



Temperature

Water Quality Standards Criteria Summaries: A Compilation of State/Federal Criteria



DISCLAIMER

This publication was prepared by Battelle under contract to the U.S. Environmental Protection Agency (Contract 68-03-3534). Secondary information sources were used to compile data presented in this document. Each State was given an opportunity to review and provide comments on a draft of this information document. In no event shall either the United States or Battelle have any responsibility or liability for any use, misuse, or reliance upon the information contained herein, nor does either warrant or otherwise represent in any way the accuracy, adequacy, efficacy, or applicability of the contents hereof.

The reader should consult the water quality standards of a particular State for exact regulatory language applicable to that State. Copies of State water quality standards may be obtained from the State's Water Pollution Control Agency or its equivalent.

Additional information may also be obtained from the:

Standards Branch
Criteria and Standards Division (WH-585)
Office of Water Regulations and Standards
U.S. Environmental Protection Agency
Washington, D.C. 20460
202-475-7315

This document may be obtained only from the National Technical Information Service (NTIS) at the following address:

National Technical Information Service
5285 Front Royal Road
Springfield, Virginia 22161
703-487-4650

The NTIS order number is: PB89-141550

INTRODUCTION

This digest is compiled to provide general information to the public as well as to Federal, State, and local officials. It contains excerpts from the individual Federal-State water quality standards establishing pollutant specific criteria for interstate surface waters. The water quality standards program is implemented by the U. S. Environmental Protection Agency where responsibility for providing water quality recommendations, approving State-adopted standards for interstate waters, evaluating adherence to the standards, and overseeing enforcement of standards compliance, has been mandated by Congress.

Standards, a nationwide strategy for surface water quality management, contain three major elements: the use (recreation, drinking water, fish and wildlife propagation, industrial, or agricultural) to be made of the navigable water; criteria to protect these uses; and an antidegradation statement to protect existing high quality waters, from degradation by the addition of pollutants. Guidance for the development of standards by individual States is contained in two EPA documents entitled Water Quality Standards Handbook (1983) and Quality Criteria for Water (1986).

Temperature standards, which are the subject of this digest, are set to control thermal pollution, or the amount of heated wastes discharged into a water body. Thermal pollution creates adverse conditions which can inhibit a balanced aquatic ecosystem by accelerating the activity of aquatic plants, oxygen solubility and depleting mechanisms, and taste and odor.

The following guidelines were developed by EPA and published in Quality Criteria for Water, 1986 (Gold Book) to assist states in developing and implementing temperature policies.

Freshwater Aquatic Life

For any time of year, there are two upper limiting temperatures for a location (based on the important sensitive species found there at that time):

1. One limit consists of a maximum temperature for short exposures that is time dependent and is given by the species-specific equation:

$$\text{Temperature} = \frac{(I/b)(\log_{10} [\text{time}] - a)}{(Co)} - 2^{\circ}\text{C}$$

(min)

where: \log_{10} = logarithm to base 10 (common logarithm)

a = intercept on the "y" or logarithmic axis of the line fitted to experimental data and which is available for some species from Appendix II-C, National Academy of Sciences 1974 document.

b = slope of the line fitted to experimental data and available for some species from Appendix II-C, of the National Academy of Sciences document.

and

2. The second value is a limit on the weekly average temperature that:

a. In the cooler months (mid-October to mid-April in the north and December to February in the south) will protect against mortality of important species to mid-April in the north and December to February in the south) will protect against mortality of important species if the elevated plume temperature is suddenly dropped to the ambient temperature, with the limit being the acclimation temperature minus 2 $^{\circ}$ C when the lower lethal threshold temperature equals the ambient water temperature (in some regions this limitation may also be applicable in summer).

or

b. In the warmer months (April through October in the north and March through November in the south) is determined by adding to the physiological optimum temperature (usually for growth) a factor calculated as one-third of the difference between the ultimate upper incipient lethal temperature and the optimum temperature for the most sensitive important species (and appropriate life state) that normally is found at that location and time.

or

c. During reproductive seasons (generally April through June and September through October in the north and March through May and October through November in the south) the limit is that temperature that meets site-specific requirements for successful migration, spawning, egg incubation, fry rearing, and other reproductive functions of important species. These local requirements should supersede all other requirements when they are applicable.

or

d. There is a site-specific limit that is found necessary to preserve normal species diversity or prevent appearance of nuisance organisms.

Marine Aquatic Life

In order to assure protection of the characteristic indigenous marine community of a water body segment from adverse thermal effects:

a. the maximum acceptable increase in the weekly average temperature resulting from artificial sources is 1 $^{\circ}$ C (1.8 F) during all seasons of the year, providing the summer maxima are not exceeded; and

b. daily temperature cycles characteristic of the water body segment should not be altered in either amplitude or frequency. Summer thermal maxima, which define the upper thermal limits for the communities of the discharge area, should be established on a site-specific basis. Existing studies suggest the following regional limits:

	Short-term Maximum	Maximum True Daily Mean*
Sub tropical regions (south of Cape Canaveral and Tampa Bay, Florida, and Hawaii	32.2°C (90°F)	29.4°C (85°F)

Cape Hatteras, N.C., to Cape Canaveral, Fla.

32.2°C (90°F) 29.4°C (85°F)

Long Island (south shore) to Cape Hatteras, N.C.

30.6°C (87°F) 27.8°C (82°F)

(* True Daily Mean = average of 24 hourly temperature readings.)

Baseline thermal conditions should be measured at a site where there is no unnatural thermal addition from any source, which is in reasonable proximity to the thermal discharge (within 5 miles) and which has similar hydrography to that of the receiving waters at the discharge.

Since water quality standards are revised from time to time, following procedures set forth in the Clean Water Act, individual entries in this digest may be superseded. This digest will be updated periodically. Because this publication is intended for use only as a general information reference, the reader needs to refer to the current approved water quality standards to obtain the latest information for special purposes and applications. These can be obtained from the State water pollution control agencies or the EPA Regional Offices.

REFERENCES

- 5 California Thermal Water Quality Control Plan for Control of Temperature in Coastal and Interstate Waters and Enclosed Bays and Estuaries
- 9 Florida Administrative Code, Chapter 17-4, 1987 and Florida Administrative Code, Chapter 17-3, 1988.
- 20 Water Quality and Water Pollution Control, Subtitle 50, Chapter 1, Maryland Department of Health and Mental Hygiene.
- 35 Ohio Water Quality Standards, Chapter 3745-1 of the Administrative Code, Ohio Environmental Protection Agency, 1985.
- 38 Pennsylvania Water Quality Standards, Department of Environmental Resources, Title 25. Part 1. Subpart C. Article II. Chapter 93 of Pennsylvania Code.
- 40 South Carolina Water Classifications and Standards, Regulation 61-68, Office of Environmental Quality Control, South Carolina Department of Health and Environmental Control, 1985.
- 43 Texas Surface Water Quality Standards, Texas Water Commission, Rule Change, 1988.
- 44 Utah Standards of Quality for Waters of the State, Wastewater Disposal Regulations: Part II, State of Utah Department of Health: Division of Environmental Health, 1988.
- 45 Vermont Water Quality Standards, State of Vermont Water Resource Board, 1987.
- 46 Virginia Water Quality Standards, State Water Control Board, 1987.
- 48 Water Quality Standards, West Virginia Legislative Rules, State Water Resources Board, 1985.
- 51 Water Quality Standards for American Samoa, July 1984, page 17.
- 53 Revised Guam Water Quality Standards, Guam Environmental Protection Agency, 1984, page 11.
- 54 Commonwealth of Northern Mariana Islands Marine and Fresh Water Quality Standards, Commonwealth Register, Vol.8, No. 5, 1986, page 4465.
- 56 Marine and Fresh Water Quality Standard Regulations, Trust Territory, 1986, page 7.
- 57 Water Quality Standards for Coastal Waters of the Virgin Islands, Title 12, Chapter 7, Subchapter 186, 1985, pp. 264-266.

ENVIRONMENT REPORTER, The Bureau of National Affairs, Inc., Washington, D.C.
20037.

- 1 Pages 701:1003-1004, June 26, 1981, 701:1005-1010, September 5, 1980.
- 2 Pages 706:1004, 1008, November 7, 1986.
- 3 Page 711:1018, February 7, 1986.
- 4 Page 716:1004, August 30, 1985.
- 6 Pages 726:1009, 1012, August 22, 1986.
- 7 Pages 731:1004-1007, May 14, 1982.
- 8 Pages 736:1007-1009, March 28, 1986.
- 9 Pages 746:1009-1010, September 5, 1986.
- 11 Pages 756:1003-1007, September 20, 1985.
- 12 Pages 761:1027, 1031-32, January 23, 1987.
- 13 Pages 766:0506, 0508-0509, December 31, 1982.
- 14 Pages 771:1003-1004, August 10, 1984, 771:1007-1008, December 26, 1980, 771:1014, 1016, 1019, January 10, 1986.
- 15 Pages 776:1005-1006, December 26, 1986.
- 16 Page 781:1011, March 27, 1987.
- 17 Pages 786:1008-1009, November 29, 1985.
- 18 Page 791:1007, January 18, 1985.
- 19 Pages 796:0521-0522, January 23, 1987.
- 21 Pages 806:1002-1003, June 21, 1985.
- 22 Pages 811:1006-1007, February 13, 1987.
- 23 Pages 816:1006-1008, June 25, 1982.
- 24 Pages 821:1002-1003, October 25, 1985.
- 25 Page 826:1008, June 21, 1985.
- 26 Pages 831:1004-1009, April 19, 1985.
- 27 Page 836:1003, March 27, 1987.
- 28 Pages 841:1001, 1005, 1008, June 29, 1984.

- 29 Page 846:1005, October 5, 1984.
- 30 Pages 851:1004, 1015-1016, 1025, April 11, 1986.
- 31 Page 856:1002, June 11, 1982.
- 32 Pages 861:1039-1040, November 29, 1985.
- 33 Pages 866:1008, September 6, 1985, 866:1009, 1013, August 29, 1986.
- 34 Page 871:1003, June 7, 1985.
- 36 Pages 881:1003-1005, September 26, 1986.
- 37 Pages 886:1005-1006, 1008, 1010, 1012-1013, 1015, 1017-1018, 1020, 1022-1023, 1025, 1028, 1030, 1032, 1036, 1038, 1040, 1042, 1044, 1046, May 9, 1986.
- 39 Pages 901:1003, 1005, August 9, 1985.
- 41 Pages 911:1005-1006, March 22, 1985.
- 42 Pages 916:0542-0544, September 7, 1984.
- 47 Pages 941:1001, 1003-1005, October 21, 1983.
- 49 Pages 951:1002, 1004, December 19, 1986.
- 50 Pages 956:1005-1006, July 5, 1985.
- 52 Page 741:1003, March 28, 1986.
- 55 Page 896:1003, December 23, 1983.

Alabama¹**Public Water Supply:**

a. The maximum temperature in streams, lakes, and reservoirs, other than those in river basins listed in Part b, hereof, shall not exceed 90°F.

b. The maximum temperature in streams, lakes, and reservoirs in the Tennessee and Cahaba River Basins, and for that portion of the Tallapoosa River Basin from the tailrace of Thurlow Dam at Tallassee downstream to the junction of the Coosa and Tallapoosa Rivers which has been designated by the Alabama Department of Conservation and Natural Resources as supporting small-mouth bass, sauger, or walleye, shall not exceed 86°F.

c. The maximum in-stream temperature rise above ambient water temperature due to the addition of artificial heat by a discharger shall not exceed 5°F in streams, lakes, and reservoirs in non-coastal and non-estuarine areas.

d. The maximum in-stream temperature rise above ambient water temperature due to the addition of artificial heat by a discharger shall not exceed 4°F in coastal or estuarine waters during the period October through May, nor shall the rise exceed 1.5°F during the period June through September.

e. In lakes and reservoirs there shall be no withdrawal from, nor discharge of heated waters to, the hypolimnion unless it can be shown that such discharge or withdrawal will be beneficial to water quality.

f. In all waters the normal daily and seasonal temperature variations that were present before the addition of artificial heat shall be maintained, and there shall be no thermal block to the migration of aquatic organisms.

g. Thermal permit limitations in State discharge permits may be less stringent than those required by criteria a through d hereof when a showing by the discharger has been made pursuant to Section 316 of the Federal Water Pollution Control Act (FWPCA), 33 U.S.C. 1251 et seq. or pursuant to a study of an equal or more stringent nature required by the State of Alabama, authorized by Title 22, Section 22-22-9(c), Code of Alabama, 1975, that such limitations will assure the protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife, in and on the body of water to which the discharge is

State

Water Use and Criteria Values

made. Any such demonstration shall take into account the interaction of the thermal discharge component with other pollutants discharged.

Swimming and Other Whole Body Water-Contact Sports:
Same as Public Water Supply

Shellfish Harvesting: Same as Public Water Supply

Fish and Wildlife: Same as Public Water Supply

Agricultural and Industrial Water Supply: The maximum temperature rise above natural temperatures before the addition of artificial heat shall not exceed 5°F in streams, lakes, and reservoirs, nor shall the maximum water temperature exceed 90°F.

Industrial Operations: Same as Agricultural and Industrial Water Supply

Navigation: Same as Agricultural and Industrial Water Supply

Alaska²

Fresh Water Uses:

Drinking, Culinary, and Food Processing - Shall not exceed 15°C.

Water Supply:

a. Agriculture, Including Irrigation and Stock Watering - Shall not exceed 30°C.

b. Aquaculture - Shall not exceed 20°C at any time. The following maximum temperature shall not be exceeded, where applicable:

Migration Routes - 15°C

Spawning Areas - 13°C

Rearing Areas - 15°C

Egg & Fry Incubation - 13°C

For all other waters, the weekly average temperature shall not exceed site specific requirements needed to preserve normal species diversity or to prevent appearance of nuisance organisms.

c. Industrial, Including Any Water Supplies Used in Association with a Manufacturing or Production Enterprise (Other Than Food Processing), Including Mining, Placer Mining, Energy Production or Development - Shall not exceed 25°C.

Water Recreation:

a. Contact Recreation - Shall not exceed 30°C.

- b. Secondary Recreation - Not applicable.
- c. Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife Including Waterfowl and Furbearers - Shall not exceed 20°C at any time. The following maximum temperature shall not be exceeded, where applicable:
 - Migration Routes - 15°C
 - Spawning Areas - 13°C
 - Rearing Areas - 15°C
 - Egg & Fry Incubation - 13°CFor all other waters, the weekly average temperature shall not exceed site specific requirements needed to preserve normal species diversity or to prevent appearance of nuisance organisms.

Marine Waters:**Water Supply:**

- a. Aquaculture - Shall not cause the weekly average temperature to increase more than 1°C. The maximum rate of change shall not exceed 0.5°C per hour. Normal daily temperature cycles shall not be altered in amplitude or frequency.
- b. Seafood Processing - Shall not exceed 15°C.
- c. Industrial, Including Any Water Supply Used in Association with a Manufacturing or Production Enterprise (Other Than Food Processing) Including Mining, Placer Mining, Energy Production or Development - Shall not exceed 25°C.

Water Recreation:

- a. Contact Recreation - Not applicable.
- b. Secondary Recreation - Not applicable.
- c. Growth and Propagation of Fish, Shellfish, Aquatic Life and Wildlife Including Seabirds, Waterfowl and Furbearers - Shall not cause the weekly average temperature to increase more than 1°C. The maximum rate of change shall not exceed 0.5°C per hour. Normal daily temperature cycles shall not be altered in amplitude or frequency.
- d. Harvesting For Consumption of Raw Mollusks or Other Raw Aquatic Life - Same as c. Growth and Propagation.

State

Arizona³

Water Use and Criteria Values

Domestic Water Source - No standard.

Full Body Contact and Incidental Human Contact - No person shall raise the natural ambient water temperature more than 3° degrees Celsius.

Aquatic and Wildlife - No person shall raise the natural ambient water temperature more than 3.0 degrees Celsius.

Aquatic and Wildlife, Cold Water Fishery - No person shall raise the natural ambient water temperature more than 1.0 degrees Celsius.

Agricultural Irrigation and Agricultural Livestock Watering - No standard.

Arkansas⁴

Heat shall not be added to any waterbody in excess of the amount that will elevate the natural temperature, outside the mixing zone, by more than 5°F (2.8°C) based upon the monthly average of the maximum daily temperatures measured at mid-depth or three feet (whichever is less) in streams, lakes or reservoirs:

Maximum allowable temperatures are ecoregion specific.

California⁵

The standards establish a complex set of thermal requirements. For many categories of receiving waters, requirements differ between "thermal waste" (herein "TW," defined as water used for transporting waste heat) and "elevated temperature waste" (herein "ETW," defined as any discharge, including thermal waste but excluding irrigation return water, which exceeds the natural temperature of the receiving water.

