WAC 173-201A
Surface Water Quality Standards
for the State of Washington

Cost Benefit Analysis

June 2003

Executive Summary

The Department of Ecology has determined that the probable benefits of the amendments to the surface water quality standards (WAC 173-201A) exceed the probable costs. The analysis indicates that the benefits may exceed the costs at a ratio of more than 4 to 1.

This document provides a summary of the analysis and the background information that was used in making the determination. The analysis evaluates the shifts from the existing standards to the amended standards.

Where possible Ecology has tried to quantify benefits and costs in a conservative way, in that the calculations and assumptions are biased against the rule. Where uncertainty surrounds quantitative estimates of costs and benefits the paper provides qualitative information to help determine whether overall benefits or costs will accrue.

The estimated effect of the rule amendment, accrued over 20 years, is a net benefit of approximately $100 million. This benefit results largely from increases in fish populations, and does not include unquantified benefits that will occur as a result of the amendment. Other unquantified costs are not included in the estimate.

Section 1. Introduction

The Washington Administrative Procedures Act, RCW 34.05.328(1)(c) requires that an agency determine that the probable benefits of rule amendments are greater than its probable costs before adoption of a rule. The agency must take into account both qualitative and quantitative benefits and costs and the specific directives of the statute being implemented.

Background

Intent and Statutory Authority

The state's surface water quality standards set limits on pollution in our lakes, rivers and marine waters in order to protect beneficial uses, such as swimming and aquatic life. Both state and federal law require that clean water be maintained to provide benefits to the public. The dollar figures for many of these benefits can be quantified. The dollar figures of some others are often unquantifiable, or quantified only with great difficulty, including important benefits such as propagation and protection of wild life, birds, game, fish and other aquatic life, which are all components of a balanced and healthy ecosystem. The beneficial uses of surface waters are protected by the state's water quality standards: WAC 173-201A. The federal Clean Water Act requires states to review and revise as necessary their water quality standards every three years. The majority of changes in the amended rule have been analyzed and discussed with stakeholders over the past ten years.

FEDERAL REQUIREMENT

Clean Water Act 303(c) (2)(A) states:
"…Such standards shall be such as to protect the public health or welfare, enhance the quality of the water and serve the purposes of this Chapter. Such standards shall be established taking into consideration their use and value for public water supplies, propagation of fish and wildlife, recreational purposes and agricultural, industrial and other purposes and also taking into consideration their use and value for navigation.

In addition to the federal requirements the Department of Ecology is required under State Statute to "retain and secure high quality waters".

WASHINGTON STATUTORY REQUIREMENTS:

WATER POLLUTION CONTROL ACT

90.48.010 Policy enunciated.
It is declared to be the public policy of the state of Washington to maintain the highest possible standards to insure the purity of all waters of the state consistent with public health and public enjoyment thereof, the propagation and protection of wild life, birds, game, fish and other aquatic life, and the industrial development of the state, and to that end require the use of all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the state of Washington. Consistent with this policy, the state of Washington will exercise its powers, as fully and as effectively as possible, to retain and secure high quality for all waters of the state. The state of Washington in recognition of the federal government's interest in the quality of the navigable waters of the United States, of which certain portions thereof are within the jurisdictional limits of this state, proclaims a public policy of working cooperatively with the federal government in a joint effort to extinguish the sources of water quality degradation, while at the same time preserving and vigorously exercising state powers to insure that present and future standards of water quality within the state shall be determined by the citizenry, through and by the efforts of state government, of the state of Washington.

90.48.035 Rule-making authority.
The department shall have the authority to, and shall promulgate, amend, or rescind such rules and regulations as it shall deem necessary to carry out the provisions of this chapter, including but not limited to rules and regulations relating to standards of quality for waters of the state and for substances discharged therein in order to maintain the highest possible standards of all waters of the state in accordance with the public policy as declared in RCW 90.48.010.

90.48.260 Federal Clean Water Act – Department designated as state agency, authority – Powers, duties and functions.

> The department of ecology is hereby designated as the State Waste Pollution Control Agency for all purposes of the federal clean water act as it exists on February 4, 1987, and is herby authorized to participate fully in the programs of the act. . .

WATER RESOURCES ACT OF 1971

> **RCW 90.54.020 General declaration of fundamentals for utilization and management of waters of the state.**
> (b) Waters of the state shall be of high quality. Regardless of the quality of the waters of the state, all wastes and other materials and substances proposed for entry into said waters shall be provided with all known, available, and reasonable methods of treatment prior to entry. Notwithstanding that standards of quality established for the waters of the state would not be violated, wastes and other materials and substances shall not be allowed to enter such waters which will reduce the existing quality thereof, except in those situations where it is clear that overriding considerations of the public interest will be served.

After a lengthy public process, several important changes to the state's water quality standards are being made. The changes are based on new science, public feedback at statewide workshops, special work sessions, and new water quality data.

Rule Changes

The rule amendment to WAC 173-201A includes major changes in the following areas:

Antidegradation		
Existing Rule	Amended Rule	Rationale
The existing policy does not contain implementation details. All activities that could impact waters are covered.	Tier II – Entities wanting to discharge to high quality waters must undergo an alternatives analysis and show they are in the overriding public interest. However, only activities with a measurable effect on water quality and only certain activities (i.e. NPDES permits, 401 certifications) would have to go through this "Tier II analysis." Tier III – To be designated for the non-degradation status of an outstanding resource water, a water must meet certain eligibility requirements, which includes scientific, economic, and social factors. Also, a new subsection was added to Tier III allowing a water to either be placed in a non-degradation status or a de minimus degradation-only status.	The final language contains important implementation details – making it fair and consistent. By limiting the activities required to undergo a Tier II analysis, resources can be focused on larger issues. The final rule has a mechanism to protect waters at a very high level, without requiring an absolute non-degradation status.
Temperature		
Existing Rule	Amended Rule	Rationale
Char: There are no criteria designed to protect char, which need very cold water. Currently, most of these waters are Class AA (16ºC daily maximum criterion), and a few are Class A (18ºC daily maximum criterion	Char: 12ºC 7-DADM[1] applied year-round. When determined necessary by the department, a 9ºC 7-DADM criterion for spawning and incubation also applies.	The EPA regional temperature project strongly recommended the 12ºC and 9ºC criteria to protect char. In some waters, a 9ºC criterion would be necessary to protect spawning.
Salmon: 16ºC (daily maximum) for Class AA streams and 18ºC (daily maximum) for Class A streams. Both criteria are designed to protect spawning and rearing, and both apply year-round.	Salmon: 16ºC 7-DADM in "core" areas (former Class AA waters) and 17.5ºC 7-DADM in "non-core" areas (former Class A waters). When determined necessary by the department, a 13ºC 7-DADM for spawning and incubation also applies.	The EPA regional temperature project used "core" and "non-core" terminology, and it also contained the 13ºC criteria. In some waters, a 13ºC criterion would be necessary to protect spawning. Not all waters require 16ºC, so a 17.5ºC criterion was added for "non-core" waters.
Salmon Rearing Only (no spawning): 21ºC (daily maximum) for Class B streams	Salmon Rearing Only: 17.5ºC 7-DADM.	Waters used only for salmon rearing do not have to be as cold as water used for salmon spawning.
Redband Trout and Warm Water Fish: There are no criteria designed to protect redband trout	Redband Trout: 18ºC 7-DADM Warm Water Fish: 20ºC 7-DADM	Waters used by redband trout or warm water fish do not have to be as cold as water used for salmon.

or warm water fish. These fish are protected by one of the other criteria: 16ºC (Class AA), 18ºC (Class A), or 21ºC (Class B). All criteria are daily maximum temperatures	Note: During this rule-making, no waters would be assigned to these criteria. Future rule-makings would be necessary before these criteria are applied.	
Marine Bacteria Standards		
Existing Rule	Amended Rule	Rationale
Shellfish Harvesting and Primary Contact: 14 cfu/100mL (Class AA & A) Secondary Contact: 100 cfu/100mL (Class B) and 200 cfu/100mL (Class C)	Shellfish Harvesting and Primary Contact: fecal coliform at 14 cfu/100mL Secondary Contact: enterococci at 70 cfu/100mL	

(1) 7-DADM is the seven-day average of the daily maximum temperatures. For an average water body with continuous temperature monitoring, the 7-DADM is about 1°C lower than the daily maximum

In addition to the major changes outlined above, the rule also contains amendments to the ammonia criteria for freshwater, it was reorganized and rewritten to provide better usability and understandability, and was reorganized in a use-based format to provide more understandability and flexibility. These smaller changes are addressed within the text of this report.

The major rule amendments for temperature, antidegradation, and bacteria are addressed specifically in the cost benefit analysis below.

Section 2: Cost Benefit Analysis

The Department of Ecology (Ecology) has made determinations regarding the probable net benefits of several parts of the amendments to WAC 173-201A Surface Water Quality Standards. Ecology reviewed the proposed amendments to the following sets of requirements which are inextricably linked together: Temperature, Antidegradation, and Bacteria.

- The probable benefits of the Temperature Standards exceed the probable costs due to expected shifts in fish populations. See the section *Cost Benefit Analysis for Temperature Standards.*

- Antidegredation is believed to reduce costs and improve the flexibility of the economy with respect to preserving water quality. Several of the components are described below in *How the Rule Amendment Promotes an Adaptive Economy* and the *Cost Benefit Analysis for Antidegradation.*

- The bacterial amendments result in a net cost. See the section *Cost Benefit Analysis for Bacterial Standards.* In this case Ecology is weighing the net costs of the bacteria amendments against the remaining benefits of the rule. The benefits of the total rule far outweigh the costs of the bacteria amendments.

Potential benefits of the rule amendment accrued over a 20-year time period, and compared to the existing rule, are summarized in the table below.

Rule change	Potential Benefits	Benefit over 20-years	Effects
Temperature criteria: addition of more restrictive spawning criteria in approximately 14% of freshwaters statewide	Increases in salmon and trout populations	Estimated: $129 million.	Will increase benefit
Temperature criteria: less restrictive temperature requirements in approximately 86% of freshwaters statewide.	Fewer agricultural best management practices needed	Not quantified	Will increase benefit
	Fewer or postponed cooling requirements for point source dischargers	Not quantified	Will increase benefit
	Possible reductions in permit costs	Not quantified	Will increase benefit
Bacteria criteria: addition of enterococci as a marine indicator in Class B and C waters	More reliable assessment of potential for illnesses from marine recreational activities	Not quantified	Will increase benefit
Explicit and limited antidegradation requirements	Fewer actions required to conduct Tier II analysis	Not quantified	Will increase benefit

Potential costs of the rule amendment accrued over a 20-year time period, and compared to the existing rule, are summarized in the table below.

Rule change	Potential Costs	Cost over 20-years	Effects
Temperature criteria: addition of more restrictive spawning criteria in approximately 14% of freshwaters statewide.	Increase agricultural best management practices needed for streamside land converted to agriculture through state or county programs (only in areas not already covered by local programs)	Estimated: $1 million, represents an underestimation of costs, not based on these agricultural lands already meeting existing Water quality standards, moderate certainty	Will increase costs
	Increased permit costs	Estimated: $27 million, high potential variance	Will increase costs
	Greater risk of third party lawsuits	Not quantified	Might increase costs
Temperature criteria: less restrictive temperature requirements in approximately 86% of freshwaters statewide.	Reduced quality of overall aquatic life habitat	Not quantified	Will increase costs
Bacteria criteria: addition of enterococci as a marine indicator in Class B and C waters	Increased monitoring costs for point sources and ambient monitoring.	Permit costs: $69,000 Ambient Monitoring: $229,000	Will increase costs
	Increased risk of Illness	$863,000	Will increase costs

Costs to Sectors

The proposed amendments are expected to have an impact on point source permits and agriculture, but not on forest practices or stormwater.

Point Sources: The proposed rule will affect permitted point source facilities and local county governments in a few places. Impacts to these groups are evaluated in the sections: *"Cost Benefit Analysis for Bacterial Standards,"* and *"Cost Benefit Analysis for Temperature Standards."*

Agriculture: Agricultural practices also affect water quality. These practices have broad guidance and use of best management practices is expected to increase compliance with the new standards. Ecology received substantial commentary on the impacts of the rule change for agriculture and has included an evaluation of that potential within the section

called, "*Cost Benefit Analysis for Temperature Standards*" in the sub-section called "*Agriculture*."

Stormwater: Business related stormwater may also affect water quality. Ecology's expectation is that the proposed changes to the standard will not require any substantive changes in currently accepted stormwater practices because current practices represent the best available methods for managing urban stormwater.[1]

Forest practices: Forestry activities are covered under the Forest and Fish rules. The rule amendment will not require any substantive changes in the current Forest Practices Rules (see Appendix A). One commenter indicated: *"…one benefit of the proposed WQS for temperature should be more accurate identification of areas where the forest practices rules do and do not provide suitable thermal conditions for various fish species. In most if not all cases, we believe the current forest practices rules will provide sufficient shade for forested stream segments to avoid anthropogenic temperature increases harmful to salmonid fish or other beneficial uses. Before any additional regulatory requirements are imposed, there should be clear understandings on which water segments are not achieving those goals, why they are not, and what practical measures could be taken to better achieve those goals."* The final rule makes a significant adjustment in this direction by allowing some waters to become warmer and requiring cooler waters where the spawning occurs.

Section 3. Factors Affecting the Analysis

General Information

Many factors affect the estimates contained in this economic analysis. Some of the factors are decisions made by Ecology as the analysis was carried out, while others are the result of situations outside the control of Ecology. Some of the factors are briefly summarized below, and explained in more detail in Appendix B. Other factors affecting the analysis are described within the body of the report.

Some factors affected how quantification was done:

- A qualitative understanding of how the rule may work in the economy and the environment was used as a basis for modeling.
- The best available data was used.
- Conservative estimates were used in the analysis, where possible. This means that many of the selected values have a bias against the changes in the rule. Where this was not possible this is stated in the area where the number was used.
- Costs and benefits in this analysis are accrued over a 20-year time period.

