Nutrient Overview

Nationally, nutrients are one of the top causes of water quality impairments according to EPA (http://www2.epa.gov/nutrient-policy-data/status-state-adoption-numeric-nutrient-standards). Reducing the point sources will cost billions of dollars nationwide (including the City of Pueblo) and may not improve the streams due to nutrients entering streams from of nonpoint sources

I. SOURCES

Nutrients can occur naturally in water but additional sources can increase concentrations of nitrogen and phosphorus significantly (http://www2.epa.gov/nutrientpollution). Examples of sources of nutrients are listed below.

POINT SOURCES

- Wastewater effluent, both municipal and industrial
- Runoff and leachate from waste disposal sites
- Runoff and infiltration from animal feed lots
- Runoff from mines, oil fields, and unsewered industrial sites
- Storm sewer outfalls from cities
- Runoff from construction sites, large site with permits
- Overflows of combined storm and sanitary sewers

NONPOINT SOURCES

- Runoff from agriculture
- Runoff from pasture and range
- Urban runoff (lawn and streets)
- Septic leachate and runoff from failed septic systems
- Runoff from construction, small sites
- Runoff from abandoned mines
- Atmospheric deposition
- Activities on land that generate contaminants, such as logging, wetland conversion, construction and development of land or waterways

Like the human body, water bodies require nutrients, such as nitrogen and phosphorus, to be healthy, but too many nutrients can be harmful. Nutrients can degrade the water quality interfering with the use of the water for fisheries, recreation, agricultural uses and for drinking water. Phosphorus is not toxic to humans and animals but can stimulate toxic algal blooms or may cause oxygen depletion in the streams and lakes. Nitrogen can also stimulate the growth of algae. Nitrogen in the form of nitrate is toxic in high levels to humans and animals. Nitrate is currently regulated for drinking water.

II. REVIEW OF EPA's POSITION

> "Today, EPA is encouraging all states, territories and authorized tribes to accelerate their efforts and give priority to adopting numeric nutrient standards or numeric translators for narrative standards for all waters in states and territories that contribute nutrient loadings to our waterways. The state's nutrient criteria plan should reflect the state's approach to setting standards for its waters, and include schedules for adopting those standards.
>
> To be effective, nutrient criteria should address *causal* (both nitrogen and phosphorus) and *response* (chlorophyll-a and transparency) variables for all waters that contribute nutrient loadings to our waterways. EPA encourages the adoption of standards for all four parameters because of the interrelationships between these parameters and its experience showing that controlling *both* nitrogen and phosphorus is important to successfully combating nutrient pollution in all waters. As always, states, territories and authorized tribes have the flexibility to address nutrient pollution using a subset of or alternatives to these parameters if they are shown to be scientifically defensible and protective of designated uses. Where a state, territory or authorized tribe shows that one causal variable (nitrogen or phosphorus) is the limiting nutrient, it should develop criteria for at least that nutrient. However, if the non-limiting nutrient is likely contributing to a downstream impairment, numeric criteria for that nutrient should be considered as well."

III. COLORADO ADOPTED NUTRIENT STANDARDS

The Colorado Water Quality Control Commission preliminarily approved the new nutrient control regulations at the March 2012 Commission hearing with a unanimous vote. Final approval occurred at the Commission hearing on June 11, 2012 including a few changes proposed by the Governor's Office at the May 14, 2012 hearing. Two new regulations will apply to point source dischargers, including domestic wastewater dischargers, non-domestic wastewater dischargers, and municipal: Regulation #31-The Basic Standards and Methodologies for Surface Water and Regulation #85-Nutrients Management Control Regulation.

Regulation #85 -Nutrients Management Control Regulation

Regulation #85 will require dischargers to meet effluent limits for Total Phosphorus (TP) and Total Inorganic Nitrogen (TIN). The TP and TIN limits shown in Table 1 will be incorporated during the next normally scheduled round of discharge permit renewals beginning July 1, 2013.

Exclusions: Dischargers that meet one of the following criteria will be exempt from these effluent nutrient limits:

- any existing domestic wastewater treatment facility that is owned by a disadvantaged community. A community is considered to be disadvantaged if it has a population of 5,000 or

less with a median household income that is 80% or less of the statewide median household income; or

- any existing domestic wastewater treatment facility with a design capacity less than or equal to 1.0 mgd.

Table 1 - Regulation #85

Category	*Parameter*	*Annual Median* [c]	*95th Percentile* [d]
Existing Dischargers [a]	Total Phosphorus (as P) Total Inorganic Nitrogen (as N) [e]	1.0 mg/L 15 mg/L	2.5 mg/L 20 mg/L
New Dischargers [b]	Total Phosphorus (as P) Total Inorganic Nitrogen (as N) [e]	0.7 mg/L 7 mg/L	1.75 mg/L 14 mg/L

[a] Existing Dischargers are defined as treatment facilities discharging prior to May 31, 2012 or that have submitted a request for preliminary effluent limits to the Division prior to May 31, 2012.