1. Cold Interstate Waters - ETW's are prohibited.

2. Warm Interstate Waters

a) TW's with temperature greater than 5°F above receiving water temperature are prohibited.

b) ETW's shall not raise receiving water temperature by more than 5°F.

c) Colorado River - Maximum rise 5°F in river, 3°F in Lake Havasu. Maximum temperatures in degrees

State

Water Use and Criteria Values

Fahrenheit:

Jan	60	Jul	90
Feb	65	Aug	90
Mar	70	Sept	90
Apr	75	Oct	82
May	82	Nov	72
June	86	Dec	65

d) Lost River - Maximum rise 2°F up to 62°F maximum temperature.

3. Coastal Waters

a) Existing Discharges

- 1) ETW's must comply with limitations necessary to protect beneficial uses.

b) New Discharges.

- 1) ETW's must be to open ocean away from the shoreline, dispersion through the vertical water column.
- 2) ETW's away from areas of special biological significance.
- 3) TW's must have a maximum temperature not exceeding water temperature by more than 20°F.
- 4) ETW's must not increase water temperature more than 4°F at (a) shoreline, (b) surfaced beyond 1,000 feet from the discharge system. Surface limits must be maintained at least 50% of the tidal cycle. Alternate objectives may be specified if they assure full protection of the aquatic environment. (May be specified only with State Board and EPA concurrence.)
- 5) Additional limitations may be imposed when necessary to protect the aquatic environment.

4. Enclosed Bays

a) Existing Discharges

- 1) ETW's must comply with limitations necessary to protect beneficial uses.

b) New Discharges

- 1) ETW's must comply with limitations necessary to protect beneficial uses. Maximum discharge temperature must not exceed receiving water temperature by more than 20°F.
- 2) TW's with temperature greater than 4°F above receiving water temperature are prohibited.

5. Estuaries

a) Existing Discharges

1) ETW's:

- a) Temperature shall not exceed receiving water temperature by more than 20°F.
 - b) Must not, individually or combined, create zone (receiving water temperatures more than 1°F above natural) which exceeds 25% of cross-sectional area of main channel;
 - c) No discharge shall cause a surface water temperature rise greater than 4°F above the natural temperature of the receiving water at any time or place.
 - d) Additional limits necessary to protect beneficial uses.
- 2) TW's must comply with 5A(1) and their maximum temperature must not exceed 86°F.

b) New Discharges

- 1) ETW's must comply with 5A(1).
- 2) TW's with temperature greater than 4°F above receiving water temperature are prohibited.
- 3) Additional limits necessary to protect beneficial uses.

General Provisions - Standards also contain general provisions which include the following:

1. Authorization for additional individual limitations to confine heat dispersion to a 1 1/2°F isotherm in a minimal, defined area;
2. Prohibition of cumulative heat effects in excess of the standards;
3. A requirement that the State Board designate biologically significant areas for special protection;
4. Authorization to make exceptions if:
 - a) The heat discharge will be beneficial;
 - b) Intermittent heat is the least harmful method of control fouling organisms in intake and discharge structures;

State

Water Use and Criteria Values

- c) Compliance would cause a greater environmental impact than modification of the standards, or
- d) Compliance by existing discharges would not be commensurate with the benefit to the aquatic environment.

NOTE: Exceptions will be made only with EPA concurrence.

In addition, the following temperature objectives apply to intrastate surface waters:

The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses.

At no time or place shall the temperature of any COLD water be increased by more than 5°F above natural receiving water temperature.

At no time or place shall the temperature of WARM intrawaters be increased more than 5°F above natural receiving water temperature.

Colorado⁶

Aquatic Life Class 1: Cold Water Biota and Warm Water Biota - Temperature shall maintain a normal pattern of diurnal and seasonal fluctuations with no abrupt changes and shall have no increase in temperature of a magnitude, rate, and duration deemed deleterious to the resident aquatic life. Generally, a maximum 3°C increase over a minimum of a four-hour period, lasting for 12 hours maximum is deemed acceptable for discharges fluctuating in volume or temperature. Where temperature increases cannot be maintained within this range using BMP, BATEA, and BPWT control measures, the Division will determine whether the resulting temperature increases preclude an aquatic life classification.

Aquatic Life Class 1: Cold Water Biota - Max 20°C with 3°C increase.

Aquatic Life Class 1: Warm Water Biota - Max 30°C with 3°C increase.

Aquatic Life Class 2 - established on a case-by-case basis.

State

Connecticut⁷

Water Use and Criteria Values

Inland Waters: Class AA - No increase other than of natural origin except when it can be demonstrated that cold water fish spawning and growth will not be impaired.

Inland Waters: Class A - Same as Class AA.

Inland Waters: Class B - No increase except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 85 degrees F, or in any case raise the normal temperature of the receiving water more than 4 degrees F.

Inland Waters: Class C - Same as Class B.

Coastal and Marine Waters: Class SA - No increase except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 83 degrees F or in any case raise the normal temperature of the receiving water more than 4 degrees F. During the period including July, August, September, the normal temperature of the receiving water shall not be raised more than 1.5 degrees F. unless it can be shown that spawning and growth of indigenous organisms will not be significantly affected.

Coastal and Marine Waters: Class SB - Same as Class SA.

Coastal and Marine Waters: Class SC - Same as Class SA.

Delaware⁸

General Criteria for Freshwater Streams - Outside approved mixing zones, maximum rise above natural conditions shall be 5 degrees F. Maximum allowable stream temperature shall be 85 degrees F. unless exceeded due to natural conditions. No increase above 85 degrees F. due to discharge shall be allowed.

Cold Water Fisheries - Outside approved mixing zones, maximum rise above natural conditions shall be 5 degrees F. Maximum allowable stream temperature shall be 75 degrees F. unless exceeded due to natural conditions. No increase above 75 degrees F. due to discharge shall be allowed.

General Criteria for Saltwater Streams - Outside approved mixing zones, maximum rise above natural conditions shall be 4 degrees F. (September through May) and 1.5 degrees F. (June through August). Maximum allowable temperature shall be 85 degrees F. unless exceeded due to natural conditions. No increase above

85 degrees due to discharge shall be allowed.

Specific Criteria for Delaware River - No heat may be added except in designated mixing zones which would cause temperature to exceed 86°F. or which would cause the temperature to be raised more than 4°F during September through May or to be raised more than 1.5°F during June through August. The rate of temperature change in designated mixing zones shall not cause mortality of fish, shellfish, their eggs or larvae.

Florida⁹

All surface waters of the State shall at all places and at all times be free from thermal components of discharges which alone or in combination with other components of discharges (whether thermal or non-thermal) produce conditions so as to create a nuisance.

Thermal Surface Water Criteria - All discharges or proposed discharges of heated water into receiving bodies of water (RBW) which are controlled by the state shall be subjected to a thorough study to assess the consequences of the discharge upon the environment. The state shall be divided into two general climatological zones: Peninsular Florida, which varies from tropical in nature to temperate but is modified by the peninsular configuration and is the area south of latitude 30 degrees N (excluding Gulf and Franklin Counties); and Northern Florida which is temperate and continental and is the area above latitude 30 degrees N plus the portions of Gulf and Franklin Counties which lie below 30 degrees N.

a. Heated water discharges existing on July 1, 1972:

1. Shall not increase the temperature of the RBW so as to cause substantial damage or harm to the aquatic life or vegetation therein or interfere with beneficial uses assigned to the RBW.

2. Shall be monitored by the discharge to ensure compliance with the rule, and

3. If the Department, pursuant to notice and opportunity for hearing, finds by preponderant evidence that a discharge has caused substantial damage, it may require conversion of such discharge to offstream cooling or approved alternate methods. In making determinations regarding such conversions, the Department may consider:

a. The nature and extent of the existing damage;

b. The projected lifetime of the existing discharge;

c. Any adverse economic and environmental (including non-water quality) impacts which would result from such conversion; and

d. Such other factors as may be appropriate.

b. Heated water sources proposed for future discharges into RBW controlled by the state shall not increase the water temperature by more than the monthly temperature limits prescribed for the particular type and location of the RBW. New sources shall include all expansions, modifications, alterations, replacements, or repairs which result in an increased output of ten percent (10%) or more of the level of energy production which existed on the date this rule became effective. Water temperatures shall be measured by procedures approved by the Florida Department of Pollution Control (DPC). In all cases where a temperature rise above ambient is allowed and a maximum RBW temperature is also prescribed, the lower of the two limitations shall be the control temperature.

c. Definitions.

i. Ambient (natural) temperature of a RBW is the existing temperature of the receiving water at a location which is unaffected by manmade thermal discharges and a location which is also of a depth and exposure to winds and currents which typify the most environmentally stable portions of the RBW.

ii. Coastal waters shall be all waters in the state which are not classified as fresh waters or as open waters.

iii. A cooling pond is a body of water enclosed by natural or constructed restraints which has been approved by the Florida DPC for purposes of controlling heat dissipation from thermal discharges.

iv. An existing heat source is any thermal discharge (a) which is presently taking place, or (b) which is under construction or for which a construction or operating permit has been issued prior to the effective date of this rule.

v. Fresh waters shall be all waters of the state which are contained in lakes and ponds, or are in

flowing streams above the zone in which tidal actions influence the salinity of the water and where the concentration of chloride ions is normally less than 1500 mg/l.

vi. Open waters shall be waters in the state extending seaward from the most seaward 18-foot depth contour line (three-fathom bottom depth contour) which is offshore from any island; exposed or submerged bar or reef; or mouth of any embayment or estuary which is narrowed by headlands. Contour lines shall be determined from Coast and Geodetic Survey Charts.

vii. The point of discharge (POD) for a heated water discharge shall be primarily that point at which the effluent physically leaves its carrying conduit (open or closed), and discharges into the waters of the state, or, in the event it is not practicable to measure temperature at the end of the discharge conduit, a specific point designated by the Florida Department of Pollution Control for that particular thermal discharge.

viii. Heated water discharges are the effluents from commercial or industrial activities or processes in which water is used for the purpose of transporting waste heat, and which constitute heat sources of one million British Thermal Units per hour (1,000,000 BTU/HR.), or greater.

ix. Blowdown shall mean the minimum discharge of recirculating cooling water for the purpose of discharging materials contained in the water, the further buildup of which would cause concentrations in amounts exceeding limits established by best engineering practice.

x. Recirculating cooling water shall mean water which is used for the purpose of removing waste heat and then passed through a cooling system for the purpose of removing such heat from the water and then, except for blowdown, is used again to remove waste heat.

d. Monthly and maximum temperature limits

i. Fresh Waters - Heated water with a temperature at the POD more than 5 degrees F higher than the ambient (natural) temperature of any stream shall not be discharged into such stream. At all times under all conditions of stream flow the discharge temperature shall be controlled so that at least two-third (2/3) of the width of the stream's surface remains at ambient (natural) temperature.

Further, no more than one-fourth ($1/4$) of the cross-section of the stream at a traverse perpendicular to the flow shall be heated by the discharge. Heated water with a temperature at the POD more than 3 degrees F higher than the ambient (natural) temperature of any lake or reservoir shall not be discharged into such lake or reservoir. Further, no heated water with a temperature above 90 degrees F shall be discharged into any fresh waters in Northern Florida regardless of the ambient temperature of the RBW. In Peninsular Florida, heated waters above 92 degrees F shall not be discharged into fresh waters.

ii. Coastal Waters - Heated water with a temperature at the POD more than 2 degrees F higher than the ambient (natural) temperature of the RBW shall not be discharged into coastal waters in any zone during the months of June, July, August, and September. During the remainder of the year, heated water with a temperature at the POD more than 4 degrees F higher than the ambient (natural) temperature of the RBW shall not be discharged into coastal waters in any zone. In addition, during June, July, August, and September, no heated water with a temperature above 92 degrees F shall be discharged into coastal waters. Further, nonheated water with a temperature above 90 degrees F shall be discharged into coastal waters during the period October through May.

iii. Open Waters - Heating water with a temperature at the POD up to 17 degrees F above ambient (natural) temperature of the RBW may be discharged from an open or closed conduit into open waters under the following restraints: The surface temperature of the RBW shall not be raised to more than 97 degrees F and the POD must be sufficient distance offshore to ensure that the adjacent coastal waters are not heated beyond the temperature permitted in such waters.

iv. Cooling Ponds - The temperature for heated water discharged from a cooling pond shall be measured at the POD from the pond, and the temperature limitation shall be that specified for the RBW.

e. General.

i. Daily seasonal temperature variations that were normal to the RBW before the addition of heat from other than natural causes shall be

StateWater Use and Criteria Values

maintained.

ii. Recapitulation of temperature limitations prescribed above:

ZONE	STREAMS	LAKES	COASTAL		OPEN
			SUMMER	REMAINDER	
NORTH.	90°F Max. AM. +5°F	90°F Max. AM. +3°F	92°F Max. AM. +2°F	90°F Max. AM. +4°F	97°F Max. AM. +15°F
PENIN.	92°F Max. AM. +5°F	92°F Max. AM. +3°F	92°F Max. AM. +2°F	90°F Max. AM. +4°F	97°F Max. AM. +17°F

Georgia¹⁰

Drinking Water Supplies - Not to exceed 90 degrees F. At no time is the temperature of the receiving waters to be increased more than 5 degrees F above intake temperature except that in estuarine waters the increase will not be more than 1.5 degrees F. In streams designated as primary trout or smallmouth bass waters by the State Game and Fish Division, there shall be no elevation or depression of natural stream temperatures. In streams designated as secondary trout waters, there shall be no elevation or depression exceeding 2°F of natural stream temperatures.

Recreation - Same as Drinking Water Supplies.

Fishing, Propagation of Fish, Shellfish, Game and Other Aquatic Life: or for any other use requiring water of a lower quality - Same as Drinking Water Supplies.

Agricultural - Not to exceed 90 degrees F. At no time is the temperature of the receiving waters to be increased more than 5 degrees F above intake temperature except that in estuarine waters the increase will not be more than 1.5 degrees F.

Industrial - Same as Agricultural.

Navigation - Same as Agricultural.

Hawaii¹¹

Water Column Criteria for Streams - Temperature shall not vary more than 1°C from ambient conditions.

Specific Criteria for All Estuaries Except Pearl Harbor - Temperature shall not vary more than 1°C from ambient conditions.

State

Water Use and Criteria Values

Specific Criteria for Only Pearl Harbor Estuary - Temperature shall not vary more than 1°C from ambient conditions.

Specific Criteria for Embayments - Temperature shall not vary more than 1°C from ambient conditions.

Specific Criteria for Open Coastal Waters - Temperature shall not vary more than 1°C from ambient conditions.

Idaho¹²

Warm Water Biota - Water temperatures of 33°C or less with a maximum daily average not greater than 29°C .

Cold Water Biota - Water temperatures of 22°C or less with a maximum daily average of no greater than 19°C .

Salmonid Spawning - Water temperatures of 13°C or less with a maximum daily average no greater than 9°C .

Regulations Governing Point Source Wastewater Discharge - The wastewater must not affect the receiving water outside the mixing zone so that:

i. The temperature of the receiving water or of downstream waters will interfere with designated uses.

ii. Daily and seasonal temperature cycles characteristic of the water body are not maintained.

iii. If the water is designated for warm water biota, the induced variation is more than $+2^{\circ}\text{C}$.

iv. If the water is designated for cold water biota or salmonid spawning, the induced variation is more than $+1^{\circ}\text{C}$.

Illinois¹³

a. Temperature has STORET number (F°) 00011 and (C°) 0010.

b. There shall be no abnormal temperature changes that may adversely affect aquatic life unless caused by natural conditions.

c. The normal daily and seasonal temperature fluctuations which existed before the addition of heat due to other than natural causes shall be maintained.

d. The maximum temperature rise above natural temperatures shall not exceed 2.8°C (5°F).

StateWater Use and Criteria Values

e. In addition the water temperature at representative locations in the main river shall not exceed the maximum limits in the following table during more than one percent of the hours in the 12-month period ending with any month. Moreover, at no time shall the water temperature at such locations exceed the maximum limits in the following table by more than 1.7°C (3°F).

