Comment Response Document
Regarding the Total Maximum Daily Loads of Phosphorus and Sediment for Triadelphia Reservoir and Total Maximum Daily Loads of Phosphorus for Rocky Gorge Reservoir in Howard, Prince George's, and Montgomery Counties, MD

The Maryland Department of the Environment (MDE) has conducted a public review of the proposed Total Maximum Daily Loads (TMDLs) of Phosphorus and Sediment for Triadelphia Reservoir (Brighton Dam) and TMDLs of Phosphorus for Rocky Gorge Reservoir. The public comment period was open from July 20, 2007 through August 20, 2007. MDE received four sets of written comments.

Below is a list of commentors, their affiliation, the date comments were submitted, and the numbered references to the comments submitted. In the pages that follow, comments are summarized and listed with MDE's response.

List of Commentors

Author	Affiliation	Date	Comment Number
Fariba Kassiri	Montgomery County Department of Environmental Protection	August 17, 2007	1 through 8
Susan Overstreet	Howard County Department of Planning and Zoning	August 17, 2007	9 through 24
Samuel Moki	Prince George's County Department of Environmental Resources	August 20, 2007	25 through 26
Mohammad Habibian	Washington Suburban Sanitary Commission (WSSC)	August 20, 2007	27 through 56

Comments and Responses

1. The commentor states that the Load Allocations should be broken out by jurisdiction for ease in tracking and accounting. The commentor adds that this was done for the Baltimore Reservoirs, and given the similarity in modeling approaches, should be possible for the Patuxent Reservoirs.

   Response: An appendix (Appendix E) has been added to the TMDL report with the requested information in tabular format.

2. The commentor notes that the loads were developed using 1997 data from MDP, adding that there have been changes in land use in the past 10 years, mainly conversion from agricultural cropland to pasture or low density residential. The commentor continues that, based on information presented for the model, sediment inputs would be expected to decrease from these changes. The commentor concludes that MDE should provide estimates of land cover

changes from 1997 to 2007 and a determination of the significance of the amount of these changes and the calculated loads to the reservoirs.

Response: MDE based some of this project on an existing watershed model that was calibrated for the period of 1997. That model used land use data from Maryland Department of Planning (MDP) from 1997. The current model simulates the period of 1997 – 2003; thus, 1997 land use is also appropriate. The model is not attempting to simulate current conditions; rather, the primary purpose is to determine the assimilative capacity of the reservoirs for the applicable impairing substance(s). The answers to this comment are explained in further detail in "Modeling Framework for Simulating Hydrodynamics and Water Quality in the Triadelphia and Rocky Gorge Reservoirs, Patuxent River Basin, Maryland" which was made available throughout the public comment period.

3. The commentor states that MDE did not present any data for impairment of the Triadelphia Reservoir by sediment. Furthermore, no data was presented which indicated that the current sediment rate to the reservoirs has any detrimental effect on aquatic biota or human health. The commentor notes that there is a statement on page 22 [of the draft TMDL document] that "Maryland does not have an explicit standard for sedimentation rates in impoundments." The commentor asserts that MDE needs to provide the connection between rate of sediment accumulation and minimum necessary storage capacity of the Triadelphia Reservoir to maintain function as a drinking water supply as a reasonable goal for the sediment TMDL.

   The commentor references the TMDL document and notes that "the annual average loss in acre-ft/year and percent annual average capacity lost of 0.18% for Triadelphia (Table 6, p. 20) is identified as lower than the average for other impoundments of similar size. The values presented in the 1997 Ocean Surveys report on sedimentation in the Reservoirs indicate similar accumulation rates for both Reservoirs that is 0.18% in Triadelphia and 0.17% in Rocky Gorge. Based on the model parameters, the sediment accumulation rate would be expected to decrease as cropland is converted to pasture and low density residential. On p. 21, there is an assertion that 'Triadelphia Reservoir has experienced excessive sediment loads, resulting in a shortened projected lifespan of the reservoir' but no mention of the 'original' projected lifespan and therefore no way to determine the relationship between the calculated accumulation rate and threat to reservoir capacity."

   Response: As noted in the document, Maryland does not have a numeric standard that could serve as a TMDL endpoint for sediment in reservoirs or non-tidal streams. In the absence of an applicable numerical criterion, and given the nature of the use to be protected, Maryland has adopted a pragmatic approach for developing TMDLs for sediment in reservoirs. This approach entails the development of a methodology for determining a sediment endpoint whenever (1) a phosphorus TMDL is developed for the reservoir and (2) it can be shown that the sediment TMDL endpoint, based on the phosphorus TMDL reduction, results in preserving reservoir capacity comparable to other reservoirs under approved TMDLs. The comparison with other reservoirs is to establish that the sediment TMDL is sufficient to protect the designated uses.

The grounds for placing Triadelphia Reservoir on the 303(d) List because of a sediment impairment are not well documented. Best professional judgment, based on the extent of agriculture in the watershed and/or the fact that it is the uppermost of a pair of reservoirs, was probably the basis of the listing. Given this rationale, and the fact that the sediment reductions (a) demonstrably and significantly extend reservoir capacity, and (b) are wholly compatible with efforts needed to meet the TP reduction for the reservoir, this methodology is an appropriate approach.

