Goals and Scientific Basis of the "Protecting Cold Waters" Rule

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Preface

This write-up has its roots in a forestry leadership workshop for small-woodland owners, which was held at OSU in February, 2014.

In a brief group exercise on planning a meeting to address a particular topic, my group chose to address the current concern about the Protecting Cold Waters[1] (PCW) rule, and we developed something like the following plan, based on the guidelines that we had just been given on how to go about such a task:

> Step 1. Review the history and the scientific basis for the PCW rule from the *EPA -DEQ perspective*. Try to put ourselves in their shoes and understand what they were thinking.
>
> Step 2. Analyze the results of Step 1. Decide whether the scientific basis and the conclusions are satisfactory from an *OSWA (Oregon Small Woodlands Association) perspective*. If yes, stop.
>
> Step 3. If no, propose a *concrete alternative*, addressing *specific problems* in the EPA-DEQ approach and providing a *scientific basis* for the alternative approach.

Because this plan was just an exercise, there was never any discussion of actually following through. However, I was interested in learning about the background of the PCW rule, so I just did what amounts to Step 1 on my own. The first version of this write-up was just my own notes for my own use; initially I had no intention of a more formal write-up. I had planned to make no attempt at Step 2, critical analysis, nor at Step 3, concrete alternative, leaving those steps to anyone so inclined who had the necessary scientific background.

[1] The PCW rule puts a limit of 0.3 C on the increase in stream water temperature due to human activities, for waters that already meet the numeric standards.

1. Introduction

The "Protecting Cold Waters" summer rule (PCW) [OAR 340-041-0028 (11) (a, c)], puts a limit of 0.3 C on the increase in stream water temperature due to human activities, for waters that already meet the numeric standards. I wanted to answer the questions,

1. What is the *goal* of the PCW rule, that is, what are we trying to achieve by adhering to the rule?

2. What is the *scientific basis* for the rule, that is, what scientific evidence do we have that our adherence to the rule will contribute (or is necessary or is sufficient) in achieving the goal?

Here is the text of the PCW rule referred to above:

> OAR 340-041-0028 (11)
> (a) Except as described in subsection (c) of this rule, waters of the State that have summer seven-day-average maximum **ambient** temperatures that are colder than the biologically based criteria in section (4) of this rule, may not be warmed by more than 0.3 degrees Celsius (0.5 degrees Fahrenheit) above the colder water ambient temperature. This provision applies to all sources taken together at the point of maximum impact where salmon, steelhead or bull trout are present….
> (c) The cold water protection narrative criteria in subsection (a) does not apply if:
> (A) There are no threatened or endangered salmonids currently inhabiting the water body;
> (B) The water body has not been designated as critical habitat; and
> (C) The colder water is not necessary to ensure that downstream temperatures achieve and maintain compliance with the applicable temperature criteria.

(Part (b) of the rule, PCW – spawning, deals with point source discharges and spawning waters, is not part of this review, and is not included above.) The full temperature rule, OAR 340-041-0028, can be found through the Secretary of State website (1).

The temperature water quality websites of the US EPA (2) and the Oregon DEQ (3) are excellent sources of information on the background for the rule. This review covers just the documents on those websites or referenced on those websites; it certainly misses the details that would be familiar to someone who was actually working in the field at the time and who had participated in the studies or reviews.

First I reviewed the Clean Water Act and EPA's Antidegradation Policy, which seem to be the ultimate *legal* basis for the PCW rule. Next I examined the development of EPA's Guidance Document, to which the states referred when they developed their rules, and finally I looked at the history of DEQ's work on the PCW rule itself.

Not surprisingly, these documents were not written towards the goal of providing succinct answers to my questions. Therefore, rather than summarizing the documents with my own interpretation, I have provided extensive excerpts from the documents without any interpretation. Finally, I do try to answer my questions based on the information provided.

2. The Clean Water Act and EPA's Antidegradation Policy.

EPA's summary of the history. The legal basis for the PCW rule appears to be EPA's "antidegradation policy" of 1983, which is based on Section 101(a) of the Clean Water Act of 1972. EPA reviews the relation between the Clean Water Act and the antidegradation policy in the background statement of a pending proposed revision to the Water Quality Standards (4). The revision itself is not so relevant to the PCW rule, but the background statement shows EPA's view of the history (4):

> Section 101(a) of the CWA [Clean Water Act] emphasizes the prevention of water pollution and expressly includes the objective ''to restore and *maintain* the chemical, physical and biological integrity of the Nation's waters (33 U.S.C. 1251) (emphasis added). The antidegradation requirements that the EPA incorporated by regulation in 1983 into 40 CFR 131.12 implement the maintenance aspect of CWA section 101(a) and are an essential component of the overall WQS [Water Quality Standards] program. Although designated uses and criteria are the primary tools states and tribes use to achieve the CWA 101(a) goals, antidegradation complements these by providing a framework for maintaining existing uses, for protecting waters that are either attaining or are of a higher quality than necessary to support the CWA 101(a)(2) goals, and for protecting state/tribal identified Outstanding National Resource Waters (ONRWs). Antidegradation plays a critical role in allowing states and tribes to maintain and protect the valuable resource of high quality water by ensuring that decisions to allow a lowering of high quality water are made in a transparent public manner and are based on a sound technical record.
>
> In the Water Quality Act of 1987, Congress expressly affirmed the principle of antidegradation that is reflected in section 101 of the Act. In those amendments to the CWA, Congress incorporated a reference to antidegradation policies in section 303(d)(4)(B) of the Act (33 U.S.C. 1313(d)(4)(B)): ''Standard Attained—For waters identified under paragraph (1)(A) where the quality of such waters equals or exceeds levels necessary to protect the designated use for such waters or otherwise required by applicable WQS, any effluent limitation based on a total maximum daily load or other waste load allocation established under this section, or any WQS established under this section, or any permitting standard may be revised only if such revision is subject to and consistent with the *antidegradation policy* established under this section'' (emphasis added). This provision not only confirms that an antidegradation policy is an integral part of the CWA, but also explains the relationship of the antidegradation policy to other CWA regulatory programs. Antidegradation reviews are applicable to revisions to effluent limitations based on a TMDL, wasteload allocation, or water quality standard, but they are not required for revisions to a TMDL, wasteload allocation, or water quality standard. [Footnotes not included.]

The Clean Water Act. Here are a few more details on the main points in the excerpt above. EPA states that the main legal basis for the antidegradation policy is Section 101(a) of the 1972 Clean Water Act (CWA). Section 101(a) of the CWA is the broad introductory declaration of goals and policies, the first few lines of which are (5):

> SEC. 101. (a) The objective of this Act is to restore and **maintain the chemical, physical, and biological integrity of the Nation's waters** [emphasis added]. In order to achieve this objective it is hereby declared that, consistent with the provisions of this Act—
> (1) it is the national goal that the discharge of pollutants into the navigable waters be eliminated by 1985;
> (2) it is the national goal that wherever attainable, an interim goal of water quality which **provides for the protection and propagation of fish, shellfish, and wildlife** [emphasis added] and provides for recreation in and on the water be achieved by July 1, 1983;
> (3) it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited; …

This part of the act was codified as 33 USC 1251 (6) with essentially the same wording.

The Antidegradation Policy. One of the goals of the CWA is to "*maintain* the chemical, physical, and biological integrity of the Nation's waters." EPA states that it implemented this maintenance provision of the CWA in 1983 with its antidegradation policy (7). This antidegradation policy is part of the federal Water Quality Standards (WQS) and is published as 40 CFR 131.12. The full text of the antidegradation policy is in Appendix A. The part of the antidegradation policy that is relevant to the PCW rule is Section (a)(2), which pertains to "high-quality" waters:

> 40 CFR 131.12 (a)(2) Where the quality of the waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, **that quality shall be maintained and protected** unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning process, that allowing lower water quality is necessary to **accommodate important economic or social development** in the area in which the waters are located. In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully. Further, the State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control [emphasis added].

Thus, this antidegradation policy pertains to "high-quality" waters, those that "exceed levels necessary to support propagation of fish, shellfish, and wildlife," and states, "that [water] quality shall be maintained and protected." Also, the antidegradation policy allows some limited wiggle room to "accommodate important economic or social development." Note that the WQS and the antidegradation policy apply quite generally, not just to temperature and not just to stream waters of the Pacific Northwest.

Finally EPA makes a point to state that Congress explicitly recognized that the antidegradation policy written by EPA is a valid expression of Congress's intent in Section 101 of the CWA. That recognition appeared in a 1987 amendment to the Clean Water Act [CWA 303(d)(4)(B) and 33 USC 1313(d)(4)(B)] (5, 8), where Congress stated:

> "…where the quality of such waters equals or exceeds levels necessary to protect the designated use … any WQS established under this section … is subject to and consistent with the *antidegradation policy* established under this section [by EPA in 1983]."

Water Quality Standards Handbook. EPA has written a Water Quality Standards Handbook (9) to help EPA staff in implementing the Water Quality Standards. Section 4.5 of this handbook discusses implementation of 40 CFR 131.12(a)(2), the water quality standard relevant to the PCW rule. The full text of Section 4.5 is given in Appendix B. One should consult the full text of Section 4.5 (Appendix B) to understand the details, but here is a quick summary of some interesting points from the Water Quality Standards Handbook (9):

- EPA believes that it is best to apply antidegradation on a parameter-by-parameter basis;
- EPA elaborates on the "wiggle room" referred to above;
- EPA goes over application to point sources and nonpoint sources and the role of Best Management Practices.