	°C	°F		°C	°F
JAN.	16	60	JUL.	32	90
FEB.	16	60	AUG.	32	90
MAR.	16	60	SEPT.	32	90
APR.	32	90	OCT.	32	90
MAY	32	90	NOV.	32	90
JUNE	32	90	DEC.	16	60

f. The owner or operator of a source of heated effluent which discharges 15,000 megawatts (0.5 billion British thermal units per hour) or more shall demonstrate in a hearing before this Board not less than 5 nor more than 6 years after the effective date of these regulations or, in the case of new sources, after the commencement of operation, that discharges from that source have not caused and cannot be reasonably expected to cause significant ecological damage to the receiving waters. If such proof is not made to the satisfaction of the Board appropriate corrective measures shall be ordered to be taken within a reasonable time as determined by the Board.

g. Permits for heated effluent discharges, whether issued by the Board or the Agency, shall be subject to revision in the event that reasonable future development creates a need for reallocation of the assimilative capacity of the receiving stream as defined in the regulation above.

h. The owner or operator of a source of heated effluent shall maintain such records and conduct such studies of the effluents from such sources and of their effects as may be required by the Agency or in any permit granted under the Act.

i. Appropriate corrective measures will be required if, upon complaint filed in accordance with Board rules, it is found at any time that any heated effluent causes significant ecological damage to the

receiving stream.

j. All effluents to an artificial cooling lake must comply with the applicable provisions of the thermal water quality standards as set forth in Section 302.211 and Part 303, except when all of the following requirements are met:

1. All discharges from the artificial cooling lake to other waters of the State comply with the applicable provisions of Sections 302.211(b) through 302.211(e).

2. The heated effluent discharged to the artificial cooling lake complies with all other applicable provisions of this Chapter, except Sections 302.211(b) through 302.211(e).

3. At an adjudicative hearing the discharger shall satisfactorily demonstrate to the Board that the artificial cooling lake receiving the heated effluent will be environmentally acceptable, and within the intent of the Act, including, but not limited to:

- A. Provision of conditions capable of supporting shellfish, fish and wildlife, and recreational uses consistent with good management practices; and

- B. Control of the thermal component of the discharger's effluent by a technologically feasible and economically reasonable method.

4. The required showing in Section 302.211(j)(3) may take the form of an acceptable final environmental impact statement or pertinent provisions of environmental assessments used in the preparation of the final environmental statement, or may take the form of a showing pursuant to Section 316(a) of the CWA, which addresses the requirements of Section 302.211(j)(3).

5. If an adequate showing as provided in Section 302.211(j)(3) is found, the Board shall promulgate specific thermal standards to be applied to the discharge to that artificial cooling lake.

Secondary Contact and Indigenous Aquatic Life Standards:

- a. Temperature (STORET number ($^{\circ}\text{F}$) 00011 and ($^{\circ}\text{C}$) 00010) shall not exceed 34°C (93°F) more than 5% of the time, or 37.8°C (100°F) at any time.

Lake Michigan Water Quality Standards:

- a. STORET numbers for temperature are ($^{\circ}\text{F}$) 00011 and ($^{\circ}\text{C}$) 00010.

b. The owner or operator of a source of heated effluent shall maintain such records and conduct such studies of the effluents from such source and of their effects as may be required by the Agency or in any permit granted under the Act.

c. Backfitting of alternative cooling facilities will be required if, upon complaint filed in accordance with Board rules, it is found at any time that any heated effluent causes significant ecological damage to the Lake.

Existing Sources on January 1, 1971.

a. All sources of heated effluents in existence as of January 1, 1971 shall meet the following restrictions outside of a mixing zone which shall be no greater than a circle with a radius of 305 m (1000 feet) or an equal fixed area of simple form.

1. There shall be no abnormal temperature changes that may affect aquatic life.

2. The normal daily and seasonal temperature fluctuations that existed before the addition of heat shall be maintained.

3. The maximum temperature rise at any time above natural temperatures shall not exceed 1.7°C (3°F). In addition, the water temperature shall not exceed the maximum limits indicated in the following table:

StateWater Use and Criteria Values

	°C	°F		°C	°F
JAN.	45	7	JUL.	80	27
FEB.	45	7	AUG.	80	27
MAR.	45	7	SEPT.	80	27
APR.	55	13	OCT.	65	18
MAY	60	16	NOV..	60	16
JUN.	70	21	DEC.	50	10

b. The owner or operator of a source of heated effluent which discharges 15,000 megawatts (0.5 billion British Thermal Units per hour) or more shall demonstrate in a hearing before this Board not less than 5 nor more than six years after the adoption of this regulation, that discharges from that source have not caused and cannot be reasonably expected in future to cause significant ecological damage to the Lake. If such proof is not made to the satisfaction of the Board, backfitting of alternative cooling devices shall be accomplished within a reasonable time as determined by the Board.

Specific river temperatures are listed in Environment Reporter, pages 766:0510-0512 (March 28, 1986).

Indiana¹⁴

Water Quality for Warm Water Fish:

(The following standards are established to ensure conditions necessary for the maintenance of a well-balanced, warm water fish community. They are applicable at any point in the waters outside of the mixing zone.)

a. There shall be no abnormal temperature changes that may adversely affect aquatic life unless caused by natural conditions.

b. The normal daily and seasonal temperature fluctuations that existed before the addition of heat due to other than natural causes shall be maintained.

c. The maximum temperature rise at any time of place above natural temperatures shall not exceed 5 degrees F. (2.8 degrees C.) in streams and 3 degrees F. (1.7 degrees C.) in lakes and reservoirs.

d. Water temperature shall not exceed the maximum limits in the following table during more than one percent of the hours in the 12-month period ending with any month; at no time shall the water temperature at such locations exceed the maximum limits in the table by more than 3 degrees F. (1.7 degrees C.).

	Ohio River Main Stem °F. (°C.)	St. Joseph River Tributary to Lake Michigan °F. (°C.)	Other Indiana Streams °F. (°C.)
January	50 (10.0)	50 (10.0)	50 (10.0)
February	50 (10.0)	50 (10.0)	50 (10.0)
March	60 (15.6)	55 (12.8)	60 (15.6)
April	70 (21.1)	65 (18.3)	70 (21.1)
May	80 (26.7)	75 (23.9)	80 (26.7)
June	87 (30.6)	85 (29.4)	90 (32.2)
July	89 (31.7)	85 (29.4)	90 (32.2)
August	89 (31.7)	85 (29.4)	90 (32.2)
September	87 (30.7)	85 (29.4)	90 (32.2)
October	78 (25.6)	70 (21.1)	78 (25.5)
November	70 (21.1)	60 (15.6)	70 (21.1)
December	57 (14.0)	50 (10.0)	57 (14.0)

Water Quality for Cold Water Fish:

(The following standards are established to ensure conditions necessary for the maintenance of a well-balanced, cold water fish community. They are applicable at any point in the waters outside of the mixing zone.)

a. In lakes and streams, where the natural reproduction of trout and salmon is to be protected, no heat shall be added.

b. In put-and-take streams, no heat shall be added so as to cause temperatures to exceed 65 degrees F. (18.3 degrees C.) or a 5 degrees F. (2.8 degrees C.) rise above natural, whichever is less.

c. In lakes where a put-and-take trout fishery is to be protected, no heat shall be added.

Lake Michigan and Contiguous Harbor Areas: Minimum Water Quality Standard - the following temperature standards and criteria shall apply:

a. All temperature are expresses both in degrees Fahrenheit and degrees Celsius. In all receiving waters the point of measurement shall normally be in the first meter below the surface at such depth as to avoid thin layer surface warming due to extreme ambient air temperatures, but where required to determine the true distribution of heated wastes and natural variations in water temperatures, measurements shall be at a greater depth and at several depths as a thermal profile.

b. There shall be no abnormal temperature changes so as to be injurious to fish, wildlife, or other aquatic life or the growth or propagation thereof. In addition, plume interaction with the bottom shall be minimized and shall not injuriously affect fish, shellfish, and wildlife spawning or nursery areas.

c. The normal daily and seasonal temperature fluctuations that existed before the addition of heat shall be maintained.

d. At any time and at a maximum distance of a 1,000 foot arc inscribed from a fixed point adjacent to the discharge and/or as agreed upon by the Commissioner and Federal Regulatory Agencies, the receiving water temperature shall not be more than 3° Fahrenheit above the existing natural water temperature nor shall the maximum temperature exceed those listed in the table below, whichever is lower:

	°F	°C
January	45	7.0
February	45	7.0
March	45	7.0
April	55	13.0
May	60	15.5

State

Water Use and Criteria Values

June	70	21.0
July	80	26.5
August	80	26.5
September	80	26.5
October	65	18.5
November	60	15.5
December	50	10.0

e. All new waste heat discharges or enlargements of existing facilities exceeding a daily average of 0.5 billion BTU/hour, which had not begun operation as of February 11, 1972, and which plan to use Lake Michigan waters for cooling, shall be limited to the amount essential for blowdown in the operation of a closed cycle cooling facility.

f. Water intakes shall be designed and located to minimize entrainment and damage to desirable organisms. Requirement may vary depending upon local conditions but, in general intakes are to have minimum water velocity and shall not be located in spawning or nursery areas of important fishes. Water velocity at screens and other exclusion devices shall also be at a minimum.

g. Discharges other than those now in existence shall be such that the thermal plumes do not overlap or intersect.

h. Facilities discharging more than a daily average of 0.5 billion BTU/hour of waste heat shall continuously record intake and discharge temperature and flow and make those records available to regulatory agencies upon request.

Grand Calumet River; Indiana Harbor: Minimum Water Quality Conditions:

(The following standards are applicable at any point in the stream outside the mixing zone.)

a. There shall be no abnormal temperature changes that may adversely affect aquatic life unless caused by natural conditions.

b. Water temperature shall not, at the edge of the mixing zone, exceed the maximum limits in the following table:

Month	Grand Calumet River Indiana Harbor Ship Canal $^{\circ}\text{F}$ ($^{\circ}\text{C}$)
-------	--

January	60 (15.6)
February	60 (15.6)
March	60 (15.6)
April	65 (18.3)
May	75 (23.9)
June	85 (29.4)
July	87 (30.6)
August	87 (30.6)
September	85 (29.4)
October	75 (23.9)
November	70 (21.1)
December	60 (15.6)

Natural Spawning, Rearing, or Imprinting Areas for Salmonid Fishes:

(This standard is applicable at any point in the waters outside the mixing zone.)

No heat shall be added.

Migration Routes for Salmonid Fishes:

(These standards are applicable at any point in the waters outside of the mixing zone.)

a. The normal daily and seasonal temperature fluctuations that existed before the addition of heat due to other than natural causes shall be maintained.

b. The maximum temperature rise at any time or place above natural shall not exceed (2) two degrees Fahrenheit. In addition, the temperature shall not exceed 70 degrees Fahrenheit at any time or place during periods of migration nor exceed 85 degrees Fahrenheit at any time.

Iowa¹⁵

Class B:

1. No heat shall be added to interior streams or the Big Sioux River that would cause an increase of more than 3°C . The rate of temperature change shall not exceed 1°C per hour. In no case shall heat be added in excess of that amount that would raise the stream temperature above 32°C .

2. No heat shall be added to streams designated as cold water fisheries that would cause an increase of more than 2°C . The rate of temperature change shall not exceed 1°C per hour. In no case shall heat be added in excess of that amount that would raise the stream temperature above 20°C .

3. No heat shall be added to lakes and reservoirs that would cause an increase of more than 2°C . The rate of temperature change shall not exceed 1°C per hour. In no case shall heat be added in excess of that amount that would raise the temperature of the lake or reservoirs above 32°C .

4. No heat shall be added to the Missouri river that would cause an increase of more than 3°C . The rate of temperature change shall not exceed 1°C per hour. In no case shall heat be added that would raise the stream temperature above 32°C .

5. No heat shall be added to the Mississippi river that would cause an increase of more than 3°C . The rate of temperature change shall not exceed 1°C per hour. In addition, the water temperature at representative locations in the Mississippi river shall not exceed the maximum limits in the below table during more than one percent of the hours in the 12-month period ending with any month. Moreover, at no time shall the water temperature at such locations exceed the maximum limits in the below table by more than 2°C .

StateWater Use and Criteria Values

Zone II--Iowa-Minnesota state line to the Northern Illinois border (Mile Point 1534.6)

Zone III--Northern Illinois border (Mile Point 1534.6) to Iowa-Missouri state line.

Month	Zone II	Zone III
January	4°C	7°C
February	4°C	7°C
March	12°C	14°C
April	18°C	20°C
May	24°C	26°C
June	29°C	29°C
July	29°C	30°C
August	29°C	30°C
September	28°C	29°C
October	23°C	24°C
November	14°C	18°C
December	9°C	11°C

Kansas¹⁶

Surface Waters - Artificial sources shall not elevate the temperature of the receiving water above 90°F. Heat of artificial origin shall not be added to a stream in excess of the amount that will raise the temperature of the water more than 5°F above natural conditions. The epilimnion of lakes shall not be raised more than 3°F above that temperature which existed before the addition of heat of artificial origin. The normal daily and seasonal temperature variations before the addition of heat due to other than natural causes shall be maintained. Occasional, natural thermal conditions may exceed the maximum allowable temperature requirements.

Kentucky¹⁷

Warmwater Aquatic Habitat - Temperature shall not exceed 31.7 degrees Celsius (eighty-nine (89) degrees Fahrenheit):

1. The normal daily and seasonal temperature fluctuations that existed before the addition of heat due to other than natural causes shall be maintained.

2. The cabinet will determine allowable surface water temperatures on a site-specific basis utilizing available data which shall be based on the effects of temperature on the aquatic biota.

which utilize specific surface waters of the Commonwealth and which may be affected by person-induced temperature changes. Effects on downstream uses will also be considered in determining site-specific temperatures. As a guideline, the water temperature for all surface waters shall comply with the limits shown in the following table:

Month/Date	Period Average (°F)	Instantaneous Maximum (°F)
January 1-31	45	50
February 1-29	45	50
March 1-15	51	56
March 16-31	54	59
April 1-15	58	64
April 16-30	64	69
May 1-15	68	73
May 16-31	75	80
June 1-15	80	85
June 16-30	83	87
July 1-31	84	89
August 1-31	84	89
September 1-15	84	87
September 16-30	82	86
October 1-15	77	82
October 16-31	72	77
November 1-30	67	72
December 1-31	52	57

3. A successful demonstration concerning thermal discharge limits carried out under Section 316(a) of the Clean Water Act shall constitute compliance with the temperature requirements of this subsection. A successful demonstration assures the protection and propagation of a balanced indigenous population of shellfish, fish and wildlife in or on the water into which the discharge is made.

Coldwater Aquatic Habitat - Water temperature shall not be increased through man's activities above the natural seasonal temperatures.

Louisiana¹⁸**General Criteria**

(Numerical criteria specifically apply to water quality conditions of the surface waters of the state that are attributed to waste discharges or activities of man as opposed to natural conditions.)

The temperature standards enumerated in the tables, in most cases, represent maximum values obtained from existing data. However, in a few cases a limited number of unusually high temperatures in the range of 35° to 36°C (95-97°F) have been deleted as it is felt that these values were recorded during conditions of unseasonably high temperatures and/or unusually low flows or water levels, and, therefore, do not represent normal maximum temperatures.

The standard shall consist of two parts, a temperature differential and a maximum temperature. The temperature differential represents the maximum permissible increase above ambient conditions. There shall be no additional artificial heat added once the ambient temperature reaches the maximum temperature specified in the standards except under natural conditions such as unusually hot, dry weather as provided for below:

(a) Fresh Water

- (1) Maximum of 2.8°C (5°F) rise above ambient for streams and rivers.
- (2) Maximum of 1.7°C (3°F) rise above ambient for lakes and reservoirs.
- (3) Maximum Temperature - 32.2°C (90°F) except where otherwise listed in the tables. Maximum temperature shall be varied on a case-by-case basis to allow for the effects of natural conditions such as unusually hot and/or dry weather.

(b) Estuarine and Coastal Waters

- (1) Maximum of 2.2°C (4°F) rise above ambient during the period October through May.
- (2) Maximum 0.83°C (1.5°F) during the period June through September.
- (3) Maximum Temperature - 35°C (95°F) except when natural conditions elevate temperature above this level.

State

Water Use and Criteria Values

These temperature criteria shall not apply to privately owned reservoirs, or reservoirs constructed solely for industrial cooling purposes.

(For segment specific criteria see Environment Reporter pp.791:1021-1056 January 18, 1985)

Maine¹⁹

Freshwater Thermal Discharges - No discharge of pollutants shall cause the ambient temperature of any freshwater body, as measured outside a mixing zone, to be raised more than 5 degrees F, or more than 3 degrees F in the epilimnion of any lake or pond. In no event shall any discharge cause the temperature of any freshwater body to exceed 84 degrees F at any point outside a mixing zone established by the Board, nor shall such discharge cause the temperature of any waters which presently are designed as trout or salmon waters to exceed 68 degrees F at any point outside a mixing zone established by the Board.