Delisting Triadelphia Reservoir would require demonstrating that Triadelphia Reservoir is currently meeting applicable water quality standards for sediment, and the absence of numeric criteria for sediment in reservoirs makes this difficult, if not impossible.

4. The commentor notes that Figures 3 and 4 of the draft TMDL document should note land use as of 1997.

   Response: It is stated throughout the document, including the text introducing the figures, that land use is based on 1997 MDP data.

5. The commentor cites Figures 5-7, noting that the role of internal phosphorus and sediment sources on sediment levels was not discussed. The commentor states that MDE should include an estimate of the phosphorus loads generated from internal sediment and nutrient accumulations and the role these play in affecting water column water quality. The commentor points out that on p. 18 the release of phosphate under anoxic conditions is considered less likely than solid-phase resuspension during storm events. The commentor notes that phosphate can also be released under hypoxic conditions, as noted in the hypolimnion on p. 15. The commentor concludes that while it could be the case that this release is not significant, there is no explanation as to why it is less likely or how much less likely.

   Response: An analysis of available monitoring data for the period 1998 through 2003 strongly suggests that phosphate release from the sediment is not a significant source of phosphorus. Significant phosphate releases are expected to occur only under anoxic conditions, but an examination of the Figures A.19 through A.24 in Appendix A does not show the seasonal pattern in bottom phosphate concentrations apparent in ammonia concentrations, shown in Figures A. 27 through A.32, or nitrate concentrations, shown in Figures A.35 through A.40. Moreover, for sediment release to be the source of the increase in bottom phosphate concentrations, it must be apparent that the increase is not due to an external influx of phosphorus. Generally speaking, increases in bottom phosphate are often accompanied by even greater increases in total phosphorus, which suggests that sediment release may not be the primary source of the increase in phosphate. As Figure A.19 shows, there is a significant increase in phosphate concentrations during the summer of 1998 in Triadelphia Reservoir. This year presents the best evidence for a phosphate release from sediments, but even in this case, the increase in bottom total phosphorus concentrations is 50% greater than the increase in phosphate concentrations, as shown in Figure A.11. Years such as 2001 that show an increasing trend in phosphate concentrations during hypoxia also show increases in phosphate at all depths and also increases in total phosphorus. The W2 models also indicate that inflows to the reservoirs under stratified conditions occur as underflow, so even under relatively dry conditions, summer phosphate concentrations in the bottom of the reservoirs may be influenced by higher inflow phosphate concentrations sometimes characteristic of summer months. It is therefore not possible to analyze the water column bottom phosphate monitoring data and determine the magnitude of the impact of phosphate sediment release and for that reason they were not explicitly simulated. Sediment phosphate releases in Triadelphia and Rocky Gorge Reservoirs are insignificant as a rule and significant only as an exception.

This conclusion, based on water column monitoring data, is buttressed by Cornwell and Owens' (2002) attempts to directly measure the release of phosphate from the sediments in Triadelphia Reservoir, as part of a broader study of exchange of nutrients and dissolved oxygen between the sediments and the water column. They made three attempts to measure phosphate flux rates by incubating sediment cores in the laboratory. In 1999, they were unable to measure phosphate releases from the sediments, either because fluxes were so low or because high water column phosphate concentrations rendered their methods insensitive. During a second attempt in August 2000, low-to-modest fluxes of phosphate (5.6 -7.4 $\mu mol/m^2/hr$) were observed using longer incubation periods. A third set of cores taken from July 2001 also yielded low-to-modest flux rates between 2 -11 $\mu mol/m^2/hr$. Cornwell (2002) concluded that under aerobic conditions phosphorus is tightly bound to the sediments and under aerobic conditions the release of phosphate is modest.

The resuspension of particulate phosphorus is not explicitly simulated in the CE-QUAL-W2 models of the Patuxent Reservoirs. The resuspension of particulate phosphorus from bottom sediments is for the most part a transient phenomenon; most of the resuspended material can be expected to be redeposited, and, even if it is transported out of the reservoir, does not differ in kind from other suspended material. The source of the phosphorus in either case is external phosphorus loads, so the resuspended material does not represent a source of phosphorus distinct from those already accounted for in the TMDL. See also Section 5.4 of the modeling report, *Modeling Framework for Simulating Hydrodynamics and Water Quality in the Triadelphia and Rocky Gorge Reservoir* (ICPRB 2007), available on MDE's web site.

6. The commentor cites Section 2.1.3 of the draft report, stating that the location of the FEMA facility and the Hawlings River should be shown on at least one of the maps. The commentor adds that other permitted facilities, such as the Blue Marsh golf course facility with subsurface discharge and the facility for the GlenElg High School should also be noted.

   Response: The Hawlings River is shown on Figure 8. The location of the FEMA facility has been added to the figure. Subsurface dischargers and other facilities not discharging phosphorus or sediment are not pertinent to the TMDL.

7. The commentor states that for Figures 5 and 6 a paragraph or table is needed to describe each contributing source, including assumed percent imperviousness, and a description of how 'scour' was determined is also needed.