Significance thresholds for "degradation." Also, on the web page of Section 4.5 of the Water Quality Handbook, EPA has posted a 4-page document (10) giving additional guidance about when "degradation" is significant enough to trigger the "antidegradation" rule. The document pertains to non-BCCs (bioaccumulative chemicals of concern) in the Great Lakes, not to temperature in western Oregon, but it may reflect some thinking that would be applicable to Oregon (10):

> Relying upon input offered during a four-year open public process involving environmental groups, industry representatives, and other experts, with numerous opportunities for public input, the directors of the eight Great Lakes states and EPA technical experts reached a consensus on a significance threshold value of ten percent (10%) of the available assimilative capacity, coupled with a cumulative cap. They determined that this threshold represented a reasonable balance between the need of the regulatory agencies to limit the number of actions involving non-BCCs (bioaccumulative chemicals of concern) that are subjected to the detailed antidegradation demonstration requirements, and the need to protect and maintain water quality. They believed that any individual decision to lower water quality for non-BCCs that is limited to 10% of the available assimilative capacity represents minimal risk to the receiving water and is fully consistent with the objectives and goals of the Clean Water Act. A ten percent (10%) value is within the range of values for significance thresholds that EPA has approved in other states as well.

It should also certainly be possible to envision an "assimilative capacity" for thermal energy (heat) as the basis for triggering the antidegradation rule.

3. The EPA Guidance Document

In 2003 EPA published its Guidance Document to aid the states and tribes in developing temperature standards to protect threatened and endangered salmonids. EPA describes the motivation for this guidance in the background statement of its NW Temperature Project (11):

> In 1996, Oregon revised their water temperature standard and submitted it to EPA for approval. EPA approved Oregon's standard in 1999, but during the review process concerns were raised by EPA, the National Marine Fisheries Service and others that the standard would not fully protect all life stages of threatened and endangered salmonids. To address these concerns, EPA Region 10 started a project to develop regional temperature criteria guidance that would be protective of salmonids. States and tribes in the Pacific Northwest could then use this guidance when developing their temperature standards, as required by the Clean Water Act.

Foreword to the Guidance Document. Whereas the Clean Water Act and antidegradation policy apply in principle nationwide to all water quality indicators and all species, this 2003 EPA Guidance Document (12) applies specifically to *waters of the Pacific Northwest* with *threatened and endangered salmonids* and the water quality standards for just *temperature*. EPA explains the motivation for this focus in the Foreword to the Guidance Document (12):

> The goal of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters and, where attainable, to achieve water quality that provides for the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water. As a means of meeting this goal, section 303(c) of the CWA requires States and authorized Tribes to adopt water quality standards (WQS) and requires the U.S. Environmental Protection Agency (EPA) to approve or disapprove those standards.
>
> At this time, many Pacific Northwest salmonid species are listed as threatened or endangered under the Endangered Species Act (ESA). As a result, the ESA requires that EPA must insure that its approval of a State or Tribal WQS is **not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of their critical habitat** [emphasis added].
>
> Water temperature is a critical aspect of the freshwater habitat of Pacific Northwest salmonids. Those salmonids listed as threatened or endangered under the ESA and other coldwater salmonids need cold water to survive. Human-caused increases in river water temperatures have been identified as a factor in the decline of ESA-listed salmonids in the Pacific Northwest. State and Tribal temperature WQS can play an important role in helping to maintain and restore water temperatures to protect Pacific Northwest salmonids and aid in their recovery. For these reasons, EPA in collaboration with others, developed this guidance to better describe appropriate water temperatures to protect Pacific Northwest salmonids.
>
> The *EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards* is intended to assist States and Tribes to adopt temperature WQS that EPA can approve consistent with its obligations under the Clean Water Act (CWA) and the Endangered Species Act (ESA). This guidance document, however, does not substitute for applicable legal requirements; nor is it a regulation itself. Thus, it does not impose legally binding requirements on any party, including EPA, other federal agencies, the states, or the regulated community. Comments and suggestions from readers are encouraged and will be used to help improve the available guidance as EPA continues to build experience and understanding of water temperature and salmonids.

ESA requirements. On p. 3 of the Guidance Document (12) EPA spells out its obligation under the Endangered Species Act (13) to address threatened and endangered species when approving water quality standards (12):

> Where EPA determines that its approval of State or Tribal WQS may affect threatened or endangered species or their critical habitat, the approval action is subject to the procedural and substantive requirements of section 7(a)(2) of the ESA. Section 7(a)(2) of the ESA requires EPA to ensure, in consultation with the Service(s), that any action it takes is **not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat**.

The full text of ESA Section 7(a)(2) referred to above is (13):

> Section 7(a)(2) Each Federal agency shall, in consultation with and with the assistance of the Secretary [Secretary of the Interior or the Secretary of Commerce], insure that any action authorized, funded, or carried out by such agency (hereinafter in this section referred to as an "agency action") is **not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat** of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section. In fulfilling the requirements of this paragraph each agency shall use the best scientific and commercial data available.

Scientific basis requirement. Also on p. 3 of the Guidance Document, EPA affirms the requirement that water quality criteria adopted by states be based on sound scientific rationale (12):

> Specifically, 40 C.F.R § 131.11 requires States and Tribes to adopt water quality criteria that are based on **sound scientific rationale** and contain sufficient parameters or constituents to protect the designated uses.

The text of 40 CFR 131.11(a)(1), which incidentally immediately precedes the antidegradation policy (40 CFR 131.12) in the regulations, spells out this requirement (14):

> **§ 131.11 Criteria.** (a) *Inclusion of pollutants:* (1) States must adopt those water quality criteria that protect the designated use. Such criteria must be based on **sound scientific rationale** and must contain sufficient parameters or constituents to protect the designated use. For waters with multiple use designations, the criteria shall support the most sensitive use.

The "guidance." On pp. 32-33 in Section V.2 of the Guidance Document (12) EPA provides the guidance for "high-quality" waters that are colder than the numeric criteria. (I numbered the four paragraphs for ease of reference). The information in Paragraphs 1, 2 and 4 presents the rationale for the guidance, and Paragraph 3 presents what amounts to the guidance itself. Note also that explicit reference to the antidegradation policy (7) appears in Paragraph 1.

> **V.2. Provisions to Protect Water Temperatures That Are Currently Colder Than The Numeric Criteria**
>
> [1] One of the important principles in protecting populations at risk for any species is to first protect the existing high quality habitat and then to restore the degraded habitat that is adjacent to the high quality habitat. Further, EPA's WQS regulations recognize the importance of protecting waters that are of higher quality than the criteria (in this case, waters that are colder than numeric temperature criteria). See 40 C.F.R. § 131.12. EPA, therefore, believes it is important to have strong regulatory measures to protect waters with ESA-listed salmonids that are currently colder than EPA's recommended criteria. These waters likely represent the last remaining strongholds for these fish.

[2] Because the temperatures of many waters in the Pacific Northwest are currently higher than the summer maximum criteria recommended in this guidance, the high quality, thermally optimal waters that do exist are likely vital for the survival of ESA-listed salmonids. Additional warming of these waters will likely cause harm by further limiting the availability of thermally optimal waters. Further, protection of these cold water segments in the upper part of a river basin likely plays a critical role in maintaining temperatures downstream. Thus, in situations where downstream temperatures currently exceed numeric criteria, upstream temperature increases to waters currently colder than the criteria may further contribute to the non-attainment downstream, especially where there are insufficient fully functioning river miles to allow the river to return to equilibrium temperatures (Issue Paper 3). Lastly, natural summertime temperatures in Pacific Northwest waters were spatially diverse, with areas of cold-optimal, warm-optimal, and warmer than optimal water. The 18°C and 20°C criterion described in Table 3 and the natural background provisions and use attainability pathways described in Section VI are included in this guidance as suggested ways to address those waters that are warmer than optimal for salmonids. EPA believes it is important, however, for States and Tribes to balance the effects of the warmer waters by adopting provisions to protect waters that are at the colder end of their optimal thermal range.

[3] EPA, therefore, recommends that States and Tribes adopt strong regulatory provisions to protect waterbodies with ESA-listed salmonids that currently have summer maximum temperatures colder than the State's or Tribe's numeric criteria. EPA believes there are several ways a State or Tribe may do this. One approach could be to adopt a narrative temperature criterion (or alternatively include language in its anti-degradation rules) that explicitly prohibits more than a de minimis increase to summer maximum temperatures in waters with ESA-listed salmonids that are currently colder than the summer maximum numeric criteria. Another approach could be to identify and designate waterbodies as ecologically significant for temperature and either establish site-specific numeric criteria equal to the current temperatures or prohibit temperature increases above a de minimis level in these waters. States and Tribes following this latter approach should conduct a broad survey to identify and designate such waters within the state (or tribal lands). For non-summer periods it may be appropriate to set a maximum allowable increase (e.g., 25% of the difference between the current temperature and the criterion) for waters with ESA-listed salmonids where temperatures are currently lower than the criteria.

[4] Provisions to protect waters currently colder than numeric criteria can also be important to ensure numeric criteria protect salmonid uses. As discussed in Section V.1.A, the recommended criteria in this guidance are based in part on the assumption that meeting the criteria at the lowest downstream point at which the use is designated will likely result in cooler waters upstream. Cold water protection provisions as described here provide more certainty that this will be true. Further, if a State chooses to protect some or all of the sensitive uses in Table 4 (e.g., spawning) by using only the summer maximum criteria, it may also be necessary to protect waters currently colder than the summer maximum numeric criteria in order to assure that these sensitive uses are protected. Further, as described in Section V.1.B, protecting existing cold water is likely important in river reaches where a 20°C numeric criterion applies to protect salmon and trout migration use.

Scientific basis for the guidance. In 2001, as background for the Guidance Document, EPA published five technical issue papers (15) and a synthesis paper (16) reviewing the state of knowledge about salmonids and temperature. These papers are detailed reviews of the scientific literature with extensive tables summarizing the data. They are what one expects to see as scientific basis. However, while the basis for the *numeric criteria* (Section V.1 of the guidance) is very well documented and demonstrates that the authors know how to organize and evaluate scientific evidence, I couldn't find comparable documentation for the *PCW rule* (Section V.2.) In fact, Section V.2, which is reproduced in its entirety above, does not cite any study that addresses and supports the hypothesis that *limiting water temperature increase of high-quality waters due to human activities to no more than a de minimis amount is necessary (and sufficient) to protect threatened and endangered salmonids*. I thought that was remarkable! What the Guidance Document *does* say is discussed further in Section 6B.

