

## **2013 Colorado Nutrient Criteria Development Plan Update**

### **I. Overview of Colorado's Nutrients Regulations – Adopted June 11, 2012**

The Colorado Water Quality Control Commission adopted nutrients regulatory provisions composed of two major components: (1) scientifically-based numerical values for nutrients at levels to protect beneficial uses of Colorado waters, which would initially be applied only to streams and lakes above dischargers and to protect municipal water supplies taken directly from lakes or reservoirs; and (2) a new Nutrients Management Control Regulation establishing technology-based treatment requirements for many domestic (and some industrial) wastewater dischargers, enhanced nutrients control requirements for storm water dischargers, provisions encouraging voluntary controls of nonpoint sources, and monitoring requirements to develop better information to refine Colorado's nutrients management efforts over time. The new rules become effective September 30, 2012.

### **II. Regulation #31 (Surface Water Basic Standards) Revisions**

The Regulation # 31 revisions include interim numerical values for phosphorus, nitrogen, and chlorophyll *a* for (1) rivers and streams and (2) lakes and reservoirs. The numerical values are based on the maximum amounts of each pollutant that can be present in water and still protect the designated beneficial use. These numerical values can be considered for the adoption of standards for individual water bodies in phases. Adoption of standards during the first phase will protect high quality waters above current dischargers and protect direct use water supply reservoirs.

- During the first phase, from 2012-2017, the Commission can consider adopting standards for phosphorus or chlorophyll *a* to protect aquatic life, recreation, and water supply uses only in the following specific circumstances:
  - In headwaters upstream of existing dischargers;
  - In Direct Use Water Supply Lakes and Reservoirs where this type of protection is determined to be appropriate (chlorophyll *a* only); and
  - Under other circumstances where the Commission determines Regulation # 85 will not provide sufficient control of nutrients.
- From 2017-2022, the Commission will continue to consider adoption of standards as above, and can also consider adopting nitrogen standards in the same circumstances outlined above.
- Starting in 2022, the Commission can consider adopting numerical water quality standards for nutrients for all Colorado surface waters, as appropriate based on the information developed under the first phase efforts.

<b>Implementation Timeline for Regulation #31</b>	
<b>Month-Year</b>	<b>Action</b>
Mar-12	Reg 31, Reg 85 Rulemaking Hearing
June-12	Reg 31, Reg 85 Final Action
Sept-12	Reg 31, Reg 85 effective date
Nov-12	Arkansas/RioGrande Issues Formulation Hearing- consider upstream waters TP, PWSR
Jan-13	Arkansas/Rio Grande notice/proposal - consider upstream waters TP, PWSR
Mar-13	Reg 85 Monitoring commences
Mar-13	Arkansas/Rio Grande evidence due - consider upstream waters TP, PWSR
Apr-13	Monitoring: Data submitted
Jun-13	Arkansas/Rio Grande Rulemaking Hearing - consider upstream waters TP, PWSR
Nov-13	Upper & Lower Colo Basin Issues Formulation Hearing - consider upstream waters TP, PWSR
Dec-13	303(d) List Hearing - consider Arkansas/RioGrande upstream TP standards
Jan-14	Upper & Lower Colo Basin notice/proposal - consider upstream waters TP, PWSR
Mar-14	Upper & Lower Colo Basin evidence due - consider upstream waters TP, PWSR
Apr-14	Monitoring: Data submitted
Jun-14	Upper & Lower Colo Basin Rulemaking Hearing - consider upstream waters TP, PWSR
Nov-14	So Platte Issues Formulation Hearing - consider upstream waters TP, PWSR
Jan-15	So Platte notice/proposal - consider upstream waters TP, PWSR
Mar-15	So Platte evidence due - consider upstream waters TP, PWSR
Apr-15	Monitoring: Data submitted
Jun-15	So Platte Rulemaking Hearing - consider upstream waters TP, PWSR
Oct-15	Triennial Review Hearing Reg 85
Nov-15	Basic Standards Issues Formulation Hearing
Dec-15	303(d) List Hearing - consider 32,33,36, 37 38 upstream TP standards
Jan-16	Basic Standards notice/proposal
Mar-16	Basic Standards evidence due
Apr-16	Monitoring: Data submitted
Jun-16	Basic Standards Rulemaking Hearing
Jan-17	SanJuan/Gunnison notice/proposal - consider upstream waters TP, PWSR
Mar-17	SanJuan/Gunnison evidence due - consider upstream waters TP, PWSR
Apr-17	Monitoring: Data submitted
May-17	Interim Nitrogen Values in Reg 31 become effective (can be used upstream)
Jun-17	SanJuan/Gunnison Rulemaking Hearing - consider upstream waters TP, PWSR
Nov-17	Arkansas/Rio Grande Issues Formulation Hearing - consider upstream waters TP & TN, PWSR
Dec-17	303(d) List Hearing - consider upstream TP, TN stnds
Jan-18	Arkansas/Rio Grande notice/proposal - consider upstream waters TP & TN, PWSR
Mar-18	Arkansas/Rio Grande evidence due - consider upstream waters TP& TN, PWSR
Apr-18	Monitoring: Data submitted
Jun-18	Arkansas/Rio Grande Rulemaking Hearing - consider upstream waters TP& TN, PWSR
Oct-18	Triennial Review Hearing Reg 85
Nov-18	Upper & Lower Colo Basin Issues Formulation Hearing - consider upstream waters TP & TN, PWSR
Jan-19	Upper & Lower Colo Basin notice/proposal - consider upstream waters TP & TN, PWSR
Mar-19	Upper & Lower Colo Basin evidence due - consider upstream waters TP& TN, PWSR
Apr-19	Monitoring: Data submitted
Jun-19	Upper & Lower Colo Basin Rulemaking Hearing - consider upstream waters TP& TN, PWSR

Nov-19	So Platte Issues Formulation Hearing - consider upstream waters TP& TN, PWSR
Dec-19	303(d) List Hearing - consider upstream TP, TN standards
Jan-20	So Platte notice/proposal - consider upstream waters TP & TN, PWSR
Mar-20	So Platte evidence due - consider upstream waters TP& TN, PWSR
Apr-20	Monitoring: Data submitted
Jun-20	So Platte Rulemaking Hearing - consider upstream waters TP& TN, PWSR
Nov-20	Basic Standards Issues Formulation Hearing
Jan-21	Basic Standards notice/proposal
Mar-21	Basic Standards evidence due
Apr-21	Monitoring: Data submitted
Jun-21	Basic Standards Rulemaking Hearing
Oct-21	Triennial Review Hearing Reg 85
Dec-21	303(d) List Hearing - consider upstream TP, TN standards
Apr-22	Monitoring: Data submitted
May-22	TP & TN interim values can be used for all waters
May-22	Small/disadvantage community exemption expires
Jun-22	SanJuan/Gunnison Rulemaking Hearing - consider upstream waters TP & TN, PWSR
Apr-23	Monitoring: Data submitted
Jun-23	Arkansas/Rio Grande Rulemaking Hearing - consider TN & TP all waters, PWSR
Dec-23	303(d) List Hearing - consider any TP, TN stnds
Apr-24	Monitoring: Data submitted
Jun-24	Upper & Lower Colo Basin Rulemaking Hearing - consider TN & TP all waters, PWSR
Oct-24	Triennial Review Hearing Reg 85
Apr-25	Monitoring: Data submitted
Jun-25	So Platte Rulemaking Hearing - consider TN & TP all waters, PWSR
Dec-25	303(d) List Hearing - consider any TP, TN standards