Response: This is discussed in detail in *Modeling Framework for Simulating Hydrodynamics and Water Quality in the Triadelphia and Rocky Gorge Reservoir* (ICPRB 2007), which was made available throughout the public comment period.

8. The commentor cites p. 25 of the draft report, stating that the sentence "[T]he All-Forest Scenario constitutes an estimate of hypolimnetic DO concentrations under natural conditions" should be rephrased, noting that the reservoirs are man-made and consequently represent 'unnatural' conditions in the river system.

   Response: MDE realizes that the determination of a natural condition in an artificial entity is difficult. The term 'natural conditions' is here interpreted as a hypothetical state with anthropogenic influences within the surrounding watershed removed. Furthermore, Maryland's regulations (COMAR 26.08.02.03A(2)) specify that 'natural conditions' are a necessary consideration in the determination of an appropriate concentration of dissolved oxygen, or for that matter any other substance, in many instances. Given the complete lack of any natural lakes in the vicinity, let alone any that are in natural condition, it is impossible to measure natural conditions. In this light, as reflected in Maryland's established policy ("Dissolved Oxygen Standards in Maryland's Thermally Stratified Lakes", MDE 2005) regarding hypolimnetic DO concentrations, it is reasonable to assess natural conditions. In this case, the appropriate and best method of doing so is to run an all-forest modeling scenario.

9. The commentor cites p. 7, Section 2.1.3, pointing out that text should match Table 2: "Table 2 shows…simulation period, 1998-2004" whereas Table 2 actually shows data through 2003.

   Response: The text has been corrected to read "1998-2003."

10. The commentor cites p. 11, Section 2.2.1, noting that Table 3 also shows data through 2004 in the WSSC column for Collection Period, and asking should this be 2003? Also, under "Key water quality constituents" in the WSSC column, "NO23" should be "NO2 and NO3."

    Response: The table has been changed so that the sampling period for WSSC terminates at 11/03. "NO23" is an abbreviation for "nitrite-nitrate-N," which is the only form of nitrite or nitrate that WSSC reported 1998-2003. "NO23" has been added to the list of abbreviations.

11. The commentor cites p. 13, Section 2.2.2, suggesting Figure 10 be included in Appendix A for ease in reference while viewing appendices, and all other figures shown in document should be included in appropriate appendices, as well.

    Response: MDE feels it best to include any particular figure only once, as relevant to the point being made at hand. We feel duplication is not necessary.

12. The commentor cites Figure 10 on p. 14, Section 2.2.2, stating that the horizontal axis should be labeled as "Date of reading/data gathering", "Temp (Deg C)" should be moved next to the color codes above the graph, and "TR-1" should be included in the label of the graph as "Fig 10: Isothermal…Brighton Dam, TR-1, 1998-2003."

Response: The graph's title has been changed to refer to TR1. The commentor makes many good suggestions for improving the contour plots and making the details represented in the figures more readable. Unfortunately, these changes cannot be executed within the software used to produce these plots, and the use of alternative software is costly and would require considerable programming to implement. Contour plots are the standard method for demonstrating temperature stratification and its impact on DO concentrations. The plots are included in the TMDL to document the following three facts that are key to applying MD's DO criteria to reservoirs: (1) the Patuxent Reservoirs are regularly stratified by temperature from spring through summer; (2) the reservoirs overturn in the fall and become well-mixed; and (3) DO concentration gradients follow temperature stratification. The existing contour plots are sufficient to demonstrate the evidence for these propositions. Improved graphs could provide more information more clearly but more detailed information is not necessary to strengthen the argument.

13. On p. 16, Sec. 2.2.3, Fig. 11, the commentor asks can the colors be changed to show a gradual scale, i.e. dark red to light yellow, for ease in identifying each DO level, and further suggests that the color code bar be labeled as "DO", "Temp (deg C)" on the side be removed, and also label graph to include "TR-1."

    Response: See response to #12.

14. Citing p. 18, Sec. 2.2.4, the commentor requests an explanation of the reason for, and significance of, analyzing phosphate.

    Response: Dissolved ortho-phosphate, or dissolved inorganic phosphorus (DIP), is the form in which algae can uptake phosphorus. It is also called "bio-available phosphorus." It provides a measure of how much phosphorus is available to algae.

15. Citing p. 18, Sec. 2.2.5, the commentor asks why, in figures shown in Appendix A (A27-29, etc.), some lines are not connected, and if data is missing, to please explain why.

    Response: There are no monitoring data for locations on those dates at those depths. In particular, it appears that no samples were collected from the middle depths of the reservoirs in the Fall of 1998 and Spring of 1999.

16. On p. 20, first paragraph, Sec. 2.2.7, commentor notes that "the" should be inserted into the following sentence: "None of **the** samples collected by WSSC…had concentrations over 30ug/l." However, the commentor adds, Fig. A54 in Appendix A shows one sample over the 30ug/l at PXT 0860 in mid August 2000 (this peak sample is also shown in Table A3).

    Response: The omission in the referenced sentence has been corrected. While it is true that no sample collected by WSSC in Rocky Gorge Reservoir had Chla concentrations over 30 ug/l, one sample collected by MDE at PXT0860 in August 2000 had a Chla concentration of 31 ug/l. A sentence to this effect has been added to the document.

