlights calibration plots associated with tributaries to the Manokin River, and the low-flow conditions.

Response: The primary focus of this modeling effort was to assess the affects of nutrients and BOD on the mainstem of the Manokin River. The model's environmental parameters were set to optimize the simulation accuracy in the mainstem of the Manokin River to support permitting decisions.

The calibration plots for the mainstem of the river are reasonably accurate, and support results that are consistent with regulatory decision-making methods used elsewhere in Maryland. Despite the model's limitations, the TMDL analysis also provides reasonable management results for the tributaries. In the event that future data suggests localized water quality problems in the smaller tributaries persist, the Department is obligated to address those issues and consider refining the TMDL analysis.

Figure 11 and Figure 6 of the main report might have generated some confusion. The results of the low-flow model scenario run (Figure 11) of the main report are intended to reflect extreme conditions for temperature and flow, and are not intended to simulate the 1998 water quality conditions shown in Figure 6. The Department regrets any lack of clarity in the written presentation, which may have led the commenter to compare Figure 11 and Figure 6. The commenter is directed to Figure A12 of Appendix A, which is a calibration plot for low-flow conditions in the mainstem of the Manokin River. As can be seen in Figure A12, the average daily DO values from model adequately matches the observed DO values, except where extremely high values of chlorophyll *a* cause near-saturation levels of DO.

References:

Carlson, Robert E. 1977. A trophic state index for lakes. *Limnology and Oceanography* 22 (2): 361-369.

Lee, G. Fred, R. Anne Jones and Walter Rast. 1981. Alternative approach to trophic state classification for water quality management. Dept. Civil Engineering, Colorado State Univ., Fort Collins. Occ. Paper No. 88. 65 p.

Thomann, Robert V., John A. Mueller *Principles of Surface Water Quality Modeling and Control*, HarperCollins Publisher Inc., New York, 1987.

U.S. Environmental Protection Agency, *Report of the Federal Advisory Committee on the Total Maximum Daily Load (TMDL) Program*, EPA 100-R-98-006, July 1998.

U.S. Environmental Protection Agency, *Protocols for Developing Nutrient TMDLs*, First Edition, EPA 841-B-99-007, November 1999.