



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 8

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JUN 17 2011

Ref: 8EPR-EP

Peter Butler, Chair  
Water Quality Control Commission  
4300 Cherry Creek Drive South  
Denver, CO 80222-1530

Re: EPA Disapproval Action on the Total  
Phosphorus Standard and Temporary Modifications  
for Bear Creek Reservoir

Dear Mr. Butler:

The U.S. Environmental Protection Agency (EPA or the Agency) has completed its review of the water quality standards revisions adopted by the Colorado Water Quality Control Commission (Commission) to the Classifications and Numeric Standards for South Platte River Basin, Laramie River Basin, Republican River Basin, Smoky Hill River Basin (Regulation #38). The revisions addressed today were adopted on August 10, 2009 with an effective date for purposes of State law of January 1, 2010.

EPA received the revised standards on August 28, 2009 and initiated a review pursuant to § 303(c) of the Clean Water Act (CWA or the Act). On March 17, 2010, we approved the site-specific chlorophyll *a* (chlorophyll) numeric standard adopted for Bear Creek Segment 1c (Bear Creek Reservoir). EPA did not act on the remaining site-specific standards revisions for Bear Creek Reservoir, including the total phosphorus numeric standard and temporary modifications for chlorophyll and total phosphorus. We conducted an additional review of the remaining revisions including an external review of the technical basis of the total phosphorus standard. Our review is complete.

CWA § 303(c)(2) requires States and authorized Indian Tribes to submit new or revised water quality standards to EPA for review. EPA is required to review and approve or disapprove the submitted standards pursuant to CWA § 303(c)(3). The Region's goal is to work closely with States and authorized Tribes throughout the State or Tribal standards revision process to ensure approvable standards. Prior to the Commission's action to adopt the revised standards, EPA participated in several discussions with the Water Quality Control Division (Division) to review EPA's concerns with the protectiveness of the total phosphorous numeric standard, as described in comment letters submitted to the Commission during the rulemaking process (dated March 31, 2009, and April 28, 2009). EPA also provided testimony during the water quality standards hearing. Following adoption of the revisions we shared our technical



findings and asked the Division to reevaluate the total phosphorous numeric standard to avoid a disapproval action. Unfortunately, these efforts did not result in the adoption of a criterion that meets the requirements of 40 CFR §131.11 and now EPA has a duty to act on the revisions.

## **TODAY'S ACTION**

The Region has determined that the total phosphorus standard of 32 µg/L is too high to be considered protective of the applicable use classifications (i.e., designated uses) and we are disapproving this numeric standard. 40 CFR §131.11 requires adoption of water quality criteria that protect the designated uses. The total phosphorus standard was derived using a long-term median response ratio. Use of a median response ratio implies that a critical condition does not exist (e.g., at high or low flow), yet this is not the case for Bear Creek Reservoir. Site-specific data show that the greatest chlorophyll and phosphorus concentrations, and the highest response ratios, are typically observed during low-flow years (i.e., years with inflow less than the median inflow) making low flow the critical condition. The total phosphorus numeric standard must be protective of use classifications during the low-flow critical condition, which occurs approximately 50% of the time. Analyses indicate that the total phosphorus criterion is not protective since a total phosphorus concentration less than 32 µg/L is necessary to achieve the chlorophyll numeric standard during low flow years. See Enclosure 1 for more detail.

Additionally, the Region is disapproving the type iii temporary modifications for chlorophyll and total phosphorus adopted for Bear Creek Reservoir (Regulation #38, Bear Creek Segment 1c). The information submitted to EPA does not adequately support adoption of temporary modifications for Bear Creek Reservoir. EPA's action today does not preclude the Commission from re-considering temporary modifications in the future (e.g., based on additional information). See Enclosure 1 for additional information.

## **ENDANGERED SPECIES ACT REQUIREMENTS**

Today's disapproval of the water quality standards revisions will have no effect on listed or proposed endangered or threatened species or designated critical habitat and is otherwise not subject to ESA consultation. As a result, for the revisions addressed today, no consultation with the U.S. Fish and Wildlife Service is required.