17. On p. 21, Sec. 2.3, commentor notes that "than" should be inserted into the following sentence: "Use I and Use IV waters….DO criteria of not less **than** 5.0 mg/l…"

    Response: The sentence has been revised accordingly.

18. On p. 25, Sec. 4.3.2, 3rd paragraph, the commentor cites the text: "Figures B5 and B6….The coefficients of determination between observed values are 0.90 and 0.54…" and requests clarification if the maximum is 1.0.

    Response: The maximum is 1.0.

19. On p. 25, Sec. 4.3.2, last paragraph of section, "Appendix C contains…", the commentor asks why these plots are in a different appendix and the next section returns to Appendix B.

    Response: Appendix B contains figures discussed in the main report; Appendix C contains figures not referenced in the main report and not relevant to the main line of the argument.

20. On p.30, Sec. 4.4.2, the commentor notes that SCWQPs and NMPs only address agriculture, which is 57% of the sediment load. Another big source is scour at 38%. Is it assumed that scour can't be addressed as a contributing source?

    Response: No, it is not assumed that scour cannot be addressed**—**a reduction has been applied to scour. Scour may be addressed by riparian vegetation, streambank stabilization, and many other methods. The tools mentioned in the referenced portion of the TMDL are meant to be examples, and not exclusive of other efforts. Further discussion and enumeration of every conceivable mitigation tool is beyond the scope of a TMDL development document, and is best left to be addressed in the context of an implementation plan.

21. Citing p.32, Sec. 4.5.1, Table 7, the commentor requests further explanation of how the TMDL loads were distributed between load sources. Other than the WWTP, the commentor asks, were all sources proportionately reduced? The commentor notes that the Technical Memorandums assign loads by source and jurisdiction, respectively, and asks whether these were also proportionately reduced (by 58 or 48%).

    Response: Reductions are not exclusively proportional, but rather consider the amount of the contributing source, and the controllability of the source. A table outlining the reductions by land use and jurisdiction (Appendix E) has been added to clarify this.

22. Citing p. 33, Sec. 4.6, the commentor asks why Maryland chose to adopt this type of MOS for nutrients and requests a justification of this selection.

    Response: There are no strict guidelines or methodologies provided by the EPA for selecting a MOS, except to suggest that a MOS may be an explicit value held aside or conservative assumptions built into the analysis. The MOS is intended to account for uncertainty in water quality modeling and in uncertainty inherent to natural systems. The explicit MOS for Total Phosphorus incorporated in these TMDLs sufficiently accounts for these uncertainties. The type and amount is consistent with the MOS in other similar TMDLs (e.g., the Loch Raven and Prettyboy Reservoirs TP TMDLs; the Back River Nutrients TMDLs), and represents a reasonable and tested approach for determining a Margin of Safety.

23. Citing p. 35, Sec. 4.7, the commentor asks if all the TMDL load allocations can be separated out by jurisdiction.

    Response: This has been done and included as Appendix E. See also the response to Comment #1.

24. On p. 37, Sec. 5.0, third line of the chart "Develop forest management action plan," the commentor requests changing agency from "TAC" to "MDNR, HC, MC, MNCPPC & WSSC." Also in the seventh line in the chart "Address channel instability…." the commentor requests changing "HSCD" to "HC" in the agency column.

    Response: The commentor's requests have been taken into consideration and the chart (Table 9) has been revised accordingly.

25. The commentor references Figures 5, 6 and 7 in Section 2.1.3, and states that the role internal phosphorus and sediment sources have on nutrient and sediment levels in the reservoirs is not discussed in the report. The commentor recommends that MDE include an estimate of the phosphorus and sediment loads generated by the reservoirs, a function of internal sediment an nutrient accumulations, and the role they can play in recovery or an explanation as to why this relationship may not be relevant.

    Response: Internal sediment dynamics should not represent a net change in volumetric conditions within the reservoir over anything but very short periods of time. See also response to Comment # 5.

26. Citing Section 4.4.2, the commentor states that the study implies, "No single critical period can be defined for the water quality impact of sedimentation." The commentor also cites the statement that "Reduced sediment loading rate would result in a similar reduction in the sediment accumulation rate." The commentor states that, based on this assumption, MDE is predicting that the reduced loading rate would allow the retention of the impoundments volume for forty years, and that these assumptions can compel jurisdictions to conclude that minimal impacts from sedimentation can be expected. However, the commentor recognizes that TMDL limits for sediment must be present in order to correlate total phosphorus reductions, and recommends "that MDE remove the language that causes ambiguity and asserts the need for sediment TMDL limits on the Triadelphia Reservoir."

    Response: MDE sees no ambiguity in the cited statements within the context of the TMDL report. The first statement refers to the cumulative impact of sedimentation and supports the argument for a focus on effective, long-term sediment control. The second statement articulates the assumption that a 58% reduction in phosphorus will likely result in a reduction of approximately 29% in sediment loads, which will allow for retention of 95% of the reservoirs volume after 40 years. On this basis the sediment TMDL for Triadelphia Reservoir was determined. Please also refer to response to Comment #3.

