

Chapter 583 Nutrient Criteria for Surface Waters

SUMMARY: This Chapter establishes nutrient criteria for surface waters of the State. Nutrient enrichment can cause negative environmental impacts to surface waters, such as algal blooms, low dissolved oxygen concentrations, excessive growths of filamentous algae or bacteria, generation of cyanotoxins, or affecting the resident biological community. Methods described in this Chapter are used to make decisions about attainment or impairment of designated and existing uses of surface waters established in the State's water quality classification system (38 M.R.S.A. §§464-469). This Chapter also describes establishment of site-specific criteria.

PART I. FRESHWATER

1. **Definitions.** The following terms are defined for use in this Chapter.
 - A. "Algal bloom" means a growth of suspended algae in the water column that causes Secchi disk transparency to be less than 2.0 meters. Algal blooms usually are dominated by cyanobacteria; however they may also be dominated by other types of algae.
 - B. "Chlorophyll *a*" means a particular kind of photosynthetic pigment of algae and plants.
 - C. "Class" means the statutory goal (i.e., AA, A, B, C, GPA) assigned to a waterbody as established in *Water Classification Program*, 38 M.R.S.A. §§ 464(4), 465, 465-A, 467, and 468 for the purpose of protecting designated and existing uses.
 - D. "Colored" means water having a mean apparent color >25 standard platinum units or equivalent value of true color or dissolved organic carbon.
 - E. "Cyanotoxins" means lipopolysaccharide endotoxins, hepatotoxins, and neurotoxins produced by cyanobacteria, such as microcystin and anatoxin-a.
 - F. "Diatoms" means algae in the class Bacillariophyceae.
 - G. "Impounded waters" means riverine waters upstream of a dam and not classified as GPA where the surface elevation is essentially the same as found at the dam.
 - H. "Nutrient" means any chemical which an organism requires to live and grow. Nitrogen and phosphorus are important nutrients that frequently limit growth of aquatic organisms, especially primary producers, but the term includes many other essential and trace elements.
 - I. "Patches of fungi and filamentous bacteria" means visible growths of aquatic fungi or filamentous bacteria (e.g., sewage fungus), excluding iron and manganese bacteria.
 - J. "Percent algal cover" means the amount of stream and river substrate covered by filamentous algae greater than 2 centimeters long or periphyton mats greater than 1 millimeter thick.
 - K. "Periphyton" means a layer of microscopic algae, bacteria, and fungi growing on a substrate within a waterbody.
 - L. "pH" means a measure of water acidity.

- M. “Phaeophytin” means a byproduct of chlorophyll degradation formed when chlorophyll loses its central magnesium molecule.
- N. “Phytoplankton” means algae suspended in the water column.
- O. “ppb” means parts per billion, which is equivalent to micrograms per liter ($\mu\text{g/L}$).
- P. “ppm” means parts per million, which is equivalent to milligrams per liter (mg/L).
- Q. “Secchi-disk depth” means a measurement of water clarity using a Secchi disk.
- R. “TP” means total phosphorus.
- S. “Turbid” means that the water is not clear or transparent due to small organic and inorganic particles suspended in the water.
- T. “Type” means a kind of waterbody based on size, geomorphology, movement of water, and substrate type, such as pond, lake, wadeable stream with rocky bottom, wadeable stream with unconsolidated substrate, impoundment, and non-wadeable river.
- U. “Water column chlorophyll *a*” means a measurement of the concentration of chlorophyll *a* in a water sample. It is an indicator of phytoplankton or algal blooms.
2. **Purpose and applicability.** The purpose of this Chapter is to establish nutrient criteria used to protect and assess designated and existing uses as described in *Water Classification Program*, 38 M.R.S.A. §§ 464(4), 465, and 465-A. This Chapter also provides related implementation policy.