Table 1. Implementation Timeline for Regulation 31

### III. New Regulation #85 (Nutrients Management Control Regulation)

Regulation # 85 requires certain larger wastewater treatment facilities to meet effluent limits for phosphorus and nitrogen based on levels determined to be achievable with available technology. It focuses control requirements on the major regulated sources of nutrient pollution in Colorado and includes provisions to fine-tune application of the new treatment requirements. For example, there are exceptions, exclusions, and delays for small facilities, facilities in disadvantaged communities, and facilities that have minimal impacts. Regulation # 85 contains a voluntary approach for agriculture and other nonpoint sources, with the potential for additional regulatory requirements after ten years if needed, and monitoring requirements that will develop better information for future nutrients management decision-making.

- Technology-based effluent limits for the larger wastewater dischargers, including industrial discharges with significant nutrient concentrations, based on biological nutrient removal (BNR), to expedite nutrient load reductions from current sources.
  - Existing dischargers must meet an annual median of 1.0 mg/L for phosphorus and 15 mg/L for total inorganic nitrogen, and a 95<sup>th</sup> percentile of 2.5 mg/L for phosphorus and 20 mg/L for total inorganic nitrogen.

- New dischargers must meet an annual median of 0.7 mg/L for phosphorus and 7 mg/L for total inorganic nitrogen, and a 95<sup>th</sup> percentile of 1.75 mg/L for phosphorus and 15 mg/L for total inorganic nitrogen.
- Provisions that fine-tune the application of these new treatment requirements:
  - 46 of the largest domestic wastewater treatment facilities in the state (out of a total of approximately 400 domestic dischargers) will be subject to the new treatment requirements during the first ten years.
  - Domestic facilities 1 MGD or less or owned by a disadvantaged community are excluded from these effluent limits.
  - There is a ten-year deferment for (1) dischargers subject to existing, basin-specific nutrients control regulations, (2) domestic facilities 2 MGD or less, and (3) domestic and industrial facilities that are in a low priority watershed.
  - There is an exception from the effluent limits for dischargers with minimal impact on nutrient levels:
    - Where a discharger demonstrates it is unlikely to cause or contribute to an exceedance of the interim values in Regulation # 31;
    - For noncontact cooling water and construction dewatering where nutrients are not added; and
    - Where a discharger demonstrates the Regulation # 31 in-stream values are attainable with a less stringent effluent limit.
  - Variances where the benefits of controls do not bear a reasonable relationship to the costs of controls for individual dischargers.
  - Provisions for nutrient trading, to enhance flexibility for dischargers' compliance.
  - Provision for long-term compliance schedules for the construction of new treatment facilities, operations, or other measures.
- Requirements for stormwater facilities (municipal separate storm sewer systems or "MS4s") to implement nutrient-focused public education programs and best management practices at municipally-owned facilities.
- Provisions encouraging voluntary controls by nonpoint sources in the first ten-year phase of implementation, with potential regulatory requirements after this initial phase.
- Discharger monitoring requirements, to better characterize relative source contributions and the effectiveness of control measures, to better inform future nutrients management decisions:
  - Ongoing monitoring requirements for wastewater dischargers.
    - Effluent and in-stream monitoring for larger dischargers.
    - Only effluent monitoring for smaller dischargers.
  - A monitoring "gap analysis" and filling in any identified gaps in water quality characterization for municipal stormwater dischargers.
  - Encouraging voluntary monitoring efforts by agriculture and other nonpoint sources.

<b>Implementation Timeline for Regulation #85</b>	
March 13/14, 2012	Commission takes preliminary final action
April 9, 2012	Commission takes final action
May 10, 2012	Regulation #85 is published in Colorado Register
May 30, 2012	Regulation #85 becomes effective
May 31, 2012	<ul style="list-style-type: none"> <li>• Domestic and industrial facilities identified in 85.5(1)(a)(iii) and 85.5(2) – effluent limits in 85.5(1)(a) and (b) will be implemented into permits as they come up for renewal. They will also be required to be met by new or modified facilities as site applications are submitted.                             <ul style="list-style-type: none"> <li>○ Compliance schedules will likely be included in permits for existing facilities.</li> <li>○ Facilities may submit applications for a variance.</li> <li>○ Facilities may submit applications for a trade.</li> </ul> </li> <li>• MS4 Permittees – BMP requirements in 85.5(4) will be implemented into permits as they come up for renewal.</li> <li>• Nonpoint sources and agricultural operations – BMP, public education measures, and nutrient management plans are encouraged. The Division will collaborate with owners/operators of agricultural operations to pursue grants to control nonpoint sources.</li> </ul>
March 1, 2013	<ul style="list-style-type: none"> <li>• All domestic dischargers, even those not subject to effluent limits, and industrial dischargers identified by the Division must begin monitoring their effluent and the receiving stream for nutrients. Compliance with these requirements is automatic – i.e., implementation of these requirements into a permit is not required. Facilities must submit a certification to the Division that the sampling and analysis plan is in place and that monitoring is taking place.</li> <li>• Nonpoint sources and unpermitted point sources are encouraged to monitor for nutrients.</li> </ul>
April 15, 2014	Data collected by entities submitted to the Division for the period from March 1, 2013 – December 31, 2013.
October 31, 2014	MS4s identified in 85.6(3)(a) must submit a Discharge Assessment Data Report.
April 15, 2015	Data collected by entities submitted to the Division for the period from January 1, 2014 – December 31, 2014.
2015 Triennial Review	<ul style="list-style-type: none"> <li>• The Division will report to Commission on progress of nonpoint source and agricultural operations nutrients reduction.</li> <li>• Based on information in the Discharge Assessment Data Reports submitted in 2014, the Division may propose additional monitoring or BMP requirements for MS4s.</li> <li>• The Division may recommend changes to the regulation to improve its effectiveness.</li> </ul>
April 15, 2016	Data collected by entities submitted to the Division for the period from January 1, 2015 – December 31, 2016.
April 15, 2017	Data collected by entities submitted to the Division for the period from January 1, 2016 – December 31, 2016.
May 31, 2017	Interim Nitrogen Values Become Effective
April 15, 2018	Data collected by entities submitted to the Division for the period from January 1, 2017 – December 31, 2017.
2018 Triennial Review	The Division may recommend changes to the regulation to improve its effectiveness.
April 15, 2019	Data collected by entities submitted to the Division for the period from January 1, 2018 – December 31, 2018.
April 15, 2020	Data collected by entities submitted to the Division for the period from January 1, 2019 – December 31, 2019.
April 15, 2021	Data collected by entities submitted to the Division for the period from January 1, 2020 – December 31, 2020.
2021 Triennial Review	The Division may recommend changes to the regulation to improve its effectiveness.