Guidance on de minimis temperature increases. Also, the concept of a de minimis increase of 0.25 C appears on p. 21 of the Guidance Document (12):

> A State or Tribe may, if it has not already done so, wish to consider adopting a provision in its WQS that allows for a de minimis temperature increase above the numeric criteria or the natural background temperature. A State or Tribe might choose to include a de minimis increase allowance as a way of accounting for monitoring measurement error and tolerating negligible human impacts. **The data and information currently available to EPA appear to indicate that an increase on the order of 0.25°C for all sources cumulatively (at the point of maximum impact) above fully protective numeric criteria or natural background temperatures would not impair the designated uses, and therefore might be regarded as de minimis. [emphasis added]**

Preliminary drafts of the Guidance Document. The final Guidance Document itself was discussed above. Here is a brief review of the history of that document based on information on EPA's water temperature web page (2).

EPA prepared the Guidance Document in two drafts (October 2001 and October 2002 (17)) and the final version, April 2003 (12). Extensive public comments on the two drafts are posted on the website (18, 19). EPA summarized responses to public comments and changes from the first draft to the second draft in a public information document (20).

Because I found no copy of the first draft itself, I started by looking at the comments about the PCW provisions in the first draft, which begin on p. 45 (18), where one finds comments from many different points of view.

The section of the second draft (17) that is related to the PCW rule is given in Appendix C. It's shorter than, but very similar to, the final guidance document, which was just discussed on the previous two pages. Comments on the second draft are organized in three documents according to constituency (19). I searched these pdf documents for "V.2" and "cold water" and again found comments from a wide range of points of view. Two interesting issues, which DEQ addressed in the final PCW rule, were: the addition of thermal energy upstream may not always significantly impact temperature downstream; and the rules should apply only if endangered species are present, for example (19):

> EPA's dogged adherence to the false notion that "*these cold water segments in the upper part of a river basin likely plays a critical role in maintaining temperatures downstream*" is counterproductive and severely weakens our confidence in EPA's objectivity and technical competency.
>
> The Criteria Should not Apply in Unoccupied and Upstream Areas. In the Introduction section, on page 1, the Guidance states: "Standards for temperature . . . will protect cold water salmonid species". The Guidance needs to make clear that there is absolutely no need to meet these standards in waters which do not contain these cold water salmonid species. As a result, the statements appearing on pages 19, 20 and 28, regarding the application of the criteria upstream and in areas where there is potential to restore temperatures, should be removed or modified.

As it turned out, both of these issues were addressed as possible exceptions to DEQ's final PCW rule, OAR 340-041-0028 (11) (c), which is quoted in the Introduction.

Finally, EPA summarized its temperature guidance in a 2-page public information flier (21).

4. DEQ's PCW Rule

DEQ's water temperature home page has a lot of information about other issues arising in 2012 and 2013; these issues are not directly related to PCW and are not discussed here.

I worked my way chronologically through DEQ's water temperature home page (3). I started with a 1995 Temperature Issue paper, which provides a thoughtful discussion of the issues *at that time* (22). That document provides a relatively clear statement of a goal:

> **3.10.3 The Threatened & Endangered Species Provision**
> *"No measurable temperature increases are allowed in Oregon waters containing threatened or endangered species as defined in the Endangered Species Act … . "* The purpose of this clause would be to ensure that where threatened or endangered species exist, no additional stress is brought to bear on those species through increased temperatures. An objective of the temperature standard should be to minimize the risk that additional species or populations will become threatened or endangered. This clause would apply to new and ongoing activity as defined in Section 3.2 of this issue paper.

In 1997, DEQ published "The Scientific Basis for Oregon's Stream Temperature Standard: Common Questions and Straight Answers" (23). A statement regarding a goal appears (p. 4),

> No measurable increase from anthropogenic activities in stream segments containing federally listed Threatened or Endangered species if the increase would impair the biological integrity of the population. Where T&E species occur, additional human caused stressors should not be added. If stream temperatures are an important variable to the species, such as with cold water fish, additional human caused warming should not be added to their environment.

DEQ had a Technical Advisory Committee (TAC) of experts from government, academia and industry reviewing EPA's Guidance Document and DEQ's proposed response. DEQ's website (3) gives a summary of the November, 2003 TAC report (24) as Attachment 2C (but I didn't find the document to which Attachment 2C is an attachment.)

DEQ had asked the TAC to review EPA's technical issue papers (15, 16). The TAC didn't seem to be concerned about lack of scientific documentation for the PCW guidance (24):

> DEQ asked the Temperature TAC to review these papers to determine whether they generally presented a good scientific basis for our review, or whether they saw significant issues or gaps. In general, the TAC found the papers provided a complete and accurate summary of the current scientific literature.

The TAC wrote a clear statement of its rationale for a PCW rule, but didn't cite or discuss any of the supporting scientific evidence (but that wasn't really the job of the TAC) (24):

> **Cold Water Protection**
>
> Anthropogenic warming of stream reaches that are colder that the numeric criterion should be limited for 3 reasons. First, the natural thermal regime of a stream is presumed to provide the best thermal conditions for the native aquatic communities. Second, there is value to having a diversity of thermal habitats, including reaches that are colder than the criteria. And third, added heat will remain in the water for some distance downstream, providing the possibility for accumulative warming if multiple sources of warming overlap. This can cause the stream to exceed the criteria further downstream, reducing the amount of optimal or suitable habitat available within a sub-basin.

> The TAC felt it would be appropriate to have a narrative criterion limiting human caused increases to: 1) summer maximum stream temperatures in reaches or sub-basins with T&S [sic] species and in reaches designated as ecologically significant cold-water refugia (including all bull trout spawning & juvenile rearing habitat); and 2) April and May temperatures in waters where steelhead rearing and smoltification is occurring.
>
> In most cases, reaches that remain colder than the criteria in the summer will be in upper portions of the sub-basin, impacted primarily or only by nonpoint sources. In these areas, the de minimis increase could be applied cumulatively over a 6th field HUC scale. A small number of spatially limited increases greater than 0.3 degrees may be possible without impacting fish if they are located in areas without fish and managed in a way that the impact is no longer measurable at the base of a 6th field HUC. Other issues related to a de minimis increase are discussed below under “de minimis" increase allowance for human use. …

The TAC went on to detail some aspects of the de minimis increases (see the full text (24) for the full statement):

> …The following are some of the observations and comments of the TAC related to the de minimis increase allowance:
>
> 1. The TAC agrees that some small increment of warming above the criteria or natural condition is probably not going to harm fish. The numeric criteria are conservative. An increase of 0.2 or 0.3°C is within the range of uncertainty in the thermal requirements of fish and the ability to estimate natural conditions.
> 2. Whether the de minimis allowance is 0.2 or 0.3°C is a policy call. However, the farther temperature gets from the natural condition, the greater the risk for aquatic life. The effect occurs on a continuum, it is not a threshold.
> 3. The incremental increase in maximum temperatures that can occur without causing harm will depend on the background temperature.
> 4. The de minimis allowance should be stated to the nearest one-tenth of one degree. It should not be stated to the one-hundredth of a degree, giving a false sense of precision.
> 5. The error of temperature recording instruments is currently about 0.2 degrees C but is likely to decrease over time as newer and more precise temperature sensors become available. From a practical perspective, the ability to measure the difference in temperature between 2 points in space or time with a limited number of data points could be twice that amount. …

The final document is DEQ's 2008 guidance document (25), which is designed to help DEQ staff in the implementation of the rules. The first few chapters of the guidance document contain an interesting review of the history of the rules, and the PCW guidance is discussed in Section 3.7, pp. 32-37, which is attached in Appendix E. The DEQ guidance just reiterates, in great detail and with a few examples, the points mentioned above. The DEQ Guidance does have an interesting statement about the purpose of the rule (p. 32):

> **Purpose**. The purpose of the summer cold water protection criterion is to limit human warming of streams that currently stay cold throughout the summer and contain salmon, steelhead or bull trout. Protecting a range of cold water habitats is important for temperature sensitive fish and other cold water biota. In addition, because added heat is transported downstream, limiting the warming of upper cold water reaches will, under some conditions, reduce the amount of habitat downstream that exceeds the criteria. This provision is intended to prevent or minimize degradation of high quality streams.

5. Summary of key documents

Here is a simplified summary of the main documents discussed above pertinent to the PCW rule, as I understand them, with a lot of the details omitted for clarity. The references to the full texts should be consulted for the context. This summary is a snapshot of my evolving understanding, not an authoritative statement from an expert in environmental policy.

In 1972 Congress passed the Clean Water Act (5), one of the goals of which was to maintain the chemical, physical, and biological integrity of the Nation's waters and, where possible, provide for the protection and propagation of fish and wildlife.

In 1983 EPA translated that congressional aspiration into its regulations on Water Quality Standards, which included among other things, the antidegradation policy (7) and the requirement that water quality standards be based on sound scientific rationale (14). One provision of the antidegradation policy states that, when the *quality of the waters exceed levels* necessary to support propagation of fish and wildlife (i.e., "high-quality" waters), that quality shall be maintained, unless the state finds that allowing lower water quality is necessary to accommodate important economic or social development. This policy appears to apply to all high-quality waters of the nation, all water quality parameters and all species. In 1987 Congress affirmed that EPA's antidegradation policy reflected the intent of the Clean Water Act (8).

In 2003, EPA gave guidance to the Pacific Northwest states (12) about what they should do to comply with this policy. This guidance was restricted to high-quality waters of the Pacific Northwest that contain, or have been designated as critical habitat for, salmonids listed through the Endangered Species Act (ESA). Two approaches were suggested to the states: (i) explicitly prohibit more than a de minimis temperature increase in these waters; or (ii) identify and designate waters as ecologically significant and either establish site-specific numeric criteria equal to the current temperature or prohibit more than a de minimis temperature increase in these waters. Also EPA reiterated its obligation under the ESA (13), "that any action it takes is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat." The *guidance itself* appears to differ from the *antidegradation policy* in three ways: (i) it pertains specifically to temperature as a water quality parameter and only to salmonids listed under the ESA, vs. all water quality parameters and all species; (ii) it has no allowance for permissible lowering of water quality to accommodate development; and (iii) while the guidance document asserts the role of maintaining the temperature in protecting threatened and endangered species, the guidance itself refers just to *maintaining the temperature*. So the *goal* has shifted somewhat from protection of the species to just maintaining the temperature.