NOTE: Class GPA waters must have stable or decreasing trophic state (as shown by less nutrient enrichment) as described in 38 M.R.S.A. § 465-A(1)(B). In addition, no change in land use in a watershed of a Class GPA water may result in a water quality impairment or increase in trophic state of the GPA water as described in 38 M.R.S.A. § 465-A(1)(C). These two provisions are addressed in part by Department under Stormwater Management, 06-096 CMR 500 (effective December 27, 2006) and by many local ordinances, both of which require certain new developments to incorporate stormwater phosphorus mitigation measures based on lake specific watershed phosphorus budgets and other provisions in “Volume II of the Maine Stormwater Best Practices Manual - Phosphorus Control in Lake Watersheds: A Technical Guide to Evaluating New Development”.

3. **Description of nutrient and response indicators.** The following nutrient and response indicators are part of the nutrient criteria used to protect designated and existing uses as described in Section I.4 of this Chapter. The Department shall determine the appropriate number, timing, and frequency of samples by considering a variety of information, such as the type of waterbody being sampled, knowledge of past water quality, and potential variation in indicator values.
- A. **Total phosphorus** ($\mu\text{g/L}$, ppb). Total phosphorus may either be measured as the seasonal mean of an established set of total phosphorus concentration samples or determined using the Diatom Total Phosphorus Index (DTPI), which is computed using the protocols described in *Protocols for Calculating the Diatom Total Phosphorus Index (DTPI) and Diatom Total Nitrogen Index (DTNI) for*

Wadeable Streams and Rivers (DEPLW-0970A) dated December 1, 2009. The Department requires laboratory analytical methods for total phosphorus have a reporting limit of ≤ 1 ppb.

- B. **Response indicators.** The following response indicators protect designated and existing uses described in 38 M.R.S.A. §§ 464(4), 465, and 465-A. A variety of response indicators are necessary because of the variety of waterbody types in Maine. Some response indicators are not applicable to all waterbody types. In addition, concentrations of cyanotoxins above appropriate health guidelines for recreational exposure are evidence of non-attainment of nutrient criteria. Response indicators are applicable May 1 – October 31. Non-attainment of response indicators may be based on a single sample that meets quality control requirements where other evidence indicates the presence or effect of excess nutrients.
- (1) **Percent algal cover.** Percent algal cover is estimated with viewing bucket surveys or appropriate alternative method. This indicator is restricted to stream and rivers segments less than 1.25 meters deep. The percent cover is computed by determining the percent of surveyed substrate covered by filamentous algae greater than 2 cm long or periphyton mats greater than 1 millimeter thick.
 - (2) **Water column chlorophyll *a* ($\mu\text{g/L}$, ppb).** This indicator is based on measurements of chlorophyll *a* that have not been adjusted for phaeophytin. For Class AA, A, B, and C flowing waters, samples are collected by grab sample. For Class GPA waters, samples are collected using depth-integrated, epilimnetic cores. For impoundments, samples are collected using either depth-integrated, photic-zone cores or depth-integrated epilimnetic cores. Low gradient Class AA or A waters with water velocity less than 5.0 centimeters per second have a different value than other Class AA or A waters (see Table 1).
 - (3) **Secchi disk depth (meters, m).** Secchi disk depth measurements are collected in still or slow moving waters in which water velocity does not interfere with the measurement (e.g., lakes, ponds, impoundments, still segments of large rivers). The uses are protected if the Secchi disk measurement is greater than or equal to 2.0 meters for waterbodies greater than or equal to 2.0 meters deep. For waterbodies less than 2.0 meters deep, Secchi disk depth must be all the way to the bottom. If the water is colored or turbid because of non-algal particles, Secchi disk measurement must be accompanied by chlorophyll *a* samples to confirm a nonattainment condition due to nutrients.
 - (4) **Patches of fungi and filamentous bacteria.** This indicator includes macroscopically observable patches of fungi and filamentous bacteria (e.g., sewage fungus) on the substrate. This indicator excludes iron and manganese bacteria.
 - (5) **pH.** The pH range must be within 6.0-8.5.
 - (6) **Dissolved oxygen concentrations (mg/L , ppm).** This indicator is established for each class in 38 M.R.S.A. §§ 465 and 465-A.