<b>Implementation Timeline for Regulation #85</b>	
April 15, 2022	Data collected by entities submitted to the Division for the period from January 1, 2021 – December 31, 2021.
May 31, 2022	If voluntary nonpoint source BMPs are not effective in managing nutrients, the Commission may consider the adoption of prohibitions or precautionary measures to further limit nutrient concentrations.
June 1, 2022	<ul style="list-style-type: none"> <li>• Facilities subject to Control Regulations 71-74 will be subject to Regulation #85 effluent limits as their permits come up for renewal or a site application is submitted</li> <li>• The Commission may consider the adoption of prohibitions or precautionary measures for nonpoint sources and agricultural operations.</li> </ul>

# **NUTRIENT CRITERIA DEVELOPMENT PLAN FOR COLORADO**

**September 26, 2002**

**Colorado Department of Public Health & Environment  
Water Quality Control Division  
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**Developed in conjunction with the  
Colorado Nutrient Criteria Development Workgroup**

# NUTRIENT CRITERIA DEVELOPMENT PLAN FOR COLORADO

September 26, 2002

## INTRODUCTION

Anthropogenic eutrophication of the nation's surface waters resulting from excess nutrient additions (primarily nitrogen, N, and phosphorous, P) has been an ongoing problem in the U.S. for many years (Laws, 1993). Recently, the U.S. Environmental Protection Agency (EPA) has been striving to develop national nutrient criteria. In a national report to congress (USEPA, 1996), the EPA reported that N and P are among the leading causes of water quality impairment in the U.S. According to the report, 40% of rivers and 51% of lakes have designated use impairments from excess nutrients, which have resulted in excessive algal growth. (Nutrients have not been identified as a major cause for listings under Section 303(d) for Colorado water bodies.) In October 1997, a Clean Water Action Plan (CWAP) was initiated by EPA to address nutrient over-enrichment in the nation's surface waters. The CWAP includes the development of water quality nutrient criteria as one of its components. In choosing to regulate N and P concentrations, it is inherently assumed that these nutrients regulate the growth of algae. In March 1998, the CWAP was presented in the Federal Register. As it appears in the Federal Register, the plan called for the development of region-specific nutrient criteria for different types of water bodies, so as to account for the wide natural variation in nutrients that are found around the country.

In the January 9, 2001 Federal Register notice, EPA recommended that states and authorized tribes develop a nutrient criteria plan to outline their process for how and when they intend to adopt nutrient criteria into their water quality standards. In addition, EPA recommended that states develop a plan for nutrient criteria development by the end of 2001 and adopt nutrient criteria by 2004. However, on November 14, 2001, Geoffrey Grubbs, the Director for EPA's Office of Science and Technology, distributed a memo to state pollution control administrators providing additional guidance on developing plans, the flexibility available, and new expectations on timeframes for plan development and criteria adoption. According to this memo, "...states should begin drafting a nutrient criteria plan and discussing the specifics of the plan with EPA within the next few months" (from November 2001), and by the end of 2004, EPA will evaluate the progress of the state and determine how it compares with the schedule in the plan.

The Grubbs memo represented a significant departure from the original EPA proposed timeline. The Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Commission (WQCC), is responsible for establishing nutrient criteria for the state. As staff to the WQCC, the Water Quality Control Division (Division) intends on using the flexibility suggested by EPA in developing a plan for nutrient criteria that is scientifically defensible, specific to the unique conditions in Colorado, and considerate of stakeholder concerns. To that end, the Division has been holding regular meetings with a Nutrient Criteria Development Workgroup. The meetings are regularly attended by approximately thirty individuals, representing state municipalities, consulting firms, law firms, environmental groups, state and federal agencies, and the administrator of Colorado Water Quality Control Commission (WCCC). Early in the process, the workgroup decided to separate the two water body types for nutrient criteria development: 1) streams and rivers; and 2) lakes and reservoirs. This division was made because of the different ways the state historically has dealt with nutrients in the two water body types. The two approaches are summarized briefly below. For the rest of this document, the two approaches have been combined and organized into a single format in order to address efficiently the criteria suggested by EPA.

The development of Nutrient Criteria for streams and rivers in Colorado is in its infancy. The state has very little monitoring data for chlorophyll *a* and algal community structure. Only a few studies of lotic systems have addressed relationships between nutrient levels, algal biomass and beneficial uses. In addition, there is a large degree of variation in nutrient levels between and within river basins. In discussions with other Region 8 states, it has become apparent to the Division that other states are



struggling with many of the same problems and that there is no clear consensus on how plans should be developed for rivers and streams. Based on the flexibility from EPA in their November 2001 memo, and the paucity of available data to make an appropriate plan for exactly how criteria will be set, we feel that there is a need to analyze existing data on nutrients and algal communities in the state and devise a sampling plan for collecting additional data to assess the relationships among nutrient levels, algal growth, and designated uses.

Colorado is much more experienced in the development of nutrient criteria for lakes and reservoirs. Colorado currently has nutrient criteria in place on five reservoirs: Dillon Reservoir, Cherry Creek Reservoir, Chatfield Reservoir, Bear Creek Reservoir, and Standley Lake. The nutrient criteria on these reservoirs are applied as site-specific total phosphorus standards on Dillon Reservoir and Chatfield Reservoir, a chlorophyll *a* standard on Cherry Creek Reservoir, and narrative standards on Bear Creek reservoir and Standley Lake. The nutrient criteria were developed based on long-term intensive site-specific watershed assessments, and modeling of relationships between nutrient concentrations and algal growth.

Most lake monitoring in Colorado has focused on only a few lakes. Lake and reservoir data that would provide a broad ecoregional perspective for development of nutrient criteria are needed. Additional information on nutrients and algal production must be collected from many different lakes in order to support development of regional nutrient criteria for lakes and reservoirs.

This plan describes the conceptual framework for development of nutrient criteria for Colorado. The plan does not represent a definitive implementation plan. Methodologies will have to be developed and are beyond the scope of this plan, but will result from this plan. Many of the tasks outlined in this document will be ongoing and occur concurrently.