Also in 2003, DEQ published its PCW rule (1). The PCW rule and related parts of the same administrative rule (1) did establish critical habitat areas for endangered salmonids, declared that the temperature difference should be measured at the point of maximum impact, and limited temperature increase to a de minimis value of 0.3 C for high-quality waters that: contain endangered salmonids OR have been designated as critical habitat for endangered salmonids OR are necessary for downstream waters to meet the temperature criteria.

Summary of goals. The *goals* (what are we trying to achieve? how do we measure success?) quoted from the laws and regulations are summarized in Table 1. EPA also cites the federal goals repeatedly in official statements. These goals are apparently what we are trying to achieve with PCW.

Table 1. Goals of key laws and regulations behind the PCW rule.

Document	Key goals relevant to PCW Rule
Clean Water Act (5)	"*maintain* the chemical, physical, and biological integrity of the Nation's waters;" "provides for the protection and propagation of fish, shellfish, and wildlife"
Endangered Species Act (13)	"any action … is **not likely to jeopardize the continued existence** of any endangered species or threatened species or **[not likely to] result in the destruction or adverse modification of habitat** of such species"
Antidegradation Policy (7)	"Where the quality of the waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, **that quality shall be maintained and protected** "
PCW rule (1)	"waters … may not be warmed by more than 0.3 degrees Celsius"

As can be seen, the Clean Water Act and Endangered Species Act assert the role of maintaining the habitat in protecting the species, while the goal in the antidegradation policy and the PCW rule shifts to the water quality and the temperature water quality parameter itself. To maintain the link between the *rule* and the underlying *goals*, the necessity and sufficiency of the rule in achieving the goals should have been verified at the time the rule was being considered and adopted.

There should have been some critical examination of the scientific evidence that "any increase in temperature due to human activities beyond a de minimis amount will be harmful to the threatened and endangered salmonids and therefore constitutes an unacceptable degradation of the habitat," or equivalently, "the *current* temperature regime is necessary and sufficient to protect threatened and endangered salmonids." Such evidence may exist, but it certainly wasn't mentioned or discussed in EPA's Guidance Document (12).

A much simpler way of expressing this conundrum is, are we sure that the easily measured parameter temperature is an appropriate substitute for assessing the level of protection of the salmonids, which is the primary goal, but which is more difficult to measure?

6. Back to the questions --

Everything presented up to here is just a summary of the primary documents readily available on the web. I'm not an expert in this field and I wasn't paying attention during the rulemaking process, so I'm sure there is a lot of information that I'm missing; but I have read most of the documents, and I have tried to make an objective analysis. Now I'll return to the questions,

1. What is the *goal* of the PCW rule, that is, what are we trying to achieve by adhering to the rule?

2. What is the *scientific basis* for the rule, that is, what scientific evidence do we have that our adherence to the rule will contribute (or is necessary or is sufficient) in achieving the goal?

and discuss some answers. The short answer is that the goals and scientific basis for the PCW rule are not laid out very clearly in the documents I examined.

A. Goals. As I've thought more about this issue, it turns out that clarifying the *goal* of the rule may be at least as important as establishing the *scientific basis* for the rule. Here are two ways of looking at the goals.

1. Goals inferred from the documents reviewed here. Goals are not listed explicitly, but the statements in the EPA guidance and in Section 4 from DEQ seem to reflect a mindset of just-to-be-sure, extra-measure-of-caution, pull-out-all-the-stops, "best-possible" habitat, which is operationally defined by the rule as "no human impact on temperature." But in this case "best-possible" may not be the best possible: it is limited in scope just to heat added from human activities and doesn't address other habitat factors (e.g., channel structure) that are necessary for a beneficial thermal regime. Although this "best-possible" goal is *implicit* in the documents, I found that neither it, nor its limited scope, has been discussed explicitly or addressed in the reviews. Perhaps someone who was involved in the process could shed some light on this point.

An *alternative goal* could be to consider all the complexity of the habitat, take whatever measures are scientifically demonstrated to be necessary to protect threatened and endangered salmonids, but also accommodate other beneficial uses of the landscape to the extent possible.

The first *goal* strives to minimize the risk to the threatened and endangered salmonids through management of just one aspect of a complex habitat, without regard to other beneficial uses of the landscape. The current PCW rule was written to achieve that *goal*. The *alternative goal* is to protect threatened and endangered salmonids, but accommodate other beneficial uses of the landscape to the extent possible. And while it's comparatively easy to write a rule that *minimizes* risks with regard to one aspect of the habitat (heat added due to human activities), it is more difficult to *quantify* the risk and write a scientifically based rule that more comprehensively addresses heat and temperature in all aspects of the habitat.

It seems through all of these documents, EPA, DEQ (and ODF), have been implicitly pursuing the first *goal*, while OSWA has been looking at the rule from the perspective of the *alternative goal*. So the next question that I have is, what do EPA, DEQ (and ODF) think about the *alternative goal*?

2. Goals associated with different approaches to rule-making. In the face of scientific uncertainty about the possible harm to the environment that might result from a proposed activity, two different approaches might be used to deal with the uncertainty. In a traditional approach, the burden of proof lies with the *regulator* to show that a *regulation is necessary to prevent harm to the environment*. In an alternative approach (a form of the "precautionary principle"), the burden of proof lies with the *proponent of the activity* to show that the *activity is not harmful to the environment*. Here I juxtapose possible consequences of these two approaches in establishing the need for the PCW rule.

a. *Traditional approach*. If it is suspected that operations under the current FPA riparian buffer rules might lead to an increase in stream temperature that is harmful to threatened and endangered salmonids, but there is no scientific consensus that it *is* harmful, the burden of proof that it *is* harmful lies with EPA / DEQ / ODF before further restrictions are applied to the operation. When in doubt, *assume a regulation is not necessary until proven otherwise*.

In this case, there would be a need beyond 40 CFR 131.11, the requirement that regulations be based on sound science, for EPA / DEQ / ODF to provide a scientific basis for the PCW rule, since the burden of proof lies with them to show that the current temperature regime *must* be maintained to protect the salmonids. In this case, if regulations aren't developed in a timely manner, the resource may be "under-protected."

b. *Alternative approach*. If it is suspected that a forest operation under the FPA might lead to an increase in stream temperature that is harmful to threatened and endangered salmonids, and there is no scientific consensus that it is *not* harmful, the burden of proof that it is *not* harmful lies with those conducting the forest operations under the FPA. When in doubt, *assume an activity is harmful until proven otherwise*.

In this case, it could be argued that there is no need (beyond 40 CFR 131.11, the requirement that regulations be based on sound science) for there to be a scientific basis for the PCW rule, since the burden of proof lies *not* with the EPA / DEQ / ODF to show that the current temperature regime *must* be maintained to protect the salmonids, but with forest operators to show that a modest temperature increase is *not* harmful to the salmonids. So, protection rules might be imposed on a "just to be on the safe side," "extra margin of safety," "might help and probably won't hurt" basis, without a true scientific basis, with the burden of scientific proof that such rules are *not* necessary falling on forest operators. Application of this approach runs the risk of "overprotecting" one use of the resource at the expense of other uses of the resource.

These two examples just illustrate two approaches to the problem. I have cast my discussion in this report in terms of the traditional approach, because it is more consistent with the requirement that water quality criteria be based on sound scientific rationale, it was certainly the prevailing approach in the 1970s and 1980s when the laws and regulations were written, and I saw no discussion at all of the alternative approach in the documents I reviewed.

B. Scientific basis. Here's how it should all fit together: the best management practices (BMPs) under the Forest Practices Act (FPA) should ensure that the temperature criteria are met, and the temperature criteria should be necessary and sufficient for the threatened and endangered salmonids to be protected, achieving the goals of the Clean Water Act and Endangered Species Act with respect to the temperature water quality.

This chain of logic can be re-expressed more formally as a series of hypothesis, all of which have to be true, in one form or another, to achieve the goal of protecting, and not "overprotecting," threatened and endangered salmonids through BMPs:

1. limiting temperature increases due to human activities in high-quality waters *to no more than 0.3 C*, is necessary and sufficient to protect threatened and endangered salmonids;
2. *FPA riparian buffer management practices* will maintain the temperature of high-quality waters *within 0.3 C*;
3. *FPA riparian buffer management practices* will not have other, unintended, *significant adverse effects* on critical habitat.

There are of course other ways to formulate these hypotheses, but some form of this basic structure has to be true if the BMPs are to meet the goal of protecting, and not over-protecting, the salmonids. The first hypothesis is a statement of what is required to protect the salmonids. The second hypothesis links that which is required to protect the salmonids to the efficacy of the BMPs in meeting these requirements. The third hypothesis is a check against unintended adverse consequences of the BMPs.

When our group posed the question about scientific basis, we envisioned the traditional scientific method: some form of a series of hypotheses such as the ones listed above, a presentation of scientific data, a critical review of the data and finally a decision about whether the scientific evidence supports the hypotheses.

An alternative way to approach the three hypotheses listed above would be to adopt hypotheses #1, and #3 as *axioms* – that is, premises so obvious that they are accepted without controversy or scientific review -- but invest a great deal of effort (Ripstream study) in testing of the second hypothesis through the traditional scientific method described above. Also, the ongoing Paired Watershed studies may shed some light on Hypotheses #1 and #3 through the traditional scientific method.

The fact that I could not find any critical review for hypotheses #1 and #3 in the documents I reviewed makes me think that *EPA / DEQ / ODF must be following something more like the alternative approach*, not the traditional full scientific approach we had envisioned.