27. The commentor cites *Page 35, Section 5.0 Assurance of Implementation*, and states: Assurance of Implementation of TMDL is its most important element and the key to its success. However, the assumptions of this section related to the implementation aspect seem to be quite optimistic and unrealistic with respect to control of nonpoint sources. This is becoming more so as agencies involved face financial challenges and competing needs. Given this, we believe that the lead agencies responsible for load reduction must be identified. The well-established practice is that pollution prevention and control are the clear responsibility of those causing the pollution. This paradigm provides much needed incentive for pollution avoidance/reduction. Without identifying the responsible parties and their responsibilities, there is no incentive for pollution avoidance and no assurance that any load reduction will be achieved. As such, TMDL will not reach its goal of protecting these precious and vital source waters.

    Response: We agree that an early, and perhaps initial, component of a detailed implementation plan be the identification of responsible parties, followed by determination of specific tasks for these entities to accomplish. However, the present project is the determination of the assimilative capacities of these reservoirs for the impairing substances in question; a required component of the documentation thereof is a section describing a reasonable assurance of implementation; a detailed implementation plan is beyond the scope of the TMDL development documentation. Local governments, utilities and other interested parties are encouraged to avail themselves of the document entitled "Maryland's 2006 TMDL Implementation Guidance for Local Governments."

    While the necessary reductions to meet the TMDL goals are challenging, we do not believe that they are unreasonable or impossible. That said, it again must be reiterated that the primary purpose of the TMDL development process—the task outlined in the present document—is to determine the assimilative capacity of the impairing substances of the water bodies in question, and not necessarily to present a detailed roadmap for implementation.

28. The commentor notes that on p. *vi* of the Executive Summary, the fourth paragraph states that the annual average load is used in the analysis. This is a reasonable basis for very large water bodies such as the Chesapeake Bay. However, the commentor continues, with our reservoirs having only a few months of detention time, use of an annual average load assumption may not be appropriate and may result in underestimation of the seasonal loads and algal growth. We suggest that seasonal loading be considered for future projection scenarios and for identifying necessary reduction of phosphorus loading. Also, phosphorus release from reservoir bottom sediment can add to phosphorus loading during warm seasons and this should be considered in seasonal scenarios.

    Response: While the TMDL in question presents average annual loads as well as daily loads, it is important to point out that the continuous simulation modeling methodology used insures that the eutrophication-related effects of nutrient loading that occur on a seasonal basis are simulated in the model. In other words, storm loads occurring at various times during the year are represented in the watershed model, and reductions to meet the TMDL thus inherently to some degree address this issue. Generally speaking, P loads do not elicit an immediate water quality response, and it has been generally regarded as desirable to address the loads on an annual basis. Regarding sediment phosphorus release, please refer to the response to Comment #5.

29. The commentor notes that the entire period of 1998-2003 data has been used for calibration, and that it seems like the calibrated model is not verified with independent data; i.e., data outside the period for the calibration. Model verification is important for future projection scenarios. The commentor suggests that data which are available for recent years (beyond 2003) be used for model verification, or in the absence of such, that the period of existing data be divided into calibration years and validation years.

    Response: Many modelers do not agree that model calibration should be further tested by verification with an independent data set, as the commentator suggests. In fact Cole and Wells (2003), who developed the version of the CE-QUAL-W2 model used in this project, argue strongly against separating model development into calibration and verification stages, and urge instead that all available data be used in model calibration. They cite, among other reasons, the fact that different algal species can dominate in different years, making it difficult to separate years into calibration and verification data sets. Cole and Wells maintain the purpose of a model is not to predict the future but to determine "what might have occurred if a particular set of boundary forcing functions were to occur…" (Cole and Wells, 2003, p.22) In other words, the primary purpose of the model is to establish the linkage between forcing functions like constituent loads and water quality response, which is precisely the role of models in TMDL development.

30. The commentor, citing *Page 28, Section 4.3.4, 4th Paragraph*, states that the second to last sentence concludes that "low DO concentrations in the bottom layers of the reservoirs are therefore a naturally occurring condition." The commentor continues: "This is a major issue and can undermine the drive for reservoir protection. As such it needs in-depth analysis and careful consideration of facts and data. Although it seems that at least there is some response in this model to external loads (in contrast to the previous [Tetra Tech, 2002] model), it still is not as much as might have been expected. The report attributes the seasonal hypoxia under forested conditions to reservoir morphology and bases this on the results of the modeling and sensitivity analyses. However, we question whether the model represents forested conditions. Figures 5 and 7 on pages 9 and 10 shed more light on our concern. The figures show the contributions of scour to phosphorus and sediment loads for Triadelphia Reservoir as 28% and 38%, respectively. It is reasonable to assume that scour is mainly related to bank erosion and legacy sediments left in the flood plain, and that the scour contribution to loading is reflected in model calibration. Since scour under the fully forested condition is expected to be minimal, the calibrated model with current (i.e., high) scour data will not be a good predictor of the fully forested condition. This observation brings into question the validity of the model findings that low dissolved oxygen conditions will exist even if the watershed had remained fully forested. The report should elaborate on and address this important point."