Some factors were not quantified:

- An adaptive economy
- People and cultures value water quality in different ways. Sometimes water quality cannot be valued by individuals or groups because people feel so strongly about the issue that they will not talk with a researcher about it. The quality being valued is priceless to

[1] Bill Moore, Environmental Engineer, Water Quality Program, Department of Ecology.

the group or person being questioned, as in the case of clean water and tribal culture in the Pacific Northwest (e.g., tribal values for water quality, discussed in Appendix B).

- Rule clarity: The rule was amended using language and organization that will make it easier to use and understand. The change to use-based standards will make the standards less complicated and make future use-modifications easier from an organizational standpoint.
- Neutral Changes: The rule amendment includes neutral changes that do not necessarily result in costs or benefits. This includes many of the features in the antidegradation amendments.
- Extinction Risk: This rule is assumed to have no impact on the risk of extinction of species in Washington.
- Benefits to fish and aquatic life other than salmonids.

Amendment moves toward allowing an adaptive economy

This amendment in the standards allows a more adaptive economy by removing unnecessary encumbrances on flexibility. This is probably the most important unquantified benefit. One of the important shifts made by the amended rule is that it tends to improve the long term ability to make innovative choices and adapt. This is an important shift in approach to regulation and cost control.

An economy is an adaptive system, and future adaptations are inherently hard to foresee. Faced with a new situation, people on the ground come up with solutions that no expert can see in advance. This means that when we predict the cost of a restriction on the economy (like a regulation), we are likely to overestimate the cost.[2]

Further, this proposed rule amendment has criteria which are more flexible than permits, which for example, might require a specific technology to be used to reduce contamination. Where innovation is permitted and encouraged, such as the water quality offsets allowed with the new rule language for antidegradation,[3] real costs can be far lower than the expected costs. For example, EPA has estimated that significant cost reductions would occur as a result of a flexible approach to TMDLs:

> "The National Cost to Implement Total Maximum Daily Loads (TMDLs) Draft Report estimates that flexible approaches to improving water quality could save $900 million dollars annually compared to the least flexible approach (EPA, August 2001). Nitrogen trading among publicly owned treatment works in Connecticut that discharge into Long

[2] This is not an abstract idea, but is historically based, as illustrated by the predictions of regional losses in response to revised forest provisions. Predictions that reduced tree harvests would cripple the region's economy were followed by a decade of fast regional economic growth – along with reductions in harvest. There were large losses. Some communities have suffered very substantial losses. Some individuals lost both their current jobs and their retirement incomes, just months before retirement. Some people lost jobs they loved. This included deep personal losses (including abuse and possibly mortality), high unemployment in some towns, as well as well as sizeable property and capital losses. However, the economy responded creatively and, as a whole, did well.

[3] WAC 173-201A-450

> Island Sound is expected to achieve the required reductions under a TMDL while saving over $200 million dollars in control costs."[4]

Also, for example, when the Clean Air Act was passed, industry argued that the cost per annual ton year of sulfur dioxide reductions would be approximately $5,000. EPA expected costs of $2,500 per annual ton year. The $2,500 per annual ton year became the sale price for new emissions in a trading program designed by EPA. The Chicago Board of Trade now provides for sales of sulfur dioxide emissions rights by either EPA or private parties. The prices of the private trades at the Chicago Board of Trade are an order of magnitude less than these early expected costs per ton year. In 2003 the market clearing price for current year emissions was $171.80. The market clearing price for seven year advance bids was $80.[5]

It is reasonable to assume that meeting the proposed new standards will require changes in how some economic activities are carried out, that some of those changes will be costly, and that these costs will be unevenly distributed even within the particular sectors affected. However, it is also reasonable to bear in mind that prospective estimates of this type are likely to overstate the truth.

Growth areas are unpredictable and the use of AKART[6] allows companies to shift and encourages innovation and diffusion. Every few years, new technology or new methods stimulate a new area of enterprise. This benefit cost analysis is a snapshot at a point in time, and reflects the economy and prices as of this writing. The costs and benefits shift with changes in the direction of growth in business areas. For example, granulated media filters are currently a dominant technology. But membrane filters, which are expected to be less expensive and just as effective, are being introduced rapidly.[7]

There are two fundamentally different views of what makes an economy prosper. In the older view, the key to wealth is the extraction of resources from the environment at the lowest expenditure in human labor and human-made capital. Anything that makes this extraction more expensive hobbles the economy.

There is an emerging view in which economic prosperity is a process and a set of skills, rather than a collection of things or a specific level of agricultural harvests. People still have to eat food and heat their houses, so physical resources are necessary, but society can do these things in many ways. More importantly, unimpeded access to natural resources is not sufficient for prosperity. All the natural resources under the sun will not create prosperity where a society is not structured to make efficient use of the resources extracted. Intangibles such as the habit of innovating and networks of economic agents can create wealth on a small natural-resource base, while abundant resources will lie fallow without these social structures to use them well. The fact that the price of fish has fallen at the same time as the catch has dropped **(see section** "*Cost*

[4] Quote from http://www.epa.gov/owow/watershed/trading/finalpolicy2003.html downloaded 3/20/2003.
[5] EPA, http://www.epa.gov/airmarkets/auctions/2003/03spotbids.html, http://www.epa.gov/airmarkets/auctions/2003/09advbids.html
[6] All Known And Reasonable Technology
[7] One company which had a website on its granulated filter was questioned about costs and responded that they had just shifted to a membrane filter.

Benefit Analysis for Temperature Standards") is an indication of the power of an economy to adjust to a massive shift in the availability of a renewable asset through imports and aquaculture.

This has an implication for the economic impact of the amended rule. In the real world there would be levels of protection that are obviously too weak (e.g. no requirements), and levels that are obviously too stringent (e.g. no discharges). But there is a relatively wide zone within which the exact level of regulation is less important than the way in which the regulation is structured. A prescriptive rule would tell industries and farms exactly what technologies to use, under the assumption that this would accomplish a specific environmental outcome. It would also be a much easier rule on which to perform a benefit-cost analysis, because the cost-incurring actions would be spelled out in the rule, rather than having to be inferred. The technologies specified may not be the least-cost path to the desired outcome, and the specification itself stifles economic creativity, or channels it into the search for ways around the rule. The incentive for innovation and adaptation is hobbled, and the economy may be crippled in ways more far-reaching than merely the obvious matter of making access to natural resources more expensive.

This amended rule is an outcome-based rule in contrast to a prescriptive rule. It focuses on actual uses of the water, and it leaves the exact methods of compliance up to the individual regulated entities. For example a company may choose to use a water tower to cool water or to do stream restoration that provides shade and cooling. While there may be some increase in the cost of access to natural resources, the more important economic asset – people's ability to adapt and find innovative solutions – is unaffected.

All that being said, it is still possible that an economic analysis will overlook costs. If water bills go up, for example, low income people may cut back on their use of water in ways that those with sufficient income would never consider.

Why quantifying environmental quality is difficult

Placing dollar figures on the costs and benefits of environmental protection is often difficult for reasons outlined below.

Given the existing regulatory structure in the United States, our water is well protected in comparison to many other parts of the world. In Washington the benefits and costs are less dramatic and costs and benefits are often institutionalized and therefore harder to quantify.

Humans and animals are dependent on the environment for sustenance, such as for the air we breathe and the water we drink. Quantifying subsets of that environment, and then placing an even more specific dollar value on that subset based on its relative quality is not an easy task. This analysis is only based on monitorable shifts rather than generating a complete picture of the total value accruing to the changes. For example:

- Cooler waters would generate population increases for Char. However, we don't have monitoring data that will allow Ecology to build an "average stock impact" model, like the work done for salmon. Thus these values are not counted.

Benefit estimation

In general, the benefits that are derived from maintaining the quality of the environment are undervalued. Reasons this can occur include:

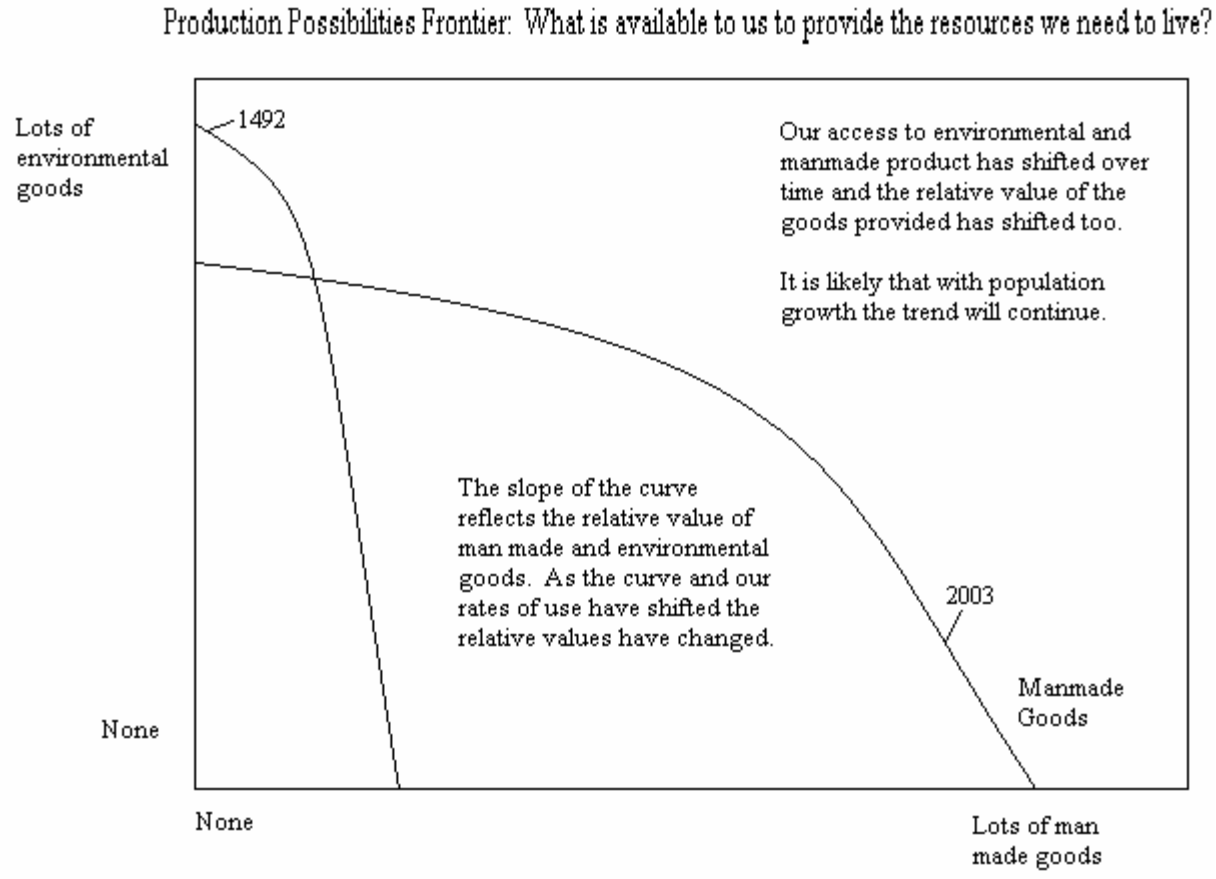
- the inability to predict what will occur in the future;
- incomplete data about the current environmental system being examined; and
- increasing population and wealth tends to increase demand for environmental benefits, but also increase demands on the environment itself in order to maintain the population and increased wealth.

Lack of knowledge about the future is a critical reason for undervaluing environmental qualities. Inability to predict future public needs means we cannot calculate the future benefits from specific environmental factors. For instance, forty years ago a valuation of the benefits of protecting rainforests might have focused on sustainable harvest (for food) of plants and animals associated with specific forest environments. With the advent of genetic engineering and an upsurge in interest in plant-based chemicals for pharmaceutical use, a present-day effort to place value on the benefits of rainforest would include this new potential benefit.

The effects of the loss of a species are also difficult to value prior to the loss. Sometimes we do not value things until it is too late. The passenger pigeon was sold in New York right up to the time it went extinct and the price never wavered because there were so many substitutes. However, when the last one died it created a sense of outrage that drove a wide variety of environmental and hunting reforms.

Incomplete data about the specific environmental system being examined is another reason environmental qualities might be undervalued. For example, in studies of salmonids over the past decade information about the role they play as nutrients to the watershed around their spawning areas has been documented. Nutrient transfer occurs when wild animals remove salmon carcasses from the river after spawning. The nutrients from these carcasses are transferred up into the watershed either as direct remains of the carcasses or in fecal matter from the animals ingesting the carcasses.[8] The nutrients from salmon help support the forests and the associated animal life in the areas adjacent to spawning streams. Additionally, the nutrients brought into the system by the fish help support animals and plants that people do not traditionally use but are necessary for the system to function. Even if these organisms are identified, they may be undervalued because their roles are not recognized. In both of these ways incomplete scientific knowledge of environmental systems limits the ability to examine all the potential benefits associated with a specific environmental factor.

[8] Naiman RJ, Bilby RE, Schindler DE, Helfield JM. 2002. Pacific salmon, nutrients, and the dynamics of freshwater and riparian ecosystems. Ecosystems, 5:399-417. Bilby RE, Fransen BR, Bisson PA, Walter JK. 1998. Response of juvenile coho salmon (Oncorhynchus kisutch) and steelhead (O. mykiss) to the addition of salmon carcasses to two streams in southwestern Washington, U.S.A. Can J Fish Aquat Sci 55:1908-18.



Another way that inability to know the future hampers economic analysis has to do with the relative rarity of resources. In the past there were lots of environmental resources and very few man made goods. People were willing to trade off lots of environmental goods for a man made one (see the slope of the line in the graph as the rate of trading off environmental and man made goods). In the future, as environmental resources become scarcer relative to the size of the population and other man made products (such as TVs) become less scarce, people might be willing to trade off more man made goods to maintain environmental resources. This will be reflected in a higher "willingness to pay." This has already been happening to some extent, for example recycling replaces mined product, people vote for local revenues for waste water treatment and support environmental legislation.