## **CONCLUSION**

EPA Region 8 applauds the Commission and the Division for their work to address the eutrophication issues and nutrient criteria for Bear Creek Reservoir. The adoption of numeric nitrogen and phosphorus criteria, the causal parameters responsible for eutrophication in both near-field and downstream waters, is an integral step to resolving water quality impairments associated with excessive nitrogen and phosphorus loading.

Enclosure 1 discusses options for resolving the disapproval issues, and we look forward to working with the State to resolve the disapproval issues discussed in this letter. If you have any questions concerning this letter, contact Lareina Guenzel on my staff at 303-312-6610.

Sincerely,

A handwritten signature in cursive script that reads "Carol L. Campbell".

Carol L. Campbell  
Assistant Regional Administrator  
Office of Ecosystems Protection  
and Remediation

Enclosure

cc: Sarah Johnson, Water Quality Control Division Standards Unit Manager



## **RATIONALE FOR EPA'S ACTION ON THE TOTAL PHOSPHORUS STANDARD AND TEMPORARY MODIFICATIONS FOR BEAR CREEK RESERVOIR**

Today's action addresses revisions to water quality standards adopted by the Water Quality Control Commission (Commission) on August 10, 2009. EPA acted on the majority of the revisions in a letter dated March 17, 2010. In the March 2010 letter, EPA did not act on the total phosphorus (TP) numeric standard or the temporary modifications for chlorophyll *a* (chlorophyll) and TP adopted for Bear Creek Reservoir to allow for additional time for a technical review. EPA has now completed its review and this document provides the rationale for the disapproval action taken by EPA on the remaining revisions.

### **Total Phosphorus Numeric Standard**

Today EPA disapproves the 32 µg/L total phosphorus numeric standard adopted for Bear Creek Reservoir. The rationale for EPA's action is described below.

On August 10, 2009, the Commission adopted numeric standards for chlorophyll (10 µg/L) and TP (32 µg/L) to replace the following narrative criterion.

“Concentrations of total phosphorus in Bear Creek Reservoir shall be limited to the extent necessary to prevent stimulation of algal growth to protect beneficial uses. Sufficient dissolved oxygen shall be present in the upper half of the reservoir hypolimnion layer to provide for the survival and growth of cold water aquatic life species. Attainment of this standard shall, at a minimum, require shifting the reservoir trophic state from a eutrophic and hypertrophic condition to a eutrophic and mesotrophic condition.”

Both numeric standards are mixed layer seasonal mean values for July through September, and compliance is required in four years out of five. In its March 2010 action letter, EPA concurred with the Commission that the adopted chlorophyll numeric standard is protective of use classifications and approved the criterion. EPA did not, however, act on the TP numeric standard in the March letter because of several unresolved issues. As also discussed in its March 31, 2009, and April 28, 2009, comment letters submitted to the Commission during the rulemaking process, and in its testimony provided during the water quality standards hearing, EPA's primary concern continues to be that the applicable use classifications are not protected during low-flow critical conditions,<sup>1</sup> as these conditions were not taken into consideration when deriving the TP numeric standard. EPA's specific concerns with the adopted TP numeric standard include the following:

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<sup>1</sup> The critical condition is when the reservoir is most stressed and the criterion is most likely to be exceeded. A combination of environmental factors (e.g., flow, season, temperature, etc) may contribute to the critical condition.