## CONCEPTUAL APPROACH AND OBJECTIVES

EPA recommended three options for developing nutrient criteria:

1. Develop nutrient criteria that fully reflect localized conditions and protect specific designated uses, using EPA's Technical Guidance Method
2. Adopt EPA's 304(a) Criteria Recommendations
3. Develop a Unique System

Based on initial review and negative reaction to the EPA 304(a) nutrient criteria, for rivers and streams and for lakes and reservoirs, Colorado does not expect simply to adopt EPA's 304(a) criteria. Instead, the Division anticipates using a combination of options 1 and 3. EPA nutrient criteria guidance documents, along with other relevant guidance documents will be used for establishing goals, developing a conceptual model, data screening, and evaluation of expected conditions.

There is much discussion as to the definition of expected or conditions. Some states and EPA refer to "reference conditions". Colorado has introduced the term "expected conditions" in a number of criteria development processes. Expected conditions are considered to be the broad range of conditions that reflect least or minimal impact by human-induced nutrient loads. At this time, the stakeholders working on these processes seem to prefer the use of "expected conditions" rather than "reference conditions".

For rivers and streams, the Division anticipates developing a statewide approach with regionalization for establishing nutrient criteria. Key elements of the conceptual approach include:

1. Assessments conducted at the basin or sub-basin level (it is anticipated that in some cases site-specific standards may need to be implemented where basin or sub-basin level assessments are not refined enough to account for local conditions)
2. Criteria based on comparisons to "expected conditions"
3. Criteria based on biological endpoints of the algal community that are linked to the designated uses.

EPA recognizes that states have specific priorities for nutrient criteria development, and offered the flexibility to prioritize state waters in a way other than by the EPA ecoregions (Grubbs Memo, 2001). Therefore, Colorado anticipates using a phased approach for developing nutrient criteria for lakes and reservoirs. Based on Colorado's familiarity and experience in setting lake and reservoir nutrient standards, the Colorado strategy will be to develop nutrient standards for selected targeted water bodies that have significant nutrient issues and are high on our list of priorities. This will make up the first phase for development of nutrient criteria. (Prioritization will be discussed in a later section.) Although a statewide or ecoregion approach will not be used at this time, in the next phase of nutrient criteria development, information from these site-specific efforts will be used to develop ecoregional nutrient criteria for lakes and reservoirs. These phases may occur concurrently.

As in the Cherry Creek Reservoir example for a site-specific effort, development of these criteria will include assessment of watershed loading to the reservoir, and development of models. Models will be developed that link watershed loading to lake chemistry. Models will be developed to link lake chemistry (N and P concentrations) to lake response (chlorophyll *a* concentrations).

## PARAMETERS INCLUDED IN THE CRITERIA

The four primary nutrient criteria parameters suggested by EPA (2000) are: water column concentrations of total nitrogen, total phosphorus (causal parameters), and algal biomass (as chlorophyll *a*), and turbidity or transparency (response parameters). Nutrient criteria for Colorado lakes and rivers will be based on the causal parameters N, and P, as well as the response parameters Chlorophyll *a*, algal communities and

transparency (Secchi depth or turbidity). Other possibilities for causal parameters that will be considered include orthophosphate, total Kjeldahl nitrogen, ammonia, nitrate, and DOC. Additional response parameters such as dissolved oxygen, pH, plankton or macrophyte biomass, percent cover, and species composition may also be considered. Considerations in the form of the criteria may include spatial scale, temporal cycles such as diel or seasonal cycles, and determination of attainment. Colorado anticipates developing numeric criteria.

Further investigation of the literature and field studies, along with consultation with the EPA Regional Technical Assistance Groups (RTAG), will be needed to determine which parameters would be best for statewide or basin-specific indicators. The RTAGs are a group of State and Federal specialists established in each EPA Region to help develop and administer the National Nutrient Criteria Program.

## **CRITERIA DEVELOPMENT PROCESS**

### **Regionalization**

Colorado anticipates developing nutrient criteria that will be applied as a system other than EPA ecoregions and Subecoregions.

For the purpose of characterizing nutrients, EPA (2000) suggests classifying water bodies to identify groups of rivers or streams that have comparable characteristics (i.e., similar biological, ecological, physical, and/or chemical features) so that data may be compared or extrapolated within stream types. For rivers and streams, EPA suggests a two-phased approach: 1) categories based primarily on physical parameters (e.g., climate, geology, substrate features, etc.) and 2) categories based on nutrient gradient (based on measured nutrient concentrations and algal biomass). The guidance document also suggests that this physical nutrient characterization can be complemented by designated use classifications.

For lakes and reservoir, Colorado's anticipated approach will be phased to incorporate a site-specific empirical approach with EPA's technical guidance. In the future, information from high-priority, site-specific efforts will be used to support development of lake and reservoir nutrient criteria on a sub-ecoregional basis or other classification system. Some suggestions for developing categories of lakes will be in the following section on Relation to Physical Classification.

### **Relation to Physical Classification**

The term “classification” as used here refers to the process of grouping or classifying water bodies based on physical characteristics, and should not be confused with regulatory use classification. Nutrient criteria will be established for two basic water body types: streams/ivers and lakes/reservoirs.

A meaningful organization of stream networks ultimately depends on the identification of geomorphologically similar stream reaches that respond to nutrient loads in a similar fashion. Classification systems that incorporate these factors should be used in developing a spatial framework for habitat indicators. Some of the factors that are anticipated to be included in the classification system for streams and rivers in Colorado include: beneficial uses, designated uses, land use/watershed characteristics, underlying geology, stream order, size/shape, downstream water body, flow, downstream loading, stream gradient (slope), width/depth ration, entrenchment ratio, sinuosity, channel materials, etc. This information is critical in assessing the relationship between nutrients and the algal community. It is anticipated that data related to these parameters will need to be collected and organized as we proceed with the nutrient criteria development process.

It should also be recognized that there may be water bodies that will require site-specific consideration. Examples of stream segments that may need site specific interpretations of nutrient criteria include those with the following characteristics: water transfers or diversions, effluent dominated, highly engineered water bodies, or water bodies that cross ecoregional boundaries (Tetra Tech, 2002).

Additional classification for lakes and reservoirs may be based on physical characteristics such as: Lake vs. reservoir, geologic origins, surface area, mean depth, reservoir management, residence time, stratification and mixing, or ecoregion. We recommend avoiding trophic classifications.

Classifications may not be as important in a site-specific context, but will be part of the general assessment for regional criteria.

Although this document emphasizes the basic split in water body types (streams vs. lakes), it is Colorado’s intention to consider water quality of downstream waters and to ensure that applicable standards provide for the attainment of downstream water quality standards. Overall, the goal of this task is to determine categories of water bodies that will have different nutrient criteria.

