

Colorado Nutrient Criteria
Concept Paper
June 2010

I. Overview

This concept paper sets forth the Water Quality Control Division's current thinking regarding a proposal for adoption and implementation of numerical nutrient criteria, to be advanced for consideration in a June 2011 Water Quality Control Commission rulemaking hearing regarding the Basic Standards and Methodologies for Surface Water, Regulation #31 (Basic Standards). This paper is intended to provide transparency regarding the Division's thinking as the work group process progresses, and may be revised based on further discussions and/or analyses.

The Division believes that numerical criteria to be added to the Basic Standards regulation for phosphorus and nitrogen should be based on the best available science regarding the levels of these nutrients that are protective of classified uses of state waters. Considerations regarding feasibility and cost of treatment or other control measures would not influence these numerical criteria. Rather, issues regarding feasibility and cost of control measures, as well as considerations such as sustainability and environmental trade-offs, would be taken into account in implementing these Basic Standards criteria into site-specific nutrient standards and discharge permit requirements.

While recognizing the additional costs to regulated activities, adoption and implementation of nutrient criteria and standards will result in substantial benefits in terms of protection of classified uses. The discussions at the May 11, 2010 work group meeting began to outline these benefits, and the Division intends to work with interested parties over the coming months to further identify and examine available information about nutrient criteria benefits. The Division believes that actively pursuing options to fully realize the benefits of nutrient criteria is important over the long run. In the short run, as elaborated below, it is also important to develop an approach that realistically considers the costs and technical complexity of implementation.

II. Numerical Criteria

The Division continues to be committed to developing a numeric nutrient criteria proposal to protect uses based on the best possible science and with reliance on data from Colorado lakes and streams.

A. Lakes and Reservoirs – Aquatic Life and Recreation

The Division is developing a nutrient criteria proposal for lakes and reservoirs that seeks to balance potentially competing interests (clarity for swimming vs. fisheries productivity) without compromising protection of other uses. The focus is on algal abundance (chlorophyll concentration) as the response variable that has a direct impact on classified uses. The proposed summer average total nitrogen and total phosphorus values were derived using the chlorophyll/nutrient relationship for Colorado lakes and reservoirs. The relationship is based on

the long-term trophic condition that is consistent with the desired balance of uses. A separate chlorophyll concentration threshold may also be proposed to avoid nuisance algae blooms.

B. Lakes and Reservoirs – High Quality Water Supply

The Division is developing a nutrient criterion proposal for high quality water supply lakes and reservoirs to reduce the formation potential for disinfection byproducts (DBPs). DBPs are known to cause cancer and are regulated under the Safe Drinking Water Act. DBPs are formed when organic carbon in the water is subjected to disinfection (e.g., using chlorine or chloramines), and DBP formation potential has been correlated with chlorophyll levels in the source water in the State of New York. Data from Colorado lakes and reservoirs is being used to adapt the predictive relationship that was developed for New York lakes. The proposed criterion would be in the form of a summer average chlorophyll level and applied only on a site-specific basis.

C. Rivers and Streams – Aquatic Life

The Division is developing a nutrient criteria proposal for rivers and streams based on levels necessary to protect the aquatic life use. The macroinvertebrate community is used as the surrogate for the aquatic life use. The health of the community is measured using a multimetric index (MMI) that incorporates taxa richness, community composition, pollution tolerance, and ecological function. The MMI was developed to discriminate between minimally disturbed sites and those with significant anthropogenic influences. The data collected by the Division show that the health of the macroinvertebrate community as determined by the MMI declines as the nutrient concentrations increase. The Division derived the relationship between MMI scores and nutrient concentrations with an EPA-recommended statistical tool (quantile regression). The Division's proposal is based on the assumption that a five percent decline in aquatic life condition from minimally disturbed sites in Colorado as measured using the MMI is acceptable. The proposed criteria would be in the form of median total nitrogen and total phosphorus concentrations.

D. Rivers and Streams – Recreation

The Division is proposing a chlorophyll criterion for the protection of recreational use in rivers and streams based on user surveys conducted in other states. In these surveys, 150 mg/m² of chlorophyll (based on a sample of attached algae) has been identified by users as the threshold between what is an acceptable level and what is undesirable for recreation because attached algae are too abundant. The proposed criteria would be in the form of mg/m² chlorophyll from attached algae.

