



DEPARTMENT CIRCULAR

DEQ-12A

Montana Base Numeric Nutrient Standards

GENERAL INTRODUCTION

This circular (DEQ-12A) contains information pertaining to the base numeric nutrients standards (§75-5-103(2), MCA) and their implementation. This information includes the standards' concentration limits, where the standards apply, and their period of application. DEQ-12A is adopted by the Board of Environmental Review under its rulemaking authority in §75-5-301(2), MCA.

Circular DEQ-12B contains information about variances from the base numeric nutrient standards and is a separate document available from the Department. DEQ-12B addresses effluent treatment requirements associated with general nutrient standards variances, as well as effluent treatment requirements for individual nutrient standards variances and to whom these apply. Unlike DEQ-12A, DEQ-12B is not adopted by the Board of Environmental Review; DEQ-12B is adopted by the Department following its formal rulemaking process, pursuant to §75-5-313, MCA.

The Department has reviewed a considerable amount of scientific literature and has carried out scientific research on its own in order to derive the base numeric nutrient standards (see **References** in this circular). Because many of the base numeric nutrient standards are stringent and may be difficult for MPDES permit holders to meet in the short term, Montana's Legislature adopted laws (e.g., §75-5-313, MCA) allowing for the achievement of the standards over time via the variance procedures in Circular DEQ-12B. This approach should allow time for nitrogen and phosphorus removal technologies to improve and become less costly and to allow time for nonpoint sources of nitrogen and phosphorus pollution to be better addressed.

Circular DEQ-12A

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1.0 Introduction

Elements comprising Circular DEQ-12A are found below. These elements are adopted by the Montana Board of Environmental Review. The nitrogen and phosphorus concentrations provided here have been set at levels that will protect beneficial uses and prevent exceedences of other surface water quality standards which are commonly linked to nitrogen and phosphorus concentrations (e.g., pH and dissolved oxygen; see Circular DEQ-7 for those standards). The nitrogen and phosphorus concentrations provided here also reflect the intent of the narrative standard at ARM 17.30.637(1)(e) and will preclude the need for case-by-case interpretations of that standard in most cases.

1.1 Definitions

1. **Ecoregion** means mapped regions of relative homogeneity in ecological systems derived from perceived patterns of a combination of causal and integrative factors including land use, land surface form, potential natural vegetation, soils, and geology. See also Endnote 1.
2. **Large river** means a perennial waterbody which has, during summer and fall baseflow (August 1 to October 31 each year), a wadeability index (product of river depth [in feet] and mean velocity [in ft/sec]) of 7.24 ft²/sec or greater, a depth of 3.15 ft or greater, or a baseflow annual discharge of 1,500 ft³/sec or greater. See also, Endnote 6.
3. **Total nitrogen** means the sum of all nitrate, nitrite, ammonia, and organic nitrogen, as N, in an unfiltered water sample. Total nitrogen in a sample may also be determined via persulfate digestion or as the sum of total kjeldahl nitrogen plus nitrate plus nitrite.
4. **Total phosphorus** means the sum of orthophosphates, polyphosphates, and organically bound phosphates, as P, in an unfiltered water sample. Total phosphorus may also be determined directly by persulfate digestion.
5. **Wadeable stream** means a perennial or intermittent stream in which most of the wetted channel is safely wadeable by a person during baseflow conditions.

2.0 Base Numeric Nutrient Standards

Table 12A-1 contains the base numeric nutrient standards for Montana's flowing waters. In **Table 12A-1** nutrient standards for wadeable streams are grouped by ecoregion, either at level III (coarse scale) or level IV (fine scale). Following the ecoregional standards is a list of wadeable streams with reach-specific standards. These waterbodies have characteristics dissimilar from those of the ecoregions in which they reside and have therefore been provided reach-specific values. **For wadeable streams, the standards should be applied in this order: named stream reach first (if applicable) then level IV ecoregion (if applicable) then level III ecoregion.** **Table 12A-1** also contains a list of large river segments for which base numeric nutrient standards have been developed. Note that the ecoregional values in **Table 12A-1** do not apply to large rivers within those ecoregions. See Endnote 6 for a list of all large Montana rivers. If a particular large river reach is not listed in **Table 12A-1**, standards for it have not yet been developed.

Table 12A-2 contains base numeric nutrient standards for Montana's lakes and reservoirs. The Department has not yet developed regional lake criteria, but it is expected that when they are developed they will be grouped by ecoregion. As such, placeholders for future ecoregionally-based criteria are provided in the table. The table also provides lake-specific standards. The Department anticipates that reservoir standards will generally be developed case-by-case and, therefore, will be individually listed, as provided for in the table.

Table 12A-1. Base Numeric Nutrient Standards for Wadeable Streams in Different Montana Ecoregions.
If standards have been developed for level IV ecoregions (subcomponents of the level III ecoregions) they are shown in italics below the applicable level III ecoregion. Individual reaches are in the continuation of this table.