- (7) **Aquatic life use attainment.** This indicator is established for each class in 38 M.R.S.A. §§ 465 and 465-A, and where applicable *Classification Attainment Evaluation Using Biological Criteria for Rivers and Streams*, 06-096 CMR 579 (Effective May 27, 2003).
4. **Nutrient criteria.** The nutrient criteria in Table 1 shall be used to protect and maintain designated and existing uses of applicable water quality classes, as well as provide for the attainment and maintenance of water quality standards of downstream waterbodies. The criteria in Part I of this Chapter apply during the period of May 1 to October 31. Combinations of nutrient and response indicators apply, depending on the type of waterbody (e.g., wadeable stream with rocky substrate, non-wadeable river with unconsolidated substrate). A total phosphorus value in Table 1 may be replaced by a site-specific value under circumstances, either: (1) as provided in Section I.5.B(2) of this Chapter, or (2) as required by a Total Maximum Daily Load analysis or a load allocation necessary to restore water quality standards in a receiving or downstream waterbody. For Maine Pollutant Discharge Elimination System (MEPDES) permits, or National Pollutant Discharge Elimination System (NPDES) permits for interstate waters, where total phosphorus limits are warranted, the values in Table 1 will be used to determine appropriate total phosphorus limits, unless replaced by a site-specific value.

DRAFT

Table 1. Nutrient criteria for Class AA, A, B, C, and GPA surface waters of the State.

	Statutory Class							
	AA/A	B	C	A Impounded	B Impounded	C Impounded	GPA	
	≤18.0 µg/L (ppb) TP ^a and all of the response indicator ^b values in this column OR all of the response indicator ^b values in this column	≤30.0 µg/L (ppb) TP ^a and all of the response indicator ^b values in this column OR all of the response indicator ^b values in this column	≤33.0 µg/L (ppb) TP ^a and all of the response indicator ^b values in this column OR all of the response indicator ^b values in this column	≤18.0 µg/L (ppb) TP ^a and all of the response indicator ^b values in this column OR all of the response indicator ^b values in this column	≤30.0 µg/L (ppb) TP ^a and all of the response indicator ^b values in this column OR all of the response indicator ^b values in this column	≤33.0 µg/L (ppb) TP ^a and all of the response indicator ^b values in this column OR all of the response indicator ^b values in this column	≤15.0 µg/L (ppb) TP ^a and all of the response indicator ^b values in this column OR all of the response indicator ^b values in this column	
Nutrient criteria	Percent Algal Cover ^c	≤ 20.0	≤ 25.0	≤ 35.0	--	--	--	
	Water Column Chl <i>a</i> (µg/L, ppb)	≤ 3.5 (≤ 5.0 ^d)	≤ 8.0	≤ 8.0	≤ 5.0	spatial mean ≤ 8.0 and no value > 10.0	spatial mean ≤ 8.0 and no value > 10.0	≤ 8.0
	Secchi Disk Depth (m)	≥ 2.0						
	Patches of Bacteria and Fungi	None observed						
	pH	6.0-8.5						
	Dissolved Oxygen (mg/L, ppm)	As per 38 M.R.S.A. § 465					--	
	Aquatic Life	As per 38 M.R.S.A. §§ 464 and 465 and where applicable <i>Classification Attainment Evaluation Using Biological Criteria for Rivers and Streams</i> , 06-096 CMR 579 (Effective May 27, 2003)					As per 38 M.R.S.A. § 465-A	

a – The total phosphorus (TP) value for the statutory class applies unless a site specific value has been adopted.

b – Response indicators include percent algal cover, water column chlorophyll a, Secchi disk depth, patches of bacteria and fungi, pH, dissolved oxygen, and aquatic life criteria. Concentrations of cyanotoxins should be within appropriate health guidelines for recreational exposure. When implementing the criteria, the Department applies the appropriate combination of response indicators depending on the waterbody type (e.g., wadeable vs. deep, rocky vs. unconsolidated substrate, flowing vs. not flowing). Some response indicators are not applicable to all waterbody types.

c – Percent algal cover is applicable to waters less than 1.25 meters in depth.

d – Applicable to low gradient Class AA or A waters with water velocity less than 5.0 centimeters per second.