Why quantifying costs is difficult

Sometimes the cost of environmental protection can be overestimated or underestimated. This is generally a result of the following factors:

- Technology available to polluters may change and reduce costs. (cost over estimated)
- The assimilative capacity of the environment may be exceeded. (cost unrecognized)
- Hidden costs of economic adjustments due to shifts in competitive equilibrium, such as premature scrapping of facilities, under-utilization of infrastructure, concentrating growth in areas that obtain competitive advantages, meeting consumer demand with more

distant production, increasing transportation costs and adverse environmental impacts associated with longer transportation distances, reducing competition by shifting economies of scale. (costs under estimated)

- Indirect social costs, including increased physical and mental health care needs, alcohol and drug related social problems, etc. associated with pockets of unemployment and economic declines. When a company lays someone off, the individual sometimes loses more than simple income, including daycare, retirement fund participation, and medical benefits. Each of these creates side issues that may be uncounted. (costs under estimated)
- Unexpected results. (costs either over or under estimated)Some results may be unexpected. For example, Ecology did not expect counties to react to the bacteria portion of the rule by proposing to test for two indicators rather than substituting one for the other. Given the movement of water, they have logical reasons for complying in this way. Ecology was also unaware that come companies and counties are already doing both tests for other reasons. These types of factors can lead to costs being over or underestimated. This is especially difficult if a technology is rarely used.

Section 4. Cost Benefit Analysis for Antidegradation

The antidegradation section of the rule [Part III 173-201A-300 through 330] has been rewritten to describe how the antidegradation section will be implemented.

Antidegradation Information

A section on antidegradation has been in Washington's water quality standards for many years, and is based not only on requirements from the federal Clean Water Act, but also on the Water resources act of 1971 (RCW Chapter 90.54), which states:

90.54.020(3)(b). Waters of the state shall be of high quality. Regardless of the quality of the waters of the state, all wastes and other materials and substances proposed for entry into said waters shall be provided with all known, available, and reasonable methods of treatment prior to entry. Notwithstanding that standards of quality established for the waters of the state would not be violated, wastes and other materials and substances shall not be allowed to enter such waters which will reduce the existing quality thereof, except in those situations where it is clear that overriding considerations of the public interest will be served.

While the antidegradation section has been in the standards for many years, the lack of implementation language on how to achieve the three tiers of antidegradation has impacted the ability to adequately implement the regulation, and thus meet the goals of both the state and federal statutes. EPA has encouraged all states to develop more explicit implementation language to achieve the required antidegradation protection. Therefore, the new language in WAC 173-201A-300-330 provides important details for administering the three tiers of the antidegradation section of the standards.

Ecology analyzed each tier of antidegradation to determine the costs and benefits of the antidegradation section. This analysis (below) concluded that the additional language on implementation resulted in either:

- a cost reduction,
- a neutral cost, or
- provided clarification to the existing rule and thus would not be considered a "new" cost.

These considerations are discussed in more detail below.

Tier I Cost Benefit Analysis

Tier I requires that water quality necessary to protect existing and designated uses of a water must be maintained and protected. Tier I protection is already in the water quality standards and requires compliance with the established numeric and narrative water quality criteria. The additional language in the section describing Tier I explains how the state deals with degraded waters and natural conditions. No new protection is added to Tier I that is not in the existing standards. Therefore, Ecology concludes that **the new language for Tier I represents a neutral cost.**

Tier II Cost Benefit Analysis

Tier II requires that where a water is demonstrated to be of a higher quality than a criterion assigned to that water, the water quality must be protected at the higher level unless the department determines that a lowering of water quality is necessary and in the overriding public interest. The existing antidegradation section is broadly written and does not contain important details regarding the Tier II analysis. It does not spell out specific actions that must undergo a Tier II analysis but instead is written broadly in terms of the goals for the waterbody. The existing regulations appear to have a zero threshold for action on the part of Ecology, and is written so as to apply to all types of activities whether or not under the direct control of Ecology.

The new rule language significantly narrows the scope of the existing rule language, thus the number of actions that are required to do Tier II analysis is greatly reduced. The new language adds a section that provides a significant amount of detail on what activities need to be considered for a Tier II analysis and what types of information can be provided for the Tier II analysis to determine that the activity is necessary and in the overriding public interest. This section also describes how Tier II applies to general permits and general water pollution programs and allows for an adaptive management process. **These factors reduce the uncertainty and the direct burden of the rule.**

Activities Required to do a Tier II Analysis

In developing the implementation language for Tier II analysis, Ecology carefully considered potential costs to the regulated industry as the language was drafted. A key element of implementing Tier II protection is to determine what actions should be

considered for a Tier II analysis. Earlier draft versions of the proposed rule had a very broad application of Tier II (similar to the existing Tier II language) indicating that any action that could potentially lead to a lowering of water quality should be included in the analysis. Ecology received many comments on the implications of a broad application and the authority of the department to require activities outside of its jurisdiction to go through this detailed analysis. Based on this feedback, the new language limits a Tier II analysis only to new and expanded actions that require an authorization or approval that Ecology has jurisdiction over (such as NPDES Permits, State Waste Discharge Permits, Clean Water Act 401 certifications, and general pollution control programs).

Only activities with measurable changes go through a Tier II analysis

The language also limits the Tier II analysis to those actions that would cause a measurable change in the quality of a waterbody. This requirement assures that resources are spent on those actions that will cause a measurable change and therefore not require resources to be used on insignificant actions. Likewise, Ecology staff can focus their attention on a fewer number of Tier II analyses and therefore do a better job ensuring the goals of Tier II are met.

Further, the new language provides details on Tier II analyses for general permits and pollution control programs, and stipulates that individual actions covered under these will not be required to go through a Tier II analysis, and that adaptive management is allowed for determining compliance. **Collectively, these limitations and clarifications are viewed as a form of cost reduction from the existing regulation.**

Tier II Analysis Requirements

New language in the Tier II section requires that once an activity has been determined to cause a measurable lowering in water quality, then an analysis must be conducted to determine if the lowering of water quality is necessary and in the overriding public interest. The existing regulation requires that actions only be allowed when it is clear that "overriding considerations of the public interest will be served." However, it is not clear from this general statement in the existing language how that analysis is to be carried out.

There are two steps to conduct the Tier II analysis. The first, to determine overriding public interest, requires a statement of the benefits and costs of the social, economic, and environmental affects associated with the action. Examples are given of the kinds of information that can be provided with the statement; it is up to the applicant to decide what information will best support the statement. Ecology does not anticipate that this will require an exhaustive and costly economic analysis. Because the new language for determining overriding public interest makes the existing regulation more explicit, and suggests information that likely already exists as part of the proposal or is readily available, no costs accrue from this requirement.

The second step is to conduct an alternatives analysis to show that the proposed action is necessary. The new language gives several examples of what may be considered as alternatives to prevent or minimize the lowering of water quality. These examples are virtually identical to requirements for an engineering analysis to meet AKART, which must be conducted for all new

or expanded permitted activities in accordance with 173-240 (Submission of Plans and Reports for Construction of Wastewater Facilities). Since the Tier II antidegradation review only occurs for new or expanded actions, the requirement to conduct the Alternatives Analysis would already be a standard part of the permitting process.

Tier III Cost Benefit Analysis

Tier III requires that waters of unique quality and character that would constitute an outstanding national resource water be eligible to be set aside from all future degradation.
The existing regulation for Tier III is general, listing the criteria to become a Tier III water but does not provide specifics on the process for designating the water. The new language in the rule provides more detail on eligibility, the nominations and designation process, and allowances for temporary water quality exceedances. Because any Tier III water would need to be identified in the water quality standards, a rule-making would need to occur, which would potentially include the costs and benefits particular to that water. The new language includes the alternative of being able to place Tier III waters into a category of protection that would allow de minimus degradation from well controlled actions. This has the effect of granting greater flexibility in selecting the most appropriate level of protection to minimize impacts to the surrounding community. **The new rule language for Tier III clarifies and provides more limited application then exists with the existing language, and thus new costs are not associated with the change.**

Net Costs and Benefits

Ecology's proposal for antidegradation provides cost reductions by limiting how and when antidegradation is applied. Specific requirements outlined in the Tier II analysis portion of the rule are already required as a part of the permitting process, thus are considered cost neutral.

Section 5. Cost Benefit Analysis for Temperature

General Information

The temperature amendments are expected to generate benefits that exceed the costs. The rule amendment modifies the freshwater criteria for temperature. The modifications are summarized in the following table:

Existing Standards	Final Rule
Char: There are no criteria designed to protect char, which need very cold water. Currently, most of these waters are Class AA (16ºC daily maximum criterion), and a few are Class A (18ºC daily maximum	Char: 12ºC 7-DADM[1] applied year-round. When determined necessary by the department, a 9ºC 7-DADM criterion for spawning and incubation also applies.

criterion)	
Salmon: 16ºC (daily maximum) for Class AA streams and 18ºC (daily maximum) for Class A streams. Both criteria are designed to protect spawning and rearing, and both apply year-round.	Salmon: 16ºC 7-DADM in "core" areas (former Class AA waters) and 17.5ºC 7-DADM in "non-core" areas (former Class A waters). When determined necessary by the department, a 13ºC 7-DADM for spawning and incubation also applies.
Salmon Rearing Only (no spawning): 21ºC (daily maximum) for Class B streams.	Salmon Rearing Only: 17.5ºC 7-DADM.
Redband Trout and Warm Water Fish: There are no criteria designed to protect redband trout or warm water fish. These fish are protected by one of the other criteria: 16ºC (Class AA), 18ºC (Class A), or 21ºC (Class B). All criteria are daily maximum temperatures	Redband Trout: 18ºC 7-DADM Warm Water Fish: 20ºC 7-DADM Note: During this rule-making, no waters would be assigned to these criteria. Future rule-makings would be necessary before these criteria are applied.

(1) 7-DADM = 7-day average daily maximum temperature

The uses of Redband Trout and Warm Water Fish have no waters assigned to them. Future rule-makings to assign the uses would be necessary before these criteria could be applied. Because future rule-makings are also subject to requirements for a Cost Benefit Analysis, these two uses and criteria are considered cost neutral for this rule.

Costs

Agriculture

Agriculture in Washington is an important and diverse industry that encompasses everything from very large commercial field crop and livestock operations to very small part-time crop or livestock producers. The change in the temperature standards might result in more restrictive temperature criteria in approximately 16% of the waters running through agricultural land. Approximately 84% of the waters running through agricultural land will have less stringent criteria than the old criteria.

Ecology supports the use of best management practices when working with agricultural discharges to surface waters. Best management practices used by agricultural facilities seem to be an effective way to improve surface water quality. Draft work indicates that mapped spawning waters are found within agricultural areas where best management practices (in this case buffers) are used.[9] Buffers used as best management practices seem to make agriculture a more benign activity with respect to the fish. This lends further credence to the Conservation Reserve Enhancement Program (CREP) and Ecology's support for CREP and the best

[9] The buffered agricultural land is classified in forestry by lands in agricultureare less likely to have spawning than average lands by a ratio of 2.8 to 1; based on SASSI lands in agriculture.

management practices it supports. Ecology is also committed to the Agriculture, Fish and Water (AFW)[10] process to address agriculture's contribution to fish recovery.

Agriculture has been moving toward compliance with the Clean Water Act in many areas through actions taken on farm plans. This economic analysis is based on the assumption that compliance with the state water quality standards and the Clean Water Act is mandatory, but the selection of management practices used to achieve compliance is up to the landowner. The analysis estimates the potential statewide cost of incorporating the revised temperature standard into the farm plans in the approximately 16% waters on new private agricultural land that might be affected by more stringent standards for temperature. **This analysis does not estimate the benefits to new agricultural land that are on the approximately 84% of water bodies that will be affected by less restrictive standards for temperature.** Ecology assumes no impact for existing agriculture. (The percentage figures for waterbodies where criteria might change were based on GIS analysis of maps, and while approximate, they are reasonable estimates to use in this analysis.)

While the rest of this report addresses the incremental changes from the old rule to the new rule, this section differs in an important way. **In this section Ecology assumes that best management practices are not in place to meet the old temperature requirements**. This is significant because it increases the possible effect of the rule far beyond the effect that would occur if best management practices were already in place, and only the incremental rule change were addressed.

Agricultural Community's Concern about the Proposed Rule Amendment

Ecology received a substantial number of comments about the possible impacts of the proposed rule change on agriculture. (These comments are contained in Appendix E) Almost all temperature comments about agriculture addressed the proposed change of the freshwater temperature criteria. Specific concerns about future requirements for stream-side buffers zones and threats to water rights were frequently expressed. While Ecology rarely orders actions on a farm directly, Ecology recognizes the agricultural community's concern that individual civil suits can have the same effect. This section presents an evaluation of the potential effects of the final amendments on agriculture, and focuses specifically on the concerns expressed during the public comment period: buffer requirements and water rights.

[10] The AFW group is a broad-based stakeholder group made up of a coalition of farmers, environmental groups, government agencies, legislators, and tribes.

