



## Background

The Missouri Department of Natural Resources, with the input of stakeholders, has developed revised numeric nutrient criteria for lakes (now located at 10 CSR 20-7.031(5)(N)). The rule provides scientific rationale for criteria development, while strengthening the link between the criteria and the designated uses of lake waters. The department selected aquatic habitat protection as the focus of the current numeric nutrient criteria for Missouri reservoirs.

### Rule Development and Timeline

The department convened a stakeholder group in September 2011 to address the United States Environmental Protection Agency's (EPA) comments and revise Missouri's numeric nutrient criteria for lakes. The stakeholder group included representatives from municipalities, agricultural and environmental groups, scientists and engineers, the Missouri Department of Conservation, the University of Missouri, and EPA. The department retained Jones Aquatic Consulting LLC to provide scientific and technical input in the development of the criteria.

The department considered input from the stakeholder group and developed a rule that provides for the most appropriate and scientifically defensible protections for the aquatic life designated use. That approach, based on EPA's bioconfirmation guiding principles, provides the following:

- Targets aquatic life protection against impairment without adversely impacting fisheries;
- Focuses on the biological response of nutrients in lakes systems;
- Considers regional differences in lakes and existing organism food chains; and
- Supplements response impairment thresholds with conservative nutrient screening thresholds and biological assessment endpoints to better support determinations of impairment.

The department considered several different sources of information and lines of evidence to derive the lake numeric nutrient criteria. These sources of information included the following:

- Missouri-specific lake and reservoir water chemistry data to derive robust relationships between criteria and aquatic life protection;
- Relevant peer-reviewed scientific literature concerning lake ecosystem dynamics and aquatic life response to nutrients;
- Recent numeric nutrient criteria development activities in other states; and
- Expert scientific opinion.

Missouri's rule was developed, in part, to address EPA's August 2011 disapproval of the majority of Missouri's numeric nutrient criteria for lakes at 10 CSR 20-7.031(4)(N). EPA cited concerns regarding scientific rigor, reproducibility, and connection to designated uses, which the department has addressed in the new rule. As required in a December 2016 federal Consent Decree, EPA signed a

notice of proposed rulemaking on Dec. 27, 2017, regarding its August 2011 disapproval. In its proposal, EPA seeks comment on two alternatives. The first alternative proposes nutrient protection values and eutrophication impact factors in a combined criterion approach. The second alternative requests comments on a combined criterion approach that would mirror the State of Missouri's proposal for lake nutrient water quality standards. EPA will not proceed with final rulemaking (or will withdraw its final rule, if applicable) if Missouri adopts and submits criteria to address EPA's 2011 disapproval and EPA approves those criteria as meeting Clean Water Act requirements.

The proposal for the department's current Numeric Nutrient Criteria Rule was placed on public notice from Oct. 16, 2017, through Nov. 28, 2017. The department held a public hearing on the proposed rule on Nov. 21, 2017. The Missouri Clean Water Commission adopted the department's rule proposal at its Jan. 4, 2018, meeting.

### Numeric Nutrient Criteria Rule Fundamentals

Missouri's water quality standards rule includes numeric chlorophyll-a (Chl-a) criteria for lakes based on location. These criteria apply to all lakes 10 acres or larger during normal conditions that are assigned designated uses in the Missouri Use Designation Dataset, with the exception of lakes located in the Big River Floodplain ecoregion.

### Missouri Lake Ecoregion Chl-a Criteria and Nutrient Screening Values

Lake Ecoregion	Chl-a Criterion (µg/L)	Screening Values (µg/L)		
		Total Phosphorous (TP)	Total Nitrogen (TN)	Chl-a
Plains	30	49	843	18
Ozark Border	22	40	733	13
Ozark Highland	15	16	401	6

Lakes with water quality that exceed nutrient criteria are deemed impaired for excess nutrients. Lakes with water quality that exceed screening values for Chl-a, TN, or TP are deemed impaired for excess nutrients if any of the following eutrophication impacts are documented for the respective designated uses within the same year. Eutrophication impacts for aquatic life uses include the following:

- (I) Occurrence of eutrophication-related mortality or morbidity events for fish and other aquatic organisms;
- (II) Epilimnetic excursions from dissolved oxygen or pH criteria;
- (III) Cyanobacteria counts in excess of 100,000 cells per milliliter (cells/ml);
- (IV) Observed shifts in aquatic diversity attributed to eutrophication;
- (V) Excessive levels of mineral turbidity that consistently limit algal productivity during the period May 1 – Sept. 30