Finally, I go back the EPA Guidance Document report and the DEQ TAC report and analyze a little more closely what they *did* say, in an attempt to understand what they were thinking.

EPA Guidance Document. Paragraphs 1, 2 and 4 of Section V.2 of the Guidance Document (12) contains EPA's basis for the PCW guidance. I have extracted the nine main points that I found in those paragraphs, dropping modifiers in favor of brevity and clarity, added the emphasis, the numbers and the material in square brackets, but have otherwise just quoted the Guidance Document (12). (These excerpts are shown highlighted within the original text in Appendix D.) Here is that extract, comprised of direct quotes from the Guidance Document (12):

> 1. One of the important principles in protecting populations at risk for any species is to first protect the existing high quality habitat.
>
> 2. EPA's WQS [Water Quality Standards] regulations recognize the importance of protecting waters that are of higher quality than the criteria. See 40 C.F.R. § 131.12 [(a)(2)].
>
> 3. These waters [colder than EPA's recommended criteria] ***likely*** represent the last remaining strongholds for these fish.
>
> 4. The high quality, thermally optimal waters that do exist are ***likely*** vital for the survival of ESA-listed salmonids. Additional warming of these [thermally optimal] waters will ***likely*** cause harm by further limiting the availability of thermally optimal waters.
>
> 5. Protection of these cold water segments in the upper part of a river basin ***likely*** plays a critical role in maintaining temperatures downstream. Thus, in situations where downstream temperatures currently exceed numeric criteria, upstream temperature increases to waters currently colder than the criteria ***may*** further contribute to the non-attainment downstream….
>
> 6. Lastly, natural summertime temperatures in Pacific Northwest waters were spatially diverse, with areas of cold-optimal, warm-optimal, and warmer than optimal water. … EPA ***believes*** it is important … for States and Tribes to balance the effects of the warmer waters by adopting provisions to protect waters that are at the colder end of their optimal thermal range.
>
> 7. Provisions to protect waters currently colder than numeric criteria ***can*** also be important to ensure numeric criteria protect salmonid uses.
>
> 8. It ***may*** also be necessary to protect waters currently colder than the summer maximum numeric criteria in order to assure that these sensitive uses are protected.
>
> 9. Protecting existing cold water is ***likely*** important in river reaches where a 20°C numeric criterion applies to protect salmon and trout migration use.

The first statement is a broad principle. The second statement is a reference to the antidegradation policy, which could be regarded as the legal basis for the guidance. I'm not sure what the authors' intent was with Statements 3-9: it looks to me like these statements are a list of "potential benefits" that could result from following the guidance. No attempt was made to support them with science. Because each of these statements is qualified by a word like "likely, may, can, believes," I think that the authors stopped short of considering these statements to be facts, clearly supported by science, and, in fact, no papers are cited in support of these statements. These statements may be supported by scientists who are familiar with the primary scientific literature, but the direct citations did not make it into the Guidance Document (12).

So, I am left wondering, what actually *is* the scientific evidence for this part of the guidance, that it is necessary to maintain the current water temperature in order to protect the threatened and endangered salmonids? Many of these statements seem to reflect an "extra margin of safety / just to be sure" point of view that would be consistent with the *best-possible* habitat goal, the *assume-an-activity-is-harmful-until-proven-otherwise-so-no-need-to-show-that-a-regulation-is-necessary* approach to environmental regulations, and the *axiom-like* acceptance of two of the three hypotheses discussed earlier.

DEQ TAC Report. DEQ's TAC states a rationale for the PCW rule as follows (24), paraphrased from the original which is quoted in Section 4:

> Anthropogenic warming of stream reaches that are colder than the numeric criterion, where threatened and endangered species are present, should be limited for three reasons:
>
> 1. The natural thermal regime of a stream is presumed to provide the best thermal conditions for the native aquatic communities.
>
> 2. There is value to having a diversity of thermal habitats, including reaches that are colder than the criteria.
>
> 3. Added heat will remain in the water for some distance downstream, providing the possibility for accumulative warming if multiple sources of warming overlap. This can cause the stream to exceed the criteria further downstream, reducing the amount of optimal or suitable habitat available within a sub-basin.

The TAC emphasizes the "natural thermal regime." From the broad perspective that evolution occurred under a "natural thermal regime," the first statement might appear to be "intuitively obvious," and not necessarily in need of any scientific examination. And if we have the natural thermal regime, presumably the second and third points would be satisfied as well. From the "extra margin of safety / just to be sure" point of view and the *best-possible* habitat goal, and looking just at the added heat aspect of the thermal habitat, one might conclude that the natural thermal regime is an obvious goal without the need for any particular scientific evidence or review. However, it's important to bear in mind that it's the *current* thermal regime that is maintained by the PCW rule, not necessarily the *natural* thermal regime.

From the broader perspective of *all* aspects of the habitat, one might have second thoughts. If a heat source had been shown to have an adverse effect on the habitat, and the heat source was the *only* aspect of the habitat that had been disturbed over the last 200 years, then not allowing that heat source could reasonably be expected to restore or maintain the natural thermal regime and have a *significant* effect on protecting and restoring threatened and endangered salmonids. But it's not just the thermal regime that has been disturbed, it's also the channel structure, the flow regime and many other aspects of the habitat that have been altered from historical disturbance patterns (for example, by stream channel modifications, removal of large wood, disappearance of beavers, erosion, passage barriers, dams, hatchery fish, industrial fishing, agricultural and logging practices, urban development, wildfire suppression, etc.) And the thermal regime of the habitat is *itself* closely coupled to the channel structure and the flow regime. So one might ask, how significant is controlling a heat source going to be at restoring the natural thermal regime of the habitat, when the flow regime and channel structure, and many other aspects of the habitat, remain highly altered from their historic natural regimes? Of course the extent of the habitat alteration varies over the watershed, being generally less severe in the upper reaches where the PCW rules generally applies, and generally more severe lower in the watershed closer to civilization, but it's still significant in the upper reaches important to salmonids in summer.

7. What to do?

Consideration of all of these other factors and the associated uncertainties could make one want to:

a. ignore them all and stick with the simple premise that not allowing a temperature increase from human activities will have a significant impact on maintaining the *current* thermal regime, with concomitant protection and restoration of the salmonids, all without presenting a critical examination of the evidence for such a premise;

b. throw up one's hands and say it's so complicated we can't do anything rationally so it's best to do nothing, or study it interminably so it's effectively doing nothing;

c. consider the *entire habitat* carefully, evaluate the evidence, and make the best rational, scientifically based decision that we can. Then,

   i. if there's clear evidence to show that the PCW rule is indeed *necessary and sufficient* to protect threatened and endangered salmonids, invoke BMPs to ensure that the PCW rule is met;

   ii. if the evidence is not clear about the benefit of the rule, then focus habitat protection and restoration efforts where they are more likely to have a *significant* effect, incorporating social acceptance in all aspects of the analysis.

I realize that a more appropriate time to have made these comments was in the early 2000s during the public comment period. I also realize that the people who did make comments and DEQ's TAC didn't seem particularly concerned about the points I raise here. Maybe they were more concerned at the time about the numeric criteria and focused their efforts there. I did contact two members of the team that worked on developing the PCW rule and ask for their comments. They didn't exactly agree to respond, but they did agree to have a look at it; but, after several weeks and a few follow-up attempts, I have heard nothing. So, *let the reader judge for himself or herself.*

The author.

John Westall was a faculty member at OSU for almost thirty years before retirement. He taught and led a research program in environmental and analytical chemistry, working extensively with EPA's Office of Research and Development and the Department of Energy on environmental chemistry issues. Since retirement he has worked as a volunteer for the Luckiamute Watershed Council and the Oregon Small Woodlands Association. He and his wife own and manage a small woodland in Benton County, which includes about 800 feet of a perennial stream that is designated by ODF as a small fish-bearing stream; however, their forest management plan would be entirely unaffected by any conceivable change to the riparian management rules.
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Literature cited.

In lieu of the standard format for citations, I've entered a brief description of the reference and a web link. For the types of documents cited here, I find this approach much more convenient. In the short term, that works fine, but in the long term problems will arise when web links are re-organized. All links verified on 4/30/14.

1. OAR 340 Division 041, within which the full text of OAR 340-041-0028 can be found:
http://arcweb.sos.state.or.us/pages/rules/oars_300/oar_340/340_041.html

2. EPA's NW water temperature web page:
http://yosemite.epa.gov/R10/WATER.NSF/1507773cf7ca99a7882569ed007349b5/ce95a3704aeb5715882568c400784499!OpenDocument

3. DEQ's water temperature web page:
http://www.deq.state.or.us/wq/standards/temperature.htm

4. EPA's proposed revisions to Water Quality Standards, September, 2013. Federal Register, Vol. 78, No. 171. The link is to the full text of the proposed rule; the excerpt is on p. 54526.
http://www.gpo.gov/fdsys/pkg/FR-2013-09-04/pdf/2013-21140.pdf

5. The Clean Water Act, initially passed 1972, with revisions through 2002, from the US Senate web site, reached by a link from the EPA Clean Water Act web site. Sections 101(a) and 303(d)(4)(B) are related to the antidegradation policy, to which the PCW rule is related:
http://www.epw.senate.gov/water.pdf

6. Codification of Section 101 of the Clean Water Act, 33 USC 1251, 2011; basis for antidegradation policy:
http://www.gpo.gov/fdsys/pkg/USCODE-2011-title33/pdf/USCODE-2011-title33-chap26-subchapI.pdf

7. Federal Water Quality Standards, Antidegradation Policy 40 CFR 131.12
http://www.gpo.gov/fdsys/pkg/CFR-2011-title40-vol22/pdf/CFR-2011-title40-vol22-sec131-12.pdf

8. Codification of Section 303(d)(4)(B) of the Clean Water Act, 33 USC 1313, 2011; affirmation of basis for antidegradation policy:
http://www.gpo.gov/fdsys/pkg/USCODE-2011-title33/pdf/USCODE-2011-title33-chap26-subchapIII-sec1313.pdf