Counties where new Class B, char, and spawning temperature changes will occur. LF = lineal feet									
	County Rule		LF Cooler Waters given % Growth of AG & County Law	Value (+ tax) of Possible Buffer given % Growth & Existing County Law	1997 minus 1987 Agriculturea Acreage		1997 minus 1987 Irrigated Agricultureal Acreage		**Increase in Ac**
County	Existing County Buffer Requirments for Agriculture	Lineal Feet of Lower Criteria Waters on Ag Land			Acreage	% Increases	Acreage	% Increases	Examples of Increased Uses
01-Adams*	***None***	2,736,734	**273,758**	**$ 403,017**	**99,705**	**10.0%**	16585	0.12618597	Wheat
02-Asotin	***None***	254	**46**	**$ 51**	**335**	**18.2%**	-130		Hay Alfalfa
04-Chelan	***None***	5,229	**369**	**$ 2,886**	**8,165**	**7.1%**	-717		Wheat
05-Clallam	New Use	1,182			-5,540	-20.8%	-978		Irrigated Hay
06-Clark	New Use	1,073			-21,805	-23.0%	-142		Irrigated Pasture
07-Columbia*	200 ft.	89,058			**5,261**	**1.6%**	1,367	62.2%	Pasture
08-Cowlitz	***None***	1,051			-6,509	-17.3%	-448		Vegetables
11-Franklin	***None***	85			-97,097	-14.7%	-11		Hay Alfalfa
12-Garfield	***None***	7,662			-12,977	-3.8%	-1,221		Wheat
13-Grant*	New Use	2,960,788			**9,054**	**0.8%**	77,004	20.9%	Vegetables
16-Jefferson*	***Voluntary***	1,329	**483**	**$ 4,340**	**3,488**	**36.3%**	413	95.2%	Hay
17-King	New Use +fallow rule	547			-12,519	-23.1%	-18		Vegetables
19-Kittitas	***None***	63,459			-225,523	-55.9%	-1,853		Hay
20-Klickitat	New Use	38,572			-109,721	-15.7%	-3,505		Tame Hay not Alfalfa
21-Lewis	New Use	252			**5,414**	**4.8%**	-1,477		Wheat
22-Lincoln		547			-103,277	-7.0%	-5,832		Wheat
23-Mason	New Use	1,171			**8,268**	**70.6%**	23	6.4%	Pasture
24-Okanogan	New Use	4,110			-160,456	-12.0%	-3,320		Cherries
26-Pend Oreille	***None***	70,203	**611**	**$ 2,272**	**545**	**0.9%**	-948		Pasture
27-Pierce	New Use	8,359			-7,886	-13.4%	-953		Irrigated Vegetables Harvested
29-Skagit	New Use	2,028			**1,421**	**1.5%**	3,477	54.8%	Cucumbers & Pickles
31-Snohomish	New Use	35,700			-21,195	-25.9%	-1,258		Irrigated Pasture
32-Spokane	***None***	8,397			-23,212	-3.8%	-4,200		Wheat
33-Stevens	New Use (no permit required)	1,802			-662	-0.1%	-2,260		Pasture
37-Whatcom	***SCS***	548			-21,075	-16.9%	-2,976		Orchards
39-Yakima	New Use	16,666			**70,562**	**4.4%**	30,276	12.2%	Hay
36-Walla Walla	***Confined Animal Operations only***	59,062	**3,432**	**$ 7,419**	**39,253**	**5.8%**	21,803	28.9%	Wheat
38-Whitman	**Wetland only**	85,709			-104,147	-7.4%	-4,502		Wheat
INDEXED TOTAL FOR A 20 YEAR PERIOD			**557,399**	**$ 993,017**					
GovStats - 1997 Census of Agriculture									
1.9% of streams (by length) are July/August spawning streams as identified by SaSI.									
Assumed buffer width				45		0.01463415			
Caution Notes									
(1) The real number of early spawning streams that will require the narrative are unknown, and SaSI is just the basis for an estimation.									

General Information about Effects on Agriculture

All fresh surface waters in the state of Washington are currently covered by the existing temperature requirements in WAC 173-201A. The amended temperature requirements could have the following effects on agricultural land:

- 16% of the waters running through agricultural land might have more restrictive temperature criteria. These include the following waters
    1. waters used for salmon rearing only
    2. waters used by salmon and trout for seasonal spawning

3. waters used by char

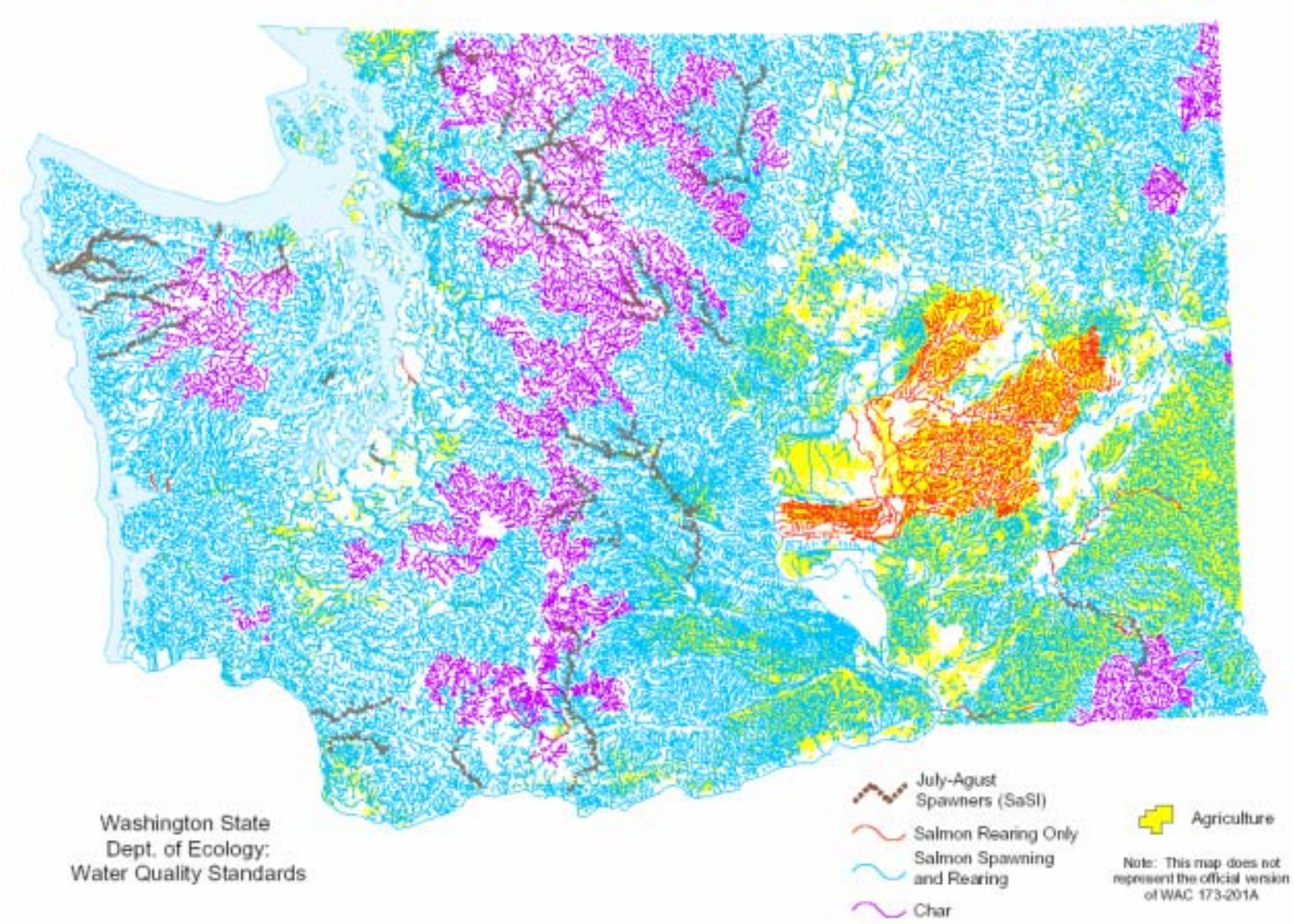
- 84% of the fresh water rivers, streams, and lakes running through agricultural land will have requirements less stringent (higher temperature) than the existing rule.

Twenty-nine counties might have some waterbodies that have either year-round or seasonal temperature requirements that are more restrictive than the existing requirements (See table above). An exception to this shift occurs when the natural temperature of the waterbody is higher than the standard.

Note: Printed map resolution on letter-sized paper is unclear. If you are viewing an electronic copy of the map you can use your zoom feature to enlarge it and see each area better.

Economic Losses: Agriculture might experience economic losses on lands bordering fresh surface waters where the temperature standard is being lowered. Over the whole state, about 16% of the fresh surface waters in the state on private agricultural land might have more restrictive temperature requirements as a result of the amendment, and many of these requirements could be seasonal. Losses could happen if the temperature of the waterbody is higher than the new temperature criteria at the same time of year as a summer spawning population is using the reach. The map on the next page shows the salmon rearing areas (indicated by red lines), summer spawning areas for salmon and trout (as per SASSI[11]; indicated by brown rivers in bold lines) and the char use areas (indicated by purple). In these areas the temperature criteria might be more restrictive. The yellow areas are agriculture.

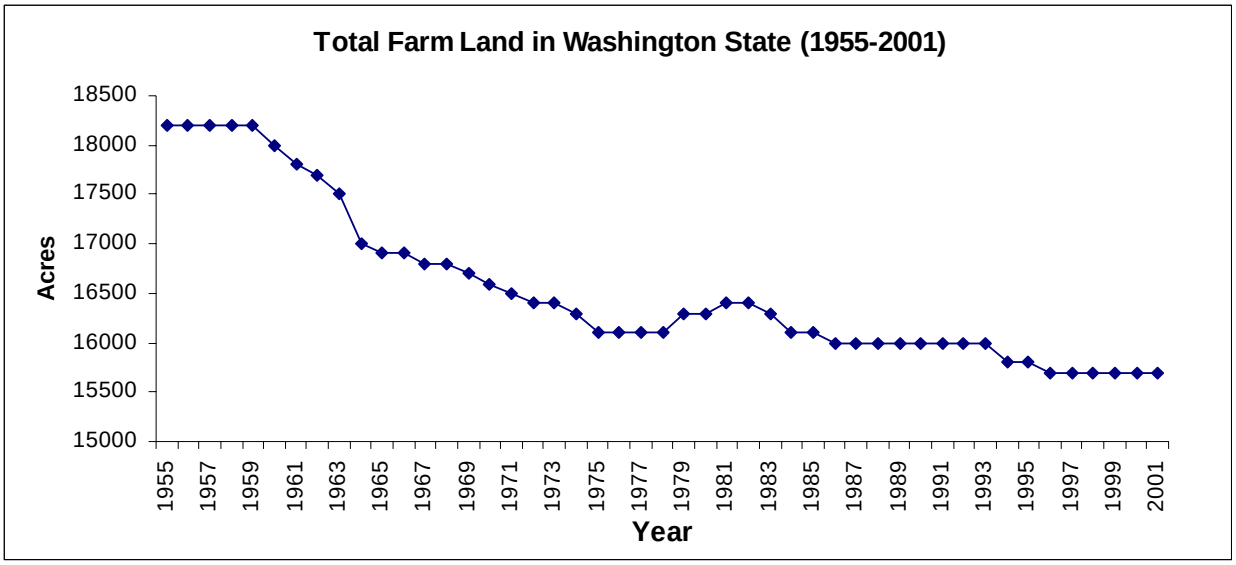
[11] Salmon and Steelhead Stock Inventory (SASSI)


Washington State
Dept. of Ecology:
Water Quality Standards
July-Agust
Spawners (SaSI)
Salmon Rearing Only
Salmon Spawning
and Rearing
Char
Agriculture
Note: This map does not
represent the official version
of WAC 173-201A

Economic Benefits: Agriculture may benefit on lands bordering fresh waters where the temperature criteria are less restrictive than the existing criteria (indicated by the blue and green river lines). In approximately 86% of the fresh water rivers and streams that run through private agricultural land, requirements less stringent (higher temperature) than the existing rule will be in place. If there is growth in agriculture or conversion of land bordering the existing Class AA or A areas, (where temperature criteria become less stringent) there may be a benefit. Because the less stringent changes are on average ½ºC to 1ºC temperature increases it is difficult to estimate what change might accrue as a result.

Economic Mechanisms: Agriculture reacts dynamically to changes in the economic climate like any other industry. If one crop is no longer viable then another will take its place, resulting in the decline or growth of product sectors within the agricultural industry. Some changes are limited by existing law and rules and others are not.

- If the land adjacent to a river is shifted by the owner from agricultural use to another agricultural use then there is no loss to agriculture.
- If the land adjacent to a river is shifted by the owner from agricultural use to some other use (e.g., housing development) then this shift is already regulated by most county shoreline rules. Thus there is no loss to agricultural land owners from the amendment.
- On the other hand, if the owner wanted to shift from forestry into agriculture, the change of use might affect the temperature of the water. The right to do this might be limited by the water quality standards as well as by existing county shoreline rules.



Overall, agricultural acreage in Washington is declining (see figure above). However moving land from one agricultural use into another agricultural use occurs, even in counties with overall declines in agriculture itself. Further, agricultural acreage has grown in several affected counties (see large summary above, the **bold** acreage figures). Between 1987 and 1997, total acreage in agriculture increased in Adams, Asotin, Chelan, Columbia, Grant, Jefferson, Lewis, Mason, Pend Oreille, Skagit, Yakima and Walla Walla. Total irrigated acreage increased in Adams,

Columbia, Jefferson, Mason, Skagit, Yakima, and Walla Walla. Even in counties with net reductions in agricultural acreage, there were increases within some sectors of agriculture.

As land is retired from agriculture, productive assets, including land and water rights, will be sold. As land is added to agriculture, productive assets including land and water rights will be purchased. Where the amendment affects the new land use, both land values and water right values could be affected. Land use effects are examined in the Buffer Scenario analysis below, and Water Rights are examined following the Buffer Scenario.

Buffer Scenario

The use of buffers as a regulatory tool to meet the new temperature criteria was a common concern of the agricultural community. Buffers are likely the most costly type of best management practice that might be used to meet the new temperature standards on agricultural land, so this analysis uses the lost land value from a 45 foot buffer to estimate costs. This analysis indicates a total cost potential of $1 million in foregone property and property taxes over a 20-year period.

Important Assumptions used in this analysis:

- **In this analysis Ecology assumes that best management practices are not already in place to meet the old temperature requirements**. This is significant because it increases the possible effect of the rule far beyond the effect that would occur if best management practices were already in place. **In this case Ecology clearly overstates the impact that the incremental change will have.**
- Ecology has limited the lineal feet of surface water used in the analysis to only those counties where agricultural acreage is expanding. In this case there is a possibility that new agricultural land could be created on affected waterbodies, and that the land would be created in counties that have overall reductions in agricultural acreage. This would serve to underestimate the effects on agriculture. This underestimation is larger than the overestimation of effects resulting from the assumption that best management practices are not already in place.

How often might buffer costs be chosen for use on agricultural land?

A cost impact for a specific piece of agricultural land will be unusual, however on a statewide basis there might be impacts.