Tidal Water Thermal Discharges - No discharge of pollutants shall cause the monthly mean of the daily maximum ambient temperature in any tidal body of water, as measured outside the mixing zone, to be raised more than 4 degrees F, nor more than 1.5 degrees F from June 1 to September 1. In no event shall any discharge cause the temperature of any tidal waters to exceed 85 degrees F at any point outside a mixing zone established by the Board.

Maryland²⁰

Class I Waters: Water Contact Recreation; Aquatic Life, and Water Supply - The maximum temperature outside the mixing zone determined in accordance with Section F of this regulation or with Regulation .29-.32 may not exceed 90°F (32°C) or the ambient temperature of the surface waters, whichever is greater.

A thermal barrier that adversely affects aquatic life may not be established.

Class II Waters: Shellfish Harvesting - same as Class I waters.

Bacteriological - same as Class I waters.

The maximum temperature outside the mixing zone determined in accordance with Section F of this regulation or with Regulation .29-.32 may not exceed 68°F (20°C) or the ambient temperature of the surface water, whichever is greater.

State

Water Use and Criteria Values

A thermal barrier that adversely affects aquatic life may not be established.

Class IV Waters: Recreational Trout Waters - The maximum temperature outside the mixing zone determined in accordance with Section F of this regulation or with Regulation .29-.32 may not exceed 75°F (23.9°C) or the ambient temperature of the surface water, whichever is greater.

A thermal barrier that adversely affects aquatic life may not be established.

Massachusetts²¹

Inland Waters:

Class A, Class B, and Class C - Shall not exceed 83°F (28.3°C) in warm water fisheries or 68°F (20°C) in cold water fisheries nor shall the rise resulting from artificial origin exceed 4.0°F (2.2°C).

Coastal and Marine Waters:

Class SA, Class SB, and Class SC - No increase except where the increase will not exceed the recommended limits on the most sensitive water use.

Michigan²²

General Considerations:

(1) In all waters of the state, the points of temperature measurement normally shall be in the surface 1 meter, but where otherwise required, measurements shall be made at greater depths as a thermal profile.

(2) Monthly maximum temperatures, based on the ninetieth percentile occurrence of natural water temperatures plus the increase allowed at the edge of the mixing zone and in part on long-term physiological needs of fish, may be exceeded for short periods when natural water temperatures exceed the ninetieth percentile occurrence. Temperature increases during these periods may be permitted by the commission, but in all cases shall not be greater than the natural water temperature plus the increase allowed at the edge of the mixing zone.

(3) Natural daily and seasonal temperature fluctuations of the receiving waters shall be preserved.

Great Lakes and Connecting Waters:

(1) The Great Lakes and connecting waters shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 3 degrees Fahrenheit above the existing natural water

StateWater Use and Criteria Values

temperature.

(2) The Great Lakes and connecting waters shall not receive a heat load which would warm the receiving water at the edge of the mixing zone to temperatures in degrees Fahrenheit higher than the following monthly maximum temperatures:

a. Lake Michigan north of a line due west from the city of Pentwater:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	40	50	55	70	75	75	75	65	60	45

b. Lake Michigan south of a line due west from the city of Pentwater:

J	F	M	A	M	J	J	A	S	O	N	D
45	45	45	55	60	70	80	80	80	65	60	50

c. Lake Superior and the St. Marys River:

J	F	M	A	M	J	J	A	S	O	N	D
38	36	39	46	53	61	71	74	71	61	49	42

d. Lake Huron north of a line due east from Tawas point:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	40	50	60	70	75	80	75	65	55	45

e. Lake Huron south of a line due east from Tawas point, except Saginaw bay:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	40	55	60	75	80	80	80	65	55	45

f. Lake Huron, Saginaw bay:

J	F	M	A	M	J	J	A	S	O	N	D
45	45	45	60	70	75	80	85	78	65	55	45

g. St. Clair river:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	40	50	60	70	75	80	75	65	55	50

h. Lake St. Clair:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	45	55	70	75	80	83	80	70	55	45

i. Detroit river:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	45	60	70	75	80	83	80	70	55	45

k. Lake Erie:

J	F	M	A	M	J	J	A	S	O	N	D
45	45	45	60	70	75	80	85	80	70	60	50

Inland Lakes, General Standards - Rule 72. Inland lakes shall not receive a heat load which would:

a. Increase the temperature of the thermocline or hypolimnion or decrease the volume thereof.

b. Increase the temperature of the receiving waters at the edge of the mixing zone more than 3 degrees Fahrenheit above the existing natural water temperature.

c. Increase the temperature of the receiving waters at the edge of the mixing zone to temperatures greater than the following monthly maximum temperatures:

J	F	M	A	M	J	J	A	S	O	N	D
45	45	50	60	70	75	80	85	80	70	60	50

Inland Lakes, Anadromous Salmonid Migrations - Rule 73. Warmwater inland lakes which serve as principal migratory routes for anadromous salmonids shall not receive a heat load during periods of migration at such locations and in a manner which may adversely affect salmonid migration or raise the receiving water temperature at the edge of the mixing zone more than 3 degrees Fahrenheit above the existing natural water temperature.

Rivers, Streams and Impoundments:

1. Rivers, streams, and impoundments naturally capable of supporting coldwater fish shall not receive a heat load which would do either of the following:

a. Increase the temperature of the receiving waters at the edge of the mixing zone more than 2 degrees Fahrenheit above the existing natural water temperature.

b. Increase the temperature of the receiving waters at the edge of the mixing zone to temperatures greater than the following monthly maximum temperatures:

J	F	M	A	M	J	J	A	S	O	N	D
38	38	43	54	65	68	68	68	63	56	48	40

2. Rivers, streams, and impoundments naturally capable of supporting warmwater fish shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 5 degrees Fahrenheit above the existing natural water temperature.

3. Rivers, streams, and impoundments naturally capable of supporting warmwater fish shall not receive a heat load which would warm the receiving water at the edge of the mixing zone to temperatures greater than the following monthly maximum temperatures.

StateWater Use and Criteria Values

a. For rivers, streams, and impoundments north of a line between Bay City, Midland, Alma and North Muskegon:

J	F	M	A	M	J	J	A	S	O	N	D
38	38	41	56	70	80	83	81	74	64	49	39

b. For rivers, streams, and impoundments south of a line between Bay City, Midland, Alma and North Muskegon, except the St. Joseph river:

J	F	M	A	M	J	J	A	S	O	N	D
41	40	50	63	76	84	85	85	79	68	55	43

c. St. Joseph river:

J	F	M	A	M	J	J	A	S	O	N	D
50	50	51	65	75	85	85	85	85	70	60	50

4. Non-trout: rivers and streams that serve as principal migratory routes for anadromous salmonids shall not receive a heat load during periods of migration at such locations and in a manner which adversely affect salmonid migration or raise the receiving water temperature at the edge of the mixing zone more than 5 degrees Fahrenheit above the existing natural water temperature.

Minnesota²³

Fisheries and Recreation: Class A - No material increase in temperature.

Class B - 5°F above natural in streams and 3°F above natural in lakes, based on monthly average of the maximum daily temperature, except in no case shall it exceed the daily average temperature of 86°F.

Class C - 5°F above natural in streams and 3°F above natural in lakes, based on monthly average of the maximum daily temperature except in no case shall it exceed the daily average temperature of 90°F.

Mississippi²⁴

The maximum temperature rise above natural temperatures shall not exceed 5°F in streams, lakes and reservoirs nor shall the maximum water temperature exceed 90°F, except that in the Tennessee River the temperature shall not exceed 86°F. In lakes and reservoirs there shall be no withdrawals from or discharge of heated waters to the hypolimnion unless it can be shown that such discharge will be beneficial to water quality. In all waters the normal daily and seasonal temperature variations that were present before the addition of artificial heat shall be maintained. The discharge of any heated waste into any coastal or estuarine waters shall not raise temperatures more than 40°F above natural during the

period October through May nor more than 1.5°F above natural for the months June through September. There shall be no thermal block to the migration of aquatic organisms. Requirements for zones of passage as referenced in Section I (8) shall apply. In addition to the general requirements of Section I (92), the temperature shall be measured at a depth of 5 feet in waters 10 feet or greater in depth; and for those waters less than 10 feet in depth, temperature criteria will be applied at mid-depth.

In those specific cases where natural conditions elevate the temperatures in excess of the limits expressed herein, Section I (3) shall apply on a case-by-case basis.

Missouri²⁵**Classified Waters:**

1. Beyond the mixing zone, water contaminants shall not raise or lower the temperature of a stream more than five degrees (5°F). Water contaminants shall not cause or contribute to stream temperature in excess of ninety degrees (90°F). However, site-specific ambient temperature data and requirements of sensitive resident aquatic species will be considered, when data are available, to establish alternative maxima or deviations from ambient temperatures.
2. Water contaminants shall not raise the temperature of designated cold-water fishery waters more than two degrees (2°F), nor shall they cause the temperature of these waters to exceed sixty-eight degrees (68°F).
3. Water contaminants shall not cause any measurable rise in the temperature of lakes. An increase is allowable for Lake Springfield, Thomas Hill Reservoir, and Montrose Lake; however, discharges from these lakes must comply with thermal limits for streams.
4. For the Mississippi River, Zones 1A and 2, the water temperature outside the mixing zone shall not exceed the maximum limits indicated in the following table during more than one percent of the time in any calendar year. The Zone 1B table limits may not be exceeded more than five percent of the time in a calendar year. At no time shall the river water temperature outside of 25% of the cross sectional area or volume of the river exceed the listed limits by more than 3 degrees F. Zone 1A-Des Moines River to Lock and Dam No. 25. Zone 1B-Lock and Dam No. 25 to Lock and Dam No. 26. Zone 2-Lock and Dam No. 26 to the Missouri-Arkansas state line.

	Zones 1A, B ($^{\circ}$ F)	Zone 2 ($^{\circ}$ F)
January	45	50
February	45	50
March	57	60
April	68	70
May	78	80
June	86	87
July	88	89
August	88	89
September	86	87
October	75	78
November	65	70
December	52	57

The Clean Water Commission will consider granting exceptions to these limits. Environmental Protection Agency concurrence will be obtained before an exception is granted.

Montana²⁶

Class A-1 - A 1° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 66° F; within the naturally occurring range of 66° F to 66.5° F, no discharge is allowed which will cause the water temperature to exceed 67° F; and where the naturally occurring water temperature is 66.5° F or greater, the maximum allowable increase in water temperature is 0.5° F. A 2° F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55° F, and a 2° F maximum decrease below naturally occurring water temperature is allowed within the range of 55° F to 32° F.

Class B-1 - A 1° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 66° F; within the naturally occurring range of 66° F to 66.5° F, no discharge is allowed which will cause the water temperature to exceed 67° F; and where the naturally occurring water temperature is 66.5° F or greater, the maximum allowable increase in water temperature is 0.5° F. A 2° F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55° F, and a 2° F maximum decrease below naturally occurring water temperature is allowed within the range of 55° F to 32° F. This applies to all waters in the state classified B-1 except for Prickly Pear Creek from McClellan Creek to the Montana Highway No. 433

crossing where a 2°F maximum increase above naturally occurring water temperature is allowed within the range of 32°F to 65°F ; within the naturally occurring range of 65°F to 66.5°F , no discharge is allowed which will cause the water temperature to exceed 67°F ; and where the naturally occurring water temperature is 66.5°F or greater, the maximum allowable increase in water temperature is 0.5°F .

Class B-2 - A 1°F maximum increase above naturally occurring water temperature is allowed within the range of 32°F to 66°F ; within the naturally occurring range of 66°F to 66.5°F , no discharge is allowed which will cause the water temperature to exceed 67°F ; and where the naturally occurring water temperature is 66.5°F or greater, the maximum allowable increase in water temperature is 0.5°F . A 2°F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55°F , and a 2°F maximum decrease below naturally occurring water temperature is allowed within the range of 55°F to 32°F .

Class B-3 - A 3°F maximum increase above naturally occurring water temperature is allowed within the range of 32°F to 77°F ; within the naturally occurring range of 77°F to 79.5°F , no thermal discharge is allowed which will cause the water temperature to exceed 80°F ; and where the naturally occurring water temperature is 79.5°F or greater, the maximum allowable increase in water temperature is 0.5°F . A 2°F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55°F , and a 2°F maximum decrease below naturally occurring water temperature is allowed within the range of 55°F to 32°F .

i. These allowable increase apply to all waters in the state classified B-3, except for the mainstem of the Yellowstone River from the Billings water supply intake to the water diversion at Intake, where a 3°F maximum increase above naturally occurring water temperature is allowed within the range of 32°F to 79°F ; within the range of 79°F to 81.5°F , no thermal discharge is allowed which will cause the water temperature to exceed 82°F ; and where the naturally occurring water temperature is 81.5°F or greater, the maximum allowable increase in water temperature is 0.5°F .

ii. From the water diversion at Intake to the North Dakota state line, a 3°F maximum increase above naturally occurring water temperature is allowed within the range of 32°F to 82°F ; within

the range of 82°F to 84.5°F, no thermal discharge is allowed which will cause the water temperature to exceed 85°F; and where the naturally occurring water temperature is 84.5°F or greater, the maximum allowable increase in water temperature is 0.5°F.

Class C-1 - A 1°F maximum increase above naturally occurring water temperature is allowed within the range of 32°F to 66°F; within the naturally occurring range of 66°F to 66.5°F, no discharge is allowed which will cause the water temperature to exceed 67°F; and where the naturally occurring water temperature is 66.5°F or greater, the maximum allowable increase in water temperature is 0.5°F. A 2°F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55°F, and a 2°F maximum decrease below naturally occurring water temperature is allowed within the range of 55°F to 32°F.

Class C-2 - Same as Class C-1.

Class E - No increase in naturally occurring temperature is allowed which will or is likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish, or other wildlife.

Class C-3 - Same as Class B-3.

Nebraska²⁷

Aquatic Life - The temperature of a receiving water shall not be increased by a total of more than 5°F (3°C) from natural outside the mixing zone.

For the Missouri River, from the South Dakota-Nebraska State Line near Ft. Randall Dam to Sioux City, Iowa, maximum temperature limit is 85°F (29°C) with an allowable change of 4°F (2°C) from natural. For cold waters the maximum limit is 72°F (22°C) with an allowable change of 5°F (3°C) from natural. For warm waters the maximum limit is 90°F (32°C). For impoundments, the temperature of the epilimnion of surface waters shall not be raised more than 3°F (2°C) above that which existed before the addition of heat of artificial origin. Unless a special study shows that the discharge of heated effluent into the hypolimnion will be desirable, such practice is not recommended and water for cooling should not be pumped from the hypolimnion to be discharged to the same body of water.

State

Water Use and Criteria Values

Nevada²⁸

Class A - Must not exceed 20°C. Allowable temperature increase above natural receiving water temperature: None.

Class B - Must not exceed 20°C for trout waters or 24°C for non-trout waters. Allowable temperature increase above natural receiving water temperatures: None.

Class C - Must not exceed 20°C for trout waters or 34°C for non-trout waters. Allowable temperature increase above normal receiving water temperature: 3°C.

Specific temperature criteria for different control points are available in the Environment Reporter, pages 841:1014-1073.

New Hampshire²⁹

Class A - No artificial rise in temperature.

Class B and C - No artificial temperature rise exceeding that recommended by the New Hampshire fish and game department, the New England interstate water pollution control commission, or the National Technical Advisory Committee, Department of Interior, whichever is most appropriate for the existing situation.

New Jersey³⁰

Mixing Zone - Temperature changes in designated heat dissipation areas shall not cause mortality of the aquatic biota nor create conditions which allow the introduction or maintenance of populations of undesirable organisms at nuisance levels.

Thermal Alterations (Temperatures shall be measured outside of heat dissipation areas)

1. Streams:

FW2-TP - No thermal alterations which would cause changes in ambient temperatures except where properly treated wastewater effluents are discharged. Where such discharges occur, temperatures shall not deviate more than 0.6°C (1°F) from ambient temperature.

FW2-TM - No thermal alterations which would cause temperatures to exceed ambient by more than 1.1°C (2°F) at any time or which would cause temperatures in excess of 20°C (68°F).

FW2-NT - No thermal deviations which would cause temperatures to deviate more than

State

Water Use and Criteria Values

2.8°C (5°F) at any time from ambient temperatures. No heat may be added which would cause temperatures to exceed 27.8°C (82°F) for small mouth bass or yellow perch waters, or 30°C (86°F) for other non-trout waters.

All SE - No thermal alterations which would cause temperatures to deviate from ambient by more than 2.2°C (4°F), from September through May, nor more than 0.8°C (1.5°F) from June through August, nor cause temperatures to exceed 29.4°C (85°F).

2. Lakes, Ponds or Reservoirs:

PW2-TM - No thermal alterations except where it can be shown to be beneficial to the designated and existing uses.