**Prioritization and Coverage**

The Division is planning to sample in the South Platte and Arkansas River basins during 2002 and 2003. This allows the Division to maximize resources, by tying nutrient criteria monitoring to monitoring efforts based on the triennial review schedule. Sampling in these areas first will serve the dual purpose of filling in data gaps for macroinvertebrates in the existing Division database on biological parameters and providing additional information for expected conditions for stream assessment.

Identification and prioritization for development of nutrient criteria for lakes and reservoirs has been through several processes. These sites are prioritized in the following manner:

- (a) High Priority Sites were identified through the Standards Review Process conducted during Basin Triennial Reviews. These sites were identified as not attaining standards. Other high priority sites were identified through the 303(d) listing process. Examples include Barr Lake and Fruitgrowers Reservoir.
- (b) Medium Priority Sites were brought to WQCD’s attention by stakeholders groups. Examples include Grand Lake, Barr Lake, and Prewitt Reservoir
- (c) Low Priority Sites are from geographical areas not yet covered by previous monitoring efforts or for which older data have demonstrated no water quality problems.

Table 1 illustrates the prioritization process for lakes and reservoirs. This table is an example, and is not finite.

Table 1. Lake Prioritization

Lake	Standards non-attainment	303(d) List	Public Concern	Problem reported	Existing data and/or information	Priority Rank	Triennial RMH
Barr L.	X	X	X	X	X	High	2009
Fruitgrowers R.	X	X	X	X	X	High	2006
Prewitt R.			X	X	X	Med	2009
Grand Lake			X		X	Med-Low	2008
Island Lake					X	Low	2007

As stated previously, criteria will be developed with a phased approach. In the first phase, Colorado anticipates continuing with its site-specific approach. Colorado’s resources (financial and staffing resources) are already committed to developing nutrient criteria for the “high priority” lakes identified above. These lakes represent different ecoregions in the state, and intensive studies on these lakes will provide valuable data for the second phase, which will be development of nutrient criteria to be applied statewide.

Note that while taking this site-specific approach, the state plans to continue to collect statewide data (through its own monitoring, as well as from other agencies) and compile and evaluate existing data for phase 2. These phases will be concurrent. The reason for designating the phases is that resources are limited. Resources have been identified for site-specific efforts (319 funding, etc.), but not for the regional approach.

## **Protection From Impairment During Criteria Development**

There has been concern expressed by some stakeholders that there isn't adequate protection of the water bodies statewide, during this criteria development process. Colorado feels that there are several mechanisms in place that could provide protection against nutrient degradation of water bodies during this time. First, many water bodies are in segments designated as Outstanding Waters. Therefore, no degradation is allowed. Many other water bodies carry Reviewable designation, so antidegradation applies to those where we have numeric standards in place (i.e. nitrate standards for Water Supply uses). Colorado's Mixing Zone Policy protects any lake receiving a direct discharge. Other mechanisms could include proposals for specific segments for the WQCC to adopt standards based on existing quality.

Interim measures to protect water bodies, while criteria are being developed, are important and will be explored. These interim measures could include triggers or screening levels for narrative criteria to prevent degradation. For example, Colorado's Basic Standards for Surface Water (5 CCR 1002-31) provide narrative descriptions that could be applied:

“(1) Except where authorized by permits . . . state surface waters shall be free from substances attributable to human-caused point source or non-point source discharge in amounts, concentrations, or combinations which:

- (a) for all surface waters except wetlands;
  - (ii) form floating debris, scum, or other surface materials sufficient to harm existing beneficial uses; or
  - (iii) produce color, odor, or other conditions in such a degree as to create a nuisance or harm existing beneficial uses or impart any undesirable taste to significant edible aquatic species or to the water; or
  - (iv) are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life; or
  - (v) cause a film on the surface or produce a deposit on shorelines. . .”

There is a need to determine the relationships among these narrative criteria, expected conditions and beneficial uses.

EPA (2000) suggests that, at a minimum, the state should protect established uses for the water bodies within state lands. Other possible narrative criteria that have been suggested by other states include:

- “no nuisance algal blooms such that swimming is restricted during summer months.”
- “no increase in nutrient concentrations over reference conditions.”
- “no change in the macroinvertebrate community due to an increase in nutrients”
- “free from excess nutrients that cause or contribute to undesirable or nuisance aquatic life or produce adverse physiological response in humans, animals, or plants.”
- “There shall be no increase, in any waters, of total phosphorous above background conditions that may contribute to the acceleration of eutrophication or the stimulation of the growth of aquatic biota in a manner that has an undue adverse effect on any beneficial values or uses of any adjacent or downstream waters.”

### **Inventory Existing Data**

The first step for developing nutrient criteria for rivers and streams in Colorado is to develop a database of parameters integral to assessing the effects of nutrients on lotic systems in the state (including data on nutrients and other water quality parameters, the algal community, the macroinvertebrate community, and physical characteristics). Information related to biological parameters will be entered into EDAS, a relational database that has been developed for the Division for storing and analyzing biological information. Data entry into EDAS has already been initiated for the state's macroinvertebrate data.

Expected sources of this information include the CDPHE STORET database, data collected for TMDLs, etc.; regional and site-specific studies conducted by the USGS (e.g., NAWQA and other site-specific studies) and other government agencies, data compiled by Workgroups such as the Water Quality Forum's Impacted Water Supply Workgroup, and research studies conducted by universities (CU, Utah State, etc.).

As for rivers and streams, a database of existing data for lakes and reservoirs will be developed. The database should include data on physical characteristics, nutrients, response variables, and aquatic communities. Sources for existing data include the following: WQCD, STORET, Stakeholders groups, municipalities, State Parks, U.S.G.S., Watershed associations, U.S.A.C.E., U.S.B.O.R., CLARMA. (prepare table). Examples of existing studies include: Bear Creek Reservoir Phase I, Cherry Creek Reservoir, Barr Lake, Fruitgrowers Reservoir, and Pueblo Reservoir. CLARMA provided a list of lakes and reservoirs with ongoing nutrient monitoring programs.

Note that many states are limiting their data assessments to data collected within the last 10 years. This is Colorado's preference, as well. However, much of the data from national databases such as STORET may be obsolete

Early in this process, EPA indicated they would be willing to help the state inventory the existing data. Our needs in this situation would be for EPA to identify sources of data, to contact the sources, and to acquire the data. The state then could assemble a database. EPA has indicated they will be able to assist in some way.

### **Data Collection**

Once the existing data has been inventoried, the next step is to identify the data gaps and determine spatial and temporal parameters for data collection (e.g., it may be appropriate to analyze a single basin or fill in data gaps among multiple basins).