- The TP numeric standard of 32 µg/L was derived by dividing the chlorophyll numeric standard by the long-term median of the mean annual response ratios (0.318).<sup>2</sup> Use of a median value implies that a critical condition does not exist (e.g., at high or low flow).
- Because TP and chlorophyll concentrations decrease when annual inflow increases (see Figure 1), the highest chlorophyll concentration are expected during low-flow years (i.e., critical conditions occur during low-flow years).<sup>3</sup>
- The median response ratio associated with low-flow years (0.524) is greater than the median of all data (0.318) and indicates that a TP concentration less than the proposed 32 µg/L is necessary to achieve the chlorophyll numeric standard (Figure 2).
- The Water Quality Control Division (Division) has suggested that the release of phosphorus from lake sediments (i.e., internal load) is largely responsible for the high chlorophyll concentrations and that no further reductions of the external phosphorus load are necessary to achieve the chlorophyll criterion. EPA questions whether dissipation of the internal load should be counted upon to yield the needed 2/3 reduction in chlorophyll, especially because the reservoir on average retains more phosphorus than what is likely released from the sediments. The net retention of phosphorus is in the range of 30%-50% in most years (Table 1). Net retention was negative for only one year in 2003, which indicates that the reservoir acts primarily as a sink for phosphorus rather than a source that exports more TP than it receives. The average TP retention has been 1,291 lbs/yr since 1996 when the estimated release from the sediments is only 400 lbs/yr.<sup>4</sup>

<sup>2</sup> The response ratio for a given sample is the chlorophyll concentration divided by the total phosphorus concentration. The mean annual response ratio for a given year is calculated by averaging the ratios for that year. The long-term median annual response ratio is the 50<sup>th</sup> percentile of the mean annual response ratios. Generally speaking, a higher response ratio indicates that less phosphorus is necessary to achieve a particular chlorophyll goal.

<sup>3</sup> EPA defined low-flow years as years with inflow less than the median inflow.

<sup>4</sup> The site-specific internal phosphorous release rate was estimated by the Division to be 0.6 µg/L/d. Assuming that release occurs for 120 days and the volume of the reservoir is 1900 AF, the internal load contribution equates to about 400 lbs/yr.

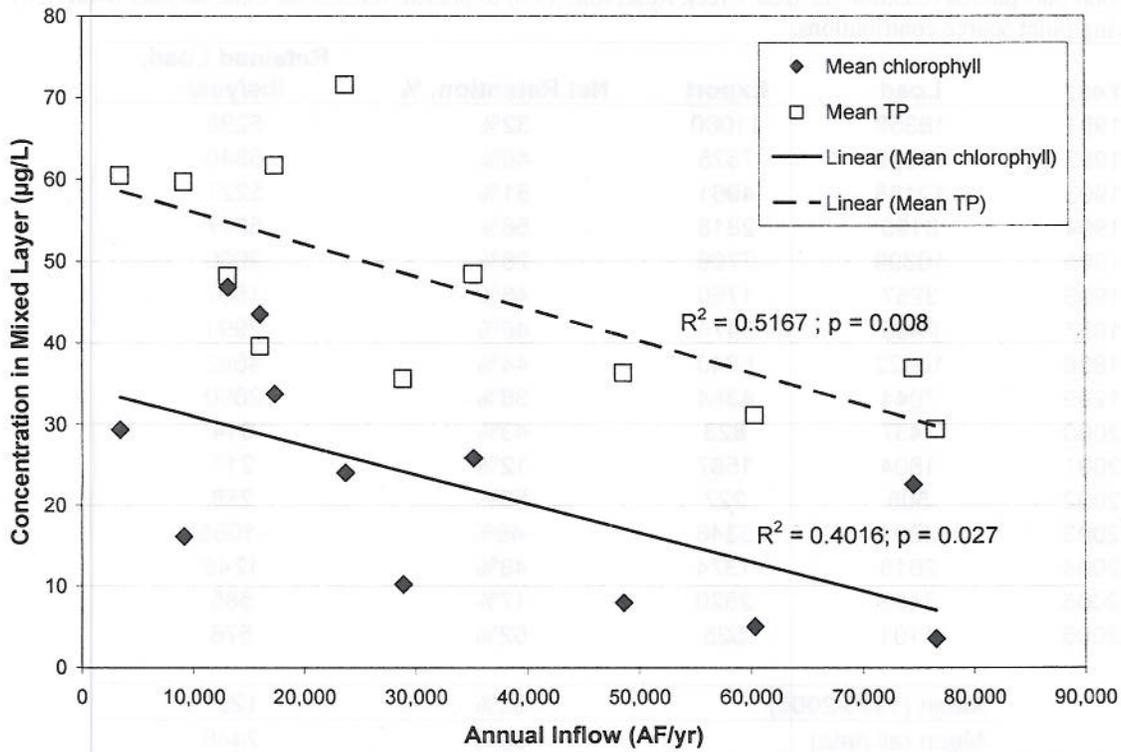


Figure 1: Relationship between inflow volume and chlorophyll and TP concentrations in Bear Creek Reservoir.