9. EPA Water Quality Standards Handbook, Chapter 4: Antidegradation (40 CFR 131.12)
http://water.epa.gov/scitech/swguidance/standards/handbook/chapter04.cfm

10. EPA Memo on Degradation Reviews and Significance Thresholds, 2005:
http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/upload/tier2.pdf

11. Background on the EPA's NW Temperature Project:
http://yosemite.epa.gov/R10/WATER.NSF/6cb1a1df2c49e4968825688200712cb7/a9b8b4ad25c0c1c9882569e4007d98fb!OpenDocument

12. EPA's Final Guidance Document, April 2003:
http://www.epa.gov/region10/pdf/water/final_temperature_guidance_2003.pdf

13. Endangered Species Act. The section on Interagency Cooperation, to which EPA refers [7(a)(2)], is on p. 15:
http://www.fws.gov/ENDANGERED/esa-library/pdf/ESAall.pdf

14. Federal Water Quality Standards, Scientific Basis for Regulations, 40 CFR 131.11:
http://www.gpo.gov/fdsys/pkg/CFR-2005-title40-vol21/pdf/CFR-2005-title40-vol21-sec131-12.pdf

15. EPA's five technical summaries on the major physical and biological considerations concerning salmonids for developing water temperature standards:
http://yosemite.epa.gov/R10/WATER.NSF/6cb1a1df2c49e4968825688200712cb7/5eb9e547ee9e111f88256a03005bd665!OpenDocument

16. Synthesis and summary of EPA's five technical summary papers (this link brings the document up in a very awkward document reader; I clicked the "Get a Copy" button to download a pdf.):
http://nepis.epa.gov/Exe/ZyNET.exe/P1004J0T.txt?ZyActionD=ZyDocument&Client=EPA&Index=1995%20Thru%201999%7C1976%20Thru%201980%7C2006%20Thru%202010%7C1991%20Thru%201994%7C2000%20Thru%202005%7C1986%20Thru%201990%7C1981%20Thru%201985%7CPrior%20to%201976&Docs=&Query=910R01007%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C00THRU05%5CTXT%5C00000020%5CP1004J0T.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x

17. EPA's Second Draft Guidance Document, October 2002:
http://yosemite.epa.gov/R10/WATER.NSF/6cb1a1df2c49e4968825688200712cb7/1442c7b1fcde026b88256c4e0074dc2f!OpenDocument

18. Comments on EPA's First Draft Guidance Document, October 2001:
http://yosemite.epa.gov/R10/water.nsf/34090d07b77d50bd88256b79006529e8/bec776a40424197088256bc200728c94/$FILE/Final%20Draft.pdf

19. Comments on EPA's Second Draft Guidance Document, October 2002:
http://yosemite.epa.gov/R10/WATER.NSF/1507773cf7ca99a7882569ed007349b5/1e2439bb1ea03fda88256c92007f99f8!OpenDocument

20. EPA's document summarizing the process in October 2002: changes from the first draft to the second draft, public meetings, opportunities for public comments:
http://yosemite.epa.gov/R10/water.nsf/1507773cf7ca99a7882569ed007349b5/1442c7b1fcde026b88256c4e0074dc2f/$FILE/Temperature%20Std%20FactSheetOct2002.pdf

21. EPA's flier summarizing the guidance:
http://www.epa.gov/region10/pdf/water/temperature_standards_fs.pdf

22. DEQ's Temperature Issue paper from 1995:
http://www.deq.state.or.us/wq/standards/docs/temperature/19921994wqStandardsReviewTemperature.pdf

23. DEQ's 1997 information document "The Scientific Basis for Oregon's Stream Temperature Standard: Common Questions and Straight Answers:"
http://www.deq.state.or.us/wq/standards/docs/temperature/tempstdccibasis1996.pdf

24. Report of DEQ's TAC (Technical Advisory Committee), 2003:
http://www.deq.state.or.us/wq/standards/docs/temperature/TACsummaryTemp2003.pdf

25. *Temperature Water Quality Standard – A DEQ Internal Management Directive*. 2008. DEQ's guidance document for implementation of the temperature standard, of which Section 3.7 covers the PCW rule:
http://www.deq.state.or.us/wq/pubs/imds/Temperature.pdf

Appendix A. EPA's Antidegradation Policy (7)

§ 131.12 Antidegradation policy.

(a) The State shall develop and adopt a statewide antidegradation policy and identify the methods for implementing such policy pursuant to this subpart. The antidegradation policy and implementation methods shall, at a minimum, be consistent with the following:

(1) Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.

(2) Where the quality of the waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully. Further, the State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control.

(3) Where high quality waters constitute an outstanding National resource, such as waters of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.

(4) In those cases where potential water quality impairment associated with a thermal discharge is involved, the antidegradation policy and implementing method shall be consistent with section 316 of the Act.

Appendix B. EPA Water Quality Standards Handbook, Chapter 4.5 (9)

4.5 Protection of Water Quality in High- Quality Waters - 40 CFR 131.12(a)(2)

This section provides general program guidance in the development of procedures for the maintenance and protection of water quality where the quality of the water exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water. Water quality in "high-quality waters" must be maintained and protected as prescribed in section 131.12(a)(2) of the WQS regulation.

High quality waters are those whose quality exceeds that necessary to protect the section 101(a)(2) goals of the Act, regardless of use designation. All parameters do not need to be better quality than the State's ambient criteria for the water to be deemed a "high-quality water." EPA believes that it is best to apply antidegradation on a parameter-by-parameter basis. Otherwise, there is potential for a large number of waters not to receive antidegradation protection, which is important to attaining the goals of the Clean Water Act to restore and maintain the integrity of the Nation's waters. However, if a State has an official interpretation that differs from this interpretation, EPA will evaluate the State interpretation for conformance with the statutory and regulatory intent of the antidegradation policy. EPA has accepted approaches that do not use a strict pollutant-by-pollutant basis (see Application of Antidegradation Policy to the Niagara River, USEPA, 1989c) (PDF) (2 pp, 145K).

In "high-quality waters," under 131.12(a)(2), before any lowering of water quality occurs, there must be an antidegradation review consisting of:

- a finding that it is necessary to accommodate important economical or social development in the area in which the waters are located (this phrase is intended to convey a general concept regarding what level of social and economic development could be used to justify a change in high-quality waters);
- full satisfaction of all intergovernmental coordination and public participation provisions (the intent here is to ensure that no activity that will cause water quality to decline in existing high-quality waters is undertaken without adequate public review and intergovernmental coordination); and
- assurance that the highest statutory and regulatory requirements for point sources, including new source performance standards, and best management practices for nonpoint source pollutant controls are achieved (this requirement ensures that the limited provision for lowering water quality of high-quality waters down to "fishable/swimmable" levels will not be used to undercut the Clean Water Act requirements for point source and Nonpoint t source pollution control; furthermore, by ensuring compliance with such statutory and regulatory controls, there is less chance that a lowering of water quality will be sought to accommodate new economic and social development).

In addition, water quality may not be lowered to less than the level necessary to fully protect the "fishable/swimmable" uses and other existing uses. This provision is intended to provide relief only in a few extraordinary circumstances where the economic and social need for the activity clearly outweighs the benefit of maintaining water quality above that required for "fishable/swimmable" water, and both cannot be achieved. The burden of demonstration on the individual proposing such activity will be very high. In any case, moreover, the existing use must be maintained and the activity shall not preclude the maintenance of a "fishable/swimmable" level of water quality protection.

The antidegradation review requirements of this provision of the antidegradation policy are triggered by any action that would result in the lowering of water quality in a high-quality water. Such activities as new discharges or expansion of existing facilities would presumably lower water quality and would not be permissible unless the State conducts a review consistent with the previous paragraph. In addition. no permit may be issued, without an antidegradation review. to a discharger to high-quality waters with effluent limits greater than actual current loadings if such loadings will cause a lowering of water quality (see Application of Antidegradation Policy to the Niagara River, USEPA, 1989c) (PDF) (2 pp, 145K).

Antidegradation is not a "no growth" rule and was never designed or intended to be such. It is a policy that allows public decisions to be made on important environmental actions. Where the State intends to provide for development, It may decide under this section, after satisfying the requirements for intergovernmental coordination and public participation, that some lowering of water quality in "high-quality waters" is necessary to accommodate important economic or social development. Any such lower water quality must protect existing uses fully, and the State must assure that the highest statutory and regulatory requirement for all new and existing point sources and all cost-effective and reasonable BMPs for nonpoint source control are being achieved on the water body.

Section 131.l2(a)(2) does not *REQUIRE* a State to establish BMPs for nonpoint sources where such BMP requirements do not exist. We interpret Section 131.12(a)(2) as *REQUIRING* States to adopt an antidegradation policy that includes a provision that will assure that all cost-effective and reasonable BMPs established under State authority are implemented for nonpoint sources before the State authorizes degradation of high quality waters by point sources (see Interpretation of Federal Antidegradation Requirement, USEPA, 1994a) (PDF) (6 pp, 446K).

Section 131.12(a)(2) does not mandate that States establish controls on nonpoint sources. The Act leaves it to the States to determine what, if any, controls on nonpoint sources are needed to provide fix attainment of State water quality standards (See CWA Section 319.) States may adopt enforceable requirements, or voluntary programs to address nonpoint source pollution. Section 40 CFR 131.12(a)(2) does not require that States adopt or implement best management practices for nonpoint sources prior to allowing point source degradation of a high quality water. However, States that have adopted nonpoint source

controls must assure that such controls are properly implemented before authorization is granted to allow point source degradation of water quality.

The rationale behind the antidegradation regulatory statement regarding achievement of statutory requirements for point sources and all cost effective and reasonable BMPs for nonpoint sources is to assure that, in high quality waters, where there arc existing point or nonpoint source control compliance problems, proposed new or expanded point sources are not allowed to contribute additional pollutants that could result in degradation. Where such compliance problems exist, it would be inconsistent with the philosophy of the antidegradation policy to authorize the discharge of additional pollutants in the absence of adequate assurance that any existing compliance problems will be resolved.