PW2-NT - No thermal alterations of more than 1.7°C (3°F) in the epilimnion or lakes and other standing waters. No discharges or heated effluent into the hypolimnion nor jumping of water from the hypolimnion (for discharge back into the same water body) shall be permitted unless it is demonstrated, to the satisfaction of the Department, that such practices will be beneficial to the existing and designated uses.

3. Coastal Waters:

SC - No direct heat additions within 1500 feet of the shoreline. No thermal alterations which would cause temperatures to deviate from ambient temperatures by more than 2.2°C (4°F) from September through May, nor more than 0.8°C (1.5°F) from June through August, nor which would cause temperatures to exceed 26.7°C (80°F).

Temperature, except in designated heat dissipation areas:

Zones

1C, 1D, 1E - Shall not be raised more than 5°F (2.8°C) above ambient temperature until stream temperatures reach 87°F (30.6°C); above 87°F (30.6°C) natural temperature will prevail.

State

Water Use and Criteria Values

2, 3, 4 - Shall not be raised more than 5°F (2.8°C) above the average 24 hour temperature gradient displayed during the 1961-1966 period, or to a maximum of 86°F (30.0°C), whichever is lower.

5, 6 - Shall not be raised above ambient temperature by more than 4°F (2.2°C) during the period from September through May nor more than 1.5°F (0.8°C) during the period from June through August, nor shall maximum temperatures exceed 86°F (30.0°C) in Zone 5 or 85°F (29.4°C) in Zone 6.

New Mexico³¹

General Standards - Maximum temperatures for each stream reach have been specified in Part G of these standards. However, the introduction of heat by other than natural causes shall not increase the temperature, as measured from above the point of introduction, by more than 2.7 degrees C (5 degrees F) in a stream, or more than 1.7 degrees C (3 degrees F) in a lake or reservoir. In no case will the introduction of heat be permitted when the maximum temperature specified for the reach [generally 20 degrees C (68 degrees F) for cold water fisheries and 32.2 degrees C (90 degrees F) for warm water fisheries] would thereby be exceeded. These temperature standards shall not apply to impoundments constructed offstream for the purpose of heat disposal. High water temperatures caused by unusually high ambient air temperatures or the reasonable operation of irrigation and aquacultural facilities are not violations of these standards.

New York³²

Water Quality Standard for Thermal Discharges:

- a. All thermal discharges to the waters of the State shall assure the protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife in and on the body of water.
- b. The criteria contained in this Part shall apply to all thermal discharges and shall be complied with, except as provided in this Part.

General Criteria:

1. The natural seasonal cycle shall be retained.
2. Annual spring and fall temperature changes shall be gradual.
3. Large day-to-day temperature fluctuations due to

heat of artificial origin shall be avoided.

4. Development or growth of nuisance organisms shall not occur in contravention of water quality standards.

5. Discharges which would lower receiving water temperature shall not cause a violation of water quality standards and section 704.3.

6. For the protection of the aquatic biota from severe temperature changes, routine shutdown of an entire thermal discharge at any site shall not be scheduled during the period from December through March.

Non-Trout Waters:

1. The water temperature at the surface of a stream shall not be raised to more than 90 degrees F at any point.

2. At least 50 percent of the cross sectional area and/or volume of flow of the stream including a minimum of one-third of the surface as measured from shore to shore shall not be raised to more than 5 Fahrenheit degrees over the temperature that existed before the addition of heat of artificial origin or to a maximum of 86 degrees Fahrenheit whichever is less.

3. At least 50 percent of the cross sectional area and/or volume of flow of the stream including a minimum of one-third of the surface as measured from shore to shore shall not be lowered more than 5 Fahrenheit degrees from the temperature that existed immediately prior to such lowering.

Trout Waters:

1. No discharge at a temperature over 70 degrees Fahrenheit shall be permitted at any time to streams classified for trout.

2. From June through September no discharge shall be permitted that will raise the temperature of the stream more than 2 Fahrenheit degrees over that which existed before the addition of heat of artificial origin.

3. From October through May, no discharge shall be permitted that will raise the temperature of the stream more than 5 Fahrenheit degrees over that which existed before the addition of heat of artificial origin or to a maximum of 50 degrees Fahrenheit whichever is less.

Water Use and Criteria Values

4. From June through September no discharge shall be permitted that will lower the temperature of the stream more than 2 Fahrenheit degrees from that which existed immediately prior to such lowering.

Lakes:

1. The water temperature at the surface of a lake shall not be raised more than 3 Fahrenheit degrees over the temperature that existed before the addition of heat of artificial origin.

2. In lakes subject to stratification as defined in Part 652, thermal discharges which will lower the temperature of the receiving waters shall be discharged to the hypolimnion, and shall meet the water quality standards contained in Parts 701 and 702 in all respects.

Coastal Waters:

1. The water temperature at the surface of coastal waters shall not be raised more than 4 Fahrenheit degrees from October through June nor more than 1.5 Fahrenheit degrees from July through September over that which existed before the addition of heat of artificial origin.

2. The water temperature at the surface of coastal waters shall not be lowered more than 4 Fahrenheit degrees from October through June nor more than 1.5 Fahrenheit degrees from July through September from that which existed immediately prior to such lowering.

Estuaries or Portions of Estuaries:

1. The water temperature at the surface of an estuary shall not be raised to more than 90 degrees Fahrenheit at any point.

2. At least 50 percent of the cross sectional area and/or volume of the flow of the estuary including a minimum of one-third of the surface as measured from water edge to water edge at any stage of tide, shall not be raised to more than 4 Fahrenheit degrees over the temperature that existed before the addition of heat of artificial origin or a maximum of 83 degrees Fahrenheit whichever is less.

3. From July through September, if the water temperature at the surface of an estuary before the addition of heat of artificial origin is more than 83 degrees Fahrenheit an increase in temperature not to exceed 1.5 Fahrenheit degrees at any point of the

estuarine passageway as delineated above, may be permitted.

4. At least 50 percent of the cross sectional area and/or volume of the flow of the estuary including a minimum of one-third of the surface as measured from water edge to water edge at any stage of tide, shall not be lowered more than 4 Fahrenheit degrees from the temperature that existed immediately prior to such lowering.

Enclosed Bays - No additional temperature change except that which occurs naturally shall be permitted in enclosed bays.

North Carolina³³

General Criteria - Upon a case-by-case determination that thermal discharges to waters of the state which serve or may serve as a source and/or receptor of industrial cooling water provide for the maintenance of the designated best use throughout a reasonable portion of the water body, the otherwise applicable temperature standards as given in the Rules below may not apply, in which case the commission shall establish a separate water quality standard for temperature for the affected portions of waters of the state. Such revisions shall be indicated in the schedules of classifications with the revised standard and shall provide for the designated best use classification applicable to the stream segment in question.

Fresh Surface Waters - Temperature not to exceed 2.8 degrees C (5.04 degrees F) above the natural water temperature, and in no case to exceed 29 degrees C (84.2 degrees F) for mountain and upper piedmont waters and 32 degrees C (89.6 degrees F) for lower piedmont and coastal plain waters. The temperature for trout waters shall not be increased by more than 0.5 degrees C (0.9 degrees F) due to the discharge of heated liquids but in no case to exceed 20 degrees C (68 degrees F).

Tidal Salt Waters - Temperature shall not be increased above the natural water temperature by more than 0.8 degrees C (1.44 degrees F) during the months of June, July, and August nor more than 2.2 degrees C (3.96 degrees F) during other months and in no cases to exceed 32 degrees C (89.6 degrees F) due to the discharge of heated liquids.

StateNorth Dakota³⁴Water Use and Criteria Values

Class I Streams - Eighty-five degrees Fahrenheit (29.44 degrees Celsius) limit. The maximum increase shall not be greater than five degrees Fahrenheit (2.78 degrees Celsius) above natural background conditions.

Ohio³⁵Lake Erie

a. There shall be no water temperature changes as a result of human activity that cause mortality, long-term avoidance, exclusion from habitat, or adversely affect the reproductive success of representative aquatic species, unless caused by natural conditions.

b. At no time shall water temperature exceed a monthly or bi-weekly average, or at any time exceed the daily maximum temperature as indicated in tables 12a and 12b to this rule. The average and daily maximum temperature standards shall apply and be measured outside of a thermal mixing zone at any point on a thermal mixing zone boundary at depths greater than three feet, as defined in paragraphs (B)(2)(a) and (B)(2)(b) of this rule.

c. The temperature of the hypolimnetic waters of lake Erie shall not exceed at any time a daily maximum as indicated in table 12 c to this rule.

Table 12c Seasonal daily maximum temperature limitations for the hypolimnetic regions of Lake Erie. Shown as degrees Fahrenheit and (Celsius).

Month	Daily Maximum
January	44 (6.7)
February	44 (6.7)
March	44 (6.7)
April	47 (8.3)
May	51 (10.6)
June	54 (12.2)
July	59 (15.0)
August	59 (15.0)
September	55 (12.8)
October	46 (7.8)
November	41 (5.0)
December	38 (3.3)

StateWater Use and Criteria Values

Table 12 e. Lake Erie Excepted Areas--includes all water of Lake designated in paragraph (C) of this rule, excluding Maumee Bay and Sanducky Bay, Tables 11h and 11i.

	Jan. 1-31	Feb. 1-29	Mar. 1-15	Mar. 16-31	Apr. 1-15	Apr. 16-30	May 1-15	May 16-31	June 1-15
Average	---	---	---	---	---	---	---	---	---
Daily Maximum	52 (11.1)	52 (11.1)	55 (12.8)	55 (12.8)	59 (15.0)	63 (17.2)	66 (18.9)	76 (24.4)	82 (27.8)
	June 1-30	July 1-31	Aug. 1-31	Sept. 1-15	Sept. 16-30	Oct. 1-15	Oct. 16-31	Nov. 1-30	Dec. 1-31
Average	74 (28.9)	84 (28.9)	84 (28.9)	84 (28.9)	---	---	---	---	---
Daily Maximum	88 (31.1)	88 (31.1)	88 (31.1)	88 (31.1)	84 (28.9)	75 (23.9)	70 (21.1)	65 (18.3)	55 (12.8)

Exceptional Warmwater Habitat and Coldwater Habitat.
At no time shall the water temperature exceed the
temperature which would occur if there were no
temperature change attributable to man's activities.

Nuisance Prevention. 98°F (37°C) maximum
94°F (34°C) 30 day average

StateWater Use and Criteria Values

Ohio River

(2) Temperature: allowable stream temperatures are:

<u>Month/date</u>	<u>Period Average (°F)</u>	<u>Instantaneous Maximum (°F)</u>
January 1-31	45	50
February 1-29	45	50
March 1-15	51	56
March 16-31	54	59
April 1-15	58	64
April 16-30	64	69
May 1-15	68	73
May 16-31	75	80
June 1-15	80	84
June 16-30	83	87
July 1-31	84	89
August 1-31	84	89
September 1-15	84	87
September 16-30	82	86
October 1-15	77	82
October 16-31	72	77
November 1-30	67	72
December 1-31	52	57

WARMWATER HABITAT OHIO

TABLE 10. TEMPERATURE CRITERIA

Table 10a. General Ohio River Basin - includes all waters of the state within the boundaries of the Ohio River basin, excluding those water bodies or water body segments as designated in Table 10b through 10e. Shown as degrees Fahrenheit and (Celsius).

	<u>Jan.</u> <u>1-31</u>	<u>Feb.</u> <u>1-29</u>	<u>Mar.</u> <u>1-15</u>	<u>Mar.</u> <u>16-31</u>	<u>Apr.</u> <u>1-15</u>	<u>Apr.</u> <u>16-30</u>	<u>May</u> <u>1-15</u>	<u>May</u> <u>16-31</u>	<u>Jun</u> <u>1-15</u>
Average:	47 (8.3)	47 (8.3)	51 (10.0)	54 (12.2)	59 (15.0)	65 (18.3)	67 (19.4)	70 (21.1)	74 (23.3)
Daily Maximum:	52 (11.1)	52 (11.1)	56 (13.3)	59 (15.0)	65 (18.3)	70 (21.1)	73 (22.8)	76 (24.4)	80 (26.7)
	<u>June</u> <u>16-30</u>	<u>July</u> <u>1-31</u>	<u>Aug.</u> <u>1-31</u>	<u>Sept.</u> <u>1-15</u>	<u>Sept.</u> <u>16-30</u>	<u>Oct.</u> <u>1-15</u>	<u>Oct.</u> <u>16-31</u>	<u>Nov.</u> <u>1-30</u>	<u>Dec.</u> <u>1-31</u>
Average	82 (27.8)	82 (27.8)	82 (27.8)	82 (27.8)	73 (22.8)	71 (21.7)	65 (18.3)	60 (15.6)	47 (8.3)
Daily Maximum:	85 (29.4)	85 (29.4)	85 (29.4)	85 (29.4)	78 (25.6)	76 (24.4)	70 (21.1)	65 (18.3)	52 (11.1)

Table 10b. Lower Great Miami River - Steele Dam in Dayton
(River Mile 891.3) to the confluence with the
Ohio River. Shown as degrees Fahrenheit and
(Celsius).

	<u>Jan.</u> <u>1-31</u>	<u>Feb.</u> <u>1-29</u>	<u>Mar.</u> <u>1-15</u>	<u>Mar.</u> <u>16-31</u>	<u>Apr.</u> <u>1-15</u>	<u>Apr.</u> <u>16-30</u>	<u>May</u> <u>1-15</u>	<u>May</u> <u>16-31</u>	<u>Jun</u> <u>1-15</u>
Average:	49 (9.4)	49 (9.4)	53 (11.9)	56 (13.3)	59 (15.0)	65 (18.3)	67 (19.4)	70 (21.1)	75 (23.9)
Daily Maximum:	54 (12.2)	54 (12.2)	58 (14.4)	61 (16.1)	68 (20.0)	74 (23.3)	77 (25.0)	79 (26.1)	83 (28.3)
	<u>June</u> <u>16-30</u>	<u>July</u> <u>1-31</u>	<u>Aug.</u> <u>1-31</u>	<u>Sept.</u> <u>1-15</u>	<u>Sept.</u> <u>16-30</u>	<u>Oct.</u> <u>1-15</u>	<u>Oct.</u> <u>16-31</u>	<u>Nov.</u> <u>1-30</u>	<u>Dec.</u> <u>1-31</u>
Average:	85 (29.4)	85 (29.4)	85 (29.4)	85 (29.4)	78 (25.6)	71 (21.7)	66 (18.9)	63 (17.2)	49 (9.4)
Daily Maximum:	89 (31.7)	89 (31.7)	89 (31.7)	89 (31.7)	83 (28.3)	76 (24.4)	71 (21.7)	68 (20.0)	54 (12.2)

Table 10c. Scioto River - Griggs Dam in Columbus (River
Mile 136) to the confluence with the Ohio River.
Shown as degrees Fahrenheit and (Celsius).

	<u>Jan.</u> <u>1-31</u>	<u>Feb.</u> <u>1-29</u>	<u>Mar.</u> <u>1-15</u>	<u>Mar.</u> <u>16-31</u>	<u>Apr.</u> <u>1-15</u>	<u>Apr.</u> <u>16-30</u>	<u>May</u> <u>1-15</u>	<u>May</u> <u>16-31</u>	<u>Jun</u> <u>1-15</u>
Average:	47 (8.3)	47 (8.3)	51 (10.6)	54 (12.2)	59 (15.0)	62 (16.7)	67 (19.4)	72 (22.2)	75 (23.9)
Daily Maximum:	52 (11.1)	52 (11.1)	56 (13.3)	59 (15.0)	65 (18.3)	70 (21.1)	75 (23.9)	79 (26.1)	82 (27.8)
	<u>June</u> <u>16-30</u>	<u>July</u> <u>1-31</u>	<u>Aug.</u> <u>1-31</u>	<u>Sept.</u> <u>1-15</u>	<u>Sept.</u> <u>16-30</u>	<u>Oct.</u> <u>1-15</u>	<u>Oct.</u> <u>16-31</u>	<u>Nov.</u> <u>1-30</u>	<u>Dec.</u> <u>1-31</u>
Average:	83 (28.3)	83 (28.3)	83 (28.3)	83 (28.3)	75 (23.9)	71 (21.7)	65 (18.3)	58 (14.4)	47 (8.3)
Daily Maximum:	87 (30.6)	87 (30.6)	87 (30.6)	87 (30.6)	80 (26.7)	76 (24.4)	70 (21.1)	63 (17.2)	52 (11.1)

StateWater Use and Criteria Values

Table 10d. Hocking River - entire mainstem. Shown as degrees Fahrenheit and (Celsius).