[b] New dischargers are defined as dischargers who submit a request for Preliminary Effluent Limits to the Division on or after May 31, 2012.

[c] Annual Median is defined as the median of all samples taken in the most recent 12 calendar months.

[d] 95th Percentile is defined as the 95th percentile of all samples taken in the most recent 12 calendar months.

[e] Total Inorganic Nitrogen is defined as the sum of nitrate as N, nitrite as N, and ammonia as N.

Monitoring:

Monitoring requirements were also established to evaluate the effectiveness of the control regulation and to determine the sources and load of nutrients at selected locations, and eventual implementation of appropriate and necessary source controls. Wastewater treatment dischargers are required to develop, implement, and document a routine water quality monitoring program. The monitoring program shall be designed to characterize the load (coincident flow and concentration) of nutrients in the discharge, the concentrations in the receiving water above the discharge, and the load of nutrients at selected locations in the rivers and streams below the discharge.

Regulation #31-The Basic Standards and Methodologies for Surface Water

Regulation #31 adopted interim water quality values for Total Phosphorus (TP), Total Nitrogen (TN), and Chlorophyll-a (Chl-a) as summarized in Table 2.

These interim values can be adopted as standards under the specific circumstances discussed below. In considering the adoption of numeric standards for specific water bodies, the Commission can review relevant site-specific factors and conditions, and may adopt standards more or less stringent than the interim values. The interim values for TP and Chl-a can be adopted as standards any time before May 31, 2022 and TN can be adopted between May 31, 2017 and May 31, 2022 in the following circumstances:

1. in headwaters located upstream of:
    a. all permitted domestic wastewater treatment facilities discharging prior to May 31, 2012, or with preliminary effluent limits requested prior to May 31, 2012;
    b. any non-domestic facility subject to Regulation #85 effluent limits and discharging prior to May 31, 2012;
2. discretionary application of Chl-a in Direct Use Water Supply Lakes and Reservoirs;
3. under other circumstances where the Commission has determined that adoption of numerical standards is necessary to address existing or potential nutrient pollution because the provisions of Regulation #85 will not result in adequate control of such pollution.

After May 31, 2022: The interim values for TP, TN, and Chl-a can be adopted as water quality standards in all segments during regularly scheduled water basin hearings.