Adams, Asotin, Chelan, Jefferson, Pend Oreille, and Walla Walla counties might experience some costs during agricultural growth periods. Some agricultural activities in other counties in the table above may experience some costs but these are likely to be more limited either by substantial reductions in agricultural land or by buffer requirements already in place at either the county or local level. For land to be affected the following three situations must all occur:

1. The land must be on an affected water body. Twenty-nine counties might have some waterbodies that have temperature requirements more restrictive than the existing requirements
    - Statewide, approximately 84% of the private agricultural lands are in areas which have criteria that will be less stringent (Warmer: Class AA or Class A).
    - Statewide, approximately 16% of the private agricultural lands are in areas which have criteria that might be more stringent (Cooler: Char, Salmon Summer Spawning, or rearing only).

2. The land must be in the process of converting from some other use into agriculture. Twelve of the potentially affected counties have increases in either acreage or irrigated acreage.

3. The land must be in a county or a municipality that does not already impose buffers[12] when land use is converted into agriculture.

The intersection of these three situations limits the impact of the amendment to the counties listed below. Combining the lineal feet of waterbodies with the growth rates gives an approximate estimate of the lineal feet of waterbodies that might be affected in the coming 20 years. If buffers are used to meet the temperature criteria contained in the amendmended rule the following counties and approximate lineal footages might be affected over a 10 year period:

Adams: 270,000 feet
Asotin: 45 feet
Chelan: 320 feet
Jefferson: 480 feet
Pend Oreille: 600 feet
Walla Walla: 2,800 feet

Over a 20 year period, perhaps double this lineal footage could be affected. This indicates approximately 600,000 lineal feet might be affected at a total cost potential of $1 million in foregone property and property taxes over a 20-year period. This analysis uses 45 foot buffers[13] on both sides of the waterbody and the value of the property,[14] which is approximately the present value of the net product of using the land. It adds to this the present value of property taxes for a 20 year period.[15]

[12] See Appendix G for notes on buffer requirements by county, which were used in this analysis.
[13] 75% of site potential tree height for a cottonwood. Cottonwood height, 60 feet, may be a better height estimator for the counties with large lineal footage.
[14] US Department of Agriculture, 1997 Census of Agriculture, County Data, Estimated market value of land and buildings@1: average per acre (dollars).
[15] Tax Adjustment based on Property Tax Statistics, 2001, Department of Revenue, Table 19: Comparison of Average Levy Rates by Year Due in 1994 - 2001.

Water rights

Ecology administers the state's allocation of water resources to meet instream and out of stream needs. Water rights are issued by Ecology to a wide variety of public, private, industrial and environmental uses. More than 1.7 million acres of croplands in Washington are irrigated from surface and groundwater sources, and provide in excess of two billion dollars of crop value per year.

The law (RCW 34.05.328) requires that Ecology look at *probable* costs and benefits. The restriction of water rights as a means to meet the new temperature criteria was a common concern of the agricultural community. This section looks at whether such an impact is probable. It examines past water rights actions by Ecology in order to determine whether water quality conditions have routinely been placed on water rights and whether those conditions, such as the revised temperature criterion, might lead to increased regulation of such water rights.

Probability that a water right would be conditioned:

To obtain the information, the four regional water resources section managers were asked to identify any such conditioned rights issued in recent years.

Only one right was identified as being conditioned with water quality standards. This was a water rights transfer from Weyerhaeuser to the Snohomish River Regional Water Authority in 2001. In this situation the water right transfer contained a specific condition resulting from modeling of the waterbody for dissolved oxygen levels. The condition restricted the amount of water that could be withdrawn instantaneously during low flow periods, but did not change the annual withdrawal volume. The model included existing withdrawals from the river as part of the background for the system. This is the only water right action in recent years where water quality conditions were added. The transfer at issue was not for agricultural purposes. While it is possible that other cases were missed, it clearly represents a rare event. Because of this rarity, costs are considered neutral for effects on water rights.

Permits

The estimated 20-year cost of the rule to approximately 14 NPDES permittees is $27 million.

This is based on the estimated likelihood of a permit being affected, multiplied by an average expected cost, given the effluent flow of the wastewater treatment facility. The permittees located in areas where the standard is being relaxed are likely to receive benefits in the form of postponed requirements for temperature controls. However, this offsetting gain is less predictable and is therefore not estimated.

The cost or gain for an individual facility depends on:

- whether the rule amendment will affect the facilities permit
- the flow from the facility and
- what the facility management decides to do to meet the standard.

In places where the standard becomes more stringent, the facility might experience costs from a new installation of technology or treatment. In places where the standard becomes less stringent, the facility might experience gains from being able to postpone or avoid an installation. This gain is not quantified.

The impact of effluent flow on cost estimation:

The flow of effluent is one of the primary drivers of the cost of the revised temperature requirements. Therefore the design flow from each facility was attached to a cost function for potentially affected facilities. Individual facility data on the maximum daily flow was used as a proxy for design flow. In most cases this is the correct flow. However, these maximum daily flows may be affected by an accident or problem that is temporary and which would not affect the design flow for meeting the standards. Thus the flows that feed into the equations may be higher than necessary and thus generate costs that are higher than those the facilities would actually experience. Where the maximum flow was unknown, average costs were used.

The cost of handling the design flow was multiplied times the average cost for that flow (see figure within discussion below). The costs of actions taken to meet permit limits based on the temperature criteria depend on what method the facility management decides to pursue. The cost for this analysis was based on an average of the costs per gallon per day of capacity for cases with flow similar to that of the potentially affected facility.

How many facilities are affected?

It is unclear whether all facilities are affected by the temperature criteria. This is because some streams receiving effluent have not been monitored sufficiently to determine whether they comply with the new criteria. In some cases effluent temperature information has not been collected. To address this uncertainty and to generate cost figures Ecology reviewed 15 cases to determine the potential impact of the temperature amendments on permittees.

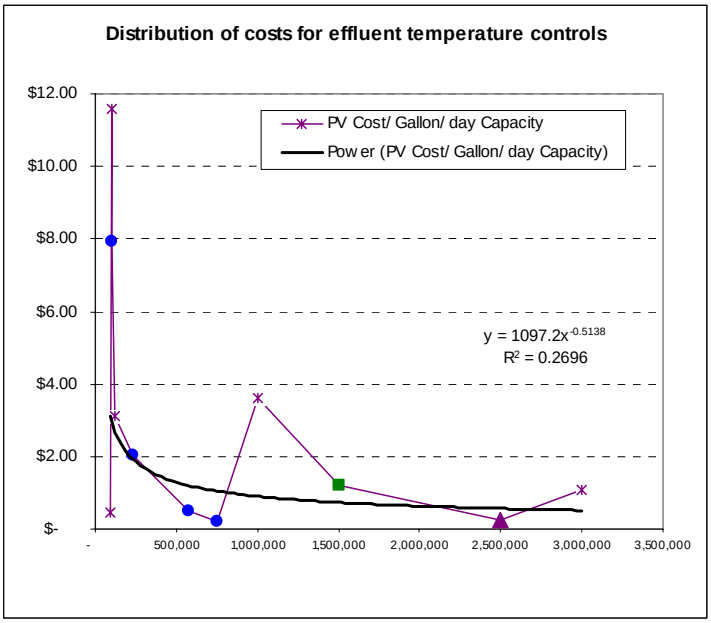
Salmon rearing only waters: There are 15 potentially affected facilities, public and private, discharging into salmon rearing-only fresh waters. Eight of these were reviewed. Two might have additional temperature related compliance costs.

- Two facilities have impoundments that only overflow in severe storm events. *No cost from rule amendment.*
- One facility discharges to a waterbody which has problems with high ambient temperatures but it is unclear if the waterbody is in compliance now. *Unclear effect – counted as a cost from rule amendment*.
- One facility has serious compliance problems with effluent limits other than temperature. *Probably no cost.*
- Three facilities already have a compliance problem for temperature under the existing rule. Probably no cost since the size of a wet bulb treatment would not change.
- One facility might comply with temperature requirements under the existing rule but will require additional work under the new rule. *Probably will have costs.*

Extrapolating from the information above to all 15 facilities results in an estimation of approximately 6 facilities that might be affected by the new temperature criteria. There was uncertainty associated with one case therefore a sensitivity analysis was done to determine the impact on the expected costs.

Char waters: There are 3 facilities discharging into the new char use waters. All of these were reviewed. *One might have additional temperature related compliance costs.*

Summer Spawning: There are 4 facilities discharging into waters which may become Summer Salmon Spawning areas. All of these were reviewed. *Two of these might have additional temperature related compliance costs.*



Existing Permits: Extrapolating from the reviewed permits to the potentially affected permits, 9 facilities may be affected (six discharging to salmon rearing-only waters, one discharging to char waters, and two discharging to potential summer spawning waters).

New permits: In the last 3 years there have been 41 new permits, or 13.6 permits per year on average. Some of the new facilities may be affected if they locate in the areas covered above. Given that 9 of 469 current facilities are affected it is possible that about 2% of the new permittees would also be affected by the rule. Over a 20 year period, one would expect an additional 5 permits to be affected.

The cost of retrofit technology

Several mechanisms exist for cooling effluent. Retrofit costs are highly variable and depend on what the facility has on hand that can be used to reduce the cost of compliance. The cost listed with each option below is a function of capital costs and ongoing costs. Capital costs are subject to a multiplier due to the interest rates paid to borrow capital.[16]

- Stream or Wetland Restoration: Passing water through a restored, shaded meander can cool the water. This may not be possible for every facility since it requires

[16] The present day capital cost estimated here is based on a 10% cost of capital, discounted using the 2.9% social rate of time preference. This yields a multiplier of 3.5.

that sufficient suitable space be available. Data from one restoration project that handles 1.5 million gallons per day provides a construction cost of $444,000, consulting costs of $66,000 and costs approximately $1.20 per gallon per day of capacity. Any given facility considering this kind of project would have to add land value to this cost. In some areas of the state this cost is very low and in others very high. Thus, depending on the facility, it could be either the cheapest or the most expensive of options. Note the large heavy green square in the graphic distribution of costs is a restoration.

- Cooling Towers: Cooling towers can reduce the temperature of water to dew point. Recently built technology including cooling towers offer a wide range of retrofit costs. These range from a present value of $.22 per gallon per day for 20 years of capacity up to $11 per gallon per day for 20 years of capacity. Note the light weight purple * in the graphic distribution of costs are water towers.

- A Cascade with Covered Settling Ponds: In one retrofit site a cover is being constructed on the settling ponds and a cascade or waterfall system is being added prior to the end of the pipe. The cost of this case is $.25 per gallon per day for 20 years of capacity. Note the large heavy purple triangle in the graphic distribution of costs is a cascade and covered settling pond.

- Refrigeration: This is the only mechanism to bring effluent temperature below the dew point. One case is being constructed at a small facility. The cost of this technology ranges from $2 to $5 per gallon per day for 20 years of summer capacity. This technology may not have economies of scale. Retrofitting at a large facility may cost more.

- Ponds with early morning release: Ponds can be constructed for holding water for later release. The water can be allowed to cool during the night and released in the morning. Alternatively, placement of the intake pipe for the released water can affect the temperature of the water leaving the pond. Shading assists in cooling. The cost of a lagoon or pond ranges from an extreme low of $.26 per gallon[17] to a more likely range of between $.62 and $1.40 per gallon of capacity.[18] Land costs will have a large impact on the costs. The duration that the water must be kept to reach the desired temperature will drive the size of the facility.

Adding through put: Non-contact cooling water used to cool industrial processes may be too hot for release. Additional water can be used to dilute this heat effect. The cost of the water to society ranges from $21 per acre foot to $1,419 depending on its use.[19]

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[17] Structured estimate of lined cooling pond only.

[18] Swine Facility Cost in Iowa, J. D. Harmon, www.extension.iastate.edu/Pages/ansci/swinereports/asl-1388.pdf.

[19] Frederick, Kenneth D, Tim VandenBerg, Jean Hanson, 1996, Economic Values of Freshwater in the United States, Discussion Paper 97-03, Resources for the Future.
Ayer, Harry W., 1983a, "Crop Water Production Functions: Economic Implications for Washington." USDA ERS Report No. AGES-830314, Washington, D.C. (Study 13)
Ayer, Harry W., 1983b, "Crop Water Production Functions for Potatoes and Dry Beans in Idaho." USDA ERS Report No. AGES-830302, Washington, D.C. (Study 13)

Benefits

The estimated benefits from this rule amendment are based on water quality and the way that it indirectly affects things that people value. The analysis below is focused on the effects of the new temperature criteria on fish populations.

- Fish: Numerous surveys and revealed preference studies have indicated that people are willing to pay for fish.
- Property: Several studies indicate that people are willing to pay more for residential land that has higher water quality.
- Shorelines: Ecology conducted a survey of willingness to pay for shoreline protection, one of the benefits of which was water quality. The positive result for this survey is an added indication of continuing value for environmental quality.[20]

Increased fish

Fish are valued by people and are essential to the ecosystem. Their value in some uses is very high, and if the proposed rule amendment increased fish populations, the benefit would be very large. The benefits estimated in this analysis, as a result of increased numbers of fish resulting from the amended temperature criteria, are:

- The minimum value of the fish based on the lowest population and the lowest dollar values is estimated to be $129 million. This includes $1.6 million for harvested fish and $127 for fish that pass into the potential breeding population.
- The value of the fish which are harvested is estimated to be $1.6 million.

Value of Minimum Fish Population Increase by Type of Use						
	Estimated minimum population change	Share Harvested	Value of Share Harvested	Share for Population	% Population Change	Value of % Population Change
Columbia						
Migratory fish	35,576	24,903	$812,030	10,673	0.53%	$36,261,009
Western Washington						
Migratory fish	35,576	24,903	$812,030	10,673	0.21%	$91,412,439
Catch Multiplier		0.7				
Probability of warm year			0.5			
Minimum Value by Use			**$1,624,059**			**$127,673,448**
Total Minimum Value						**$129,297,507**

Washington State University, 1972, "Irrigation Development Potential and Economic Impacts Related to Water Use in the Yakima River Basin." Paper for the Yakima Valley Natural Resources Development Association. (Study number 23)
Study numbering system from the Frederick paper.

[20] Survey of Washington Households on the Shoreline Management Act and Related Shoreline Issues, July 1996. Washington State Department of Ecology.