According to EPA (2000), a monitoring plan for determining appropriate nutrient criteria should be designed to detect:

- nutrient and algal conditions with statistical rigor;
- seasonal patterns in nutrient levels and their relationship to algal biomass levels;
- the assimilation capacity of the system for nutrients (i.e., how much nutrient loading can be assimilated without causing unacceptable changes in water quality or the algal community (biomass and composition));
- whether nutrient concentrations are increasing, decreasing, or staying the same over time.

The field work planned by the Division for 2002-2003 for rivers and lakes should help us begin to address these issues. Determining seasonal patterns and temporal trends will obviously require multiple sampling efforts. The intensity of sampling and data collection appropriate for ultimately establishing nutrient criteria will need to be determined.

### **Projects Planned to Address Data Needs**

For rivers and streams, there are two projects that are anticipated for the 2002 field season. These projects are expected to help determine connections between nutrients and Aquatic Life uses. Additional studies would be needed to determine relationships between nutrients and other classified uses.

**Utah State University's Reference Site Assessment Study.** Chuck Hawkins, a professor at Utah State University described his EPA-funded project for assessing reference sites throughout much of the interior western United States. The primary objective of the project is to determine the environmental factors most strongly associated with biological variation among sites and thus the type of site classification that will be most useful when performing bioassessments. Hawkins identified a total of 823 reference sites to be sampled. Twenty-nine sites have been assessed in Colorado thus far; most of these are in the mountains of Ecoregion II. Information is available from each site for water quality, habitat, and macroinvertebrate and algal community structure and the sampling was designed to be directly comparable with data collected by the E-MAP western stream pilot study.

Using the data from the study, Hawkins has developed RIVPACS-type predictive models that likely will be used by regulatory agencies in Oregon, Washington, and California for bioassessment programs. They hope to use the models together with multi-metric methods to provide the most robust assessments possible of the biological condition of a site.

Based on the results of the Montana Pilot Study and the wealth of data potentially available from Chuck Hawkins reference site assessment, the focus has changed for Colorado's Nutrient Criteria Development Plan for Rivers and Streams. Conducting a pilot study to examine the cause/effect relationships between nutrients and the algal community likely will not produce meaningful results in plains streams at the level of effort discussed at the January meeting. A pilot study in a mountain system may be more beneficial (see Rough Draft), depending on available resources. However, due to anticipated limitations, the Division feels that we can maximize our efforts in gathering information on periphyton communities throughout the state by contributing to the Utah State University program.

There are several advantages in contributing to this study:

- Since the study has numerous sites throughout the western United States, it provides a larger framework for assessing algal communities. It was intimated at the RTAG meeting that several western states are considering using the RIVPACS approach in criteria development.
- The project was funded by a grant that will be used to analyze the additional data collected in Colorado. Although we don't yet know how many sites are available for funding, the analytical costs for assessing water chemistry, as well as periphyton and macroinvertebrate community structure will be covered by the grant. Colorado will provide the field work.
- The Hawkins study will provide the largest database currently available on periphyton in Colorado.
- The reference approach utilized by RIVPACS fits in well with the anticipated approach that will be used to develop nutrient criteria for rivers and streams in Colorado. The field assessments that will be carried out this summer for nutrient criteria will also be used for development of other standards the Division is pursuing (e.g., biocriteria and sediment criteria). Thus, our efforts in the field will be maximized.

We are currently in the process of discussing site locations and sampling methods with EPA and Chuck Hawkins, but we anticipate collecting information on water quality, habitat, and algal and macroinvertebrate communities from numerous sites starting this spring. We need to collect macroinvertebrate data from sites in the South Platte and Arkansas Rivers to fill out our existing



macroinvertebrate database. Thus, we anticipate sampling these basins first (spring and summer of 2002) as part of the Utah State University program.

Note: Colorado tried to participate in the Hawkins Study during the summer of 2002. However, because of drought conditions (dry sites), the sampling event was not limited to potential reference sites.

**Pilot Study.** Based on the results of the Montana Pilot Study, it doesn't seem worthwhile at this point to pursue a pilot to address cause/effect relationships in the plains. However, it may be productive to assess a small watershed in the mountains. A study carried out by the Division and the USGS on the Eagle River (Deacon and Spahr, 1998) suggested good relationships between nutrients and algal biomass as well as dissolved inorganic nitrogen (DIN) and algal community indicators. A mountain stream pilot study may be worth pursuing, depending on available resources.

### **Relation to Colorado Use Classification and Regulatory Process**

Relating nutrient criteria (specifically algae) to designated uses seems to be one of the most intractable problems in the nutrient criteria development process. Colorado's preferred approach is to put nutrient criteria in the same framework as other water quality criteria in the state. However, it is difficult to determine how nutrients influence designated uses of water bodies. For instance, does it stink? Does it kill fish? Does it adversely affect the macroinvertebrate community? Does it limit fishing or swimming opportunities? Is it aesthetically displeasing? Answers to these questions are often subjective and difficult to apply in terms of a standard. These questions require policy decisions that the WQCC will need to address. However, beginning with a description related specifically to algae can help define the goals for nutrient criteria.

Colorado's water quality standards system includes four designated uses: Aquatic Life, Water Supply, Recreation, and Agriculture. Aside from fairly general narrative statements related to algal growth, we are not aware of specific links between algae and uses. Some of the steps necessary in relating nutrient criteria to uses include the following:

- Establish system for determining "expected conditions" in relation to nutrients and algae
- Determine regional expectations for nutrients and/or algae that reflect attainment of uses or unimpaired conditions (i.e., "expected conditions")
- Determine narrative standards for regional expectations where numeric standards can't be derived
- Define designated uses with respect to algae in streams

For states that plan on developing their own criteria, EPA (2000) suggests three possible approaches for setting criteria:

- 1) identification of reference reaches for each stream class based on best professional judgment or percentile selections
- 2) use of predictive relationships (e.g., trophic state classifications, models, biocriteria)
- 3) application and/or modification of established nutrient/algal thresholds (e.g., nutrient concentration thresholds or algal limits from published literature)

As mentioned in the previous section, Colorado anticipates using an expected conditions based approach as the primary focus for developing nutrient criteria for rivers and streams. However, depending on the results of the data collection efforts and analyses of the data, models will be assessed for accuracy and predictive capabilities. Identification of expected conditions may provide a better understanding of the range of conditions exhibited by both causal and response variables in minimally impacted water bodies and, by inference, reflect the potential stream habitat for impacted streams having similar watershed characteristics. It is recognized that this approach has some limitations. For instance, "expected conditions" have not yet been defined for Colorado rivers and streams and thus a database for these sites has not been established. Also, there are some regions of the state where land management has been so pervasive that it has eliminated the potential for comparative conditions. In these cases, site-specific

assessments to establish nutrient criteria likely will be needed (see below). However, using expected conditions appears to be a reasonable, scientifically defensible approach to establishing nutrient criteria.

