Comment Response Document
for the Nitrogen and Phosphorus TMDLs
on the Fairlee Creek
Kent 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 Nitrogen and Phosphorus loadings to the Fairlee Creek. The public comment period was open from December 3, 1998 through January 4, 1999. MDE received one set of written comments. Below is a list of commenters, their affiliation, the date they submitted comments, and the numbered references to the comments they submitted. In the pages that follow, comments are summarized and listed with MDE's response.

List of Commenters

Author	Affiliation	Date	Comment No.
Wendy L. Meyers & Jack Douglas Smith	Eastern Environmental Law Center on behalf of the Sierra Club and the American Littoral Society; and by the Earthjustice Legal Defense Fund on behalf of the Chesapeake Bay Foundation	1/4/99	1, 2, 3, 4, 5, 6, 7

Comments & Responses

1. Maryland's proposed TMDL is based on a series of water quality simulations using EPA's WASP5 contaminant fate and transport model, as described in Appendix A of the proposal; however, the use of this mechanistic-based model for this particular application is inappropriate.

   a) None of the kinetic interactions depicted in Figure A6 are independently verified for Fairlee Creek.

   b) Many of the model functions (light extinction, phytoplankton grazing, sediment-water interactions, etc.) are assumed in this application to be constant when in reality they vary with changes in other model parameters (phytoplankton density, chlorophyll-*a*, dissolved oxygen, etc.).

c) An example of the inappropriateness of Maryland's use of this model can be found in Maryland's attempt at its calibration depicted in Figures A8-A15.

d) A more appropriate model for allowable nutrient loadings to Fairlee Creek would be the Vollenweider-based approach that has been used by Maryland to develop phosphorus loading capacities for Urieville Community and Tony Tank Lakes.

Response:

a) The EUTRO5 module of the WASP5 model, distributed by U.S. EPA's Center for Exposure Assessment Modeling, was developed specifically for the analysis of eutrophication. The scientific principles supporting the kinetic interactions incorporated into the model are well established, and will not change significantly between applications to different waterbodies. The model parameters and kinetic coefficients were adjusted to reflect the conditions in Fairlee Creek. The EUTRO5 module of WASP5 has been successfully employed in many modeling applications that have included river, lake, estuarine, and ocean environments. In general, the kinetic interactions depicted in Figure A6 have been verified through the model's use in these applications.

b) The light extinction coefficient is entered into the model as a constant for each segment. During model simulation, when the coefficient is used in calculations, it is corrected based on the concentration of chlorophyll *a* in the water. For application to the Fairlee Creek, a phytoplankton grazing rate of 0.0 was assumed. This is a conservative assumption, allowing for slightly increased chlorophyll *a* concentrations. The sediment-water interactions such as sediment oxygen demand, nitrogen fluxes, and phosphorus fluxes were held constant over the model simulation. It is true that these values vary throughout the year. However, the highest values of sediment oxygen demand and nutrient fluxes occur during the summer months, when dissolved oxygen levels are low. The low flow model runs were performed for short periods of time (35 days) under these critical conditions.

c) The model calibration did an excellent job of capturing the trends in all of the water quality constituents. The calibration of the model can only predict one value at each location along the length of the river. The calibration is considered good if the predicted value is in the middle of the range of observed values. Monitoring data from river kilometer 3.3 captures the flow from an upstream reservoir, Fairlee Lake. It was assumed that the spikes seen in the data at that location were due to a release from the reservoir. The model is limited in its ability to capture sudden changes in data. As the best readily available tool, this model provides results that are considered to be reasonable for the application to Fairlee Creek. Further, the area of concern in this system is above river kilometer 3.3 where low dissolved oxygen values are more frequently observed.

d) The Vollenweider approach would not be appropriate for modeling the Fairlee Creek System. This TMDL allocates loads to the entire Fairlee Creek system. To ensure that water quality is being met at all locations along the length of the river, a model that simulates the tidal portion of the creek as well as the upstream portion must be used. A more complex model like the WASP is more appropriate for modeling the entire system.

2. The proposed TMDL is ineffective in achieving nutrient loading goals. Observed nutrient concentrations about mile 2.5 in Fairlee Creek are more than ten times greater than the limits dictated by the basic stoichiometry of aquatic ecology. A greater than 90 percent reduction in the nutrient loadings that result in the presently excessive nutrient concentrations would be necessary to achieve the dissolved oxygen and chlorophyll *a* criteria specified as water quality goals in section 3.0 of the Draft TMDL Report. These goals cannot be achieved by the existing loadings or projected year 2000 loadings, or by the proposed TMDL.

   Response: This draft documents a calibrated model that predicts that if the Fairlee Creek discharge is removed from the creek, there will be no water quality violations in the system. The WASP5 model takes in account the stoichiometric relationships between carbon, nitrogen, phosphorus, and chlorophyll *a*.