Willingness to Pay: The value people put on fish

People place a value on fish populations in Washington based on their individual perspective. Sport and commercial fishermen have a direct use value for the fish. The commercial fishermen catch fish for sale and the fish contribute directly to income. Fishermen catch fish for recreation and for food. Buyers have a value based on the food value of fish and the availability of substitutes. Many people also have a value associated with knowing that the fish populations will exist at a greater level than current levels or than current long term trends would indicate.

Willingness to pay also depends on to the status of the fish population. Willingness to pay is very high for the first fish saved. These fish are the breeding stock that maintain or restore an entire population. Willingness to pay once there are sufficient fish to provide support for the rest of the ecosystem, including man, have a lower value. Thus the total value of the fish populations increases at a decreasing rate as the fish population itself increases. At the highest populations, where a sizeable share of the fish populations are used as human food, the value of each additional fish caught is simply its value at dockside.

Estimating Willingness to Pay for Fish Populations

A willingness to pay survey of Washington households conducted in 1998[21] indicated that people would be willing to pay approximately $127 million over a 20 year period for an additional 0.5% increase in fish population of Columbia Migratory Fish and a 0.2% increase in Western Washington Migratory fish.[22]

The survey is based on a hypothetical 20 year program that people pay for on a monthly basis and which creates an increase in the fish population which is measured by the increase in the 20th year. The survey generated two sets of values for the fish population increase: a baseline flat fish population status quo and a baseline declining fish population status quo. People were willing to pay more for improvements in fish populations when the survey was based on the assumption that the fish populations were declining. People were not willing to pay as much when the survey was based on the assumption that the fish populations were stable at 1998 levels. The $127 million value is from the lower of two sets of dollar values. These values are based on the assumption that the fish populations are stable at 1998 levels. The stable population values were used because they are lower and therefore more conservative.[23] Further, based on other local programs to save the fish, the lower dollar values, which assume increases from a baseline 1998 fish population, are appropriate.

[21] Valuing Programs to Improve Multi-Species Fisheries, David Layton, Gardner Brown, Mark Plummer, University of Washington, April 1999.

[22] This present value estimate is based on the interest rate for inflation free bonds or 3.63% that was available in Nov. 30 1999, Business Section of the PI, Inflation adjusting Treasury Current Market Rate Coupon rates. We have not adjusted the interest rate to the current one because this was the value available to people when they were answering the survey. This means this value is more heavily discounted than the cost estimates in this same section.

[23] Conservative in this setting means that the value selected is biased against the rule.

The values are limited by the fact that the Department of Natural Resources Forest Practices Rule has already moved forward toward implementation.[24] This analysis includes only the additional population increase beyond the first 5% already used in the Forest Practices Rule.

The formula is:

> Value = [(percent of fish beta*(0-LN(final percent change)/Pbeta)) -(percent of fish beta*(0-LN(5 percent)/Pbeta))]. [25]

The recent DNR rules were forecast to have an impact on the regulatory environment and thus the fish. The estimated impact was approximately a 5% impact on the fish populations. The value from this 5% has already been used and can't be used twice.[26] Thus value increases created by this amendment must arise from increases in the fish populations beyond that estimated for the DNR rule.

Public Comment on Contingent Value Surveys

One commenter indicated:

> "Public opinion surveys on "willingness to pay" for environmental amenities can provide useful information but should be used with caution because they often overstate the "value" the public really is willing to pay if asked for actual cash contributions or additional taxes. For example, public opinion polls consistently show strong support for improved education, even in areas where school levies fail or pass only by narrow margins. Similarly, where large numbers of people are given convenient opportunities to make voluntary contributions or elect to pay higher rates for popular environmental causes, e.g. wildlife protection or renewable, the percentage of people who actually elect to make additional contributions usually is considerably smaller than the number who express support for those causes in public opinion polls. We suggest that the CBA put its use of "willingness to pay" surveys into context by mentioning these phenomena and citing studies on the limitations of such surveys."

There have indeed been many criticisms leveled at Contingent Valuation Method (CVM). These are nicely covered in Hausman [1993].[27] The National Oceanographic and Atmospheric Administration also convened a very select panel of experts, including Nobel winners, who were also critical of the method.[28] The Contingent Valuation used in this analysis was structured to address all the problems noted by the NOAA Panel. Further, Ecology has used the lower of the two values available from the study. Ecology could have applied the values from the study to all

[24] The prior analyses used the initial 5% of the estimated value.
[25] The Beta and Pbeta are based on the nonlinear results in the Layton, Brown, Plummer (99) paper in footnote 2.
[26] The survey asked people to value increases in the fish populations that would occur in 20 years. If a rule saves a fish for the final 20th year population then that fish can't be counted twice. Only additional increases in habitat, creating additional fish population can be called an increase.
[27] Jerry Hausman, Ed., Contingent Valuation: A Critical Assessment, Elsevier Science Publishers, 1993.
[28] Kenneth Arrow, Robert Solow, Paul R. Portney, Edward E. Leamer, Roy Radner, Howard Sherman, Report of the NOAA Panel on Contingent Valuation,

fish, however, Ecology has been more conservative in that it took an additional unnecessary step and applied the contingent value only to fish that are not harvested. Harvested fish are counted at their meat value only or $1.6 million. Further, all the summer spawning fish population values had conservative values applied to their population/temperature response. Finally no gains were estimated for other fish populations, such as char or trout, which will benefit from cooler waters. Ecology believes that the value used in this paper is conservative.

Changes in the Fish Population

The predicted minimum change in the fish population is based on average stock effects for summer salmon stocks. The mathematics of the calculations are explained in Appendix C. The expected change in adult fish is between 71,000 and 316,000 adults in warm years. The economic portion of the model assumes 70% of these fish are harvested and the remaining population is split evenly between Eastern and Western Washington. The estimated total population increase is 71,000 fish. [29]

Value of Harvested Fish

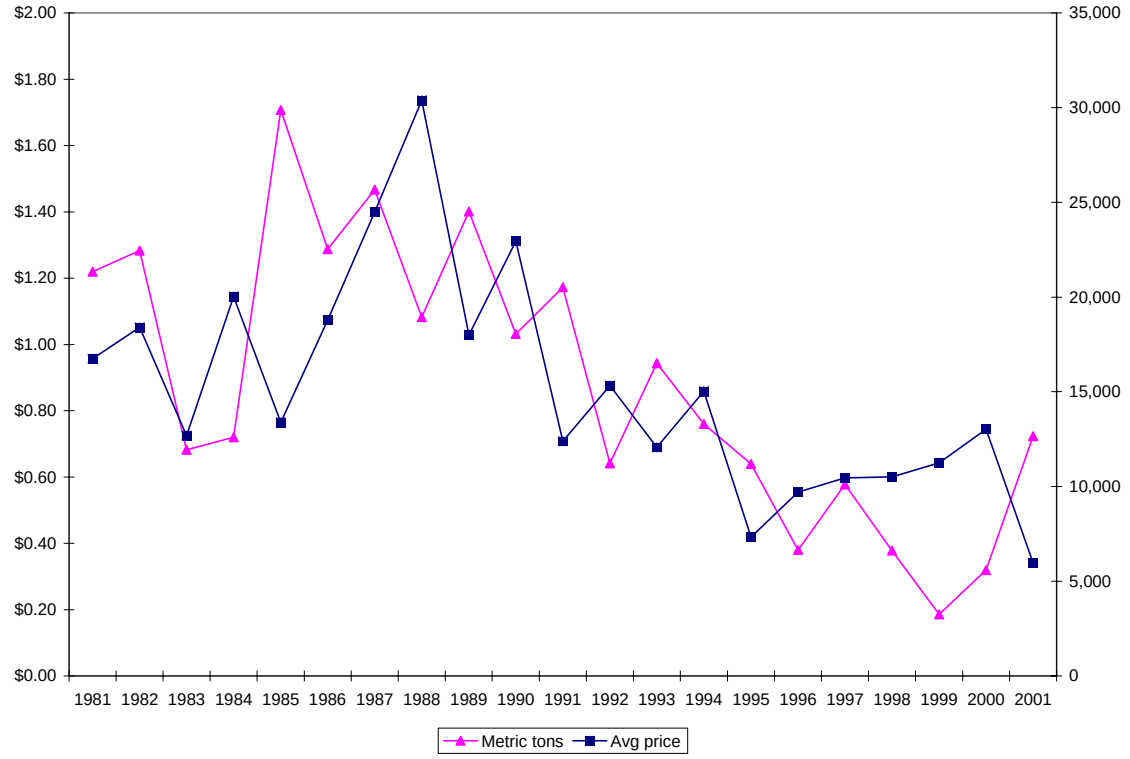
Harvested fish are valued at $.39 per pound. The present value for 20 years of catching one fish each year is $65.[30] However, the temperature changes only generate population increases in warm years. Since fish are caught each year this value was divided in half.

An increase in the number of fish would not only result in an increased population 20 years from now but also in an increased harvest in the intervening years. These fish are generally valued based on the ex-vessel price.

From the mid 1980's to the turn of the century, salmon harvests in Washington dropped by a factor of about 3½ (based on 3-year running averages of 26,028 tons/year in 1985-1987 down to 7,168 tons/year in 1999-2001). Revenues drop even more strongly, by a factor of almost 9, from $69,100,000/year in 1987-1989 down to $7,766,000/year in 1999-2001. A closer inspection reveals an important fact about prices for Washington salmon. On a year-to-year basis, there is a general tendency for an increase in harvest to be associated with a decrease in price, and vice-versa. This is what basic principles of supply and demand would suggest. A longer horizon, however, gives a different picture, as both harvests and prices have fallen (see figure on next page).

[29] One comment indicated: "…if temperatures standards reflect "optimum" levels during the warmest 7 days, they probably will be sub-optimum over the full rearing season and over the times when increased primary and secondary productivity could increase salmonid food supplies. In recent years there has been much more attention paid to the risks than the benefits of higher water temperatures, but the CBA should acknowledge that small increments in water temperatures might have potential benefits as well as potential risks for fish under some circumstances." The rule will not lower streams to temperatures that could be remotely considered " 'optimum' … for the warmest 7 days" but rather will tend to reduce spawning temperatures and thus reduce mortality.

[30] The increase is assumed to be caught each year for 20 years and is valued at $0.39 price/Lb x 13 pounds average weight.



This reflects the fact that increased imports from Alaska and Chile, as well as a greater quantity of farmed salmon, have more than made up for the decrease in local harvests. The result has been that Washington harvests are an ever-smaller portion of the supply in the state. This in turn means that local harvests have an every-smaller influence on local prices.

This complicates the calculation of what is to be gained by the increased harvests that might accompany increased stock abundance. It is possible that prices will fall even further. On the other hand some people are eating less salmon because of concerns for the fish and the wild supply, if it grew sufficiently, might out compete imports and farming. But a more neutral projection would be to carry current average prices forward. Given the role of supplies from outside the state, it would be unrealistic to project a significant increase in prices.

The next question is the increased volume of harvest that a recovery would allow. There can be no direct translation from increased abundance to increased harvest. If harvests are an extremely low fraction of total returns of adult fish, they can be increased by a greater percentage than the increase in abundance itself. On the other hand, the commingling of wild and hatchery fish leads to the imposition of lower harvests so as to protect the wild runs, and may prevent the realization of much gain in harvest.

Value in Sportfishing

The value of sport caught fish is based on the value of a fishing day for one individual. The value of salmon fishing of $61.27 would be an appropriate estimate of value for any increases in

salmon fishing days generated by this rule amendment. The analysis did not apply this higher value to the increased fish population.

Value of a Fishing Day indexed to 2003

Type of Fishery	Source	Value per fishing day	Location	Estimation Method
Coldwater	Brown and Plummer (1979)	$ 66.77	WA	HTC
		$ 119.48	OR	HTC
	Vaughan and Russell (1982)	$ 40.41	US	TC
		$ 52.67		
		$ 55.71	US	CV
	Miller and Hay (1984)	$ 55.71	ID	TC
	Sorg *et al.* (1985)	$ 27.64	ID	CV
		$ 45.17	ID	TC
	Brown and Hay(1987)	$ 24.75	US	CV
	Wade *et al.* (1988)	$ 28.90	CA	TC
Salmon	Matthews and Brown (1970)	$ 175.13	WA	CV
	Crutchfield and Schelle (1978)	$ 45.85	WA	CV
	Brown, Sorhus, and Gibbs (1980)	$ 61.27	WA	TC
		$ 101.70	OR	TC
Trout	USFWS (1980)	$ 26.03	ID	CV
		$ 29.19	US	CV
	Vaughan and Russell (1982)	$ 42.75	US	TC
	Waddington, Boyle, and Cooper (1994)	$ 37.99	WA	TC
Saltwater	Rowe et al. (1985)	$ 90.80	Pacific Coast	TC
Warmwater	Vaughan and Russell (1982)	$ 25.84	US	TC
		$ 35.38		
		$ 39.80	US	CV
	Sorg *et al.* (1985)	$ 21.12	ID	CV
		$ 46.60	ID	TC
	Hay (1988)	$ 20.34	NW	CV

Table drawn from Gardner Brown and Mark Plummer, Fisheries Benefits of Fire Department of Ecology Rules, 1997. All citations are in that document.
TC means Travel Cost
HTC means Hedonic Travel Cost
CV means Contingent Valuation

Property Values

Land values for residential and recreational uses

The rule will have a minimal impact on developed property. Only 0.2% of the waterbodies in the state have a juxtaposition of developed property and a change in water quality.

The value of land can be limited by poor water quality.[31] If the water quality is perceived as poor by buyers either because it has visible signs of poor water quality or because a shoreline has

[31] Elizabeth L. David, Lakeshore Property Values: A guide to public investment in Recreation, *Water Resources Research*, vol.4, no. 4, August 1968.

a health warning, then willingness to pay for the property will be affected. Further, the willingness to invest in the property through maintenance and the addition of improvements may be affected (Epp & Al-Ani,1979).

The following studies tend to indicate that improvements in water quality may have a positive impact on the price of residential or recreation land that is located on the water. The value shift in the more relevant articles in the literature ranges from +1% to +20%. The Leggett and Bockstael (2000) study is the best of these in that it included a wide variety of potentially confounding variables in the specification. It places a 100 m/L change in fecal coliform concentrations at a +1.5% change in the value of the property.