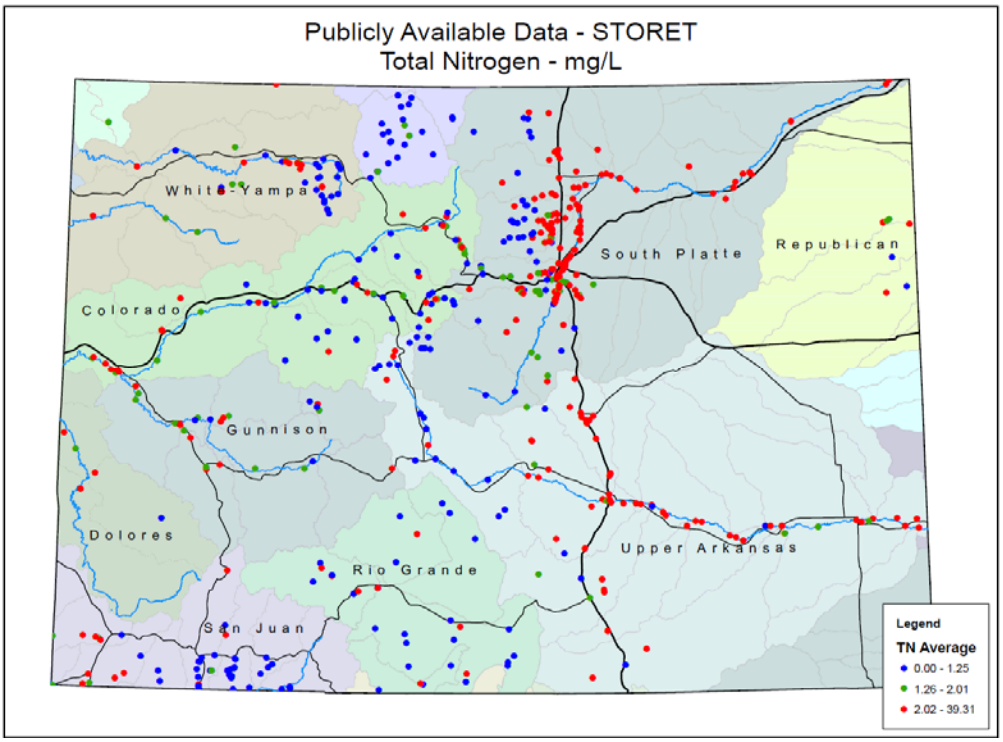
Table 2 - Regulation #31

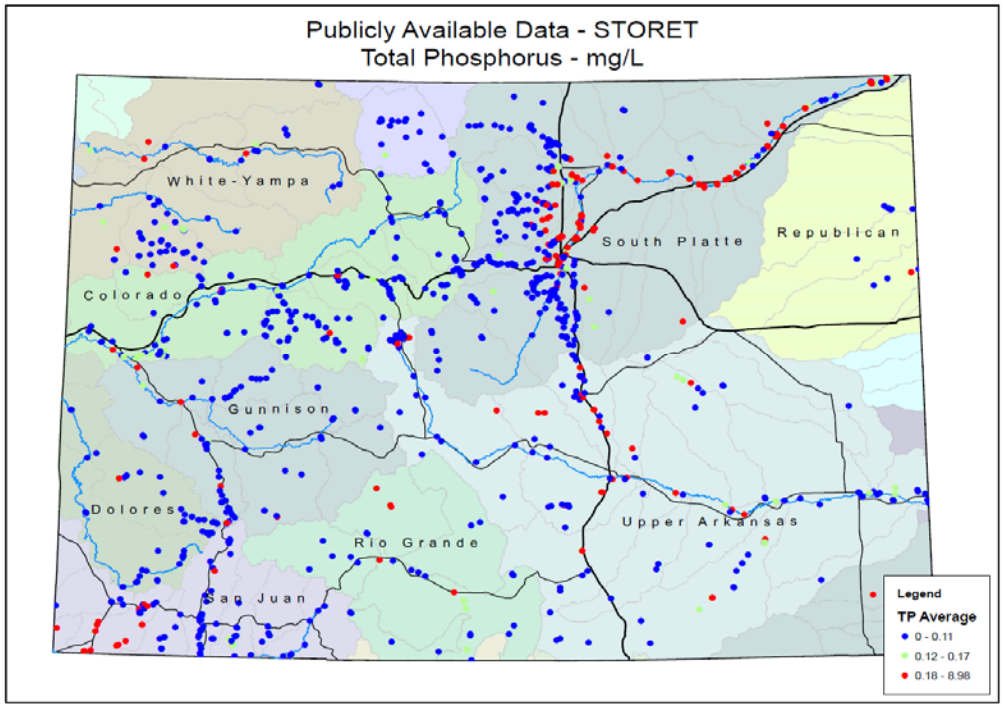
Category	*Parameter*	*Cold Water*	*Warm Water*
Lakes & Reservoirs >25 acres (aquatic life and recreation uses)	Total Phosphorus (as P) Total Nitrogen (as N) Chlorophyll-a	25 ug/l [a] 426 ug/l [a] 8 ug/L [d]	83 ug/l [a] 910 ug/l [a] 20 ug/L [d]
Direct Use Water Supply Lakes and Reservoirs (used regularly as a raw water source for drinking water)	Total Phosphorus (as P) Total Nitrogen (as N) Chlorophyll-a	NA NA 5 ug/L [e]	NA NA 5 ug/L [e]
Rivers and Streams	Total Phosphorus (as P) Total Nitrogen (as N) Chlorophyll-a [f]	110 ug/l [b] 1250 ug/l [b] 150 mg/m^2 [c]	170 ug/l [b] 2010 ug/l [b] 150 mg/m^2 [c]

[a] **TP and TN:** Summer (July1-September 30) average in mixed layer of lakes (median of multiple depths), allowable exceedance frequency 1-in-5 years.
[b] **TP and TN:** Annual median, allowable exceedance frequency 1-in-5 years.
[c] **Chl-a:** Summer (July 1 -September 30) maximum attached algae, not to exceed.
[d] **Chl-a:** Summer (July 1 -September 30) average Chl-a in the mixed layer of lakes (median of multiple depths), allowable exceedance frequency 1-in-5 years.
[e] **Chl-a:** March 1 -November 30 average Chl-a in the mixed layer of lakes (median of multiple depths), allowable exceedance frequency 1-in-5 years.
[f] Applies only to streams where a representative sample can be obtained based on the Division's protocol which is designed for hard bottom substrate not sandy.