3. The proposed TMDL loadings are unacceptable in relevance to the increase of nutrients to the waterbody. The "TMDLs" proposed are Maryland's estimates of existing or projected year 2000 loadings of nitrogen and phosphorus from the Fairlee Creek watershed plus a "margin of safety" and allocation for future growth. The projected year 2000 loadings include a 280-fold increase in phosphorus load from the Great Oak Landing WWTP. They reflect 9-10 percent reductions from existing nonpoint source loadings due to agricultural BMPs presently implemented. The proposed TMDLs include no plan to implement any further reductions in nonpoint source loadings; therefore, the proposed TMDL loadings are unacceptable.

   Response: The annual nitrogen and phosphorus TMDLs do not allocate increased nutrients to the Fairlee Creek Watershed. The estimated 1991 total nitrogen load is 90,150 lb/yr and the average annual TMDL total nitrogen load is 83,420 lb/yr, which is a reduction of 6,730 lb/yr of nitrogen. The estimated 1991 total phosphorus load is 6,540 lb/yr and the average annual TMDL total phosphorus load is 6,310 lb/yr, which is a reduction of 230 lb/yr of phosphorus. The 10% reduction in nonpoint source nitrogen loads and the 9% reduction in nonpoint source phosphorus loads have already been implemented in the basin. The reductions were estimated from the Maryland Department of Agriculture, agricultural BMP database, and reduction factors from the Tributary Strategies Technical Appendix.

The low flow nitrogen and phosphorus nonpoint source loads represent the base-flow loads in the system, and are expected to remain constant between 1991 and the projected year 2000 loads, used for the TMDLs. While double checking the low flow nonpoint source loads, a documentation oversight was noted. The total nitrogen and phosphorus loads that were used in model scenario 3, which the low flow TMDL is based on, were incorrectly entered into the document. The nonpoint source nitrogen load is 523 lb/month, and the nonpoint source phosphorus load is 47 lb/month.

The point source nitrogen loads in the watershed as a whole decrease between the 1991 loads and the TMDL loads. In the area of concern, in the upper portions of the Creek where low dissolved oxygen concentrations have been observed, both phosphorus and nitrogen loads have been reduced. In model scenario 3, for which the low flow TMDL is based on, the Fairlee WWTP effluent discharge was removed from the stream. Thus, the loads to the impaired section of the stream have decreased. The phosphorus loads coming from the Great Oak Landing WWTP can be assimilated into the downstream portion of the Creek. In this region there is more flushing and larger volumes of water. In addition, the modeling results showed no impairments in the Great Oak Landing Cove.

Finally the “Assurance of Implementation” section of the draft TMDL documents several well established programs which will be drawn upon to achieve nonpoint source nutrient reductions in the basin.

4. There are a number of discrepancies, errors and omissions in the Draft Report and its Appendix that limit the possibility to completely evaluate any analysis presented in the proposed TMDL. The following are examples of discrepancies, errors or omissions discovered within the proposed TMDL draft:

    a) Nonpoint source flows in Table A9 for scenarios 1 and 3 total more than the 1.7 cfs streamflow for these scenarios.

    b) Point source loadings (kg/day) in Table A11 appear to be numerically identical to the point source concentrations (mg/l) in Table A5.

    c) Environmental conditions for the Fairlee Creek model on page A5 include nonliving organic nutrient settling rate velocity of 0.0432 m/day and a phytoplankton settling rate velocity of 3.45 m/day. And, in the listing of kinetic coefficients for the model in Table A8, “inorganics settling velocity” is listed as 3.45 m/day and “phytoplankton settling velocity” as 0.0432 m/day.

    d) Nutrient (both nitrogen and phosphorus) concentrations for point sources in Table A 5, and scenarios 1 and 2 in Table A11, are lower by at least an order of magnitude than the respective nutrient concentrations found in conventionally treated wastewater effluents.

e) Reported concentrations of nutrients (total nitrogen, total phosphorus) in the quality-impaired portion of Fairlee Creek, about river mile 2.5, are 50 to 100 percent greater than estimated concentrations of nutrients in Tables A5 and A6 for any point or nonpoint source of pollution tributary to this portion of Fairlee Creek. This violation of the first law of thermodynamics (conservation of mass) and is one of the several reasons it has not been possible to calibrate Maryland's Fairlee Creek version of the WASP5 model.