Source	Date	Impact	Type of property	Property Value Shift
Leggett & Bockstael	2000	Fecal Coliform (100 mL)	Residential, Chesapeake Bay	1.50%
Ribaudo, Young, & Epp, USDA	1984	Algae, phosphorous	Vermont, Recreational Homes	20%
David	1968	Subjective	Wisconsin, Lake property net of improvements	0.83%
Steinnes	1991	Water Clarity: Added Value per Added Foot of Depth	Minnesota, Lake property Calculated for 1 acre lot with 121 front feet	2.30%
Epp & Al-Ani	1979	pH	Pennsylvania, Rural residential property	5.90%
		pH	Less building in areas with poor water quality: ratio of older homes in polluted/clean areas	1.42
Michael, Boyle, Bouchard	1996	Water Clarity: Added Value per Added Foot of Depth	Maine, Lakes	15%

The primary change for this rule is temperature and this is not included in the literature. The change in bacteria will only affect Class B Marine waters and that limit would not allow fecal coliform increases that approach 100 m/L. Finally the bacterial impact on property prices is probably driven by illness cause by exposure to bacterially contaminated water. Since illness is explicitly counted elsewhere, including costs of illness related to property values would result in double counting the economic effects of illness. Thus no additional economic impact on property values is predicted.

Donald J. Epp and K. S. Al-Ani, The Effect of Water Quality on Rural Nonfarm Residential Property, *American Journal of Agricultural Economics*, vol. 61, No. 3, 1979, pgs. 529-34.

Christopher G. Leggett and Nancy E Bockstael, Evidence of the Effects of Water Quality on Residential Land Prices, *Journal of Environmental Economics and Management*, Vol. 39, 2000, pgs. 121-144.

Jules M. Pretty, Christopher F. Mason, David B. Nedwell, Rachel E. Hine, Simon Leaf, and Rachel Dils, Environmental Costs of Freshwater Eutrophication in England and Wales, Environmental Science and Technology, Vol. 37, No. 2 2003, pgs 201-208.

Mark Ribaudo, C. Edwin Young, Donald Epp, *Recreation Benefits from an Improvement in Water Quality on St. Albans Bay, Vermont*, USDA, Economic Research Service, Natural Resource Economics Division, January 1984, AGES 831116.

Donald Steinnes, Measuring the Economic Value of Water Quality: the case of lakeshore land, *The Annals of Regional Science*, Spring, 1992 (26), pgs 171-176.

C. Edwin Young, Perceived Water Quality and the Value of Seasonal Homes, *Water Resources Bulletin*, April 1984, pg. 163 – 168.

Section 6. Cost Benefit Analysis for Bacteria in Marine Water

General Information

Federal guidance exists for establishing bacterial criteria that will protect humans from waterborne diseases. The guidance focuses on water contact exposure from swimming, but could pertain to non-recreational contact with surface waters as well. The federal guidance directs states to establish enterococci for marine waters. The state currently uses fecal coliform as its indicator bacteria in marine waters, and EPA generally opposes the continuation of fecal coliform nationally as a state indicator for bacteria. Based on the findings of the draft cost benefit analysis and feedback from stakeholders the change being made to Washington's standards only adds enterococci to those marine waters that are currently protected for secondary water contact (e.g. general boating, fishing) and not to marine waters protected for shellfish harvesting or primary contact (swimming).

In marine waters, Ecology demonstrated that the fecal coliform shellfish harvesting criteria, which must be retained to comply with other state and federal regulations, is as protective as the EPA directed enterococci criteria. Thus Ecology is only changing to the EPA recommended indicator of enterococci in marine waters that currently are not protected either for shellfish harvesting or primary contact recreation.

Based on Ecology's ambient marine data a significant correlation (R^2=0.71) can be found between the concentrations of enterococcus and fecal coliform. Using the best fit regression line for this relationship, a fecal coliform concentration of 100/100 ml would be equal to an enterococci concentration of 62.5/100 ml, and a fecal coliform criteria of 200/100 ml and would be compare to an enterococci concentration of 114/100 ml. Thus the change in criteria would result in comparable enterococci protection levels (63/100 ml versus 70cfu/100 ml) in Class B water and greater protection (114/100 ml versus 70cfu/100 ml) in Class C waters. Thus the change in indicators for secondary water contact from fecal coliform concentrations of 100 and 200/100 ml to an enterococci concentration of 70/100 will provide comparable and in some cases greater protection from bacterial contamination.

In spite of Ecology's recognition that the change will not materially allow increases in bacterial pollution and its associated potential for waterborne disease, we have taken a very conservative step and used EPAs risk assessment equations to calculate the potential cost to human health. It is important to note we received critical feedback from EPA on our draft cost benefit analysis. EPA strongly objected to this approach which they believe exaggerates the risks of the enterococci criteria and do not provide just credit to the value of enterococci as a superior indicator of the risk of illness. Throughout this Cost Benefit Analysis we have biased the economic impacts against the rule and we have retained the conservative estimate of increased health risks as a means to continue to include this bias

The selection of criteria values was based on the directive in state law to maintain the highest possible quality of the state's waters and upon Ecology's findings that the added risk of illness

rates and associated costs of allowing an increase in bacterial concentrations in our waters would not be offset by costs savings by industries and others. The adoption of enterococci criteria for protecting existing Class B and Class C waters represents the least burdensome approach. This determination is based on recognizing the need to satisfy EPA requirements and that for the purpose of protecting water contact in marine waters, only enterococci has been well correlated with the number of people that become ill. So where shellfish is not a use, is the only waters where a supplemental scientifically defensible criteria is needed in Washington waters. Since our analysis of the marine ambient data suggests the change will result in comparable or even better protection in some cases from allowing bacterial pollution, no material increase in illness rates is expected. Thus rather than adopting *E. coli* criteria in place of fecal coliform in freshwaters and adopting enterococci in addition to fecal coliform for most of our marine waters, the changes take the least burdensome and equally or more protective approach of only adopting enterococci criteria for Class B and C marine waters.

The rule amendment includes the following changes to the bacteria criteria:

Existing Rule	Amended Rule
Marine Water Shellfish Harvesting and Primary Contact: 14 cfu/100mL (Class AA & A) Secondary Contact: 100 cfu/100mL (Class B) and 200 cfu/100mL (Class C)	**Marine Water** Shellfish Harvesting and Primary Contact: fecal coliform at 14 cfu/100mL Secondary Contact: enterococci at 70 cfu/100mL

Costs

The bacterial test of water quality is used as an indicator of the existence of a variety of viruses, bacteria and parasites (Appendix D). The change in the rule reduces the potential risk of getting sick, to a small degree, in the Class B and C waters. These waters represent 3% of the state's marine waters. This change may create an increase risk of exposure to parasites, viruses and bacteria[32]. Based on Ecology's worst case analysis, the total expected present value of potential risk of illness, accrued over a 20-year time frame, is about $863,000. The economic analysis supporting this cost is contained in Appendix D.

Neutral Impacts

The new standards will not affect municipal permit compliance with limits for fecal coliform bacteria. Currently, most municipals have an effluent limit of 200 colonies/100 ml. This limit is technology-based. A treatment plant with a properly operated disinfection system can meet this limit. A water quality-based limit (based on dilution in the receiving water) for most facilities would be higher than 200 colonies/100ml.[33]

[33] Gary Bailey, Department of Ecology, 3/27/03.

Benefits

Enterococci is a more reliable indicator of health effects than fecal coliform. Sometimes fecal coliform may overestimate actual risk of illness. Fecal coliform testing can enumerate *Klebsiellae* and thus could possibly overstate health risks, particularly of bathing in waters with a high wood waste component.

Benefits may accrue to some permitees in areas where the fecal coliform standard gives a false reading of human pathogens. For example, wood waste may contain high fecal measurements when no human pathogens are present. If fecal coliform is the most sensitive indicator in areas with wood waste pollution, then additional testing requirements for enterococci would not be needed.

Net Costs and Benefits

The bacterial portion of the rule is not expected to generate probable benefits that exceed the probable costs. However, the estimated cost of $1.1 million is less than the net benefits of the remaining parts of the rule amendment. These are estimated to range upward of $100 million.

Time is an important but undetermined factor in this analysis. The estimates are presented as of the time the benefits and costs begin accruing. However, the benefits of reduced testing costs on the part of the permittee and the additional exposures of Washington citizens to water containing different levels of bacteria would begin and increase slowly over time as growth and investment decisions adjust under the new standard. Given this, it is not clear when the illness related losses would begin. The analysis is presented as if it started immediately.

Bacterial Shift (see General Information for context)	
Benefits	
Greater Certainty	Unquantified
Reduced Double Testing	Unquantified
Cost due potential increased risk of illness	$863,300
Permitted facility lab costs	$69,000
Ambient monitoring costs	$229,000
20 year present value of Costs	**$1,161,300**

Section 7. Summary of Costs and Benefits

The following table summarizes the costs and benefits analyzed in the report and resulting from the major rule amendments:

20-Year Costs and Benefits of the Major Rule Amendments				
Category	New Temperature Standards		New Bacteria Standards	
	Estimate	Comment	Estimate	Comment
Permit costs	(-) $27,453,162	Highly variable	(-) $69,145	Close estimate
Agriculture	(-) $993,017	Incorporates conservative and non-conservative elements	Not estimated	
Monitoring Costs	Not estimated		(-) $ 228,561	Highly variable costs
Risk of Illness	None		(-) $863,301	
Fish population	(+) $129,297,507	Lowest possible estimate	Not estimated	
Net benefit	(+) $100,851,328		(-) $1,161,007	
Net impact of amendment:			**(+) $99,690,321**	

Appendices A - G

Appendix A: Addendum to Forest Practices

June 19, 2002

TO: Water Quality Standards File

FROM: Dave Peeler

SUBJECT: Addendum to December 9, 2002 memo on "The effect of changes to the state water quality standards on forest practices for the purposes of the Small Business Economic Statement"

This memo is a follow-up to my December 9, 2002 memo written to address the effects on forests practices of the Dec. 2002 proposed revisions to the water quality standards rule. The final proposed revisions to the temperature criteria in the standards differ in fairly minor ways from the changes originally proposed. Some criteria will be lower than the earlier proposal (the criteria for char will be 1 degree lower than earlier proposed), some will be slightly higher (the salmon spawning and rearing criteria will be 1.5 degrees higher in "non-core" areas), and some will not be changed (criteria for salmon spawning and rearing in core areas, salmon rearing only, redband trout and warm water fish). In total, although the final proposed changes to temperature criteria will change the temperature requirements in waters flowing through forest lands, the effect will be the same as outlined in the December 9 memo:

> Because the forest practices rules were designed to minimize the effects of forest practices on the habitat of aquatic species and water quality, and because the new water quality standards are designed to do the same thing, the two rules are complementary. In fact, at this time, there is no evidence that the forest practices rules will have to be changed in any way to meet the new water quality standards. While adoption of new standards will change the outcome we are measuring against, it will not change the methods we use to achieve the outcome. Therefore, we expect that the new water quality standards will not result in any change in the forest practices rules, and, at most, will result in a few more trees being left in the first 75 feet of the riparian zone, where very little harvest is taking place now because of current shade requirements.

As stated in the Dec. 9, 2002 memo, in the event that future monitoring of the effect of forests practices shows that water quality standards will not be met, the adaptive management provisions of the forests and fish rules provide an avenue and methods to identify and make appropriate changes to the forestry rules and prescriptions to ensure that standards are met and aquatic resources protected.

December 9, 2002

TO: File

FROM: Dave Peeler

SUBJECT: The effect of changes to the state water quality standards on forest practices for the purposes of the Small Business Economic Statement

Minimal effect

One of the purposes of the Clean Water Act is to protect beneficial uses, which include those aquatic species that depend on clean, cold water for survival. The Forests and Fish Report has the same goal, focused specifically on protecting Washington's fish and riparian-dependent amphibians. The state water quality standards define the condition of the water that is necessary to protect beneficial uses. The new forest practices rules were designed to meet the requirements of the Clean Water Act and the Forests and Fish Report, and codify the best management practices necessary to meet the state water quality standards in the forest environment.

The new standards will lower the maximum temperature allowed by one degree in most places and by three to four degrees in streams that provide Char spawning and rearing habitat. While this is a significant change, it should be noted that the standards are designed to protect the same fish and amphibians as are covered by the forest practices rules, along with many other beneficial uses that depend on cold, clean water.

The forest practices rules contain a set of specific prescriptions that must be followed to protect riparian areas, designed to provide shade, to allow the recovery of a naturally functioning riparian zone, and to prevent sediments or forest chemicals from polluting surface waters. The rules are based on our best scientific assumptions about how the forest ecosystem works and what fish and amphibians need. The rules were designed to change over time through an adaptive management process, as we test our assumptions and gain more knowledge. Before the forest practices rules are changed through the adaptive management process, the Forest Practices Board will determine whether the new rule will provide compliance with the Endangered Species Act, restore and maintain riparian habitat to support a harvestable supply of fish, meet the requirements of the Clean Water Act, and keep the timber industry viable in the state of Washington. Rule making requires an economic analysis to occur every time the forest practices rules are changed.

Because the forest practices rules were designed to minimize the effects of forest practices on the habitat of aquatic species and water quality, and because the new water quality standards are designed to do the same thing, the two rules are complementary. In fact, at this time, there is no evidence that the forest practices rules will have to be changed in any way to meet the new water quality standards. While adoption of new standards will change the outcome we are measuring against, it will not change the methods we use to achieve the outcome. Therefore, we expect that the new water quality standards will not result in any change in the forest practices rules, and, at

most, will result in a few more trees being left in the first 75 feet of the riparian zone, where very little harvest is taking place now because of current shade requirements.

Mitigating measures

Although we expect the new water quality standards to have little or no effect on the forest practices rules, for either large or small businesses, the legislature and the Forest Practices Board have already taken steps to minimize the economic impacts of the forest practices rules on small forest landowners.