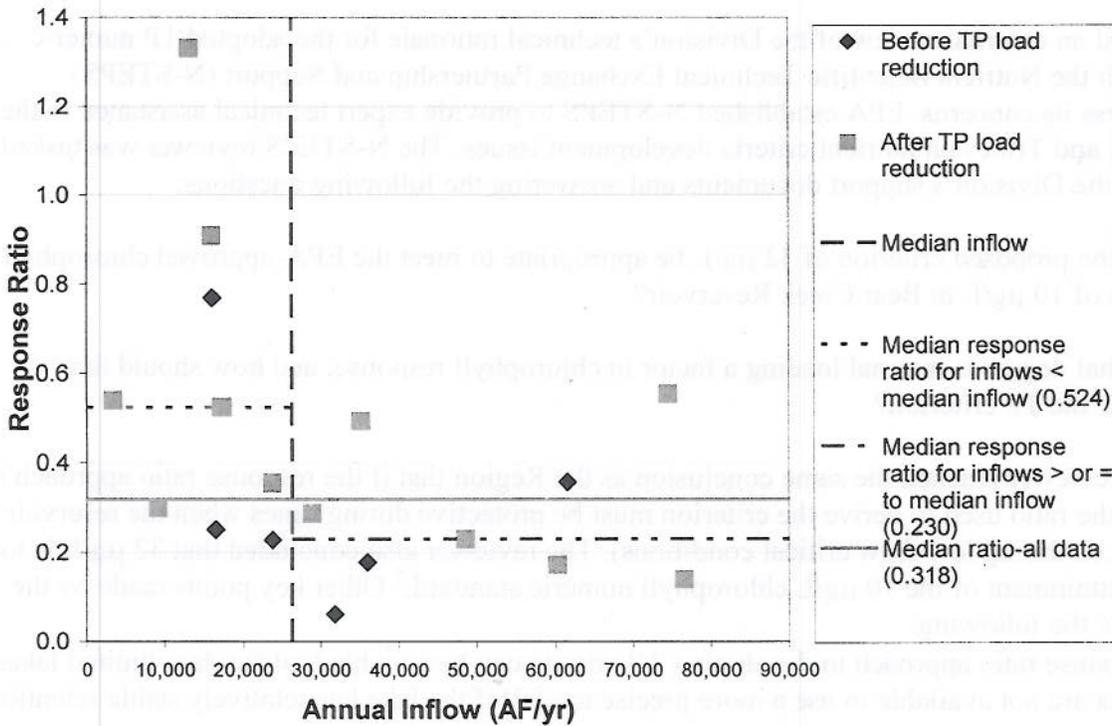


Figure 2: Annual mean response ratio and annual inflow volume for Bear Creek Reservoir from 1996-2006.

**Table 1:** Annual total phosphorus retention for Bear Creek Reservoir. 1996 to present reflects the external load reductions achieved by reducing point source contributions.

Year	Load	Export	Net Retention, %	Retained Load, lbs/year
1991	16358	11060	32%	5298
1992	13865	7525	46%	6340
1993	10188	4961	51%	5227
1994	8195	2818	66%	5377
1995	10399	7709	26%	2690
1996	3257	1750	46%	1507
1997	6465	3474	46%	2991
1998	10422	5840	44%	4582
1999	7044	4384	38%	2660
2000	1437	823	43%	614
2001	1804	1587	12%	217
2002	505	227	55%	278
2003	2291	3346	-46%	-1055
2004	2619	1374	48%	1245
2005	3405	2820	17%	585
2006	1101	525	52%	576
Mean (1996-2006)			32%	1291
Mean (all data)			36%	2446