III. Implementation

A. Standards, Variances and Compliance Schedules

The June 2011 rulemaking hearing will consider the adoption of numerical criteria for phosphorus and nitrogen, for different categories of state surface waters, to be included in the

Basic Standards. These numerical criteria would then be considered for adoption as site-specific water quality standards in the subsequent rounds of water quality standard-setting hearings for each river basin. The criteria themselves would not be self-implementing – e.g., they would not be used as the basis for discharge permit requirements prior to the adoption of segment-specific standards in individual river basins.

In rulemaking hearings considering the adoption of segment-specific standards for nutrients, the Commission can consider the full range of standard-setting options. For example, where it is demonstrated that natural or irreversible human-induced conditions preclude attainment of standards based on table value criteria, alternative site-specific standards may be adopted. In addition, where there is significant uncertainty regarding the extent to which existing quality is the result of irreversible human-induced conditions, the adoption of a temporary modification may be appropriate to provide time to determine the appropriateness of a discharger-specific variance.

In the June 2010 rulemaking hearing considering various revisions to the Basic Standards, the Commission approved a proposal to add provisions authorizing the adoption of a discharger-specific variance to water quality standards in certain circumstances. In particular, variances can now be authorized based on technological infeasibility, substantial and widespread adverse social and economic impacts, or a demonstration that the negative consequences of attaining standards outweigh the benefits. These discharger-specific variance provisions will become effective January 1, 2013, providing time for the development of implementation guidance.

Discharger-specific variances can be considered in the water quality standard-setting rulemaking hearings for individual river basins after these provisions become effective. However, the Division anticipates proposing that in the June 2011 Basic Standards hearing the Commission identify discharge concentrations that would generally be considered to represent the current “limits of technology”. The Division’s thinking about the limits of technology for phosphorus treatment and for nitrogen treatment is set forth in the following sections of this paper. This approach would mean that, where treatment beyond the limit of technology would be required to meet a permit limit based on the nutrient criteria in the Basic Standards, discharger-specific variances based on these identified limits of technology would presumptively be considered appropriate when site-specific nutrient standards are considered in individual basin hearings. As technology advances over time, it is expected that the specific “limits of technology” will continue to evolve.

In addition to discharger-specific variances based on these limits of technology, other discharger-specific variances based on a demonstration of substantial and widespread adverse social and economic impacts, or a demonstration that the negative consequences of attaining standards outweigh the benefits, could be considered in site-specific standard-setting hearings. The Division is currently considering whether it may be appropriate to propose that the Commission identify in the June 2011 Basic Standards hearing a categorical subset or subsets of circumstances where a discharger-specific variance would presumptively be considered appropriate based on one or both of these other tests. For example, are there combinations of the size, location and type of domestic wastewater treatment plants and the flow conditions of receiving waters where variances should presumptively be considered appropriate?

Once site-specific numerical nutrient standards – or alternative effluent limits adopted in conjunction with a discharger-specific variance – are in effect, these numerical values would be used in developing discharge permit requirements as existing discharge permits come up for renewal or new discharges are proposed. The use of compliance schedules, as appropriate based on the Division’s standard permitting practices, would be one implementation option available for consideration at that time.

B. Phosphorus

The Division anticipates proposing that physical/chemical treatment (addition of a flocculant plus filtration) be identified as the current “limit of technology” for phosphorus control. There are a number of domestic wastewater treatment plants in Colorado – e.g., those in the Dillon and Cherry Creek Reservoir basins – where this level of treatment for phosphorus has been in place for many years. Moreover, the Division believes that for many dischargers this level of treatment would be adequate to achieve attainment of water quality standards based on the numerical phosphorus criteria that the Division currently anticipates proposing in June 2011. Identifying this level of treatment as the limit of technology in the June 2011 rulemaking would create a presumption that, when site-specific standards are later adopted, a discharger-specific variance would be appropriate in any circumstance where this level of technology would not result in attainment of standards.

As noted above, in site-specific standard setting hearings there would also be the opportunity to consider the appropriateness of discharger-specific variances based on the other tests included in the Basic Standards – a demonstration of substantial and widespread adverse social and economic impacts, or a demonstration that the negative consequences of attaining standards outweigh the benefits.

In addition to the potential adoption of discharger-specific variances, note that in considering the adoption of phosphorus standards for individual waters, the Commission would be able to consider any appropriate proposals for site-specific standards that may differ from standards based on statewide numerical criteria adopted as a result of the June 2011 rulemaking, if those standards are determined appropriate for the protection of classified uses. Varying site-specific phosphorus standards have already been adopted for a number of reservoirs in Colorado based on site-specific analyses.