5. **Implementation.** The Department shall use the following decision framework (Figure 1) with the nutrient criteria provided in Table 1 to determine whether phosphorus or another nutrient has caused or contributed to the impairment of a designated use, and to guide site-specific phosphorus value development, where warranted. Surface waters may be divided into segments that are evaluated independently. When implementing the criteria, the Department applies the appropriate combination of response indicators depending on the waterbody type (e.g., wadeable vs. deep, rocky vs. unconsolidated substrate, flowing vs. not flowing). Some response indicators are not applicable to all waterbody types.

Figure 1. Decision framework.

	Mean total phosphorus concentration is less than or equal to the applicable value in Table 1 or an established site-specific value.	Mean total phosphorus concentration is greater than the applicable value in Table 1 or an established site-specific value.
All measured response indicators meet the values in Table 1	A. Not Impaired. Nutrient criteria attained	B. Not Impaired. Department may conduct a study to develop a site-specific total phosphorus value as described in Section I.5.B of this Chapter.
One or more of the measured response indicators do not meet the values in Table 1	C. Impaired. Department conducts weight-of-evidence analysis to determine cause of impairment as described in Section I.5.C of this Chapter.	D. Impaired. Nutrient criteria not attained.

- A. **Figure 1, A. Not impaired** - Nutrient criteria are attained if 1) the mean total phosphorus concentration is less than or equal to the value of the assigned class from Table 1 or an established site-specific value, and 2) the response indicators that are measured in a waterbody attain the values of the assigned class in Table 1.
- B. **Figure 1, B. Not impaired** – Nutrient criteria are attained if 1) the mean total phosphorus concentration is greater than or equal to the value of the assigned class from Table 1 or an established site-specific value, and 2) the response indicators that are measured in a waterbody attain the values of the assigned class in Table 1. The Department may conduct further assessment of nutrient concentrations and response indicators to determine if a site-specific total phosphorus value is warranted.
 - (1) **Options for establishing a site-specific total phosphorus value.** If the mean total phosphorus concentration is no greater than 5.0 ppb above the applicable value in Table 1, then the Department has the option of: (1) using the mean total phosphorus concentration as the new site-specific total phosphorus value without conducting further study, or (2) conducting a study as described in Section I.5.B(2) to establish a site-specific total phosphorus value. If the mean total phosphorus concentration is greater than 5.0 ppb above the applicable value, then the Department may conduct a study as described in Section

I.5.B(2). The Department may consider the factors in Section I.5.B(4) when determining if a site-specific total phosphorus value greater than the applicable value in Table 1 is appropriate.

NOTE: In some circumstances, the site-specific total phosphorus value may be less than the applicable value in Table 1.

- (2) **Study to establish a site-specific total phosphorus value.** The study shall consist of multiple years of data collection, including sampling during critical ambient conditions (i.e., below median seasonal water levels, warm temperatures, etc.). The Department will sample total phosphorus concentrations and all response indicators in Table 1 that are appropriate for the type of waterbody being studied. The Department also may collect other types of data (e.g., habitat, water chemistry) to determine if there is a mitigating factor that is 1) limiting algal and plant growth or 2) chemically or physically binding the phosphorus so it is not readily available to plants and algae. Given the potential for total phosphorus concentrations in excess of the limits assigned in Table 1 to cause or contribute to downstream water quality impacts, the Department will consider and may monitor downstream waterbodies or segments for adverse effects.
- (3) **Interpretation of study results.**
 - (a) **Does not attain response indicator criteria.** The waterbody is impaired (C or D in Figure 1) if data collected during the study do not meet applicable response values in Table 1.
 - (b) **Site-specific total phosphorus value.** If a seasonal mean of total phosphorus concentrations in a waterbody exceeds the applicable total phosphorus value, but the waterbody consistently attains all applicable response indicator values of the assigned class (Table 1) during the study, then the waterbody attains nutrient criteria and the Department may set a site-specific, total phosphorus value greater than the applicable value in Table 1. The Department shall subsequently use the site-specific total phosphorus value for decisions regarding attainment of nutrient criteria for that waterbody, permits, Total Maximum Daily Load plans, and Federal Clean Water Act §401 certifications. The applicable total phosphorus value in Table 1 will remain in effect until a new site-specific value is set. At least three years of data are required to establish a new site-specific total phosphorus value, including at least one year with critical ambient conditions (i.e., below median seasonal water flow, warm temperatures, etc.). A site-specific total phosphorus value must not be greater than the mean of the seasonal total phosphorus means found during the study.
- (4) **Considerations for site-specific total phosphorus values.** The Department will consider the following when determining if a site-specific total phosphorus value is appropriate.