EPA coordinated an external review of the Division’s technical rationale for the adopted TP numeric standard through the Nutrient Scientific Technical Exchange Partnership and Support (N-STEPS) process to address its concerns. EPA established N-STEPS to provide expert technical assistance to the Regions, States, and Tribes on nutrient criteria development issues. The N-STEPS reviewer was tasked with reviewing the Division’s support documents and answering the following questions:

- 1) Will the proposed criterion of 32 µg/L be appropriate to meet the EPA-approved chlorophyll criterion of 10 µg/L in Bear Creek Reservoir?
- 2) To what degree is internal loading a factor in chlorophyll response, and how should that influence the TP criterion?

The N-STEPS reviewer reached the same conclusion as the Region that if the response ratio approach is going to work, the ratio used to derive the criterion must be protective during times when the reservoir is most stressed (i.e., during low-flow critical conditions). The reviewer also concluded that 32 µg/L is too high to ensure attainment of the 10 µg/L chlorophyll numeric standard.<sup>5</sup> Other key points made by the reviewer include the following:

- The response ratio approach to developing TP criteria can be a viable tool for data-limited lakes (i.e., data are not available to use a more precise model) if the lake has relatively stable retention time.

<sup>5</sup> Reviewer’s comments are available on request.

- One of the more precise site-specific models, such as BATHTUB<sup>6</sup> or WASP<sup>7</sup>, should be used to develop load and concentration limits for a desired chlorophyll target and frequency.<sup>8</sup>
- Although the TP loading has been reduced, this does not mean that the phosphorus in the sediment will reduce; it may instead accrete at a slower rate than before if the reservoir continues to retain phosphorus.
- Given the current reservoir conditions, further reduction of the external phosphorus load is necessary to reduce the internal loading.
- Calculations indicate that reducing eutrophication in Bear Creek Reservoir may be very difficult without actions to directly reduce phosphorus contributions from the sediment.

### *Conclusion Regarding the Total Phosphorus Numeric Standard*

For the reasons described above, EPA is disapproving the TP numeric standard for Bear Creek Reservoir. We recommend that the Division reevaluate what TP numeric standard is appropriate to attain the chlorophyll numeric standard and protect the applicable use classifications. Options for resolving the disapproval are discussed below.

### **Temporary Modifications**

Today EPA is also disapproving the temporary modifications for chlorophyll and TP adopted for Bear Creek Reservoir. The rationale for EPA's action is described below.

With the adoption of the chlorophyll and TP numeric standards, the Commission also adopted a type iii temporary modification for both parameters. These temporary modifications were set at the existing condition and are to expire December 31, 2014. In the Statement of Basis and Purpose, the Commission states "the temporary modification...is adopted in order to recognize uncertainty regarding how soon the internal load will be reduced. It will also provide certainty regarding effluent limits over the short term while a total maximum daily load (TMDL) analysis is completed, which will include new wasteload allocations."

At the time of the hearing, Regulation 31 authorized the adoption of a type iii temporary modification where there is significant uncertainty regarding the appropriate long-term underlying standard. More specifically, temporary modifications were authorized based on uncertainty regarding what is necessary to protect use classifications and/or water quality that is feasible to achieve in light of natural conditions and/or irreversible human-induced activities in the watershed. Since the Bear Creek Reservoir hearing, Colorado has revised Regulation 31 to also require a showing that "an existing permitted discharge has a demonstrated or predicted water quality-based effluent limit compliance problem" in addition to the uncertainty regarding the appropriate standard (Colorado Regulation 31.7(3)). Although this revision to the temporary modification policy was not in effect at the time these temporary modifications were

<sup>6</sup> Information on the BATHTUB model is available at: [http://cfpub.epa.gov/crem/knowledge\\_base/crem\\_report.cfm?deid=74889](http://cfpub.epa.gov/crem/knowledge_base/crem_report.cfm?deid=74889)

<sup>7</sup> Information on the WASP model is available at: <http://www.epa.gov/athens/wwqtsc/html/wasp.html>

