White Paper
Summary of Washington's Coldwater and Warmwater Temperature Standards
Nevada Division of Environmental Protection
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Introduction

Prior to revisions in the early 2000s, Washington surface water quality standards contained three separate single daily maximum temperature criteria limits that can be applied to rivers:

- Class AA - 16°C
- Class A - 18°C
- Class B - 21°C
- Lake Class - Temperatures are to be maintained at natural levels.

Class AA and Class A provided two different levels of protection for the same set of beneficial uses, and were intended to protect salmonid spawning, rearing, and migration. Class AA was predominately applied to forested upland areas, but Class A waters were designated broadly throughout the state. Class B, was designed only to protect salmonid rearing and migration, and was not intended to fully protect spawning. There were only a small number waterbodies in the state that were assigned the Class B designation. With each class, the criteria were applied as the highest single daily maximum measurement of temperature occurring in the waterbody.

The Washington Department of Ecology (Ecology) began its triennial review in the early 1990's by convening a technical work group to evaluate the water quality criteria established to protect freshwater aquatic communities. One of the recommendations of the work group was for Ecology to re-evaluate the existing criteria for temperature. Ecology conducted an extensive review of the technical literature to establish temperature recommendations that would maintain healthy and productive populations of the state's aquatic species and not hinder efforts to recover populations of fish species that were threatened with extinction. Tracking the disapproval of temperature standards in Oregon and Idaho in the late 1990's, Ecology believed it would be more advantageous to delay revisions to the temperature standards in order to participate and benefit from EPA Region 10's regional guidance effort. However, the EPA Region 10 guidance endeavor surpassed expected timelines to finalize the guidance. In January 2003, Ecology began formal revisions to the temperature criteria as part of a broader standards review, after determining that it was more important to seek revisions than continue to wait for the EPA regional guidance to be finalized.

Ecology chose not to follow the procedures to determine criteria detailed in the Quality Criteria for Water 1986, commonly known as the Gold Book. Instead Ecology implemented a multiple lines of evidence (MLE) methodology as a means to use all of the available scientific information to support sound decision making. The first step of the MLE methodology was to sort all the scientific information by the life-stage (e.g., spawning, rearing, migration, etc.) or by some discrete environmental risk (e.g., lethality, smoltification, disease, etc.). Next, the information was sorted into different categories of study types. The following provides a simplified example of how this information was categorized into independent lines of evidence (ILOE) for the life-stage of juvenile rearing:
Study types (ILOE):

- Constant temperature laboratory testing of growth
- Fluctuating temperature laboratory testing of growth

- Controlled field studies on growth
- Studies on the distribution and health status of natural populations
- Laboratory studies examining competition and predation
- Field studies examining competition and predation

In July 2003, Ecology adopted new standards that included significant revisions to temperature. In March 2006, EPA partially disapproved Washington's standards, particularly for where and when salmonid spawning occurs and where "core" rearing occurs. In July 2006, Ecology began a regulatory process to revise application of its temperature standards in accordance with EPA's disapproval, and adopted new standards December 2006. EPA approved these updated standards in 2008 (see Table 3). The resulting temperature standards were similar to the EPA Region 10 Guidance recommendations.

Washington's fresh water temperature criteria are specified by WAC 173-201A-200(1)(c) and Table 602. Temperature standards include:

- Annual maximum threshold criteria.
- A natural conditions provision that provides for a human allowance of 0.3 ºC over natural conditions.
- Incremental warming restrictions when the water is cooler than the standards.
- Supplemental spawning-season criteria where applicable.
- Protections against acute lethal effects.

Table 1. Washington's Temperature Criteria

Beneficial Use	Highest 7DADMax[1] (° C)
Char Spawning and Rearing*	12
Core Summer Salmonid Habitat*	16
Salmonid Spawning, Rearing, and Migration*	17.5
Salmonid Rearing & Migration **Only**	17.5
Non-anadromous Interior Redband Trout	18
Indigenous Warm Water Species	20

*Note: Some streams have a more stringent temperature criterion that is applied seasonally to further protect salmonid spawning and egg incubation. The Waters Requiring Supplemental Spawning and Incubation Protection for Salmonid Species publication describes where and when additional temperature criteria are required to ensure protection for the incubation of salmon, trout, and char.[1] If the temperature criteria in the Waters Requiring Supplemental Spawning and Incubation Protection for Salmonid Species publication are colder than any other criteria, this will be the overriding criteria to apply.

[1] "7-DADMax" or "7-day average of the daily maximum temperatures" is the arithmetic average of seven consecutive measures of daily maximum temperatures. 7DADMax was chosen to better match the laboratory and field research results to an exposure period that reflects the risk of harm to aquatic species.

[1] The Waters Requiring Supplemental Spawning and Incubation Protection for Salmonid Species publication is also known as Ecology publication 06-10-038.

CHAR SPAWNING AND REARING

The key identifying characteristics of the Char Spawning and Rearing use are spawning or early juvenile rearing by native char (bull trout and Dolly Varden), or use by other aquatic species similarly dependent on such cold water. Other common characteristic aquatic life uses for waters in this category include summer foraging and migration of native char; and spawning, rearing, and migration by other salmonid species. The criterion for the Char Spawning and Rearing use is a 7-DADMax of 12 ºC.