EPA's regulation also requires maintenance of high quality waters except where the State finds that degradation is "*necessary* to accommodate important economic and social development in the area in which the waters are located." (40 CFR Part 131.12(a) (Emphasis added)). We believe this phrase should be interpreted to prohibit point source degradation as *unnecessary* to accommodate important economic and social development if it could be partially or completely prevented through implementation of existing State-required BMPs.

EPA believes that its antidegradation policy should be interpreted on a pollutant-by-pollutant and water-body-by-waterbody basis. For example, degradation of a high quality waterbody by a proposed new BOD source prior to implementation of required BMPs on the same waterbody that are related to BOD loading should not be allowed. However, degradation by the new point source of BOD should not be barred solely on the basis that I3MPs unrelated to BOD loadings, or which relate to other waterbodies, have not been implemented.

We recommend that States explain in their antidegradation polices or procedures how, and to what extent, the State will require implementation of otherwise non-enforceable (voluntary) BMPs before allowing point source degradation of high quality waters. EPA understands this recommendation exceeds the Federal requirements discussed in this guidance. For example, nonpoint source management plans being developed under section 319 of the Clean Water Act are likely to identify potential problems and certain voluntary means to correct those problems. The State should consider how these provisions will be implemented in conjunction with the water quality standards program.

Appendix C. Second Draft of the EPA Guidance Doument (17)

Here is the section of the second draft of EPA's guidance document that is related to the PCW rule:

> **V.2. Adoption of Regulatory Provisions to Protect Existing Water Temperature That is Colder Than The Numeric Criteria**
>
> [1] One of the important principles in protecting populations at risk is to first protect the existing high quality habitat and then to restore the degraded habitat that is adjacent to the high quality habitat. Further, EPA WQS regulations recognize the importance of protecting waters that are of higher quality than the criteria (i.e. colder than numeric temperature criteria). EPA, therefore, believes that for ESA-listed salmonids, it is important to have strong regulatory measures to protect waters that are currently colder than EPA's recommended criteria. These waters likely represent the last remaining strongholds for these fish. Because temperatures currently do not meet EPA's recommended summer maximum criteria for many waters in the Pacific Northwest, these high quality, thermally optimal waters are likely vital for their survival and any thermal warming to these waters will likely cause harm. Further, protection of these cold water segments in the upper part of a river basin likely plays a critical role in maintaining temperatures downstream. Therefore, if downstream temperatures are currently exceeding the numeric criteria, any upstream temperature increase will in many cases further contribute to the nonattainment downstream. Lastly, natural summertime temperatures in the Pacific Northwest were spatially diverse with areas of cold-optimal, warm-optimal, and warmer than optimal water. The 20°C criterion described in Table 3 and the natural background provisions and use attainability pathways described in Section VI are included in this guidance to address those waters that are warmer than optimal for salmonids, thus it is also appropriate to have provisions to protect waters that are at the colder end of their optimal range.
>
> [2] Thus, EPA recommends States and Tribes adopt strong regulatory provisions to protect existing water that has summer maximum temperatures colder than the EPA recommended numeric criteria in Table 3. EPA believes there are several ways a State or Tribe may do this. One approach would be to revise the State's or Tribe's antidegradation regulation to explicitly state that measurable summertime temperature increases are generally prohibited in waters with ESA listed salmonids that are currently colder than the summer maximum numeric criteria. A second approach would be a narrative temperature criterion that said the same as above. A third approach would be to identify and establish high quality waters for temperature and establish numeric criteria equal to the current conditions. EPA views this third approach to be complementary to the first two approaches, unless the third approach includes a broad application to all or most of the State's or Tribe's waters that currently have maximum temperatures lower than the numeric criteria.

Appendix D. Section V.2 of the Guidance Document (12) (parsed)

Section V.2 of EPA's Guidance Document, the section relevant to the PCW rule, parsed to highlight statements that could be regarded as the (scientific) basis for the rule; note however, that EPA made no attempt to present evidence supporting these statements.

V.2. Provisions to Protect Water Temperatures That Are Currently Colder Than The Numeric Criteria

[1] **One of the important principles in protecting populations at risk for any species is to first protect the existing high quality habitat** and then to restore the degraded habitat that is adjacent to the high quality habitat. Further, [2] **EPA's WQS regulations recognize the importance of protecting waters that are of higher quality than the criteria (in this case, waters that are colder than numeric temperature criteria). See 40 C.F.R. § 131.12.** EPA, therefore, believes it is important to have strong regulatory measures to protect waters with ESA-listed salmonids that are currently colder than EPA's recommended criteria. [3] **These waters likely represent the last remaining strongholds for these fish.**

Because the temperatures of many waters in the Pacific Northwest are currently higher than the summer maximum criteria recommended in this guidance, [4] **the high quality, thermally optimal waters that do exist are likely vital for the survival of ESA-listed salmonids. Additional warming of these waters will likely cause harm by further limiting the availability of thermally optimal waters.** Further, [5] **protection of these cold water segments in the upper part of a river basin likely plays a critical role in maintaining temperatures downstream. Thus, in situations where downstream temperatures currently exceed numeric criteria, upstream temperature increases to waters currently colder than the criteria may further contribute to the non-attainment downstream**, especially where there are insufficient fully functioning river miles to allow the river to return to equilibrium temperatures (Issue Paper 3). [6] **Lastly, natural summertime temperatures in Pacific Northwest waters were spatially diverse, with areas of cold-optimal, warm-optimal, and warmer than optimal water.** The 18°C and 20°C criterion described in Table 3 and the natural background provisions and use attainability pathways described in Section VI are included in this guidance as suggested ways to address those waters that are warmer than optimal for salmonids. **EPA believes it is important**, however, **for States and Tribes to balance the effects of the warmer waters by adopting provisions to protect waters that are at the colder end of their optimal thermal range**.

EPA, therefore, recommends that States and Tribes adopt strong regulatory provisions to protect waterbodies with ESA-listed salmonids that currently have summer maximum temperatures colder than the State's or Tribe's numeric criteria. EPA believes there are several ways a State or Tribe may do this. One approach could be to adopt a narrative temperature criterion (or alternatively include language in its anti-degradation rules) that explicitly prohibits more than a de minimis increase to summer maximum temperatures in waters with ESA-listed salmonids that are currently colder than the summer maximum numeric criteria. Another approach could be to identify and designate waterbodies as ecologically significant for temperature and either establish site-specific numeric criteria equal to the current temperatures or prohibit temperature increases above a de minimis level in these waters. States and Tribes following this latter approach should conduct a broad survey to identify and designate such waters within the state (or tribal lands). For non-summer periods it may be appropriate to set a maximum allowable increase (e.g., 25% of the difference between the current temperature and the criterion) for waters with ESA-listed salmonids where temperatures are currently lower than the criteria.

[7] **Provisions to protect waters currently colder than numeric criteria can also be important to ensure numeric criteria protect salmonid uses.** As discussed in Section V.1.A, the recommended criteria in this guidance are based in part on the assumption that meeting the criteria at the lowest downstream point at which the use is designated will likely result in cooler waters upstream. Cold water protection provisions as described here provide more certainty that this will be true. Further, if a State chooses to protect some or all of the sensitive uses in Table 4 (e.g., spawning) by using only the summer maximum criteria, [8] **it may also be necessary to protect waters currently colder than the summer maximum numeric criteria in order to assure that these sensitive uses are protected**. Further, as described in Section V.1.B, [9] **protecting existing cold water is likely important in river reaches where a 20°C numeric criterion applies to protect salmon and trout migration use**.

Appendix E. DEQ Temperature Standard Implementation (25)

This appendix (next page) contains Section 3.7, "Cold Water Protection Criterion – Summer" of DEQ's guidance manual for Temperature Standard Implementation (25). Page numbers 32-37 from the original document are retained.

Section 3.7 Cold Water Protection Criterion – Summer

Purpose

The purpose of the summer cold water protection criterion is to limit human warming of streams that currently stay cold throughout the summer and contain salmon, steelhead or bull trout. Protecting a range of cold water habitats is important for temperature sensitive fish and other cold water biota. In addition, because added heat is transported downstream, limiting the warming of upper cold water reaches will, under some conditions, reduce the amount of habitat downstream that exceeds the criteria. This provision is intended to prevent or minimize degradation of high quality streams.

Rule Language

OAR 340-041-0028 (11)
(a) Except as described in subsection (c) of this rule, waters of the State that have summer seven-day-average maximum **ambient** temperatures that are colder than the biologically based criteria in section (4) of this rule, may not be warmed by more than 0.3 degrees Celsius (0.5 degrees Fahrenheit) above the colder water ambient temperature. This provision applies to all sources taken together at the point of maximum impact where salmon, steelhead or bull trout are present….
(c) The cold water protection narrative criteria in subsection (a) does not apply if:

(A) There are no threatened or endangered salmonids currently inhabiting the water body;
(B) The water body has not been designated as critical habitat; and
(C) The colder water is not necessary to ensure that downstream temperatures achieve and maintain compliance with the applicable temperature criteria.

Policy

New sources and activities, cumulatively, may not warm the temperature of high quality cold water reaches (those that stay below the numeric criteria all summer) by more than 0.3 °C above the current ambient summer maximum temperature, with the exceptions shown in the rule language above and described below.

Definitions

For the purpose of implementing this criterion:
The "summer seven-day average maximum" temperature means the 7dAM temperature for the warmest 7-day period during the summer, or the maximum seven day average maximum for the water body or reach.

"Summer" means June 1 to September 30. [OAR 340-041-0002 (61)]

"Ambient stream temperature" means the instream temperature measured at a specified time and place.

New sources and activities means new or increased loads after the adoption of this criterion (December, 2003).

Point of maximum impact means the location(s) on a water body, or on a downstream water body, at which the greatest increase in temperature caused by human sources/activities occurs.

Human sources or activities may directly or indirectly affect stream temperature. They include point source discharges, streamside vegetation removal, channel morphology alteration, streamflow alteration, stream impoundment and more.