<sup>8</sup> EPA concurs that a site-specific model is one acceptable option (among several) for developing nutrient criteria for Bear Creek Reservoir.

adopted, since 2005 the Commission's practice generally has been to establish and retain temporary modifications only in situations involving a permit compliance problem, such that a compelling need for a temporary modification exists.<sup>9</sup>

### *Chlorophyll Temporary Modification*

EPA's disapproval of the Bear Creek Reservoir chlorophyll temporary modification is based on several concerns. First, with respect to chlorophyll, the information submitted to EPA does not provide adequate technical basis to conclude there is significant uncertainty regarding the appropriateness of the 10 µg/L chlorophyll numeric standard. The Division has not identified any reason to believe the applicable numeric standard is inappropriate for the protection of use classifications, or that natural or irreversible human-induced conditions preclude attainment. The chlorophyll numeric standard was based on the threshold for the eutrophic-mesotrophic boundary of 8 µg/L, which is expressed as a seasonal mean chlorophyll concentration.<sup>10</sup> Given that year-to-year variability in chlorophyll is to be expected, EPA agrees it is reasonable to set the numeric standard to a value that will, on average, result in the desired trophic state. The 10 µg/L numeric standard represents an 80<sup>th</sup> percentile, or a value that can be exceeded once in five years, so that the typical seasonal average for chlorophyll will be 8 µg/L. Overall, EPA agrees the numeric standard is consistent with achieving a trophic state in a range from mesotrophic to eutrophic and that information presented by the WQCD provides a strong basis for concluding the 10 µg/L numeric standard will protect the reservoir's use classifications (see EPA action letter dated March 17, 2010). The information submitted to EPA does not demonstrate significant uncertainty regarding the appropriateness of the chlorophyll numeric standard, such that a temporary modification is authorized by the EPA-approved policy at Section 31.7(3) of the Basic Standards regulation.

Second, EPA has concerns regarding Section 31.14(15) of Regulation 31. This section of the Basic Standards regulation provides that permits for point source discharges "will not include a compliance schedule to meet limits based on the underlying standard during the period that the temporary modification is in effect." The chlorophyll temporary modification does not expire until December 31, 2014. To the extent that a TMDL and waste load allocations (WLAs) are developed that identify needed point source load reductions based on the chlorophyll numeric standard, we are concerned Section 31.14(15) of Regulation 31 would preclude WLA implementation until 2015. We disagree this is an appropriate outcome because the Division has not demonstrated uncertainty with the chlorophyll standard and the temporary modification would interfere with attainment of the water quality standard as soon as possible, as required by 40 CFR §122.47.

Third, to the extent the temporary modification was adopted to protect dischargers from future compliance problems due to lower water quality-based effluent limitations (WQBELs), EPA concludes this concern is speculative and an inappropriate basis for establishing a temporary modification. It is not clear that regulated entities will not be able to comply with WQBELs in the absence of a temporary modification. In fact, the Division testified that dissipation of the internal load alone might be sufficient to attain the 10 µg/L chlorophyll standard.

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<sup>9</sup> For example, the December 2008 rulemaking hearing resulted in deletion of temporary modifications from Clear Creek segments 3a, 3b, 6 and 9b because there were no point source discharges.

<sup>10</sup> Organization of Economic Co-operation and Development (OECD: *Eutrophication of Waters*, Paris 1982).

Fourth, to the extent the chlorophyll temporary modification was adopted based on a conclusion that internal load dissipation, rather than external load reduction, is the appropriate remedy for the exceedances of the chlorophyll numeric standard, EPA recommends that such issues be addressed in the TMDL, and not by establishing a temporary modification for the reservoir. Furthermore, we are not persuaded that internal load dissipation alone is adequate to attain the numeric chlorophyll standard, and thus do not support dissipation alone as an appropriate remedy.