    Response: Simulated instream scour does not contribute any organic phosphorus or organic material which results in sediment oxygen demand. All of the organic phosphorus (and corresponding allochthonous organic matter) comes from the edge-of-stream (EOS) forest load. See Section 4.4.2 of *Modeling Framework for Simulating Hydrodynamics and Water Quality in the Triadelphia and Rocky Gorge Reservoir* (ICPRB 2007), for a discussion of how the EOS Forest phosphorus loads were determined. Section 7.1 of the report also describes the All-Forest Scenario and gives the phosphorus loads by species under the Calibration, TMDL, and All-Forest Scenarios. For the most part, as the commentator notes, the instream scour of particulate inorganic phosphorus was not significantly reduced in the All-Forest Scenario, but that was because particulate inorganic phosphorus does not contribute to either sediment diagenesis or bioavailable phosphorus, and therefore no adjustment was necessary to determine the response of bottom DO in the reservoirs to the All-Forest Scenario loading rates. Please also see response to Comment #8 for further discussion of the All-Forest Scenario.

31. Citing *Page 29, Sediment TMDL Loading Caps for Triadelphia Reservoir,* the commentor states that the basis for sediment TMDL determination is not clear. "It needs better description and more detailed analysis. It also should consider all negative consequences of reservoir capacity loss from the water supply perspective. For example, sedimentation can result in increased shallow water areas which are more prone to weed and aquatic vegetation growth, accelerating eutrophication and natural organic matter levels in water, and leading to increased treatment costs. Also, the global warming phenomenon is expected to result in more extreme events, including extended dry periods, leading to increased water demand and lower level of stream flow and thus a greater urgency for retaining reservoir storage capacity. Finally," the commentor adds, "one of the most significant points related to sedimentation addressed in our comments below is that a good portion of the sediment load comes from bank and flood plain erosion due to high stormwater flows generated by urban development. This scour load and the effect of development on it must be accounted for properly in both developed and forested conditions to ensure proper simulation results. Omission of this effect may create the perception that replacing agricultural land with urban development may reduce phosphorus loading."

    Response: MDE agrees with the commentor about the localized nature of sedimentation effects, and expects this matter to be taken into consideration during TMDL implementation. Regarding the volumetric retention of the reservoir, we agree that this is an important issue; as has been pointed out, the retention compares favorably on a national basis even before TMDL implementation, and would reasonably be expected to improve significantly thereafter. Sediment sources were estimated as described in the Modeling Report. Also, please see the response to Comment #3.

32. The commentor states that on *Page vii, Executive Summary, top table, t*he value of sediment base load in Triadelphia Reservoir (32,141 tons/year) is highly underestimated. The average actual capacity loss based on numerous surveys over the years (including data cited in Table 6, page 20) is estimated at 40 acre-feet/year. Assuming a sediment density of 1.3, the 40 acre-feet/year is equivalent to a sedimentation rate of more than 70,700 tons/year.

    Response: Sediment load calibration targets were set using the USGS software, ESTIMATOR, and the available monitoring data collected 1998-2001 (or earlier, in the case of the Patuxent River above Unity). This is a standard method for determining sediment loads. Sections 4.4 and 4.5 of *Modeling Framework for Simulating Hydrodynamics and Water Quality in the Triadelphia and Rocky Gorge Reservoirs* (ICPRB 2007), discuss how sediment loads were calibrated in more detail. Section 4.6 compares the sediment inputs used in the TMDL with other estimates based on monitoring data or modeling results. The sediment loads used in the TMDL are comparable or somewhat higher than the other estimates. The commentor's estimate is based on estimates of the reservoir's capacity loss since Brighton Dam was built in 1943. It is likely that there has been a decrease in average sediment loads (and capacity loss) over time, due to land use changes and the adoption of improved erosion control practices. The ESTIMATOR statistical model for sediment in the Patuxent River near Unity, which used data from 1985 through 2001, does show a decreasing trend with time. See Table 4.4-6 in ICPRB (2007). A decreasing trend in sediment loads probably explains the discrepancy between the commentor's load estimate and the TMDL. A decreasing trend in sediment loads (and capacity loss) also implies that the capacity preservation under the TMDL is conservatively estimated.

33. Referring to *Page 20, Section 2.2.8, 2nd Paragraph*, the commentor states that this discussion of sedimentation compares the percent capacity loss of the Triadelphia Reservoir with national average values reported in the literature. The percentage capacity loss is expected to be a function of several parameters including the size of the watershed and the volume of the reservoir. Thus comparison of the capacity loss of a given reservoir with an average level is not appropriate unless the loss is normalized for watershed size, reservoir volume, watershed slope, etc. The commentor concludes that the statement "The annual percent capacity loss…compares favorably with the national averages" thus should be removed from the report.

    Response: The comparison and retention rates as described in the literature are general and included for informational and comparative purposes. As such, we believe they have value, and we will leave them in the document. While we understand the commentor's points concerning the effect of watershed size, slope and other features, volumetric retention *per se* is an appropriate endpoint for a drinking water reservoir, regardless of these features. Please see also response to Comment #3, which discusses this in further detail.