Application

This rule applies to waters:

- That currently remain colder than the biologically based numeric criteria in section (4) throughout the summer (the maximum 7dAM during the summer is less than or equal to the applicable numeric criterion),
- Where salmon, steelhead or bull trout are present, and
- Not designated for salmon and steelhead spawning use. For spawning waters, the numeric spawning criterion and the cold water protection criterion for spawning apply [OAR 340-041-028 (11) (b)]. See next section.

Single source

As of the effective date of this rule (December 2003), if a single new source or activity increases the temperature of the stream more than 0.3 °C above the upstream ambient stream temperature or above the ambient temperature prior to the activity, the criterion is exceeded.

If a single source requests a new or increased load prior to DEQ's ability to do a cumulative impact analysis, that source will be limited to an increase of 0.3 °C with 25% of the 7Q10 low flow for dilution or at the edge of their RMZ, whichever is more restrictive. This approach is consistent with the application of the human use allowance prior to a cumulative effects analysis. If a cumulative impacts analysis is completed and all sources and activities are considered, 100% of the 7Q10 flow may be used to calculate the allowed total cumulative increase.

Cumulative impacts

As of the effective date of this rule (December, 2003), if multiple new sources and activities together cause the temperature of the stream to increase more than 0.3 °C above the upstream ambient temperature or above the ambient stream temperature prior to the activity, the criterion is exceeded.

Exceptions

This provision applies unless all three following circumstances are true :

1. No federally listed T&E salmon, trout, steelhead or bull trout species currently inhabit the water body(ies) affected by the discharge or activity,
2. The water body(ies) affected by the discharge/activity is(are) not federally designated "critical habitat" for a cold water aquatic species under the Endangered Species Act (ESA), and
3. The cold water is not necessary to ensure that downstream reaches achieve and maintain compliance with the temperature criteria.

Federal critical habitat information should be available from the US Fish and Wildlife Service (http://pacific.fws.gov/) and the National Marine Fisheries Service (http://www.nwr.noaa.gov/) ESA websites.

One way to determine that the 3rd requirement above is met is to show that the stream reach that was warmed by human activity has returned to the expected or monitored pre-activity temperature upstream of any reach that exceeds the criteria. For example, in the illustration shown in Figure 3-1, p. 37, the relationship between the difference in temperature from site 1 to site 6 (T_6-T_1) and the difference in temperature from site 5 to site 6 (T_6-T_5) should be the same after the activity as they were prior to the activity. This could occur due to nighttime cooling if the travel time allows the water to go through a full diel cycle, hyporheic influences that cool the water, groundwater inflow that mixes with the stream to cool it, or a combination of the above that make the heat load from the activity undetectable or un-measurable by the time the water reaches site 6.

A second way to determine whether this provision is met is to do a reach model to determine how far downstream the thermal increase caused by the new discharge/activities will continue to affect stream temperature. If the point along the stream at which the temperature affect of the activity is no longer detected is upstream of where the temperature criteria are exceeded, this requirement is met. Likewise, if the effect of the activity extends downstream to stream miles that do exceed the criteria, but the exceedence would occur without the impact of the activities in question and are not exacerbated by it, then this requirement is also met. If however, the model determines that additional stream miles will exceed the criteria due to the new activities, this requirement is not met and the increase is limited to 0.3 °C.

Measurement methods

The temperature metric monitored and compared to the numeric criteria is the 7-day average of the daily maximum stream temperature. Likewise, a 0.3 °C increase refers to a 7-day average increase above the numeric criteria.

The best monitoring method for determining compliance will depend on the site specific circumstances. The monitoring options include:

- temperature monitoring above and below the activity and before and after the activity if possible (see Figure 3-1, p. 37);
- a paired watershed study;
- temperature modeling of the area of concern.

See the document ODEQ Procedural Guidance for Water Temperature, 18 September 1996 on temperature monitoring methods for additional information. This document is available from DEQ.

Factors that determine monitoring method

Some of the factors that may help determine the most appropriate monitoring method include:

- whether there are one or multiple new human activities potentially affecting the temperature of the cold water reach;
- whether the activity is on or upstream of the stream reach containing salmon, steelhead or bull trout;
- how far above the fish bearing stream the activity will occur; and
- whether the activity will be ongoing or recurring (i.e. a new road, development or grazing allotment), versus a one time or infrequent activity (logging).

Application Issues

When monitoring is done to determine whether a nonpoint source activity has caused an increase in stream temperature greater than that allowed by the cold water protection criterion, the activity has already occurred. In this situation, the impact has already occurred or is ongoing. Monitoring information on the thermal impacts of nonpoint source activity is used to develop management practices rather than to regulate each individual activity. Management practices should be designed to prevent impacts from occurring in other similar situations or to discontinue ongoing impacts, such as repeated vegetation removal, in order to allow recovery of the stream and meet the limited temperature increase allowed by the criterion.

For a point source discharge, data and analysis demonstrating the ability of the source to comply with the criterion is required prior to receiving a permit.

Example – Application to permitted point source

An existing fish hatchery, small municipal discharge, or other NPDES permitted facility discharges into a small stream named Freezing Creek. Temperature data from Freezing Creek just above the discharge shows that the maximum 7dAM water temperature during the summer season is 14 °C. The use is core cold water habitat and there are listed salmon that rear here. Therefore, the numeric criterion is 16 °C and the cold water protection narrative applies. The facility increases the temperature of the stream 1 °C to 15 °C below the discharge after mixing. Renewal of the permit at the existing thermal load is allowed. If the facility wants to expand and increase their thermal load, however, the additional load may not increase the temperature of Freezing Creek below the discharge to more than 15.3 °C.

If a new fish hatchery or other permitted discharge wishes to locate on Freezing Creek, the source may not increase the existing ambient temperature prior to its new discharge, which is 14 °C in this example, by more than 0.3 °C after mixing.

Example – Monitoring a non point source activity

In the illustration below (Figure 3-1), Bear Creek and Deer Creek stay below the applicable criteria all summer and are thus subject to the cold water protection narrative criterion. If Bear Creek is fish bearing and the shaded square represents a logging site, monitoring should be done at sites #1 and 2 prior to, during and following logging. Monitoring should be done during the critical warm period (i.e. July to September) prior to logging and during the same time period the summer after logging. If the temperature increase between sites 1 and 2 following logging is 0.3 °C greater than the temperature increase between sites 1 and 2 prior to logging, the summer cold water protection criterion has not been met. If pre-logging data is not available, or to eliminated the effects if interannual climate variation, the difference in temperature between sites 1 and 2 may also be compared to the difference in temperature between sites 5 and 3 to determine whether the logging activity is causing more than the allowed increase.

If Bear Creek is not a fish bearing stream, but Deer Creek is, the monitoring should be conducted at sites #3 and 4 to determine compliance with the criterion. If an additional logging site or human activity that could potentially warm the stream occurs on Deer Creek, the upstream monitoring site should be placed above both the activity and the non fish-bearing tributary (site #5). Depending on the distance between the sites and the stream characteristics, it is possible that the only way to determine the impact of the activities is with a local reach model or paired watershed monitoring approach.

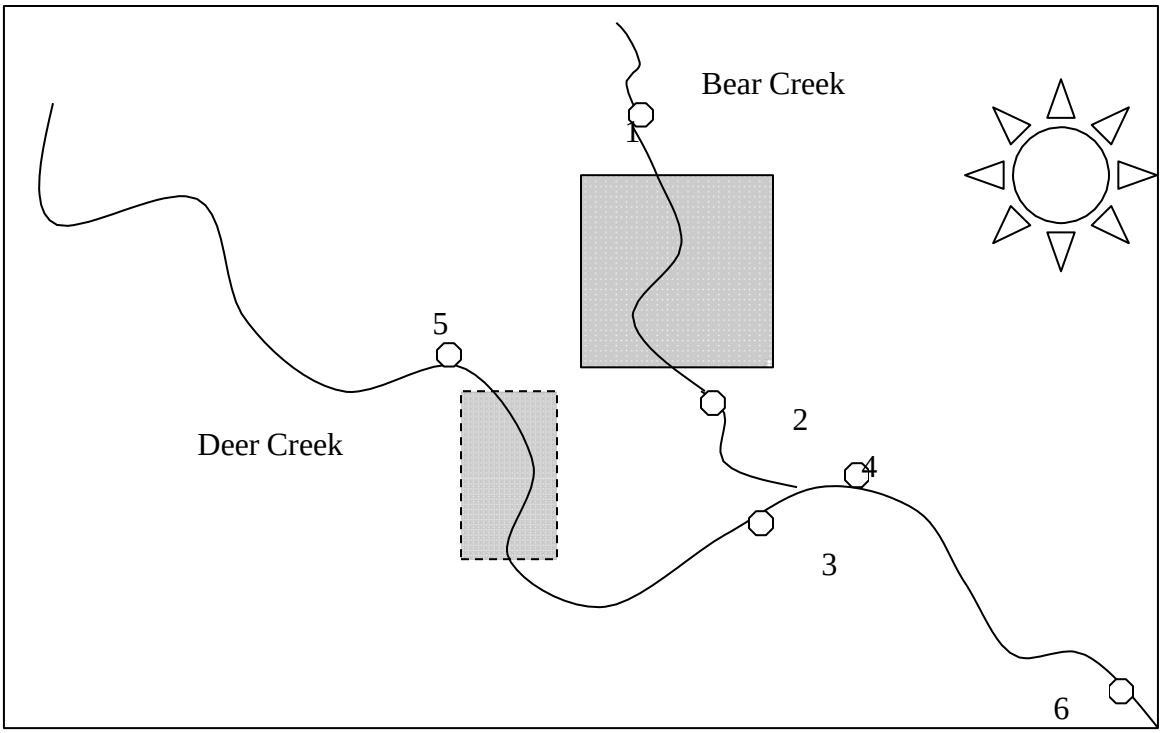

Figure 3-1: Example of Monitoring for Summer Cold Water Protection Criterion