Ecoregion ^{1,2} (level III or IV) and Number	Ecoregion Level	Period When Criteria Apply ³	Numeric Nutrient Standard ⁴	
			Total Phosphorus (µg/L)	Total Nitrogen (µg/L)
Northern Rockies (15)	III	July 1 to September 30	25	275
Canadian Rockies (41)	III	July 1 to September 30	25	325
Idaho Batholith (16)	III	July 1 to September 30	25	275
Middle Rockies (17)	III	July 1 to September 30	30	300
<i>Absaroka-Gallatin Volcanic Mountains (17i)</i>	IV	July 1 to September 30	105	250
Northwestern Glaciated Plains (42)	III	June 16 to September 30	110	1300
<i>Sweetgrass Upland (42l), Milk River Pothole Upland (42n), Rocky Mountain Front Foothill Potholes (42q), and Foothill Grassland (42r)</i>	IV	July 1 to September 30	80	560
Northwestern Great Plains (43) and Wyoming Basin (18)	III	July 1 to September 30	150	1300
<i>River Breaks (43c)</i>	IV	See Endnote 5	See Endnote 5	See Endnote 5
<i>Non-calcareous Foothill Grassland (43s), Shields-Smith Valleys (43t), Limy Foothill Grassland (43u), Pryor-Bighorn Foothills (43v), and Unglaciated Montana High Plains (43o)*</i>	IV	July 1 to September 30	33	440

*For the Unglaciated High Plains ecoregion (43o), criteria only apply to the polygon located just south of Great Falls, MT.

¹ See Endnote 1

³ See Endnote 3

² See Endnote 2

⁴ See Endnote 4

Table 12A-1, Continued. Base Numeric Nutrient Standards for Individual Wadeable Streams (and Wadeable-stream Reaches), and Large-river Reaches.

Individual Stream or Reach Description ²	Period When Criteria Apply ³	Numeric Nutrient Standard ⁴	
		Total Phosphorus (µg/L)	Total Nitrogen (µg/L)
Wadeable Streams: Clark Fork River basin			
Flint Creek, from Georgetown Lake outlet to the ecoregion 17ak boundary (46.4002, -113.3055)	July 1 to September 30	72	500
Wadeable Streams: Gallatin River basin			
Bozeman Creek, from headwaters to Forest Service Boundary (45.5833, -111.0184)	July 1 to September 30	105	250
Bozeman Creek, from Forest Service Boundary (45.5833, -111.0184) to mouth at East Gallatin River	July 1 to September 30	76	270
Hyalite Creek, from headwaters to Forest Service Boundary (45.5833, -111.0835)	July 1 to September 30	105	250
Hyalite Creek, from Forest Service Boundary (45.5833, -111.0835) to mouth at East Gallatin River	July 1 to September 30	90	260
East Gallatin River between Bozeman Creek and Bridger Creek confluences	July 1 to September 30	50	290
East Gallatin River between Bridger Creek and Hyalite Creek confluences	July 1 to September 30	40	300
East Gallatin River between Hyalite Creek and Smith Creek confluences	July 1 to September 30	60	290
East Gallatin River from Smith Creek confluence mouth (Gallatin River)	July 1 to September 30	40	300
Large Rivers⁶:			
Yellowstone River (Bighorn River confluence to Powder River confluence)	August 1 -October 31	55	655
Yellowstone River (Powder River confluence to stateline)	August 1 -October 31	95	815

² See Endnote 2

³ See Endnote 3

⁴ See Endnote 4

⁶ See Endnote 6

Table 12A-2. Base Numeric Nutrient Standards and Other Standards for Lakes and Reservoirs.

		Numeric Nutrient Standard ⁷		
Ecoregion ¹ (level III) and Number, or Individual Lake or Reservoir Description	Period of Application	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Other Standards ⁸
<i>LAKES/RESERVOIRS by ecoregion:</i>				
Middle Rockies (17)	Year-round	[]	[]	
Northern Rockies (15)	Year-round	[]	[]	
Canadian Rockies (41)	Year-round	[]	[]	
Idaho Batholith (16)	Year-round	[]	[]	
<i>LAKE SPECIFIC CRITERIA:</i>				
Flathead Lake ⁹	Year-round	5.0	95	Secchi depth ≥ 10.4 m during non turbidity-plume conditions. Phytoplankton chlorophyll <i>a</i> 1.0 µg/L, as an annual average, not to be exceeded more than once in any three year period, on average.
<i>RESERVOIR SPECIFIC CRITERIA:</i>				
	Year-round	[]	[]	

¹ See Endnote 1⁹ See Endnote 9⁷ See Endnote 7⁸ See Endnote 8

2.1 Required Reporting Values for Base Numeric Nutrient Standards

Table 12A-3 presents the required reporting values (RRVs) for total phosphorus and total nitrogen, as well as the RRVs for nitrogen fractions that can be used to compute total nitrogen.

Table 12A-3. Required reporting values^{a,b} for total nitrogen and phosphorus measurements.