34. Citing *Page 31, Section 4.5.1, Nonpoint Source Loads Paragraph*, the commentor states that the basis for determining the waste load allocation (WLA) for nonpoint and stormwater loads is not clear, nor does it seem that the text explains it either. The commentor asks: "Is it assumed that the percent load reduction will be the same for all sources? Please clarify this. More importantly, have the assumed allocations taken into consideration whether the allocation between non-point and stormwater is reasonable or how one would get to such reductions for each component?"

    Response: See Response to Comment #21. MDE considers the proposed allocations to be appropriate. How reductions in loads will be achieved is not a consideration in the allocation process.

35. The commentor notes that a period should be inserted at the end of the last sentence of the 4th Paragraph on p. *vi* of the Executive Summary.

    Response: The correction has been made.

36. The commentor refers to p. vii of the Executive Summary and states that the purpose of the "bottom table" and how it is developed is not clear.

    Response: An explanation of the development of daily loads is provided in Appendix D to the main report.

37. Citing *Page 1, Introduction, 3rd Paragraph*, the commentor states that although COMAR 26.08.02.08.M (1) (b) refers to "Rocky Gorge Dam" the structure is more properly entitled the "T. Howard Duckett Dam." The waterbody impounded behind the Duckett Dam is the Rocky Gorge Reservoir, which is used elsewhere throughout the report. Distinguishing the name of the dam from the reservoir is consistent with the distinction made for Brighton Dam and Triadelphia Reservoir.

    Response: The referenced text has been clarified and made consistent.

38. Referencing p. 2, Sec. 2.1, the commentor notes that WSSC's water filtration plant is properly entitled "Patuxent Water Filtration Plant" (delete the word "River").

    Response: The text has been revised accordingly.

39. The commentor also notes that in the last sentence of p. 2, Sec. 2.1, use of the term "secondary" reservoir for Triadelphia could be confusing. While we don't draw directly from it, this reservoir is considered as a critical part of our overall storage.

    Response: The words "as a secondary reservoir" have been deleted.

40. Citing *Page 4, Table 1*, the commentor states that use of a single value for "Normal Reservoir Depth" in each reservoir is not meaningful since the bathymetry varies considerably along the length of the reservoirs. The commentor recommends providing a typical range of depths, or replacing the single value with "Normal Reservoir Elevation" which is fixed based on spillway elevation at each dam.

    Response: The standardized terms are used as presented in "Inventory of Maryland Dams and Hydropower Resources" They are included for the purpose of providing comparison to other impoundments in Maryland.

41. The commentor, again referring to Table 1 on p. 4, states that the flow received by the Rocky Gorge Reservoir (from 132 mi^2 drainage area) is expected to be much higher than that of the Triadelphia Reservoir (from 77 mi^2 drainage area). The table shows the corresponding flows as 82.4 and 85.9 ft^3/sec, respectively. The difference between flows and contributing drainage areas needs to be clarified.

Response: The discharges cited are outflows from the respective reservoirs; in the case of Rocky Gorge Reservoir, withdrawals from the impoundment are included.

42. The commentor notes that, on p. 4 of Sec. 2.1.1, the values stated for surface area of Rocky Gorge Reservoir watershed (excluding Triadelphia Reservoir) are not consistent with the values presented in Table 1. Subtracting the Triadelphia value (Table 1) from the total Rocky Gorge data (Table 1) results in a watershed area for Rocky Gorge alone of "approximately 35,000 acres or 55 square miles."

    Response: The rounding error in the text has been changed to be consistent with the accurate values cited in the table.

43. Citing Figs. 2-4 on pp. 5-6, the commentor notes that the land use data for 1997 is cited and, presumably was used for the model calibration and related scenarios. The commentor asks why the available 2002 land use data from Maryland Department of Planning was not used?

    Response: See response to Comment #2.

44. The commentor notes that, on p. 11, Table 3, the key water quality constituents monitored by WSSC should read "NO2, NO3" (not "NO23"), and a note should be added below the table to state "WSSC's ongoing yearly sampling included the simulation period."

    Response: Please see response to comment #10.

45. The commentor notes that on p. 12, Figure 8 includes two unlabeled WSSC monitoring station points on Cattail Creek and Hawlings River. The commentor states that the identity of these monitoring points should be included in the report.

    Response: Unmarked monitoring stations have been removed from the figure.

46. The commentor notes that in Figure 9 on p. 13, the WSSC monitoring station RG2 is located much closer to, and only marginally downstream of, the US Route 29 bridge (also near MDE station PXT0860) than shown on the figure.

    Response: The figure has been corrected.

47. Referring to Fig. 10 on p. 14 and Fig. 11 on p. 16, the commentor states that the time axes on these isothermal contour charts do not appear to be linear; i.e., the intervals between dates are not equal, which leads to distortion of seasonal patterns especially over winter months when no data are available. Perhaps, the commentor suggests, it is more appropriate to cut the axes at the winter months when there are no data, or to separate the blocks of summer months by vertical dividers so that successive annual seasonal patterns can be better distinguished.

    Response: The commentor is correct. Temperature and DO are not measured at regular intervals and are not measured at all during the winter. See response to #12.