	<u>Jan.</u> <u>1-31</u>	<u>Feb.</u> <u>1-29</u>	<u>Mar.</u> <u>1-15</u>	<u>Mar.</u> <u>16-31</u>	<u>Apr.</u> <u>1-15</u>	<u>Apr.</u> <u>16-30</u>	<u>May</u> <u>1-15</u>	<u>May</u> <u>16-31</u>	<u>Jun</u> <u>1-15</u>
Average:	45 (7.2)	45 (7.2)	51 (10.6)	56 (13.3)	59 (15.0)	65 (18.3)	67 (19.4)	70 (21.1)	74 (23.3)
Daily Maximum	50 (10.0)	50 (10.0)	56 (13.3)	61 (16.1)	66 (18.9)	70 (21.1)	73 (22.8)	76 (24.4)	80 (26.7)
	<u>June</u> <u>16-30</u>	<u>July</u> <u>1-31</u>	<u>Aug.</u> <u>1-31</u>	<u>Sept.</u> <u>1-15</u>	<u>Sept.</u> <u>16-30</u>	<u>Oct.</u> <u>1-15</u>	<u>Oct.</u> <u>16-31</u>	<u>Nov.</u> <u>1-30</u>	<u>Dec.</u> <u>1-31</u>
Average:	83 (28.3)	83 (28.3)	83 (28.3)	83 (28.3)	77 (25.0)	65 (18.3)	62 (16.7)	58 (14.4)	45 (7.2)
Daily Maximum:	87 (30.6)	87 (30.6)	87 (30.6)	87 (30.6)	82 (27.8)	70 (21.1)	67 (19.4)	63 (17.2)	50 (10.0)

StateWater Use and Criteria Values

Table 10e. Muskingum River - entire mainstem. Shown as degrees Fahrenheit and (Celsius).

	<u>Jan.</u> <u>1-31</u>	<u>Feb.</u> <u>1-29</u>	<u>Mar.</u> <u>1-15</u>	<u>Mar.</u> <u>16-31</u>	<u>Apr.</u> <u>1-15</u>	<u>Apr.</u> <u>16-30</u>	<u>May</u> <u>1-15</u>	<u>May</u> <u>16-31</u>	<u>Jun</u> <u>1-15</u>
Average:	45 (7.2)	45 (7.2)	53 (11.7)	53 (11.7)	58 (14.4)	65 (18.3)	68 (20.0)	72 (22.2)	76 (24.4)
Daily Maximum:	50 (10.0)	50 (10.0)	58 (14.4)	58 (14.4)	63 (17.2)	70 (21.1)	74 (23.3)	77 (25.0)	84 (28.9)
	<u>June</u> <u>16-30</u>	<u>July</u> <u>1-31</u>	<u>Aug.</u> <u>1-31</u>	<u>Sept.</u> <u>1-15</u>	<u>Sept.</u> <u>16-30</u>	<u>Oct.</u> <u>1-15</u>	<u>Oct.</u> <u>16-31</u>	<u>Nov.</u> <u>1-30</u>	<u>Dec.</u> <u>1-31</u>
Average:	85 (29.4)	85 (29.4)	85 (29.4)	85 (29.4)	80 (26.7)	73 (22.8)	67 (19.4)	62 (16.7)	47 (8.3)
Daily Maximum:	89 (31.7)	89 (31.7)	89 (31.7)	89 (31.7)	85 (29.4)	77 (25.0)	72 (22.2)	67 (19.4)	52 (11.1)

StateWater Use and Criteria Values

Table 10f. General Lake Erie Basin - includes all surface waters of the state within the boundaries of the Lake Erie drainage basin, excluding those water bodies as designated in Table 10g through 10i. Shown as degrees Fahrenheit and (Celsius).

	<u>Jan.</u> <u>1-31</u>	<u>Feb.</u> <u>1-29</u>	<u>Mar.</u> <u>1-15</u>	<u>Mar.</u> <u>16-31</u>	<u>Apr.</u> <u>1-15</u>	<u>Apr.</u> <u>16-30</u>	<u>May</u> <u>1-15</u>	<u>May</u> <u>16-31</u>	<u>Jun</u> <u>1-15</u>
Average:	44 (6.7)	44 (6.7)	48 (8.9)	51 (10.6)	54 (12.2)	60 (15.6)	64 (17.8)	66 (18.9)	72 (22.2)
Daily Maximum:	49 (9.4)	49 (9.4)	53 (11.7)	56 (13.3)	61 (16.1)	65 (18.3)	69 (20.6)	72 (22.2)	76 (24.4)
	<u>June</u> <u>16-30</u>	<u>July</u> <u>1-31</u>	<u>Aug.</u> <u>1-31</u>	<u>Sept.</u> <u>1-15</u>	<u>Sept.</u> <u>16-30</u>	<u>Oct.</u> <u>1-15</u>	<u>Oct.</u> <u>16-31</u>	<u>Nov.</u> <u>1-30</u>	<u>Dec.</u> <u>1-31</u>
Average:	82 (27.8)	82 (27.8)	82 (27.8)	82 (27.8)	75 (23.9)	67 (19.4)	61 (16.1)	54 (12.2)	44 (6.7)
Daily Maximum:	85 (29.4)	85 (29.4)	85 (29.4)	85 (29.4)	80 (26.7)	72 (22.2)	66 (18.9)	59 (15.0)	49 (9.4)

Table 10g. Maumee River - Ohio-Indiana state line to Maumee River estuary. Shown as degrees Fahrenheit and (Celsius).

	<u>Jan.</u> <u>1-31</u>	<u>Feb.</u> <u>1-29</u>	<u>Mar.</u> <u>1-15</u>	<u>Mar.</u> <u>16-31</u>	<u>Apr.</u> <u>1-15</u>	<u>Apr.</u> <u>16-30</u>	<u>May</u> <u>1-15</u>	<u>May</u> <u>16-31</u>	<u>Jun</u> <u>1-15</u>
Average:	45 (7.2)	45 (7.2)	47 (8.3)	53 (11.7)	58 (14.4)	61 (16.1)	67 (19.4)	70 (21.1)	75 (23.9)
Daily Maximum:	50 (10.0)	50 (10.0)	52 (11.1)	58 (14.4)	63 (17.2)	68 (20.0)	72 (22.2)	76 (24.4)	80 (26.7)
	<u>June</u> <u>16-30</u>	<u>July</u> <u>1-31</u>	<u>Aug.</u> <u>1-31</u>	<u>Sept.</u> <u>1-15</u>	<u>Sept.</u> <u>16-30</u>	<u>Oct.</u> <u>1-15</u>	<u>Oct.</u> <u>16-31</u>	<u>Nov.</u> <u>1-30</u>	<u>Dec.</u> <u>1-31</u>
Average:	85 (29.4)	85 (29.4)	85 (29.4)	85 (29.4)	80 (26.7)	71 (21.7)	65 (18.3)	58 (14.4)	45 (7.2)
Daily Maximum:	89 (31.7)	89 (31.7)	89 (31.7)	89 (31.7)	85 (29.4)	76 (24.4)	70 (21.1)	63 (17.2)	50 (10.0)

Table 10h. Maumee Bay - includes all waters of the state known as Maumee Bay including the Maumee River estuary and the estuary portions of all tributaries entering Maumee Bay to the mean Lake Erie mean high water level. Shown as degrees Fahrenheit and (Celsius).

	Jan. <u>1-31</u>	Feb. <u>1-29</u>	Mar. <u>1-15</u>	Mar. <u>16-31</u>	Apr. <u>1-15</u>	Apr. <u>16-30</u>	May <u>1-15</u>	May <u>16-31</u>	Jun <u>1-15</u>
Average:	47 (8.3)	47 (8.3)	48 (8.9)	50 (10.0)	52 (11.1)	57 (13.9)	61 (16.1)	65 (18.3)	71 (21.7)
Daily Maximum:	52 (11.1)	52 (11.1)	53 (11.7)	54 (12.2)	59 (15.0)	63 (17.2)	63 (18.9)	76 (24.4)	77 (25.0)
	June <u>16-30</u>	July <u>1-31</u>	Aug. <u>1-31</u>	Sept. <u>1-15</u>	Sept. <u>16-30</u>	Oct. <u>1-15</u>	Oct. <u>16-31</u>	Nov. <u>1-30</u>	Dec. <u>1-31</u>
Average:	83 (29.3)	83 (28.3)	83 (28.3)	83 (28.3)	75 (23.9)	69 (20.6)	64 (17.8)	59 (15.0)	47 (8.3)
Daily Maximum:	87 (30.6)	87 (30.6)	87 (30.6)	87 (30.6)	80 (26.7)	74 (23.3)	69 (20.6)	64 (17.8)	52 (11.1)

Table 101. Sandusky Bay - includes all waters of the state known as Sandusky Bay including the Sandusky River estuary and the estuary portions of all tributaries entering Sandusky Bay to the Lake Erie mean high water level. Shown as degrees Fahrenheit and (Celsius).

	<u>Jan.</u> <u>1-31</u>	<u>Feb.</u> <u>1-29</u>	<u>Mar.</u> <u>1-15</u>	<u>Mar.</u> <u>16-31</u>	<u>Apr.</u> <u>1-15</u>	<u>Apr.</u> <u>16-30</u>	<u>May</u> <u>1-15</u>	<u>May</u> <u>16-31</u>	<u>Jun</u> <u>1-15</u>
Average:	47 (8.3)	47 (8.3)	48 (8.9)	50 (10.0)	52 (11.1)	57 (13.9)	63 (17.2)	68 (20.0)	74 (23.3)
Daily Maximum:	52 (11.1)	52 (11.1)	53 (11.7)	55 (12.8)	57 (13.9)	62 (16.7)	68 (20.0)	73 (22.8)	79 (26.1)
	<u>June</u> <u>16-30</u>	<u>July</u> <u>1-31</u>	<u>Aug.</u> <u>1-31</u>	<u>Sept.</u> <u>1-15</u>	<u>Sept.</u> <u>16-30</u>	<u>Oct.</u> <u>1-15</u>	<u>Oct.</u> <u>16-31</u>	<u>Nov.</u> <u>1-30</u>	<u>Dec.</u> <u>1-31</u>
Average:	83 (28.3)	83 (28.3)	83 (28.3)	83 (28.3)	75 (23.9)	69 (20.6)	64 (17.8)	59 (15.0)	47 (8.3)
Daily Maximum:	87 (30.6)	87 (30.6)	87 (30.6)	87 (30.6)	80 (26.7)	74 (23.3)	69 (20.6)	64 (17.8)	52 (11.1)

Table 10j. Mahoning River - Leavitt Road dam (RM 46.1) to the Ohio-Pennsylvania state line (RM 12.6). Shown as degrees Fahrenheit and (Celsius).

	<u>Jan.</u> <u>1-31</u>	<u>Feb.</u> <u>1-29</u>	<u>Mar.</u> <u>1-15</u>	<u>Mar.</u> <u>16-31</u>	<u>Apr.</u> <u>1-15</u>	<u>Apr.</u> <u>16-30</u>	<u>May</u> <u>1-15</u>	<u>May</u> <u>16-31</u>	<u>Jun</u> <u>1-15</u>
Average:	47 (8.3)	47 (8.3)	50 (10.0)	54 (12.2)	59 (15.0)	65 (18.3)	68 (20.0)	73 (22.8)	77 (25.0)
Daily Maximum:	53 (11.7)	53 (11.7)	57 (13.9)	61 (16.1)	65 (18.3)	70 (21.1)	76 (24.4)	79 (26.1)	84 (28.9)
	<u>June</u> <u>16-30</u>	<u>July</u> <u>1-31</u>	<u>Aug.</u> <u>1-31</u>	<u>Sept.</u> <u>1-15</u>	<u>Sept.</u> <u>16-30</u>	<u>Oct.</u> <u>1-15</u>	<u>Oct.</u> <u>16-31</u>	<u>Nov.</u> <u>1-30</u>	<u>Dec.</u> <u>1-31</u>
Average:	85 (31.7)	85 (31.7)	85 (31.7)	85 (31.7)	78 (28.3)	73 (25.0)	67 (22.2)	60 (18.9)	51 (12.8)
Daily Maximum:	89 (31.7)	89 (31.7)	89 (31.7)	89 (31.7)	83 (28.3)	77 (25.0)	72 (22.2)	66 (18.9)	55 (12.8)

StateWater Use and Criteria Values

Table 10k. Cuyahoga River - Headwaters of the Cuyahoga River Gorge Dam Pool (RM 46.2) to the Cuyahoga River Ship Channel (RM 5.7). Shown as degrees Fahrenheit and (Celsius).

	<u>Jan.</u> <u>1-31</u>	<u>Feb.</u> <u>1-29</u>	<u>Mar.</u> <u>1-15</u>	<u>Mar.</u> <u>16-31</u>	<u>Apr.</u> <u>1-15</u>	<u>Apr.</u> <u>16-30</u>	<u>May</u> <u>1-15</u>	<u>May</u> <u>16-31</u>	<u>Jun</u> <u>1-15</u>
Average:	45 (7.2)	45 (7.2)	51 (10.6)	53 (11.7)	55 (12.8)	60 (15.6)	65 (18.3)	71 (21.7)	80 (26.7)
Daily Maximum:	49 (9.4)	49 (9.4)	55 (12.8)	57 (13.9)	62 (16.7)	66 (18.9)	70 (21.1)	78 (25.6)	84 (28.9)
	<u>June</u> <u>16-30</u>	<u>July</u> <u>1-31</u>	<u>Aug.</u> <u>1-31</u>	<u>Sept.</u> <u>1-15</u>	<u>Sept.</u> <u>16-30</u>	<u>Oct.</u> <u>1-15</u>	<u>Oct.</u> <u>16-31</u>	<u>Nov.</u> <u>1-30</u>	<u>Dec.</u> <u>1-31</u>
Average:	84 (28.9)	84 (28.9)	84 (28.9)	84 (28.9)	77 (25.0)	70 (21.1)	63 (17.2)	55 (12.8)	45 (7.2)
Daily Maximum:	88 (31.1)	88 (31.1)	88 (31.1)	88 (31.1)	82 (27.8)	75 (23.9)	69 (20.6)	64 (17.8)	52 (11.1)

Oklahoma³⁶

Secondary Warm Water Fishery, Primary Warm Water Fishery, Smallmouth Bass Fishery (Excluding Lake Waters), Trout Fishery (Put and Take):

At no time shall heat be added to any surface water in excess of the amount that will raise the temperature of the receiving water more than 5°F. The normal daily and seasonal variations that were present before the addition of heat from other than natural sources shall be maintained. In streams, temperature determinations shall be made by averaging representative temperature measurements of the cross sectional area of the stream at the end of the mixing zone.

In lakes, the temperature of the water column and/or epilimnion, if thermal stratification exists, shall not be raised more than 3°F above that which existed before the addition of heat of artificial origin, based upon the average of temperatures taken from the surface to the bottom of the lake, or surface to the bottom of the epilimnion if the lake is stratified.

No artificial heat shall be added that causes the receiving stream water temperature to exceed the maximums specified below:

1. The critical temperature plus 5°F in primary and secondary warm water fishery streams and lakes except in the segment of the Arkansas River from Red Rock Creek to the headwaters of Keystone Reservoir where the maximum temperature shall not exceed 94°F.
2. 84°F in smallmouth bass streams.
3. 68°F in trout streams.

Water in privately-owned lakes and reservoirs used in the process of cooling water for industrial purposes is not classified as "waters of the State" (See Appendix I), and is exempt from these temperature restrictions, provided the water released from any such lake or reservoir into a stream system shall meet the water quality standards of the receiving stream.

Oregon³⁷

North Coast - Lower Columbia Basin:

A. Columbia River: No measurable increases shall be allowed outside of the assigned mixing zone, as measured relative to a control point immediately upstream from a discharge when stream temperatures are 68°F. or greater; or more than 0.5°F. increase due to a single-source discharge when receiving water temperatures are 67.5°F. or less; or more than 2°F. increase due to all sources combined when stream temperatures are 66°F. or less, except for specifically limited duration activities which may be authorized by DEQ under such conditions as DEQ and the Department of Fish and Wildlife may prescribe and which are necessary to accommodate legitimate uses or activities where temperatures in excess of this standard are unavoidable and all practical preventive techniques have been applied to minimize temperature rises. The Director shall hold a public hearing when a request for an exception to the temperature standard for a planned activity or discharge will in all probability adversely affect the beneficial uses.

B. All other freshwater streams and tributaries thereto: No measurable increases shall be allowed outside of the assigned mixing zones, as measured relative to control point immediately upstream from a discharge when stream temperatures are 58°F. or greater; or more than 0.5°F. increase due to a single-source discharge when receiving water temperatures are 57.5°F. or less; or more than 2°F. increase due to all sources combined when stream temperatures are 56°F. or less, except for specifically limited duration activities which which

may be authorized by DEQ under such conditions as DEQ and the Department of Fish and Wildlife may prescribe and which are necessary to accommodate legitimate uses or activities where temperatures in excess of this standard are unavoidable and all practical preventive techniques have been applied to minimize temperature rises. The Director shall hold a public hearing when a request for an exception to the temperature standard for a planned activity or discharge will in all probability adversely affect the beneficial uses.