Expected conditions for lakes have not been identified. As we proceed to develop regional criteria, we will evaluate data for expected conditions. However, it is anticipated that nutrient criteria for lakes will be based on predictive relationships as determined through models.

This section will be further refined and developed as the state proceeds in developing criteria.

#### **REGULATORY PROCESS: DETERMINATION AND ADOPTION OF NUTRIENT CRITERIA**

The schedule for development and adoption of nutrient criteria will depend on input from the stakeholder group and initial approval by the EPA on the proposed plan outline.

The previous sections of this document discuss the issues involved in developing nutrient criteria, and the processes and data collection that will need to be accomplished in order to develop proposed criteria. Colorado will attempt to establish numeric nutrient levels that will be protective of the classified uses through the use of expected conditions and cause-effect relationships. Determination of these numeric levels for nutrients depends on the accomplishment of the tasks discussed in this document (data collection, assessment, etc.) We anticipate that criteria will be developed as part of Colorado's Basic Standards review process. Once the numeric levels have been determined, these criteria will be proposed to be adopted into Colorado's Basic Standards (Regulation No. 31) at the 2010 Rulemaking Hearing. Once the criteria have been adopted into the state's Basic Standards, they can begin to be applied to water bodies as standards, which will be adopted, basin by basin, into each segment during the state's Basin Triennial Reviews, according to the Rulemaking Hearings Schedule.

## **STAFFING AND RESOURCES**

The resources required for developing nutrient criteria for Colorado have not yet been identified. Elements to be considered include:

### **Internal**

- Scientific Analysis Expertise
- Monitoring and Modeling Expertise
- Data Base Management Expertise

### **External**

- Consultants
- Universities
- Citizen Watershed Groups
- Shared Information from other states/regions/federal agencies

### **Funding**

- grants
- base budget
- special budget

Currently, no special funding for nutrient criteria development has been identified. Therefore, any work the Division provides will have to be funded by existing budgets and will be part of existing monitoring and assessment activities.

## **MILESTONES**

Table 2 presents the milestones and schedule of activities discussed in this plan. The schedule was developed in consideration of limited resources available to the Division and State generally for nutrient criteria development. It incorporates and is dependent on work products from other workgroups such as the Aquatic Life Workgroup. This schedule also is based on Colorado's regulatory process, and the schedule of upcoming Rulemaking Hearings for changes to Basic Standards, as well as Basin Standards. The milestones indicate when the products of this effort can realistically fit into the Division's current long-term schedule. Depending on how progress is made toward development of nutrient criteria, the schedule could be advanced or delayed.

Workgroup meetings will be scheduled after each milestone.

The schedule for development and adoption of nutrient criteria for rivers and streams will depend on input from the stakeholder group and initial approval by the EPA on the proposed plan outline.

## **ASSESS PROGRESS**

It is anticipated that progress towards milestones will be assessed on a regular basis, most likely related to the completion of major tasks. The entire nutrient criteria development plan should be reviewed at least annually. This plan is not meant to be a binding agreement with EPA, and can be revised.

## **LITERATURE CITED**

Geoffrey Grubbs. 2001. Memorandum. Development and Adoption of Nutrient Criteria into Water Quality Standards.

Tetra Tech. 2002. White Paper: The Development of Nutrient Criteria for Ecoregions Within: California, Arizona, and Nevada. Prepared for US EPA Region IX Regional Technical Advisory Group & CA SWRCB State Regional Board Advisory Group. Prepared by Tetra Tech, Inc. Lafayette, CA.