- (a) The risk of response indicators not meeting applicable values. For example, is a response indicator already close to an applicable value? What were the ambient conditions with respect to applicable response indicators in previous years?
 - (b) Natural environmental conditions mitigating the impact of phosphorus enrichment and the risk of those conditions changing. For example, natural limiting factors can reduce light availability (e.g., shade, turbidity, water color), bind phosphorus (e.g., clay, dissolved organic carbon, aluminum hydroxide can make phosphorus unavailable for plant growth), or reduce habitat quality for algae (e.g., fine substrate, high water velocity).
 - (c) The risk of adversely affecting downstream waterbodies by establishing a site-specific total phosphorus value greater than the applicable value in Table 1.
- (5) **Qualification.** The Department may reverse a decision that establishes a site-specific total phosphorus value if environmental conditions or mitigating factors change and a site-specific value is no longer protective. The site-specific value may be replaced by the applicable total phosphorus value in Table 1 or a new site-specific total phosphorus value that is less than the existing site-specific value.
- C. **Figure 1, C. Impaired** – The attainment result is impaired if: (1) the mean total phosphorus concentration is less than or equal to the value of the assigned class from Table 1 or an established site-specific value, and (2) one or more response indicators that are measured in a waterbody do not attain the values of the assigned class in Table 1. The attainment result also is impaired if: (1) one or more response indicators that are measured in a waterbody do not attain values of the assigned class in Table 1, and (2) total phosphorus data are insufficient to determine if they are less than or equal to the values assigned in Table 1. The Department may use a weight-of-evidence approach to determine if total phosphorus or another nutrient caused or contributed to an impairment of a use.
- (1) The Department concludes that total phosphorus caused or contributed to an impairment of a use if it is shown through weight-of-evidence that phosphorus is a plausible cause. The Department may establish a lower site-specific total phosphorus value necessary to achieve attainment of water quality standards.
 - (2) The Department concludes that another nutrient, such as nitrogen or carbon, has caused or contributed to an impairment of a use if it is shown through weight-of-evidence that the nutrient is a plausible cause responsible for the impairment. The Department may conduct a study similar to those described in Section I.5.B(2) and set site-specific value for carbon or nitrogen that would be included in the nutrient criteria for that waterbody.
 - (3) The Department concludes that the impairment is the result of a non-nutrient cause if it is shown through weight-of-evidence to be the primary cause responsible for the impairment. In this case, the nutrient criteria are attained.
 - (4) The Department cannot conclude the cause of impairment if there is insufficient information and more data collection is necessary to determine the cause of impairment.

- D. **Figure 1, D. Impaired** – Nutrient criteria are not attained if 1) the mean total phosphorus concentration is greater than the value of the assigned class from Table 1 or an established site-specific value, and 2) one or more response indicators in a waterbody do not attain the values of the assigned class in Table 1.

NOTE: **Listing impaired waterbodies** (identified in Section I.5.C or I.5.D of this Chapter). The Department shall follow the listing methodology in the biennial Integrated Water Quality Monitoring and Assessment Report (Federal Clean Water Act §§ 305(b), 303(d), and 314). The listing methodology is available for review during the public comment period of each report. When phosphorus enrichment is accompanied by another cause that contributes to an impaired use, the Department may list more than one cause of the impairment.

- E. **Natural conditions.** As provided in 38 M.R.S.A. §464.4.C, the Department may use best professional judgment to interpret decision framework outcomes and make a final determination when natural conditions have contributed to non-attainment of nutrient criteria. Examples of natural conditions affecting designated use attainment related to nutrients include, but are not limited to, proximity to unimpaired wetlands, lake outlets, tidal areas, or naturally occurring concentrations of plants, fish, or wildlife.
- F. **Data requirements**
- (1) **Responsibility for sampling.** In general, it is the responsibility of the Department, or its agents, to conduct sampling for the purpose of making decisions on the attainment of designated uses or maintenance of existing uses. In some circumstances, the Department may require an applicant or holder of a waste discharge license, water quality certification, or other Department issued permit to conduct sampling of effluent or ambient conditions. The decision by the Department to require monitoring may be based on the classification goal of the water, attainment status, existing water quality information, past performance of existing controls for point and nonpoint sources of pollution, and the nature, magnitude, and variability of the activity relative to the affected water. Sampling must be performed by qualified persons; the Department may provide training of Department standard operating procedures. Outside entities shall submit sampling plans to the Department and receive approval from the Department before collecting data.