C. Marine and estuarine waters: No significant increase above natural background temperatures shall be allowed, and water temperatures shall not be altered to a degree which creates or can reasonably be expected to create an adverse effect on fish or other aquatic life.

Hid Coast Basin:

A. Fresh Waters: No measurable increases shall be allowed outside of the assigned mixing zone, as measured relative to a control point immediately upstream from a discharge when stream temperatures are 64°F. or greater; or more than 0.5°F. increase due to a single-source discharge when receiving water temperatures are 63.5°F. or less; or more than 2°F. increase due to all sources combined when stream temperatures are 62°F or less, except for specifically limited duration activities which may be authorized by DEQ under such conditions as DEQ and the Department of Fish and Wildlife may prescribe and which are necessary to accommodate legitimate uses or activities where temperatures in excess of this standard are unavoidable and all practical preventive techniques have been applied to minimize temperature rises. The Director shall hold a public hearing when a request for an exception to the temperature standard for a planned activity or discharge will in all probability adversely affect the beneficial uses.

B. Marine and estuarine waters: Same as North Coast-Lower Columbia Basin.

Umpqua Basin:

A. Fresh waters: Same as North Coast-Lower Columbia Basin, All Other Fresh Water Streams.

B. Marine and estuarine waters: Same as North Coast-Lower Columbia Basin.

South Coast Basin:

State

Water Use and Criteria Values

A. Fresh Waters: Same as Mid Coast Basin.

B. Marine and estuarine waters: Same as North Coast-Lower Columbia Basin.

Rogue Basin:

A. Fresh Waters: Same as North Coast-Lower Columbia Basin, All Other Fresh Water Streams.

B. Marine and estuarine waters: Same as North Coast-Lower Columbia Basin.

Willamette Basin:

A. Multnomah Channel and the main stem Willamette River from mouth to Newberg, river mile 50: No measurable increases shall be allowed outside of the assigned mixing zone, as measured relative to a control point immediately upstream from a discharge when stream temperatures are 70°F. or greater; or more than 0.5°F. increase due to a single-source discharge when receiving water temperatures are 69.5°F. or less; or more than 2°F. increase due to all sources combined when stream temperatures are 68°F. or less, except for specifically limited duration activities which may be authorized by DEQ under such conditions as DEQ and the Department of Fish and Wildlife may prescribe and which are necessary to accommodate legitimate uses or activities where temperatures in excess of this standard are unavoidable and all practical preventive techniques have been applied to minimize temperature rises. The Director shall hold a public hearing when a request for an exception to the temperature standard for a planned activity or discharge will in all probability adversely affect the beneficial uses.

B. Willamette River from Newberg to confluence of Coast and Middle Forks, river mile 187: Same as Mid Coast Basin, Fresh Waters.

C. All other Willamette Basin streams:

i. Salmonid Fish Producing Waters: Same as North Coast-Lower Columbia Basin, All Other Fresh Water Streams.

ii. Non-Salmonid Fish Producing Waters: Same as Mid Coast Basin, Fresh Waters.

D. Columbia River: Same as North Coast-Lower Columbia Basin, Columbia River.

State

Water Use and Criteria Values

Sandy Basin:

A. Main Stem Columbia River (river miles 120 to 147): Same as North Coast-Lower Columbia Basin, Columbia River.

B. All other Basin Waters: Same as North Coast-Lower Columbia Basin, All Other Fresh Water Streams.

Hood Basin:

A. Columbia River (river miles 147 to 203): Same as North Coast-Lower Columbia Basin, Columbia River.

B. Other Hood River Basin streams: Same as North Coast-Lower Columbia Basin, All other Fresh Water Streams.

Deschutes Basin:

A. Columbia River (river miles 201 to 218): Same as North Coast-Lower Columbia Basin, Columbia River.

B. Other Deschutes River Basin streams: Same as North Coast-Lower Columbia Basin, All other Fresh Water Streams.

John Day Basin - Same as North Coast-Lower Columbia Basin, Columbia River.

Umatilla Basin - Same as North Coast-Lower Columbia Basin, Columbia River.

Walla Walla Basin - No measurable increase when river temperatures are 68°F. or greater,; or more than 0.5°F. due to a single-source discharge when receiving waters are 67.5°F. or less; or more than 2°F. increase due to all sources combined when river temperatures are 66°F. or less.

Grande Ronde Basin - Same as North Coast-Lower Columbia Basin, Columbia River.

Powder Basin:

A. Snake River - Same as North Coast-Lower Columbia Basin, Columbia River.

B. All other basin waters - Same as Mid Coast Basin, Fresh Waters.

Malheur River Basin - Same as North Coast-Lower Columbia Basin, Columbia River.

Water Use and Criteria Values

Owyhee Basin - Same as North Coast-Lower Columbia Basin, Columbia River.

Malheur Lake Basin - Same as North Coast-Lower Columbia Basin, Columbia River.

Goose and Summer Lakes Basin:

A. Goose Lake - Daily average temperature shall not exceed 70°F, or the daily mean ambient air temperature, whichever is greater.

B. All other waters - Same as North Coast-Lower Columbia Basin, Columbia River.

Klamath Basin

A. Salmonid Fish (Trout) Producing Waters - Same as North Coast-Lower Columbia Basin, All other Fresh Water Streams.

B. Non-salmonid Fish Producing Waters - No measurable increases shall be allowed outside of the assigned mixing zone, as measured relative to a control point immediately upstream from a discharge when stream temperatures are 72°F. or greater, or more than 0.5°F. increase due to a single source discharge when receiving water temperatures are 71.5°F. or less; or more than 2°F. increase due to all sources combined when stream temperatures are 70°F. or less, except for specifically limited duration activities which may be authorized by DEQ under such conditions as DEQ and the Department of Fish and Wildlife may prescribe and which are necessary to accommodate legitimate uses or activities where temperatures in excess of this standard are unavoidable and all practical preventive techniques have been applied to minimize temperature rises. The Director shall hold a public hearing when a request for an exception to the temperature standard for a planned activity or discharge will in all probability adversely affect the beneficial uses.

Pennsylvania³⁸

Temp₁ - No rise when ambient temperature is 58°F. or above; not more than 5°F. rise above ambient temperature until stream temperature reaches 58°F.; not to be changed by more than 2°F during any one-hour period.

Temp₂ - No rise when ambient temperature is 87°F. or above; not more than a 5°F. rise above ambient temperature until stream temperature reaches 87°F.; not to be changed by more than 2°F. during any one-hour period.

Temp₃ - For the period 2/15 to 7/31, no rise when ambient temperature is 74°F. or above; not more than 5°F. rise above ambient temperature until stream temperature reaches 74°F., not to be changed by more than 2°F. during any one-hour period; for the remainder of the year, no rise when ambient temperature is 87°F. or above; not more than a 5°F rise above ambient temperature until stream temperature reaches 87°F., not to be changed by more than 2°F. during any one-hour period.

Temp₄ - Not to exceed the following temperatures in the month indicated:

<u>Month</u>	<u>Temperature, °F.</u>
January	56
February	56
March	62
April	71
May	80
June	90
July	90
August	90
September	90
October	78
November	69
December	58

Temp₅ - Not more than 5°F. above the average daily temperature during the 1961-66 period, which is shown below, or a maximum of 86°F., whichever is less.

Average Daily Temperature
1961-1966
(Temperatures may be interpolated)

	Delaware Estuary, Head of Tide To River Mile 108.4 (about 1 mile below Pennypack Creek)	Delaware Estuary River Mile 108.4 (about 1 mile below Pennypack Creek) to Big Timber Creek	Delaware Estuary, from Big Timber Creek to Penn.- Delaware State Line
<u>Date</u>	<u>°F</u>	<u>°F</u>	<u>°F</u>
January 1	37	41	42
February 1	35	35	36
March 1	38	38	40
April 1	46	46	47
May 1	58	58	58
June 1	71	71	72
July 1	79	79	80
August 1	81	81	81
September 1	78	79	78
September 15	76	77	78
October 1	70	70	70
November 1	59	61	60
December 1	46	50	50
December 15	40	45	45

Temp₆ - Not more than 5°F. rise above the ambient temperatures until stream temperatures reach 50°F., nor more than 2°F. rise above ambient temperature when temperatures are between 50°F. and 58°F., nor shall temperatures exceed 58°F., whichever is less, except in designated heat dissipation areas.

Temp₇ - As a guideline, the maximum length of heat dissipation areas shall not be longer than 3,500 feet measured from the point where the waste discharge enters the stream. The width of heat dissipation areas shall not exceed two-thirds the surface width measured from shore to shore at any stage of tide or the width encompassing one-fourth the cross-sectional area of the stream, whichever is less. Within any one heat dissipation area only one shore shall be used in determining the limits of the area. Where waste discharges are close to each other, additional limitations may be prescribed to protect stream uses. Controlling temperatures shall be measured outside the heat dissipation area. The rate of temperature change in the heat change in the heat dissipation area shall not cause mortality of the fish.

Temp_g - As a guideline, the maximum length of heat dissipation areas shall not be longer than 3,500 feet or 20 times the average stream width, whichever is less, measured from the point where the waste discharge enters the stream. Heat dissipation areas shall not exceed one-half the surface stream width or the width encompassing one-half of the entire cross-sectional areas of the stream, whichever is less. Within any one heat dissipation area, only one shore shall be used in determining the limits of the area. Where waste discharges are close to each other, additional limitations may be prescribed to protect water uses. Controlling temperatures shall be measured outside the heat dissipation zone. The rate of temperature change in designated heat dissipation areas shall not cause mortality of the fish.

Temp_o - As a guideline, the maximum length of heat dissipation areas shall not be longer than 1,000 feet or 20 times the average width of the stream whichever is less, measured from the points where the waste discharge enters the stream. Heat dissipation areas shall not exceed one-half the surface stream width or the width encompassing one-half of the entire cross-sectional area of the stream, whichever is less. Within any one heat dissipation area, only one shore shall be used in determining the limits of the area. Where waste discharges are close to each other, additional limitations may be prescribed to protect water uses. Controlling temperatures shall be measured outside the heat dissipation zone. The rate of temperature change in designated heat dissipation areas shall not cause mortality of the fish.

Rhode Island³⁹

Class A - No allowable temperature increase other than of natural origin.

Class B - Only such increases that will not impair any usages specifically assigned to this Class. The temperature increase shall not raise the temperature of the receiving waters above the recommended limit on the most sensitive receiving water use and in no cases exceed 83 degrees F. In no case shall the temperature of the receiving water be raised more than 4 degrees F. Heated discharges into designated coldwater habitats shall not raise the temperature above 68 degrees F outside an established thermal mixing zone.

Class C - Only such increases that will not impair any usages specifically assigned to this Class or causes the growth of unfavorable species of biota.

Class D - None except where the increase will not

State

Water Use and Criteria Values

exceed the recommended limits on the most sensitive water use and in no case exceed 90°F.

Classes SA, SB, and SC - No temperature increase except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 83 degrees F or in any case raise the normal temperature more than 1.6 degrees F, 15 June through September and not more than 4 degrees F from October through 15 June. All measurements shall be made at the boundary of such mixing zones as is found to be reasonable by the Director.

South Carolina⁴⁰

a. The water temperature of all Class A and Class B free flowing waters shall not be increased more than 5°F (2.8°C) above natural temperature conditions or exceed a maximum of 90°F (32.2°C) as a result of the discharge of heated liquids unless a different temperature standard as provided for in Section E. has been established, a mixing zone as provided in D. (5) has been established, or a Section 316 (a) determination under the Federal Clean Water Act has been completed.

b. The weekly average water temperature of all Class SA, Class SB, and Class SC waters shall not exceed 4°F (2.2°C) above natural conditions during the fall, winter or spring, or 1.5°F (0.8°C) above natural conditions during the summer as a result of the discharge of heated liquids unless a different temperature standard as provided for in Section E. has been established, a mixing zone as provided in D.(5) has been established, or a Section 315(a) determination under the Federal Clean Water Act has been completed.

c. The weekly average water temperature of all Class A and Class B lakes or reservoirs shall not be increased more than 5°F (2.8°C) above natural conditions or exceed 90°F (32.2°C) as a result of the discharge of heated liquids unless a different temperature standard as provided for in Section E. has been established, a mixing zone as provided in D.(5) has been established, or a Section 316(a) determination under the Federal Clean Water Act has been completed.

Class A-Trout - Not to vary from levels existing under natural conditions, unless determined that some other temperature will protect the classified uses.

State

Water Use and Criteria Values

B-Trout - Not to vary from levels existing under natural conditions, unless determined that some other temperature will protect the classified uses.

South Dakota⁴¹

(The applicable criterion is to be maintained at all times, without exception.)

Coldwater Permanent Fish Life Propagation Waters - Temperature shall be less than 65°F.

Coldwater Marginal Fish Life Propagation Waters - Temperature may not exceed 75°F.

Warmwater Permanent Fish Life Propagation Waters - Temperature may not exceed 80°F.

Warmwater Semipermanent Fish Life Propagation Waters - Temperature may not exceed 90°F.

Warmwater Marginal Fish Life Propagation Waters - Temperature may not exceed 90°F.

Temperature change in fish life propagation waters. No discharge or discharges shall affect the temperature by more than 4°F in streams classified for the beneficial use of coldwater permanent, coldwater marginal, or warmwater permanent fish life propagation; by more than 5°F in streams classified for the beneficial use of warmwater marginal fish life propagation or warmwater semipermanent fish life; or by more than 3°F in lakes or impoundments classified for the beneficial use of fish life propagation. Exceptions to this criterion may be granted to the Board if such discharge will not impair the beneficial use of fish life propagation. In addition, the maximum incremental temperature shall not exceed 2°F per hour. There shall be no induced temperature change over spawning beds.

Tennessee⁴²

Domestic Water Supply - The maximum water temperature change shall not exceed 3 degrees C relative to an upstream control point. The temperature of the water shall not exceed 30.5 degrees C and the maximum rate of change shall not exceed 2 degrees C per hour. The temperature of impoundments where stratification occurs will be measured at a depth of 5 feet, or mid-depth whichever is less, and the temperature in flowing streams shall be measured at mid-depth.

Industrial Water Supply - Same as Domestic Water Supply.

Fish and Aquatic Life - The maximum water temperature change shall not exceed 3 degrees C relative to an upstream control point. The temperature of the water shall not exceed 30.5 degrees C and the maximum rate of change shall not exceed 2 degrees C per hour. The temperature of recognized trout waters shall not exceed 20 degrees C. There shall be no abnormal temperature changes that may affect aquatic life unless caused by natural conditions. The temperature of impoundments where stratification occurs will be measured at mid-depth in the epilimnion for warm water fisheries and mid-depth in the hypolimnion for cold water fisheries. In the case of large impoundments (100 acres or larger) subject to stratification and recognized as trout waters, the temperature of the hypolimnion shall not exceed 20 degrees C. The temperature on flowing streams shall be measured at mid-depth.

Recreation - Same as Domestic Water Supply.

Irrigation - The temperature of the water shall not be raised or lowered to such an extent as to interfere with its use for irrigation purposes.

Livestock Watering and Wildlife - The temperature of the water shall not be raised or lowered to such an extent as to interfere with its use for livestock watering and wildlife.

Texas⁴³

Consistent with the Section §307.1 of this title (relating to General Policy Statement) and in accordance with state water rights permits, temperature in industrial cooling lake impoundments and all other surface waters of the state shall be maintained so as to not interfere with the reasonable use of such waters. Numerical temperature criteria have not been specifically established for industrial cooling lake impoundments, which in most areas of the state contribute to water conservation and water quality objectives. With the exception of industrial cooling impoundments, temperature elevations due to discharges of treated domestic (sanitary) effluent, and designated mixing zones, the following temperature criteria, expressed as a maximum temperature differential (rise over ambient) are established: freshwater streams - 5°F; freshwater lakes and impoundments - 3°F; tidal river reaches, bay and gulf waters - 4°F in fall, winter, and spring, and 1.5°F in summer (June, July, and August). Additional temperature criteria (expressed as maximum temperatures) for classified segments are specified in

State

Water Use and Criteria Values

Appendix A of §307.10 of this title (relating to Appendices A through C).

Utah⁴⁴

Aquatic Life: Class 3A - Maximum temperature 20°C. Maximum temperature change 2°C.

Aquatic Life: Class 3B & 3C - Maximum temperature 27°C. Maximum temperature change 4°C.