EPA agrees with the Division that the internal phosphorus load is an important factor affecting chlorophyll conditions in the reservoir. Analyses provided by the Division identify that

- release of phosphorus from the sediment peaks during summer months when temperatures are greater than 15°C and external loads are at a minimum,
- release of phosphorus from the sediment results in water column concentrations that exceed input concentrations,
- internal load contributes about 400 pounds of phosphorus annually,
- the effect of the internal phosphorus release is more pronounced during low-flow years, and
- there is uncertainty with how quickly the internal load will dissipate.

EPA agrees that the time it will take for the internal load to dissipate is poorly understood. Given the strong correlation between TP and chlorophyll in Bear Creek Reservoir, the time it will take to achieve attainment with the numeric standard is also in doubt. However, the Division did not provide an analysis which adequately demonstrates significant uncertainty regarding the feasibility of attaining the chlorophyll numeric standard. Rather, the Division testified that the internal load could dissipate, and that through dissipation *alone*, water quality could improve to levels that attain the numeric standard within the next 20 years. EPA questions whether dissipation alone should be relied upon to yield the needed 2/3 reduction in chlorophyll, especially because the reservoir on average retains more phosphorus than what is likely released from the sediments. EPA concludes that the remedy for attaining numeric standards is appropriately addressed in a TMDL, and that the internal load issues do not provide an appropriate basis for a temporary modification.

#### *Total Phosphorus Temporary Modification*

Because EPA is disapproving the TP numeric standard, a temporary modification is not authorized by the Colorado policy at 31.7(3) of the Basic Standards regulation and therefore is also being disapproved by default. The rationale for disapproving the TP temporary modification is similar to its rationale for disapproving the chlorophyll temporary modification.

- Because of Section 31.14(15) of the Basic Standards regulation, EPA is concerned a type iii temporary modification for TP would preclude implementation of the chlorophyll numeric standard. To the extent that a TMDL identifies the need for point source reductions, these reductions would not be implemented until 2015 and thereby interfere with attaining the standard as soon as possible.
- To the extent the temporary modification was adopted to protect dischargers from potentially lower WQBELs that may result in future compliance problems, EPA concludes this concern is

- speculative and an inappropriate basis for establishing a temporary modification.
- To the extent the temporary modification was adopted based on a conclusion that internal load dissipation, rather than external load reduction, is the appropriate remedy for the high chlorophyll levels in the reservoir, we believe such issues are appropriately addressed in the TMDL, and not by establishing a temporary modification.

### **Options to Resolve the Disapproval**

EPA recommends consideration of the following options for resolving the disapproval issues and establishing water quality standards that meet CWA requirements.

Option 1 – Adopt a revised TP numeric standard that is protective of the use classifications during the low-flow critical condition, and ensures attainment of the 10 µg/L chlorophyll numeric standard. Delete the temporary modifications.

Option 2 – Adopt a revised TP numeric standard that is protective of the use classifications during the low-flow critical condition, and ensures attainment of the 10 µg/L chlorophyll numeric standard. Also, re-evaluate the need for temporary modifications. If definitive information indicates there is uncertainty with the TP and/or chlorophyll numeric standards, the Commission may consider whether temporary modifications are appropriate *to provide time for resolution of the WQS uncertainties*; however, EPA does not recommend adoption of temporary modifications as a means to influence the remedy and how load reduction responsibilities are allocated.

Option 3 – As an interim site-specific approach, delete the 32 µg/L TP numeric standard and rely on the chlorophyll numeric standard to protect use classifications. Under this option, attainment decisions would be based on the chlorophyll numeric standard, and the TMDL process would be used to identify appropriate nutrient targets and WLAs. This restoration approach would be similar to the approach that has been used successfully for Cherry Creek Reservoir. The need for numeric standards for nutrients (including both phosphorus and nitrogen) should be re-evaluated in future triennial reviews based on progress that is achieved and as information and experience is gained in developing nutrient standards on a statewide basis. Likewise, the need for temporary modifications should also be re-evaluated once the TMDL is completed and there is additional information available for evaluating whether temporary modifications are authorized and appropriate.

EPA's preference is for the State to resolve the disapproval with a State action. We look forward to working with Colorado to resolve the disapprovals discussed in this letter.