48. Citing the first sentence of the 3rd paragraph on p. 25, Sec. 4.3.2, the commentor states that the word "lower" should be replaced with "downstream" wherever referring to sampling locations on the reservoirs. This same revision is proposed for *Page 26, Section 4.3.3, 2nd and 3rd Paragraphs*, and for *Page 27, Section 4.3.4, 2nd Paragraph*.

    Response: The text has been revised accordingly.

49. Citing *Page 25, Section 4.3.2, 3rd Paragraph*, the commentor notes that in the last sentence, the second value of coefficient of determination (R^2), which is for the Rocky Gorge Reservoir simulation, seems relatively low (0.54) and suggests a poor fit. The commentor asks: Is this considered acceptable for use of the model? If not, do the findings need to be qualified?

    Response: The value of the coefficient of determination (R^2) between observed and simulated bottom DO in Triadelphia Reservoir, 0.90, shows that there is an excellent fit between observed and simulated concentrations. The comparable R^2 value for Rocky Gorge, 0.54, is still a good fit. Rocky Gorge simulation of bottom DO underpredicts hypoxia in 2000 and 2002, and does not match the timing of seasonal hypoxia as well as the Triadelphia W2 model, but still generally predicts seasonal trend in bottom DO and the magnitude of low DO concentrations. The timing of decay of sediment organic matter is more difficult to simulate in Rocky Gorge Reservoir because bottom temperatures range more widely in Rocky Gorge than Triadelphia Reservoir, and the decay rate of organic matter is a function of temperature. Since the extent of hypoxia is somewhat underestimated in Rocky Gorge Reservoir under the Calibration Scenario, it is likewise underestimated under the All-Forest Scenario, and therefore, the conclusion that the hypoxia is caused by natural conditions is drawn conservatively.

50. Citing *Page 30, Section 4.4.2, 5th Paragraph*, the commentor asks if the estimated 95% retention of reservoir volume after 40 years (resulting from a reduced loading rate) is based on the current reservoir volume (i.e., not the original volume)?

    Response: The volume referenced is the current volume.

51. The commentor refers to Table 7 on p. 32 and states that it will be very helpful if the TMDL report includes a table of current loading from each jurisdiction and the allocated load for them. This will bring to focus what is needed to be done by each jurisdiction.

    Response: The information as requested by the commentor is provided in Appendix E. Please also see response to Comment #1.

52. Citing the Stormwater Loads paragraph in Sec. 4.5.2, p. 33, the commentor expresses concern that there appears to be resignation that stormwater sediment loads cannot be reduced (granted, the relative amount of loading from this source appears to be quite low). Furthermore, this logic is not clear to the commentor, because if there are no meaningful

sediment load reductions for stormwater BMPs, how is it reasonable that there would be phosphorus load reductions for stormwater since the phosphorus is mostly bound to solids?

Response: The ratio of sediment–to–phosphorus reductions cited in the TMDL document—0.5:1 to 0.7:1—is a general one. MDE chose the lower (more conservative) end of the range. Given the very small contribution of the MS4 load to the overall sediment load, and the uncertainty of applying a quantified ratio to the MS4s, MDE decided not to ascribe a specific, percentage reduction of sediment loading to the MS4 source. In reality, there will very likely be reductions in sediment from stormwater sources. The lack of a quantified reduction reflects, in addition to this uncertainty, a conservative assumption in the TMDL.

53. The commentor asks: What are the guarantees that any of the programs cited [presumably in the Assurance Section] can be counted on for the assumed required control without specific requirements assigned to specific agencies, especially given the limited progress to date with the Chesapeake Bay program and the Patuxent Reservoir Protection Group on this issue?

    Response: Please see response to Comments # 20 and 27. The Assurance of Implementation is intended to be an overview of tools and resources available for the development of an implementation plan.

54. Citing *Page 20, Section 5.0, 3rd Paragraph*, the commentor states that the last sentence presumes that the State is giving high priority for funding and restoration of Category I watersheds. After having just applied for and been denied grants in this Category I watershed, it appears that this presumption may not be realistic.

    Response: It is expected that the establishment of a TMDL for the reservoirs may increase the likelihood of future grants being given to restore these waterways.

55. Citing *Page 36, Section 5.0, 5th Paragraph*, the commentor asks: Is it realistic to expect the reductions from the "maximum extent practicable" stormwater NPDES permits to yield significant reductions for this source (particularly given the previously expressed questions about the effectiveness of stormwater BMPs and since there are no numerical limits yet on these permits to the best of our knowledge)? What is this "maximum practicable" extent and will it achieve the TMDLs for the reservoirs?

    Response: Stormwater loads are relatively small. A maximum practicable reduction of 15% from the baseline is assumed. Please see Appendix E for details.

56. Citing *Page 37, Section 5.0, 7th Paragraph*, the commentor asks: Referring to the five-year watershed cycle strategy, when is the follow-up monitoring for the Patuxent Reservoirs watershed?

    Response: Follow-up monitoring for the Upper Western Shore region of Maryland, which includes the Patuxent drainage basin, is occurring during calendar year 2007. While no sampling for the watershed cycling strategy is to occur in the reservoirs per se, sampling is conducted in tributaries in the watersheds draining to the reservoirs.