In addition, waters requiring supplemental temperature criteria to protect reproduction by native char species (bull trout and Dolly Varden) are specified in the Waters Requiring Supplemental Spawning and Incubation Protection for Salmonid Species publication. The criterion to protect summer reproduction by native char species is a 7-DADMax of 9 ºC. The applicable time frames vary depending on the waterbody.

This criterion is protective of incubation as long as human actions do not significantly disrupt the normal patterns of fall cooling and spring warming that provide significantly colder temperatures over the majority of the incubation period.

CORE SUMMER SALMONID HABITAT

The key identifying characteristics of the Core Summer Salmonid Habitat use are summer (June 15 - September 15) salmonid spawning or emergence, or adult holding; use as important summer rearing habitat by one or more salmonids; or foraging by adult and subadult native char. Other common characteristic aquatic life uses for waters in this category include spawning outside of the summer season, rearing, and migration by salmonids. The criterion for the Core Summer Salmonid Habitat use is a 7-DADMax of 16 ºC.

Temperature requirements are particularly critical during spawning and egg incubation periods. Those life stages need a cooler temperature to ensure that fertilized eggs have high survival success and the embryos develop into healthy emergent fry. For the window of time when that life stage occurs, waters require more stringent temperature criteria.[2] Waters requiring supplemental temperature criteria to protect the summer season spawning of salmonids are specified in the Waters Requiring Supplemental Spawning and Incubation Protection for Salmonid Species publication. The criterion to protect summer reproduction areas for salmon and trout is a 7-DADMax of 13 ºC. The applicable time frame varies depending on the geographic location and the subspecies present in the area. For example, in one area where salmon and trout are spawning and incubating eggs, the critical time period is February 15 - July 1. Outside that window of time (July 2 – February 14) the underlying less restrictive standard applies.

This criterion is protective of incubation as long as human actions do not significantly disrupt the normal patterns of fall cooling and spring warming that provide significantly colder temperatures over the majority of the incubation period.

[2] The salmonid populations targeted are those that have eggs and embryos developing in the stream bed in late spring to early fall. Salmonid populations which begin spawning in late fall or whose young have emerged from the stream gravels before late spring do not require added protection.

SALMONID SPAWNING, REARING, AND MIGRATION

The key identifying characteristic of the Salmonid Spawning, Rearing, and Migration use is salmon or trout spawning and emergence that only occurs outside of the summer season (September 16 - June 14). Other common characteristic aquatic life uses for waters in this category include rearing and migration by salmonids. The criterion for the Salmonid Spawning, Rearing, and Migration use is a 7-DADMax of 17.5 ºC.

Some streams have a more stringent temperature criterion that is applied seasonally to further protect salmonid spawning and egg incubation. See the Core Summer Salmonid Habitat use discussion for more information.

SALMONID REARING AND MIGRATION ONLY

The key identifying characteristic of the Salmonid Rearing and Migration **Only** use is use only for rearing or migration by salmonids (i.e., not used for spawning). The criterion for the Salmonid Rearing and Migration **Only** use is a 7-DADMax of 17.5 ºC.

NON-ANADROMOUS INTERIOR REDBAND TROUT

For the protection of waters where the only trout species is a non-anadromous form of self-reproducing interior redband trout (*O. mykis*), and other associated aquatic life the criterion is a 7-DADMax of 18 ºC.

INDIGENOUS WARM WATER SPECIES

For the protection of waters where the dominant species under natural conditions would be temperature tolerant indigenous nonsalmonid species the criterion is a 7-DADMax of 20 ºC. Examples of temperature tolerant indigenous nonsalmonid species include dace, redside shiner, chiselmouth, sucker, and northern pikeminnow.

NATURAL CONDITIONS NARRATIVE

In recognition of the fact that waterbodies can have naturally higher temperatures than the numeric criteria, Ecology has a narrative standard that allows the temperature standard to be set at the natural condition of the specific stream, and also allow a small increment of human warming for those waters with naturally high temperatures: “When a water body's temperature is warmer than the criteria in Table 200 (1)(c) (or within 0.3°C (0.54°F) of the criteria) and that condition is due to natural conditions, then human actions considered cumulatively may not cause the 7-DADMax temperature of that water body to increase more than 0.3°C (0.54°F).”

CONCLUSIONS

Washington is not a great overall model for Nevada to use as a template because its standards are largely driven by anadromous fish. Moreover, Washington's criterion for warm water species (20 ºC) is the same as Nevada's current criterion for Trout Waters. In addition, Washington's criterion for non-anadromous form of self-reproducing interior redband trout (*O. mykis*) (18 ºC) is more restrictive than Nevada's current criterion for Trout Waters and it is generally accepted that redband trout have a higher temperature tolerance than most trout. However, certain portions of Washington's standards should be helpful in developing Nevada's temperature criteria such as:

- Washington's criteria for Char Spawning and Rearing (i.e., bull trout);
- Washington's Natural Conditions narrative criterion.