Response:

a) The nonpoint source flows used in the model for scenarios 1 and 2 add up 1.56 cfs, the 7Q10 flow in the Fairlee Creek watershed. The flows entered into Table A9 were in error. The correct flows have been added to the table. These were documentation oversights, which do not affect the TMDL computations.

b) The point source loads for scenarios 1 and 2 are the same as the point source loadings used for the calibration of the model. The values for all the water quality constituents in table A5 should be in kg/day, not mg/l. The correct units have been added to the table.

c) The nonliving organic nutrient settling rate velocity used in the modeling process was 3.45 m/day, and the phytoplankton settling rate velocity was 0.0432 m/day. Table A8 lists the values correctly. The text on page A5 was corrected. These were documentation oversights, which do not affect the TMDL computations

d) The nutrient concentrations used in the model for scenarios 1 and 2 represent actual measured values, from both of the WWTPs operating in the basin.

e) When the units from Table A5 are corrected to read kg/d for all of the water quality constituents, the concentrations of nutrients from Fairlee WWTP can be calculated from the loads and flows as a total nitrogen concentration of 8.075 mg/l and total phosphorus concentration of 0.803 mg/l. The only nonpoint load above mile 2.6 comes from segment 13. From Table A6, the total nitrogen concentration is 2.029 mg/l, and the total phosphorus concentration is 0.252 mg/l. Summed together the total load from point and nonpoint sources above river mile 2.6 is a total nitrogen concentration of 10.101 and a total phosphorus concentration of 1.054. During the July and August 1991 water quality surveys the highest total nitrogen measurement was 6.6 mg/l and total phosphorus was 0.8 mg/l. Thus, the highest measured instream concentrations of nutrients are less than the estimated concentrations of nutrients from Table A5 and Table A6.

5. The proposed TMDL describes a water quality simulation model that defies the existing water quality data, but is nevertheless applied to "demonstrate" that existing nitrogen and phosphorus loadings from point and nonpoint sources will achieve water quality standards in Fairlee Creek. (As explained more fully in the comments of Dr. Jack Douglas Smith attached herein). The proposed TMDL describes the Fairlee Creek system, in section 2.3, as "impaired by an over enrichment of nutrients. Nitrogen and phosphorus loadings from both point and nonpoint sources have resulted in higher than acceptable chlorophyll *a* concentrations and dissolved oxygen concentrations below the standard of 5 mg/l." Section 4.6 of the draft concludes "the sum of nutrient loadings to Fairlee Creek from existing and anticipated point sources and anticipated land uses can be maintained safely within the TMDLs established here." The contradiction of this point is if the levels of nutrients are acceptable to meet the levels established by the TMDL there was no reason to develop a TMDL for nutrient levels in the first place. A TMDL needs to be established because Fairlee Creek's water quality demonstrates an overabundance of nutrients; therefore, it is obvious that current loadings are not stringent enough to control the nutrient levels.

   Response: The existing nonpoint source loads represent a 10% reduction in nitrogen loads and a 9% reduction in phosphorus loads from baseline conditions. The model is used to demonstrate that, under these nonpoint source conditions, and the removal of the Fairlee WWTP, and future point source loads from the Great Oak Landing WWTP, will be protective of water quality throughout the Fairlee Creek watershed.

6. Water Quality in Great Oak Landing Cove is irrelevant to the Fairlee Creek TMDL. In Table 3, the Draft Report presents model calculations of dissolved oxygen and chlorophyll *a* in Great Oak Landing Cove to "provide the justification" for the TMDL proposed. Begging the question of validity of any calculations by this model, water quality in Great Oak Landing Cove at river mile 2.l is not relevant to any consideration of the quality-impaired portion of Fairlee Creek above mile 2.6.

   Response: The TMDL allocates loads to the entire Fairlee Creek system. The Great Oak Landing Cove is part of this watershed. To ensure that water quality is being met throughout the entire system, the dissolved oxygen and chlorophyll *a* model results for all four scenarios were included in the document.

7. Stoichiometric relations listed in Table A8 in the Draft Report can provide some insight to what might be appropriate nutrient concentration objectives to satisfy the criteria for dissolved oxygen (5 mg/l) and chlorophyll *a* (50 μg/l) proposed for Fairlee Creek. The stoichiometry of algal respiration implies that a potential 4 mg/l oxygen deficit will be avoided if total phosphorus does not exceed 4/107 = 0.037 mg/l. Similarly, the stoichiometry of photosynthesis implies that chlorophyll *a* will not likely exceed 50 μg/l if total phosphorus does not exceed 0.05/1.33 = 0.0375 mg/l. The same stoichiometry infers that an associated limitation on total nitrogen would be 0.037*10 = 0.37 mg/l.

Response: Stoichiometric analyses are insightful, however, the WASP5 model is more appropriate because it takes in account the stoichiometric relationships between carbon, nitrogen, phosphorus, and chlorophyll *a*, and the model also considers other sources and sinks of dissolved oxygen, chlorophyll *a*, and nutrients. Further, the model incorporates natural feed back loops in the system such as death, decay, and settling of phytoplankton in the water column.