**Figure 1. Flowchart for developing nutrient criteria in rivers and streams.**

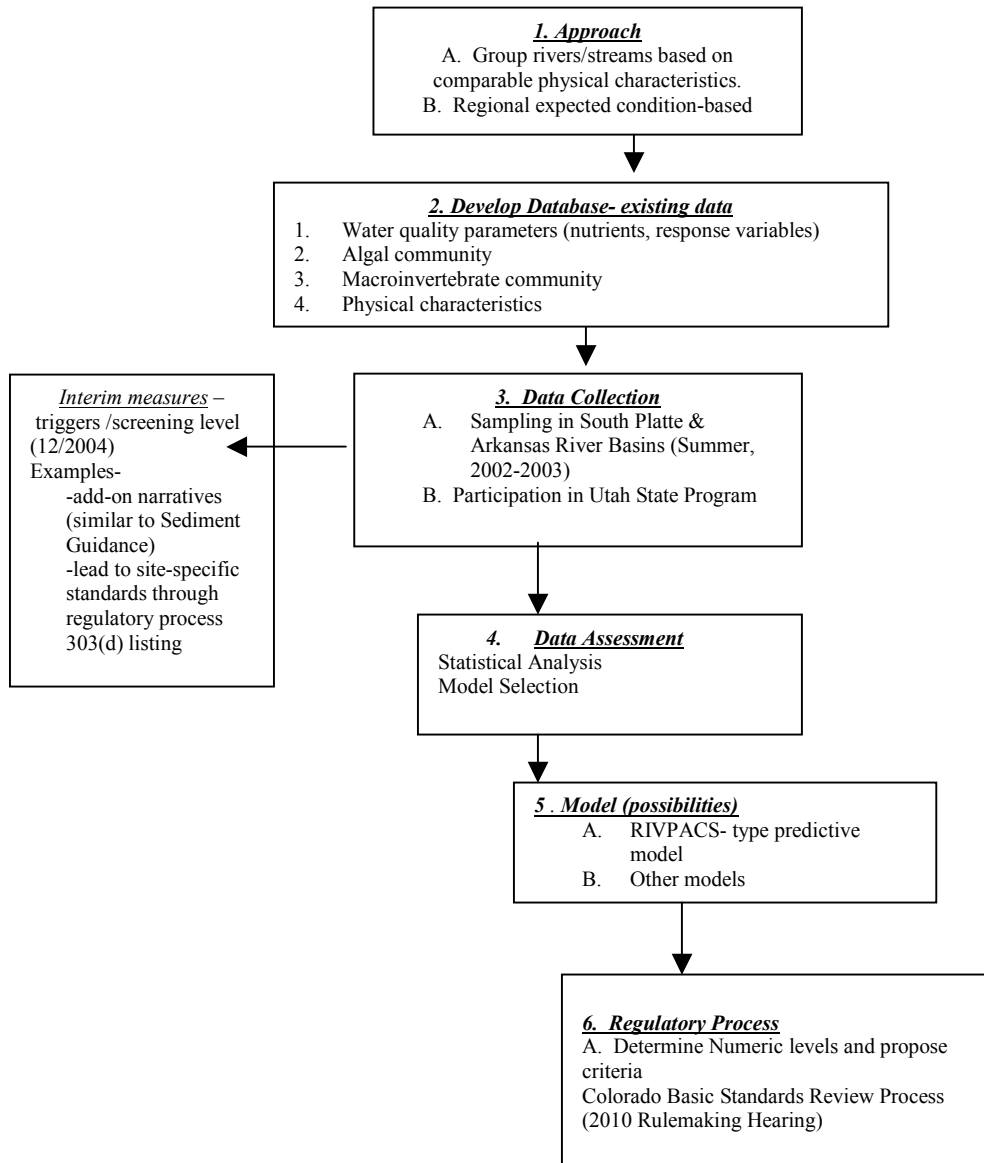
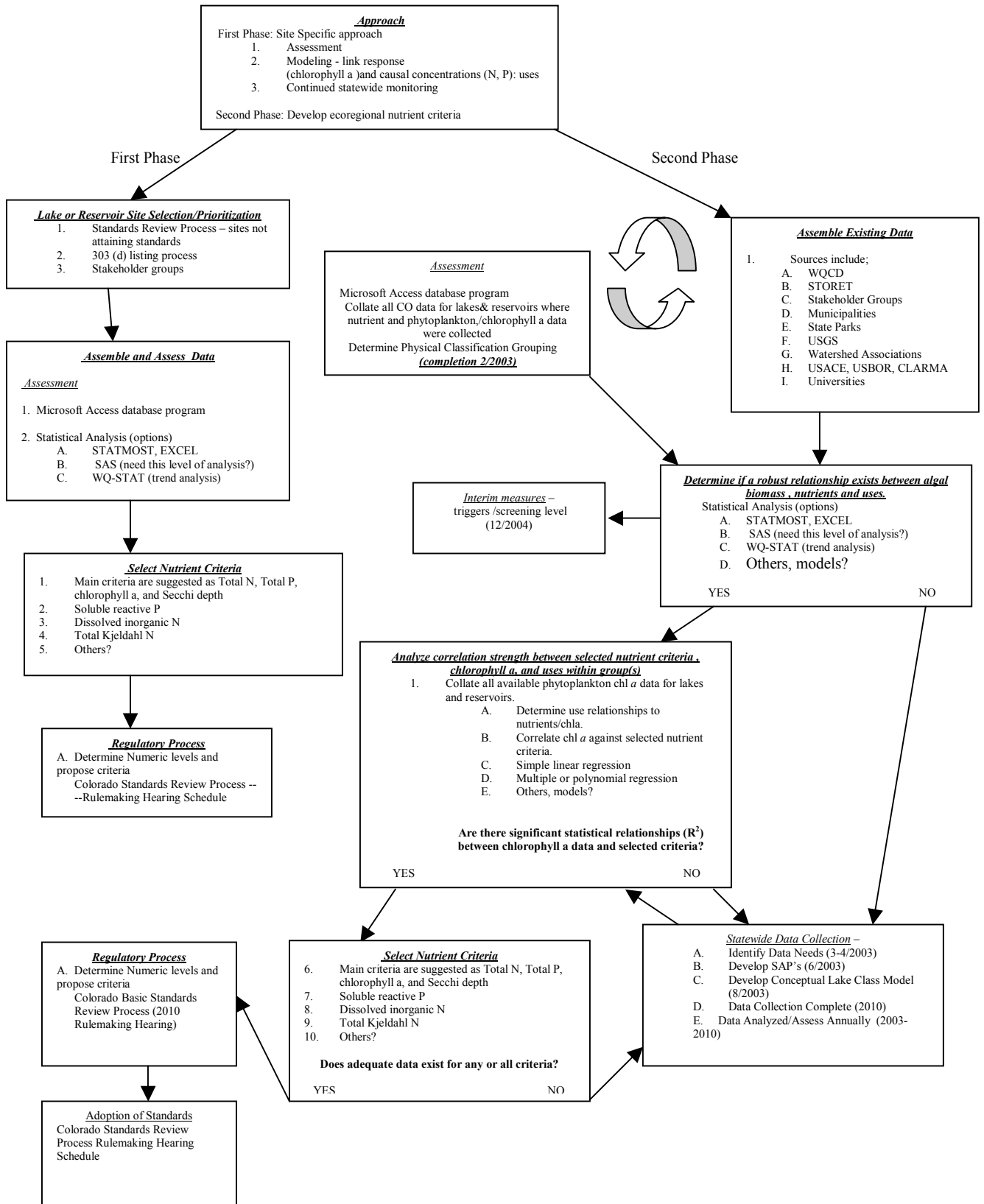


Figure 2. Flowchart for developing nutrient criteria in lakes and reservoirs.



\*While EPA expects that it will be necessary to modify the plans as new information becomes available or unanticipated problems arise, it is also essential that states/authorized tribes and EPA discuss and agree upon any changes to the plan, particularly since EPA intends to rely heavily on the plans to demonstrate to the public that EPA, states and authorized tribes are addressing the problems of nutrient over-enrichment as expeditiously as possible. (Grubbs, 11/14/2001)

**Table 2. Milestones and Proposed Schedule for Nutrient Criteria Workgroup**

Major Activity/Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Nutrient Criteria Workgroup Progress Update (2X/yr or following task completion)	■	■	■	■	■	■	■	■	■	
Review Nutrient Criteria Plan--Workgroup (January, each year)										
Inventory existing Lake and Reservoir data/create database (Feb 2003)		■								
Inventory existing River and Stream data/create database (Mar 2003)		■								
Evaluate Existing Data (March 2003)		■								
Identify Data Needs (March-April 2003)		■								
Data Collection Plans--SAAPs (June 2003)		■								
Lake and Reservoir Methods (SOPs) (June 2003)		■								
River and Stream Methods (SOPs) (June 2003)		■								
Data collection--Lakes and Rivers (ongoing)		■								
Develop Conceptual Lake Classification Model (August 2003)		■								
Develop interim measures to protect WQ (December 2004)			■							
Data Swap with other agencies/workgroup members (January 2003)	■									
Criteria--assess data, streams and lakes (December, each year)		◇	◇	◇	◇	◇	◇	◇	◇	
Basic Standards (Aquatic Life Use Classification/Assessment Methodology) RMH				■						
Basic Standards Issue Scoping							■			
Basic Standards Issue Formulation								■		
Basic Standards RMH									■	
Standards and Classifications RMHs (Lakes, site-specific)						■	■	■	■	

Note: Nutrient Criteria Workgroup Meetings will be scheduled to report on deliverables for each milestone

Key to symbols:

☺ Milestone Review

■ Work in progress

◇ data review/assess