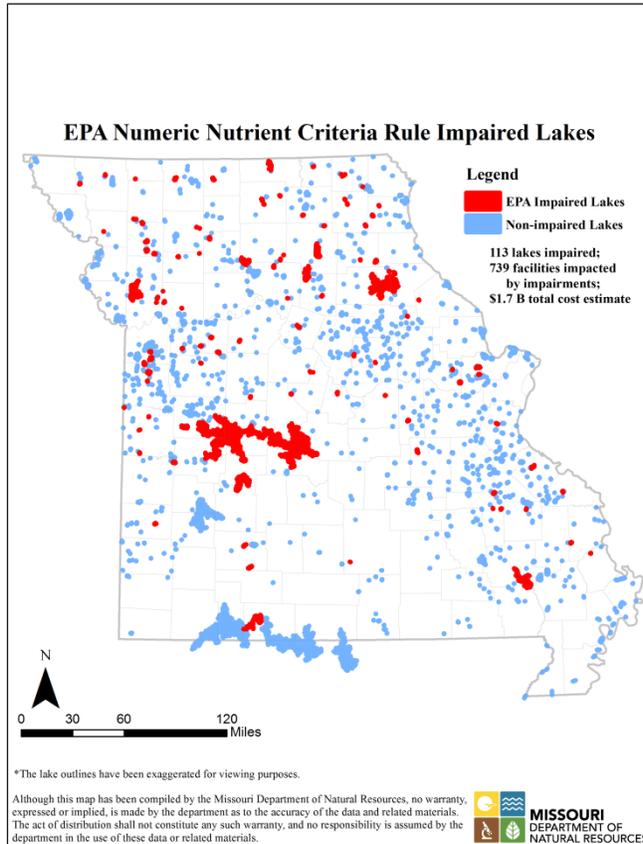
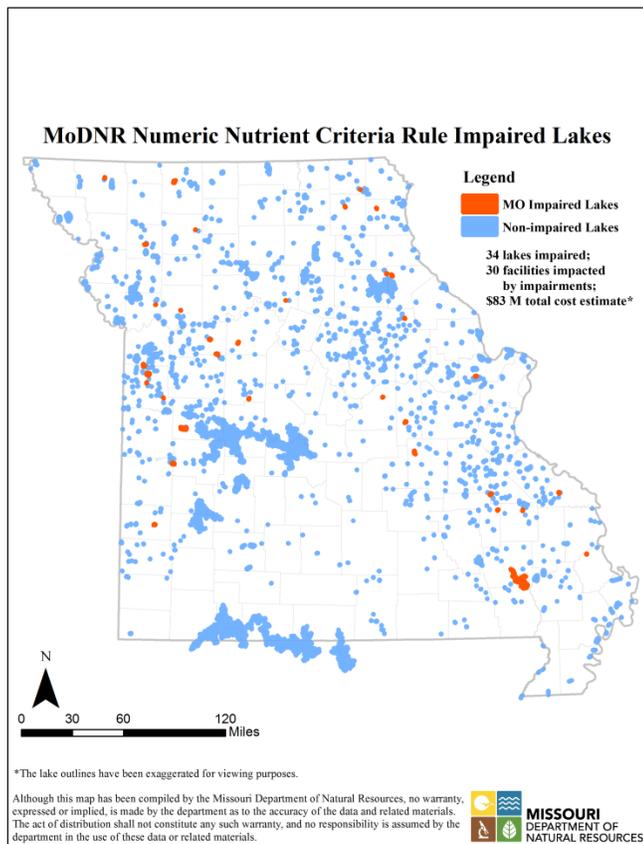
### Proposed EPA Lake Ecoregion Nutrient Protection Values and Eutrophication Impacts

Lake Ecoregion	Proposed Criterion (µg/L)		
	TP	TN	Chl-a
Plains	44	817	14
Ozarks	23	500	7.1

(1) Lake and reservoir water quality must not exceed nutrient protection values for chlorophyll- a. (2) Lake and reservoir water quality also must not exceed nutrient protection values for total nitrogen and total phosphorus unless each of the following eutrophication impacts are evaluated and none occur within the same three-year rolling average period: (I) Eutrophication-related mortality or morbidity events for fish and other aquatic organisms; (II) An excursion from the DO or pH criteria in Missouri water quality standards applicable for Clean Water Act purposes; (III) Cyanobacteria counts equal to or greater than 100,000 cells per ml; (IV) Observed shifts in aquatic diversity directly attributable to eutrophication; or (V) Excessive levels of mineral turbidity that consistently limit algal productivity during the period May 1-September 30, or Secchi disk measurements of turbidity equal to or less than EPA's recommended Level III Ecoregions IX (1.53 m) or XI (2.86 m).

## Impact of Impairments Associated with EPA’s Proposed Rule and Estimated Costs

EPA’s proposal would result in an impairment designation for 113 lakes in Missouri, including Lake of the Ozarks, Truman Lake, and Mark Twain Lake, and would impact an estimated 739 wastewater facilities. Missouri’s rule, by contrast, designates only 34 lakes as impaired and impacts only 30 wastewater facilities. Based on current data, the impairment designations under EPA’s proposal are estimated to cost \$1.7 billion to impacted wastewater facilities, compared to \$83.1 million attributed to Missouri’s rule.