NOTE: **Data collection.** All data collection must follow Department standard operating protocols and quality assurance procedures.

- (2) **Routine sampling.** Routine sampling takes place during the summer months (June 1 – September 30) for streams and rivers and ice free months (May 1 – October 31) for lakes, with exceptions for special circumstances. Routine phosphorus samples are not taken during or soon after storms or flood events. The Department shall use best professional judgment and accepted statistical practices to determine the amount of nutrient and response indicator data necessary to meet data quality objectives to make an attainment decision.
- (3) **Special circumstances.** When routine sampling procedures are not ecologically appropriate or when sampling is necessary outside of the routine sampling period, a sampling and

analysis plan shall be developed in accordance with methods established in the scientific literature that are appropriate for the habitat conditions of the sample site or time of year.

- (4) **Data quality.** The Department will evaluate data quality and sufficiency before making use attainment decisions. The Department will evaluate the data quality, ensure that data are representative of ambient conditions, and identify potential circumstances of atypical natural conditions as described in Section I.5.E of this Chapter. Data from outside sources may be used if the Department determines them to be of sufficient quantity and quality. Additional sampling may be required after the Department reviews data quality and sufficiency.

NOTE: NPDES permit limits. The Department may incorporate phosphorus, nitrogen, or carbon limits in Maine Pollutant Discharge Elimination System (MEPDES) permits, or National Pollutant Discharge Elimination System (NPDES) permits for interstate waters, after evaluating nutrient and response indicators and the relative contributions of point and non-point sources in the contributing watershed and determining that there is reasonable expectation that such discharge would cause or contribute to an impairment of water quality standards. The Department considers both nutrient and response indicators when determining if permit limits are necessary to maintain or restore water quality standards. The Department must incorporate nutrient limits if nutrients in the discharge would cause or contribute to an impairment of water quality standards. Any such discharge limits must be as stringent as necessary for that waterbody to attain water quality standards including ensuring compliance with the antidegradation provisions pursuant to 38 M.R.S.A. § 464(4)(F). In the absence of site-specific analysis or values, the Department shall use the values in Section I.4 to determine appropriate total phosphorus limits. The Department may revise nutrient limits after conducting site-specific studies of nutrient loads and response indicator values, such as a Total Maximum Daily Load study. The Department may also reevaluate and subsequently reduce permit limits if it is determined that the limits are insufficient to ensure attainment of water quality standards. The Department shall provide for public review and comment for proposed revisions of permit limits. If water quality standards are not attained after establishing limits, the Department may reevaluate the permit and may subsequently assign new phosphorus limits in the permit. The Department may establish discharge limits for carbon or organic material, such as total suspended solids or biochemical oxygen demand, as alternatives to phosphorus limits if organic enrichment accompanies phosphorus enrichment and controlling organic enrichment is an appropriate means of restoring or maintaining water quality standards.

PART II. ESTUARINE AND MARINE WATERS

NOTE: The Department intends to add criteria to Part II of this Chapter at a future date to protect and maintain designated and existing uses of Class SA, SB, and SC waters as described in *Standards of Classification of Estuarine and Marine Waters*, 38 M.R.S.A. § 465-B.

9 - 16. Estuarine and marine nutrient criteria. Reserved

PART III. SITE-SPECIFIC NUTRIENT CRITERIA

NOTE: The Department will use this section to list waterbody segments with site-specific nutrient criteria

17. List of site-specific nutrient criteria. Reserved.

AUTHORITY: 38 M.R.S.A §§ 341-D(1-B) and 464(5)
EFFECTIVE DATE:

DRAFT