Nutrient	Method of Measurement	Required Reporting Value
Total phosphorus	Persulfate digestion	3 µg/L
Total nitrogen	Persulfate digestion	70 µg/L
Total nitrogen	Sum of:	(a) total kjeldahl nitrogen 150 µg/L
		(b) nitrate + nitrite See RRVs below
Nitrate- as N		20 µg/L
Nitrite- as N		10 µg/L
Nitrate + Nitrite-as N		20 µg/L

^a See definition for required reporting values found in footnote 19 of Department Circular DEQ-7.^b Concentrations in Table 12A-3 must be achieved unless otherwise specified in a permit, approval, or authorization issued by the Department (DEQ-7; ARM 17.30.702).

2.2 Developing Permit Limits for Base Numeric Nutrient Standards

For total nitrogen and total phosphorus, the critical low-flow for the design of disposal systems shall be based on the seasonal 14Q5 of the receiving water (ARM 17.30.635(2)). When developing permit limits for base numeric nutrient standards, the Department will use an average monthly limit (AML) only, using methods appropriate for criterion continuous concentrations (i.e., chronic concentrations). Permit limits will be established using a value corresponding to the 95th percentile probability distribution of the effluent. Nitrogen and phosphorus concentrations of the receiving waterbody upstream of the discharge may be characterized using other frequency distribution percentiles. The Department shall use methods that are appropriate for criterion continuous concentrations which are found in the document "*Technical Support Document for Water Quality-based Toxics Control*," Document No. EPA/505/2-90-001, United States Environmental Protection Agency, 1991.

3.0 Endnotes

- (1) Ecoregions are based on the 2009 version (version 2) of the U.S. Environmental Protection Agency maps. These can be found at: http://www.epa.gov/wed/pages/ecoregions/mt_eco.htm . For Geographic Information System (GIS) use within the Department, the GIS layers may be found at: L:\DEQ\Layers\Ecoregions.lyr
- (2) Within and among the geographic regions or watersheds listed, base numeric nutrient standards of the downstream reaches or other downstream waterbodies must continue to be maintained. Where possible, modeling methods will be utilized to determine the limitations required which provide for the attainment and maintenance of water quality standards of downstream waterbodies.
- (3) For the purposes of ambient surface water monitoring and assessment only, a ten-day window (plus/minus) on the beginning and ending dates of the period when the criteria apply is allowed in order to accommodate year-specific conditions (an early-ending spring runoff, for example).
- (4) The 30 day average concentration of these parameters may not be exceeded more than once in any five-year period, on average.
- (5) In this level IV ecoregion, the narrative standard for nuisance aquatic life (ARM 17.30.637(1)(e)) applies in lieu of specific base numeric nutrient standards.

(6) **Table E-1** below shows the beginning and ending locations for large rivers in Montana.

Table E-1. Large river segments within the state of Montana.

River Name	Segment Description
Big Horn River	Yellowtail Dam to mouth
Clark Fork River	Bitterroot River to state-line
Flathead River	Origin to mouth
Kootenai River	Libby Dam to state-line
Madison River	Ennis Lake to mouth
Missouri River	Origin to state-line
South Fork Flathead River	Hungry Horse Dam to mouth
Yellowstone River	State-line to state-line

(7) No lake or reservoir in **Table 12A-2** shall have a total nutrient concentration that exceeds the values shown, as an annual average, more than once in any three year period, on average. The Department will determine on a case-by-case basis whether or not a permitted discharge to a stream or river is likely to be affecting any downstream lake or reservoir. If so, the permittee would be required to meet its average monthly nutrient limit year-round.

(8) Parameters listed under this column are standards specific to lakes and reservoirs.

(9) Standards and related assessment information (excluding Secchi depth) are to be determined from 0-30 m depth-integrated samples. Samples and Secchi depth measurements are to be collected at the Midlake Deep site which is located approximately 1 mile west of Yellow Bay Point in a pelagic area of the lake (approximately at latitude 47.861, longitude -114.067).

4.0 References

The following are citations for key scientific and technical literature used to derive the base numeric nutrient standards. This is not a complete list; rather, it contains the most pertinent citations. Many other articles and reports were reviewed during the development of the standards.

Biggs, B.J.F., 2000. New Zealand Periphyton Guideline: Detecting, Monitoring and Managing Enrichment in Streams. Prepared for the New Zealand Ministry of the Environment, Christchurch, 122 p.

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- Suplee, M.W., V. Watson, A. Varghese, and J. Cleland, 2008. Scientific and Technical Basis of the Numeric Nutrient Criteria for Montana's Wadeable Streams and Rivers. Helena, MT: Montana Department of Environmental Quality, 86 p.
<http://deq.mt.gov/wqinfo/standards/NumericNutrientCriteria.mcp>

- Suplee, M.W., and V. Watson, 2013. Scientific and Technical Basis of the Numeric Nutrient Criteria for Montana's Wadeable Streams and Rivers—Update 1, *and addendums*. Helena, MT: Montana Dept. of Environmental Quality.
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