During the rulemaking process, the Department of Natural Resources provided a Regulatory Impact Report. The report estimated the worst-case scenario that assumed all facilities would need to upgrade treatment and remove nutrients from discharges. Changes in site conditions or additional data may cause impairments to waters not currently considered impaired.

## Impaired Lakes under Missouri's Rule

Name
1. Atkinson Lake
2. Ben Branch Lake
3. Blind Pony Lake
4. Busch W.A.- Kraut Run Lake
5. Deer Ridge Community Lake
6. DiSalvo Lake
7. Edina Reservoir
8. Edwin A Pape Lake
9. Ella Ewing Community Lake
10. Fredricktown City Lake
11. Garden City Lake
12. Harrison County Lake
13. Harrisonville City Lake
14. Higginsville Reservoir (South)
15. Indian Lake
16. Jamesport Community Lake
17. Lake Killarney
18. Lake Tywappity
19. Lake Wappapello
20. Lamar Lake
21. Monroe City Lake
22. Monroe City Lake B
23. Montrose Lake
24. Nodaway Lake
25. North Lake
26. Peaceful Valley Lake
27. Perry County Community Lake
28. Raintree Lake
29. Ray County Community Lake
30. Rocky Hollow Lake
31. Spring Fork Lake
32. Sterling Price Community Lake
33. Vandalia Community Lake
34. Willow Brook Lake

## Impaired Lakes under EPA's Rule

Name					
1.	Adrian Reservoir	42.	Jackrabbit Lake	83.	Monroe City Lake B
2.	Atkinson Lake	43.	Jamesport City Lake	84.	Montrose Lake
3.	Austin Community Lake	44.	Jamesport Community Lake	85.	Nodaway Lake
4.	Baring Country Club Lake	45.	King City New Reservoir	86.	North Lake
5.	Ben Branch Lake	46.	King Lake	87.	Odessa Lake
6.	Bilby Ranch Lake	47.	La Plata Lake - New	88.	Peaceful Valley Lake
7.	Binder Lake	48.	Labelle Lake #2	89.	Perry County Community Lake
8.	Blind Pony Lake	49.	Lake Forest	90.	Peters Lake
9.	Breckenridge Lake	50.	Lake Girardeau	91.	Pomme de Terre Lake
10.	Bucklin Lake	51.	Lake Killarney	92.	Pony Express Lake
11.	Busch W.A.- Kraut Run Lake	52.	Lake Lucern	93.	Prairie Home C.A. Lakes
12.	Butler Lake	53.	Lake Nell	94.	Prairie Lee Lake
13.	Cameron Lake #4 (Grindstone Reservoir)	54.	Lake of the Ozarks	95.	Raintree Lake
14.	Catclaw Lake	55.	Lake Paho	96.	Ray County Community Lake
15.	Coot Lake	56.	Lake Sherwood	97.	Rocky Hollow Lake
16.	Cottontail Lake	57.	Lake Showme	98.	Rothwell Lake
17.	Crystal Lake	58.	Lake Springfield	99.	Savannah City Reservoir
18.	D C Rogers Lake	59.	Lake St. Louis	100.	Shelbina Lake
19.	Deer Ridge Community Lake	60.	Lake Taneycomo	101.	Shepard Mountain Lake
20.	DiSalvo Lake	61.	Lake Thunderhead	102.	Smithville Lake
21.	Drexel City Reservoir South	62.	Lake Tishomingo	103.	Spring Lake
22.	Edina Reservoir	63.	Lake Tywappity	104.	Spring Fork Lake
23.	Edwin A Pape Lake	64.	Lake Wanda Lee	105.	Sterling Price Community Lake
24.	Ella Ewing Community Lake	65.	Lake Wappapello	106.	Thomas Hill Reservoir
25.	Elmwood City Lake	66.	Lamar Lake	107.	Unionville Reservoir
26.	Fountain Grove Lakes	67.	Lancaster City Lake - New	108.	Vandalia Community Lake
27.	Fredricktown City Lake	68.	Lawson City Lake	109.	Vandalia Reservoir
28.	Glover Spring Lake	69.	Limpp Community State Lake	110.	Water Works Lake
29.	Gopher Lake	70.	Little Dixie Lake	111.	Watkins Mill Lake
30.	Green City Lake	71.	Long Branch Lake	112.	Willow Brook Lake
31.	Hamilton Lake	72.	Macon Lake	113.	Worth County Community Lake
32.	Harmony Mission Lake	73.	Manito Lake		
33.	Harrison County Lake	74.	Maple Leaf Lake		
34.	Harrisonville City Lake	75.	Marceline City Lake (New)		
35.	Hazel Hill Lake	76.	Marceline Reservoir		
36.	Henry Sever Lake	77.	Mark Twain Lake		
37.	Higginsville Reservoir (South)	78.	Maysville Lake		
38.	HS Truman Lake	79.	McDaniel Lake		
39.	Hunnewell Lake	80.	Memphis Reservoir		
40.	Indian Creek Community Lake	81.	Milan Lake South		
41.	Indian Lake	82.	Monroe City Lake		