C. Nitrogen

The Division anticipates proposing that biological nutrient removal (BNR) be identified as the current “limit of technology” for wastewater treatment to remove nitrogen. The Division believes that, unless there is a relatively high low flow to design flow ratio coupled with upstream nitrogen concentrations lower than the standard, this level of treatment generally would not be adequate to achieve attainment of water quality standards based on the numerical nitrogen criteria that the Division currently anticipates proposing in June 2011. Currently available information indicates that in many circumstances attaining water quality standards based on the

anticipated nitrogen criteria would require membrane treatment, such as reverse osmosis, with substantial energy costs and brine disposal costs.

Because of the unique challenges that would be faced by many wastewater treatment plants in Colorado if they were subject to discharge permit limits based on attaining water quality standards resulting from the anticipated numerical nitrogen criteria, the Division currently anticipates proposing that the Commission adopt a five-year delayed effective date for numerical nitrogen criteria. This would mean that numerical nitrogen criteria adopted as a result of the June 2011 rulemaking would not become effective until January 1, 2017. This would provide an opportunity to review the nitrogen criteria in the next major Basic Standards rulemaking (June 2016) before such criteria became effective. This would also provide the Division and affected entities time to plan for funding needs and to better understand technical issues. Of course, this would mean that numerical water quality standards for nitrogen would not generally be adopted in individual river basins until after this January 1, 2017 effective date. The Commission would retain its ability to consider site-specific water quality standards, including for nitrogen, prior to that date where warranted by unique site-specific considerations.

During the interim period prior to the delayed effective date of nitrogen criteria in the Basic Standards, the Division anticipates that there would be further analysis of the feasibility and cost of nitrogen control options for point sources, as well as for nonpoint sources, including the monitoring of national developments in this area. The Division currently anticipates that nitrogen monitoring requirements may be included in discharge permits during this period. In addition, prior to the effective date of the numerical criteria, there would be an opportunity to consider any further developments related to the science of identifying nitrogen levels appropriate for protecting classified uses of state waters.

D. Stormwater Sources

The Division anticipates numerical nutrient standards for rivers and streams adopted after the Basic Standards hearing to be implemented into permits under a low-flow scenario as described in the Basic Standards. At this time, the Division does not anticipate implementing numeric effluent limits for nutrients into stormwater permits for discharges to rivers and streams unless the stream is listed as impaired for a nutrient and the subsequent TMDL assigns a waste load allocation to the stormwater discharges from industries or municipal separate storm sewer systems. Such permits may include practice-based limits (e.g., BMPs) to reduce the amount of nutrients discharged. However, due to the accumulation of nutrients in lakes and reservoirs, the Division does expect that stormwater discharges that may impact a lake or reservoir will have to be evaluated to determine if the stormwater discharge may cause or contribute to an exceedance of a nutrient standard, which could result in the inclusion of additional requirements in the permit.

E. Nonpoint Sources

The implementation discussion above focuses on point source discharges of nutrients. In a number of instances, nonpoint sources can also be a significant source of nutrient pollution of Colorado's surface waters. Once the Commission adopts nutrient criteria, and subsequently site-

specific water quality standards for nutrients, those standards will need to be factored into Colorado's nonpoint source management efforts.

Unlike point sources, nonpoint source of pollution are not currently subject to enforceable regulatory requirements. Rather, Colorado has addressed these sources through efforts such as the development of best management practices under Commission Reservoir Control Regulations and under the Agricultural Chemicals and Groundwater Protection Act. At this time the Division does not intend to propose any changes to the basic approach to nonpoint source management in Colorado. However, the Division does contemplate an enhanced cooperative, non-regulatory approach to address nonpoint sources of nutrients.

In particular, the Division intends to explore additional opportunities to work cooperatively with the Colorado Department of Agriculture, the Natural Resources Conservation Service, and Colorado State University Cooperative Extension to identify options for improving control of nutrients from irrigated crop production.

IV. Conclusion

The Division believes that the approach set forth in this concept paper would result in water quality management of nutrients that would be consistent with federal and state law, that takes into account current practical realities, and that is designed to result in the best attainable water quality for the protection of classified uses for Colorado surface waters in the long run. The Division welcomes input regarding this approach and anticipates that the concepts set forth in this paper may be refined as discussions proceed prior to the June 2011 rulemaking.