IV. COLORADO SOURCES

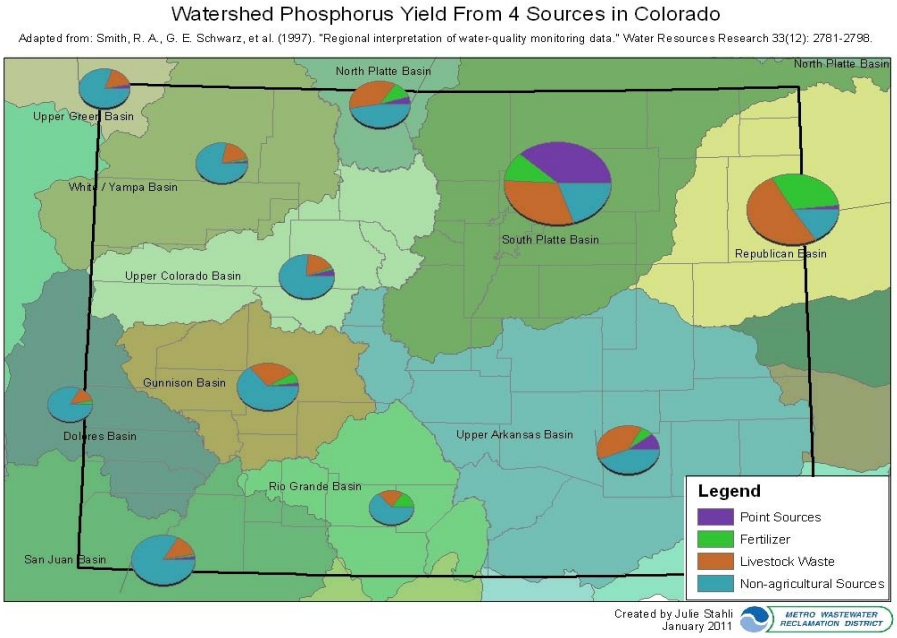
Total nitrogen and total phosphorus in Colorado is higher in areas with higher urban densities but exceedances of the Regulation #31 interim values can be seen statewide as shown by the red dots.



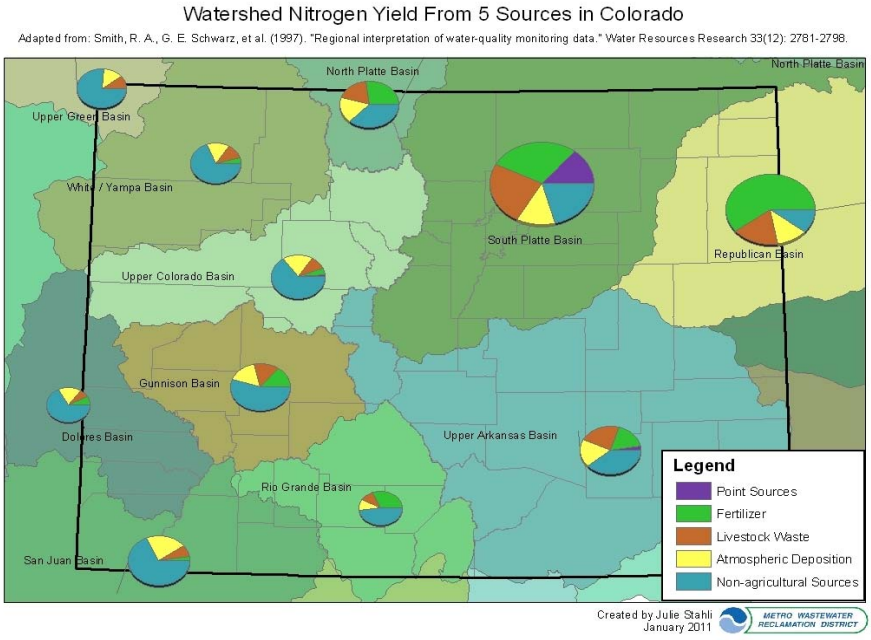


In some watersheds, nonpoint source nutrient loadings outweigh point sources to a degree that advanced treatment for nutrient removal and even complete elimination of point sources by zero discharge would have limited effect on water quality. Complex site specific considerations are required to determine whether limitations on nutrients will provide water quality benefits and to what extent those limits will be associated with water quality improvements. These studies can cost several hundred thousand dollars to determine site specific standards.

RELATIVE SOURCES OF PHOSPHORUS IN COLORADO



RELATIVE SOURCES OF NITROGEN IN COLORADO



V. IMPACT ON PUEBLO WATER RECLAMATION FACILITY

The requirement of treatment technology standards in the Pueblo discharge permit for nutrients does not ensure that water quality benefits will result. It does mean that the City of Pueblo will maintain compliance with nutrient regulations, and that wastewater treatment costs will increase. The City of Pueblo Water Reclamation Facility will incur both capital and operating cost increases to implement nutrient removal. Nutrient removal will require additional treatment to be built and will require additional energy, chemicals, maintenance materials, and labor which increase operations and maintenance costs.

The potential water quality benefits from nutrient removal will depend on whether the Pueblo Water Reclamation Facility is a major source of nutrients or if the majority is from non-point sources. Additional monitoring and modeling is expensive but will need to be performed to protect the Pueblo rate payers.