Domestic Source: Classes 1A, 1B, and 1C; Recreation and Aesthetics: Classes 2A and 2B; Aquatic Life: Class 3D; and Agriculture: Class 4 - Insufficient evidence to warrant the establishment of numerical standard. Limits assigned on case-by-case basis.

Vermont⁴⁵

a. General - The change or rate of change in temperature, either upward or downward, shall be controlled so as to prevent any undue adverse effect on aquatic biota, fish and wildlife.

b. Cold Water Fish Habitat - The total increase in temperature from background conditions due to all discharges and activities shall not at any time exceed 1.0°F except as provided for in paragraph (d) below.

c. Warm Water Fish Habitat - The total increase in temperature from background conditions due to all discharges and activities shall not at any time exceed the values derived from tables 1 or 2 except as provided for in paragraph (d) below.

Table 1. Rivers, Streams, Brooks and Creeks

<u>Background temperature</u>	<u>Total allowable increase above background temperature</u>
Above 66°F	1°F
63° to 66°F	2°F
59° to 62°F	3°F
55° to 58°F	4°F
Below 55°F	5°F

Table 2. Lakes, Ponds, Reservoirs and other waters

<u>Background temperature</u>	<u>Total allowable increase above background temperature</u>
Above 60°F	1°F
50° to 60°F	2°F
Below 50°F	3°F

d. **Assimilation of Thermal Wastes** - The Secretary may, by permit condition, specify temperature criteria which exceed the values specified above in order to authorize discharges of thermal wastes when it is shown that:

(1) The discharge will comply with all other applicable provisions of these rules.

(2) A mixing zone of 200 feet in length is not adequate to provide for assimilation of the thermal waste.

(3) After taking into account the interaction of thermal effects and other wastes, that the higher temperature will not result in thermal shock or have an undue adverse effect on aquatic biota, fish or wildlife or any beneficial values or uses associated with the classification of the receiving waters.

Virginia⁴⁶

VR680-21-01.5 Standards for Maximum Temperature

Class III: Non-tidal Waters (Coastal Zone and Piedmont Zones) - Maximum temperature 32°C.

Class IV: Mountainous Zone Waters - Maximum temperature 31°C.

Class V: Put and Take Trout Waters - Maximum temperature 21°C.

Class VI: Natural Trout Waters - Maximum temperature 20°C.

Class VII: Swamp Water - Maximum temperature will be the same as that for Classes I through VI waters as appropriate.

VR680-21-01.6 Rise Above Natural Temperature

Any rise above natural temperature shall not exceed 3°C, except in the case of Class VI waters (natural trout waters), where it shall not exceed 1°C. However, the Board can, on a case-by-case basis, impose a more

Water Use and Criteria Values

stringent limit on the rise above natural temperature. Natural temperature is defined as that temperature of a body of water (measured as the arithmetic average over one hour) due solely to natural conditions without the influence of any point-source discharge.

VR680-21-01.7 Maximum Hourly Temperature Change

The maximum hourly temperature change shall not exceed 2°C, except in the case of Class VI waters (natural trout waters) where it shall not exceed 0.5°C. This standard (limit) shall apply beyond the boundaries of mixing zones and is in addition to temperature changes caused by natural conditions.

VR680-21-01.8 Thermal Discharges into Lakes and Impoundments

In lakes and impoundments receiving thermal discharges, the temperature of the epilimnion or surface water when there is no stratification shall not be raised more than 3°C above that which existed before the addition of heat of artificial origin. The Board may, on a case-by-case basis, impose a more stringent limit on temperature rise. The increase shall be based on the monthly average of the maximum daily temperature. The temperature of releases from these lakes and impoundments shall be consistent with standards established for the receiving waters. When an applicant for a permit purposes either a discharge of heated effluent into the hypolimnion or the pumping of water from the hypolimnion for return back into the same body of water, such practice shall not be approved unless a special study shows that the practice will not produce adverse effects.

VR680-21-01.9 Site-Specific Temperature Requirements

The temperature limits set forth in Sections VR680-21-01.5 - VR680-21-01.8 may be superceded in certain locations by Site-Specific Temperature Standards or in the case where a thermal variance demonstration is performed in accordance with Section 316(a) of the Clean Water Act. Criteria for development of site specific temperature requirements is found in A. below. Criteria for 316(a) demonstrations is found in B. below.

A. Criteria for Developing Site-Specific Temperature Standards: For any specified time of year there shall be two upper limiting temperatures for a location based on temperature requirements of important sensitive species found at the location at that time. These limiting temperatures are:

1. A maximum weekly average temperature that:

- a. in the warmer months is determined by adding to the physiological optimum temperature (usually the optimum for growth) for the most sensitive important species (and appropriate life stage) that normally is found at that location and time; a factor calculated as one-third of the difference between the ultimate upper incipient lethal temperature and the optimum temperature for that species;
- b. in the cooler months is an elevated temperature that would still ensure that important species would survive if the temperature suddenly dropped to the normal ambient temperature;
- c. during reproduction seasons meets specific site requirements for successful migration, spawning, egg incubation, fry rearing, and other reproductive functions of important species;
- d. at a specific site is found necessary to preserve normal species diversity or prevent undesirable growths of nuisance organisms.

2. A time-dependent maximum temperature for short exposures.

Baseline thermal conditions shall be measured at a site where there is no unnatural thermal addition from any source, which site is in reasonable proximity to the thermal discharge (within 5 miles), and which has similar hydrography to that of the receiving waters at the point of discharge.

Standards development should be in accordance with Water Quality Criteria 1972: A Report of the Committee on Water Quality Criteria and Quality Criteria for Water, U.S. Environmental Protection Agency.

B. 316(a) Determinations

A successful demonstration accepted by the Board concerning thermal discharge limits carried out under Section 316(a) of the Clean Water Act shall constitute compliance with the temperature requirements of these standards. A successful demonstration must assure the protection and propagation of a balanced indigenous population of aquatic species and wildlife in or on the water in which the discharge is made. When making a determination concerning thermal discharge limits

State

Water Use and Criteria Values

under Section 316(a) of the Clean Water Act, the Board shall provide notice and opportunity for a public hearing.

Washington⁴⁷

Water temperature expressed in degrees Celsius.]

Class AA (Extraordinary) - Temperature shall not exceed 16.0° (freshwater) or 13.0° (marine water) due to human activities. Temperature increases shall not, at any time, exceed $t=23/(T+5)$ (freshwater) or $t=8/(T-4)$ (marine water).

When natural conditions exceed 16.0° (freshwater) and 13.0° (marine water), no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°.

For purposes hereof, "t" represents the permissive temperature change across the dilution zone; and "T" represents the highest existing temperature in this water classification outside of any dilution zone.

Provided that temperature increase resulting from nonpoint source activities shall not exceed 2.8°, and the maximum water temperature shall not exceed 16.3° (freshwater).

Class A (Excellent) - Temperature shall not exceed 18.0° (freshwater) or 16.0° (marine water) due to human activities. Temperature increases shall not, at any time, exceed $t=28/(T+7)$ (freshwater) or $t=12/(T-7)$ (marine water).

When natural conditions exceed 18.0° (freshwater) and 16.0° (marine water), no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°.

For purposes hereof, "t" represents the permissive temperature change across the dilution zone; and "T" represents the highest existing temperature in this water classification outside of any dilution zone.

Provided that temperature increase resulting from nonpoint source activities shall not exceed 2.8° and the maximum water temperature shall not exceed 18.3° (freshwater).

Class B (Good) - Temperature shall not exceed 21.0° (freshwater) or 19.0° (marine water) due to human activities. Temperature increases shall not, at any time, exceed $t=34/(T+9)$ (freshwater) or $t=16/T$ (marine water).

State

Water Use and Criteria Values

When natural conditions exceed 21.0° (freshwater) and 19.0° (marine water), no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3° .

For purposes hereof, "t" represents the permissive temperature change across the dilution zone; and "T" represents the highest existing temperature in this water classification outside of any dilution zone.

Provided that temperature increase resulting from nonpoint source activities shall not exceed 2.8° , and the maximum water temperature shall not exceed 21.3° (freshwater).

Class C (Fair) - Water temperatures shall not exceed 24.0° (freshwater) or 22.0° (marine water) due to human activities. Temperature increases shall not, at any time, exceed $t=20/(T+2)$.

When natural conditions exceed 22.0° , no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3° .

For purposes hereof, "t" represents the permissive temperature change across the dilution zone; and "T" represents the highest existing temperature in this water classification outside of any dilution zone.

Lake Class - No measurable change from natural conditions.

West Virginia⁴⁸

Warm Water B1.3

Temperature rise shall be limited to no more than 5°F above natural temperature, not to exceed 87°F at any time during months of May through November and not to exceed 73°F at any time during the months of December through April. During any month of the year, heat should not be added to a stream in excess of the amount that will raise the temperature of the water more than 50°F above natural temperature. In lakes and reservoirs, the temperature of the epilimnion should not be raised more than 3°F by the addition of heat of artificial origin. The normal daily and seasonable temperature fluctuations that existed before the addition of heat due to other than natural causes should be maintained.

Wisconsin⁴⁹

Fish and Aquatic Life:

1. There shall be no temperature changes that may adversely affect aquatic life.

2. Natural daily and seasonal temperature fluctuations shall be maintained.

3. The maximum temperature rise at the edge of the mixing zone above the existing natural temperature shall not exceed 5 degrees F for streams and 3 degrees F for lakes.

4. The temperature shall not exceed 89 degrees F for warm water fish.

Lake Michigan and Lake Superior thermal standards. For Lake Michigan and Lake Superior the following thermal standards are established so as to minimize effects on the aquatic biota in the receiving waters.

1 (a) Thermal discharges shall not raise the receiving water temperature more than 3 degrees F above the existing natural temperature at the boundary of mixing zones established in paragraphs (b) and (c).

(b) 1. The mixing zone for a shoreline thermal discharge shall be the area included within the perimeter of a rectangular figure extending 1,250 feet in both directions along the shoreline from the outfall and 1,250 feet into the lake.

2. The mixing zone for an offshore thermal discharge shall be the area within a 1,000-foot radius circle with its center at the point of discharge.

2. In addition to the limitation set forth in subsection (1), but excepting the Milwaukee Harbor, Port Washington Harbor and the mouth of the Fox River, thermal discharges to Lake Michigan shall not raise the temperature of the receiving waters at the boundary of the established mixing zone above the following limits:

January	45°F	July	80°
February	45°	August	80°
March	45°	September	80°
April	55°	October	65°
May	60°	November	60°
June	70°	December	50°

Mississippi river thermal standards. In addition to the standards for fish and aquatic life, the monthly average of the maximum daily temperature in the Mississippi river outside the mixing zone shall not exceed the following limits:

January	40°	July	84°
February	40°	August	84°
March	54°	September	82°
April	65°	October	73°
May	75°	November	58°
June	84°	December	48°

Thermal standards reviewed.

1. Whenever the owner of any source of thermal discharges, in compliance with department guidelines and after opportunity for public hearing, can demonstrate to the satisfaction of the department, that the mixing zone established pursuant to this chapter is more stringent than necessary to assure the protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife in and on the receiving water, the department may:

a. Impose a mixing zone with respect to such thermal discharge that will assure the protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife in and on the receiving water, or

b. Exempt such thermal discharge from the thermal requirements of this chapter provided this exemption will not endanger the propagation of a balanced, indigenous population of shellfish, fish and wildlife in and on the receiving water.

2. Any owner desiring a review pursuant to NR 102.07 (1) shall submit a demonstration to the department no later than June 30, 1976. The department shall reach a decision no later than December 31, 1976.

3. In the event the owner fails to make a satisfactory demonstration pursuant to NR 102.07 (1), the department shall establish a compliance date for the thermal component to be achieved no later than July 1, 1979.

4. Whenever the owner of any source of thermal discharges that commenced on or after August 1, 1975, in compliance with department guidelines and after opportunity for public hearing, can demonstrate to the satisfaction of the department that the mixing zone established pursuant to this chapter is more stringent than necessary to assure the protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife in and on the receiving water, the department may:

a. Impose a mixing zone with respect to such thermal discharge that will assure the protection and propagation of such a population, or

b. Exempt such thermal discharge from the thermal requirements of this chapter provided this exemption will not endanger the propagation of such a population.

5. In the event an owner fails to make a satisfactory demonstration pursuant to NR 102.07 (4), the discharge shall be in compliance with the thermal requirements of this chapter upon commencement of the discharge.

6. The department may require the reduction of thermal discharges or the size of configuration of a mixing zone if it finds that environmental damage is imminent or existent.

Wyoming⁵⁰

For Class I, II and III waters effluent attributable to or influenced by the activities of man shall not be discharged in the amounts which change natural ambient water temperatures to levels which are deemed to be harmful to existing aquatic life.

For impoundments and waters designated by the Wyoming Game and Fish Department as cold water fisheries effluent attributable to or influenced by the activities of man shall not be discharged in amounts which will result in a change of more than 2°F (1.1°C) in existing temperatures.

For waters designated by the Wyoming Game and Fish Department as warm water fisheries effluent attributable to or influenced by the activities of man shall not be discharged in amounts which will result in a change of more than 4°F (2.2°C) in existing temperatures.

The maximum allowable stream temperatures will be the maximum daily stream temperatures plus the allowable change, provided that this temperature is not lethal to existing fish life, which is considered to be 78°F (25.6°C) in the case of cold water fisheries and 90°F (32.2°C) in the case of warm water fisheries.

With the exception of the provisions of Section 10d and 12 of these regulations, temperature standards shall apply at all times and at all depths of the receiving water and may not be violated at any time or at any depth.

State

Water Use and Criteria Values

In all waters supporting warm and/or cold water fish there shall be no induced temperature change over spawning beds. For questions concerning the location of spawning beds the Wyoming Game and Fish Department shall be the final authority.

The various requirements of this Section may be waived only under the provisions of Section 316(a) of the Federal Act.

American Samoa⁵¹

The temperature shall not deviate more than 1.5°F from conditions which would occur naturally and shall not hourly fluctuate more than 1.0 degree Fahrenheit nor exceed 85 degrees Fahrenheit due to the influence of other than natural causes.

District of Columbia⁵²

Class B - Maximum 32.2°C; maximum change above ambient 2.8°C.

Class C - Maximum 32.2°C; maximum change above ambient 2.8°C.

Guam⁵³

Water temperature shall not be changed more than 1.0°C (1.8°F) from ambient conditions, outside an established mixing zone.

N. Mariana Islands⁵⁴

Classes AA, A, 1 & 2 - Water temperature shall not vary by more than 1.5°F (0.9°C) from the ambient conditions.

Puerto Rico⁵⁵

General Water Quality Standards:

A. No heat may be added to the waters of Puerto Rico which would cause the temperature of any site to exceed 94°F.

B. No discharge or combination of discharges into the waters of Puerto Rico shall be injurious to fish or shellfish or the culture or propagation of a balanced indigenous population thereof (nor in any way affect desired use).

C. Thermal discharges shall be confined to the epilimnetic layer of stratified lakes.

D. The rate of temperature change shall not be more than 1°F per hour and shall not exceed a total of 5°F in any 24 hour period except when due to natural causes.

State

Water Use and Criteria Values

Trust Territory⁵⁶

Temperature shall not vary by more than 0.9°C (1.5°F) from the natural conditions in marine and fresh waters.

Virgin Islands⁵⁷

Class B - Temperature not to exceed 90°F. at any time, nor as a result of waste discharge to be greater than 1.5°F. above natural. Thermal policy section 186-5 shall also apply.

Thermal Policy:

a. Fish and other aquatic life shall be protected from thermal blocks by providing for a minimum 75 percent stream or estuarine cross-section and/or volumetric passageway, including a minimum of one half of the surface as measured from water edge to water edge at any stage of tide.

b. In non-passageway the surface water temperature shall not exceed 90°F.

c. No heat may be added except in designated mixing zones which would cause temperatures to exceed 90°F., or which would cause the monthly mean of the maximum daily temperature at any site, prior to the addition of any heat, to be exceeded by more than 1.5°F.

d. No discharge or combination of discharges shall be injurious to fish or shellfish or the culture or propagation of a balanced indigenous population thereof.

e. Rate of temperature change outside the mixing zone shall not be more than 1°F. per hour nor to exceed 5°F. in any 24-hour period except when natural phenomena cause these limits to be exceeded.

f. Unless specific conditions, such as spawning ground, migratory routes, or other sections of conditions from these regulations are applicable, the mixing zone should be defined by a sphere with a specified point as the center (not necessarily the outfall but limited to one point for each installation) and a radius equal to the square root of the volume of discharge (A) expressed as millions of gallons per day, times 200 feet; and in no case exceed 3/4 mile.