- The forest practices rules established a forest riparian easement program, under which small forest landowners may be compensated for between 50 and 100% of the market value they are unable to harvest due to restrictions in the rules.
- Small forest landowners are subject to far less rigorous road maintenance and abandonment planning requirements than the larger landowners, and are not held to the same short term timelines for bringing their roads up to standards.
- Forest landowners are able to use an alternate planning process to harvest timber using prescriptions that differ from those in the rules as long as it is determined that those methods provide equal protection of riparian functions.
- Forest landowners, regardless of size, receive a 0.8 percent timber tax cut on each forest practices that complies with the aquatic forest practices rules.

Conclusion

No economic analysis of the forest practices rules is required as part of the adoption of new water quality standards because we expect that the effect of the standards change will be minimal, the forest practices rules already have mechanisms in place to mitigate any economic costs to landowners, and the rules were designed to change through time using the Administrative Procedures Act process that includes an economic analysis by the Forest Practices Board.

Appendix B: General Factors that Influence the Economic Analysis

Conservative Estimates

Throughout this analysis the estimates are made in a conservative fashion. This means that many of the selected values have a bias against the changes in the rule. Where this was not possible this is stated in the area where the number was used.

Rule Clarity

During the rule development process, Ecology evaluated the rule to incorporate "plain English" for greater understanding. More sections were added to the regulation to allow a person to more easily find a subject she/he is interested in. A new "tools" section was created to provide more detailed information on application of criteria and uses. This qualitative value accrues to all sections.

Neutral Changes

The following items are expected to be neutral and have not been analyzed.

Ammonia Criteria: The proposed adjustments to the freshwater ammonia criteria should provide reasonable levels of protection for fish and other aquatic life, and are also slightly less stringent than the existing ammonia criteria. The existing chronic ammonia criterion for waters where salmon habitat is a designated use is not proposed for change. This chronic criterion is the driver for most ammonia effluent limits for point source dischargers, and the proposed relaxation of the remaining ammonia criteria (in non-salmonid waters) will result in little or no change to effluent limits. Because effluent limits for ammonia are in general not driven by the criteria that are proposed for adjustment, the point sources required to comply with the ammonia criteria should not experience any additional costs. The slight loosening of the ammonia criteria should not result in any additional effects to fish or other aquatic life. Other minor modifications to the toxics section of the rule include switching the marine cyanide criteria values for acute and chronic. This change is a correction of an error that occurred during the last rule amendment. This will not result in any change in costs or benefits.

Time Horizon for the Cost Benefit Analysis

Ecology has selected a 20-year time horizon. Summed values in the analysis are based on present values over this 20-year span.[34]

[34] The interest rate, or social rate of time preference (SRTP), for this analysis was taken from interest rates on inflation protected government bonds. Generally the value used was 2.9% based on the average rates for I bond offerings of the US Dept. of Treasury. See Appendix F. For comparability investment is assumed to be taken from normal investment flows, which generates a flow of losses or investment return. These losses are used with a multiplier based on perpetual investment returns (of 10%) that are discounted using the SRTP. The fish population

Several things argue for a short time horizon. The evaluation takes place at a time of higher unemployment and business failure when change is often more rapid than usual. Further, switching to use driven standards will allow changes in uses to be made more easily based on appropriate scientific evidence regarding a specific water body. For example if a waterbody is identified for spawning by salmon, and in fact no salmon use the waterbody for spawning, the use can be changed to another aquatic life category, such as core salmon rearing. The standards are reviewed every 3 years. Further, the technology available changes over time. Given this, Ecology is not warranted in assuming that the rule amendments will be permanent.

On the other hand, several things argue for a longer time horizon. It has been 10 years since the last major revision and it will probably take at least 10 years to update the TMDLs and associated permits. The proposed standards are based on a combination of best available science and economic feasibility. Fish population impacts take several years beyond the final implementation of the rule to be realized. Some salmonid populations in particular have a long breeding cycle. A study of how much Washingtonians are willing to pay to preserve salmonids estimated a present value for actions taken over the next 20 years. As detailed below, this value is a large component of the analysis performed here. Finally, the capital for a wasterwater treatment plant has an approximate life-span of 30 years, but changes may be made to these plants on as frequent as a 5 year schedule. Within 15 to 20 years a treatment plant operation can be adjusted substantially through upgraded replacement technology.

Extinction Risk

The proposed amendments by themselves are unlikely to either cause or eliminate the possibility of extinctions. The temperature changes are intended to facilitate spawning where this is possible and thus should reduce, to some extent, the risk for some of the char populations and salmon runs. The probability of this rule amendment alone having an impact on long term extinction probabilities is small and is therefore not quantified. However, if the rule were to prevent an extinction the values would be very large. The penalty values for taking of a single fish in such an instance is $10,000. The value of all future fish generated by a run would also be very high.

Tribal Values for Water Quality

Quantifying the value of clean water in the protection and continuation of tribal fisheries is extremely complex and may ultimately be impossible. From the earliest of known times, tribal communities in Washington State have been heavily dependent on anadromous fish for their subsistence and for trade. Salmon is and was a central part of tribal cultural and religious practices. Today all of these uses continue throughout the state both on reservation and off reservation under treaty rights. There are currently 29 federally recognized tribes and 27 Indian reservations within Washington State. Twenty-one of the tribes of Washington State have been recognized by the federal courts as treaty tribes who, under the Stevens' treaties, ceded vast areas

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benefit uses 1999 interest rates (3.63%) because this is the value that was available to people at the time that the survey was done. This dichotomy is conservative, or biased against the rule, in that the costs are discounted less steeply than the benefits.

of land to the United States while reserving certain off-reservation rights including the right to take fish in their "usual and accustomed" places and the right to hunt on "open and unclaimed lands". In addition to the tribes in Washington State, two tribes located in other states, the Confederated Tribes of the Umatilla Reservation in Oregon and the Nez Pierce tribe of Idaho, have ceded usual and accustomed fishing areas in Washington State. The rights of Washington tribes to take fish for commercial, subsistence and ceremonial purposes under treaties have been extensively litigated in United States v. Washington.

Tribes and economic theory

From a theoretical perspective, tribe's objections to quantification in the comments below are also valid. Under the religious and cultural circumstances the value may be very high. The values ascribed by the non-tribal population reflect the available substitutes. Tribal members do not have substitutes for salmon, for affected land areas, or for water quality changes that affect their wellbeing. Willingness to pay for the general population is limited by income. For the tribal members, who have a right to fish, the appropriate value is willingness to sell and this is not limited by income. Thus the worth of the changes will be very different than the values presented below. The values in this paper should not be taken to reflect tribal values.

Comments:

The following two comments from tribes on the proposed water quality standards illustrate the difficulty of assigning a dollar figure to the tribal benefits of these resources:

Squaxin Island Tribe:

"The Squaxin are descended from maritime people who lived and prospered along the shores of the southernmost inlets of Puget Sound for untold centuries. Delicacies offered from the sea such as clams, oysters and salmon, have always been highly valued by tribal members. The aquatic creatures that sustain us offer much more than mere physical nourishment; they are an essence of our culture and traditions making them essential to our survival as people. This long history of association with the sea has made the Tribe a very committed steward of clean water in order to protect our heritage.

The United States first recognized the Squaxin Island Tribe in the Medicine Creek Treaty signed in 1854, ratified by the United States in 1855 and thereafter signed by President Franklin Pierce. With his signature, it became the supreme law of the land and Tribal recognition and sovereignty have continued to this day.

The original reservation was established on Squaxin Island. The island sits at the head of seven inlets of Southern Puget Sound – Case, Hammersley/Oakland, Totten/Little Skookum, Eld, Budd, Henderson and Nisqually/Carr inlets. More recently, lands on the mainland in Kamilche near Little Skookum Inlet were put into trust for the Tribe by the federal government.

The marine waters surrounding the island and all the water flowing off the land and out of the ground in numerous watersheds surrounding the seven adjoining inlets influences the health and

function of the Tribes Natural resource. These lands and waters comprise the Tribes usual and accustomed fishing stations and grounds – our treaty fishing area.

The protection and restoration of our natural resource base is essential to the economic well being and cultural survival of the Squaxin Island Tribe. The Squaxins reserved these rights when the treaty was signed. Without adequate protection of water quality, the Tribe cannot exercise these reserved rights."[35]
(From comment letter on proposed water quality standards to Megan White from John Konovsky, Squaxin Island Tribe, 2/26/03)

Puyallup Tribe:

"The value of our Reservation and the natural resources upon which tribal members rely for subsistence as well as their cultural and spiritual well-being are priceless. Additionally, the Puyallup Tribe has spent tens of millions of dollars in the past 15 years in salmon recovery; hatchery operations and fish production; habitat restoration projects and water quality regulation development.

The Puyallup Tribe of Indians Land Claims Settlement Act of 1989 (Public Law 101-41) established criteria for the protection of the tribe's fishery as well as the health, safety and welfare of the Tribe. The Settlement Act of 1989 envisions a permanent homeland for the Puyallup tribe. Indian reservations are unique for all practice purposes in that they are not being made anymore. Tribal members do not have the same flexibility in moving away from their homeland, as do many other U.S. citizens. Tribal members have cultural, as well as spiritual ties to the land, air and water that form their homeland."[36]

[35] Letter, Feb 26th 2003 - John Konovsky, Biologist
[36] Letter March 7, 2003 - Bill Sullivan, Director, Natural Resources for the Puyallup Indians

Appendix C: Fish Populations

Change in fish populations in response to the proposed changes in water quality standards for temperature.

Prepared by Mark Hicks, Department of Ecology
May 21, 2003

Introduction and Summary:

The purpose of this analysis is to use the knowledge gained in the process of recommending changes to Washington's water quality criteria for temperature to estimate the potential effects of the proposed changes to fish populations.

Temperature has a profound influence on the health of salmon, trout, and other cold water species. Allowing waters to warm above ecologically healthy levels affects every life stage of cold water species. For illustration, the following is provided to give a brief overview of the influence warm water can have on the life cycle of salmon:

> *Adults will migrate into freshwaters. Some will be caught by fisherman and natural predators, and the remainder will migrate upstream. Along route some will be lost to the impacts of warm water fish diseases and be removed from the potential spawning population, others will have their energy reserves drained and be physiologically stressed to the point they will be unable to ascend natural barriers and will be removed from the potential spawning population. Successful female migrants with less body fat due to increase metabolic demands will produce less or smaller eggs that in turn produce smaller and less viable fry. When faced with warmer temperatures while holding in warm waters the mature eggs held in the females will experience a direct loss of viability in addition to the loss of viability that naturally occurs if the female holds in waters awaiting more favorable spawning temperatures. Direct mortality will also occur in those eggs that are deposited in waters that are too warm, and those that survive may experience a reduction in size as newly hatched fry. Warmer waters during incubation may also alter the hatch timing which in some situations can result in detrimental emergence during strong spring flow events causing them to be washed out of the rearing streams. Those fry that successfully emerge will face greater competition for rearing space and greater predation by other warmer water-loving species. Rearing juveniles in warm water will in some cases face a reduced prey base as many important prey species are also sensitive to warm temperatures. These juveniles would also experience a greater risk of not being able to out-migrate as smolts if water temperatures are warmer than what is physiologically and ecologically protective. In addition to the direct effects from*

temperature, warm water is not capable of holding as much oxygen as cold water. This indirect effect is known to exacerbate most of the above threats from the direct effects of temperature, making the risks even greater.

The biological-effects assumptions used in this analysis are based upon the information and analyses provided in the discussion paper for establishing temperature criteria prepared by Ecology (Hicks, 2003).

Direct acute mortality to juvenile and adult fish would be avoided under the current water quality standards as well as the proposed changes. The changes in health and ultimate survival evaluated herein are related to risks of loss due to warm water diseases, reduced maximum size and reduce condition under natural stream conditions, interference with the ability to compete with warm water-tolerant species, impairment of the fertility and fecundity of ripe adult fish, reduced incubation survival, and impairment of the ability of juvenile fish to smolt and enter sea water.

This analysis independently examines the five changes proposed to the temperature criteria that would be applied to waterbodies throughout the state:

1. **The Class AA waters that will be changed to char spawning and rearing** (this would result in an average 3°C reduction in temperature and includes a narrative criteria directing temperatures to be maintained at healthy levels for spawning);

2. **The Class AA that will change to core salmon and trout spawning and rearing** (this would allow an increase in the summer temperature by an average of 1°C but also includes a narrative criteria directing temperatures to be maintained at healthy levels to protect spawning where and when it occurs);

3. **The Class A waters that will change to non-core salmon and trout spawning and rearing** (this would result in an average 0.5°C increase in summer temperature but also includes a narrative criteria to protect spawning temperatures);

4. **The Class A waters that will change to char spawning and rearing** (this would result in an average 5°C reduction in the temperature criteria and includes a narrative criteria directing temperatures to be maintained at healthy levels for spawning); and

5. **The Class B waters that will change to salmon and trout rearing-only** (this would result in an average 1.5°C reduction in temperature).

The potential improvements or degradation to fish populations for each of the five situation noted above are generally summarized by the following broad ranges of predicted effects:

	Situation Type	Total Effect Range
1.	Class AA to Char	8,640 to 43,204
2.	Class AA to Core Spawning and Rearing	11,252 to 56,263
3.	Class A to Char	6,912 to 39,472
4.	Class A to Non-Core Spawning and Rearing	40,447 to 173,395
5.	Class B to Rearing-Only	3,900
	Total Gains Statewide:	71,151 to 316,234

It is important to recognize that these estimates are based upon rivers that may now cooler than their assigned criteria, and thus much of the benefits are those that occur by not allowing the waters to be warmed to the existing temperature criteria. So, these are not fish that we will have added to existing populations as much as the proportion of the fish population that will be preserved by implementing the proposed criteria.

These conclusions are those expected to reoccur during warmer than average years, and are made on the basis of assuming that all the assumptions will actually occur. Thus these are neither annual nor one-time gains.

Assumptions and Areas of Uncertainty:

Basic Assumptions Used:

To precisely estimate the specific changes in fish populations would require sufficient data to understand specifically what temperatures are attainable in all of the state's waters and the extent to which human actions affect attainable temperatures. This would require a sophisticated modeling effort be conducted for each waterbody, and goes well beyond the resources of the department and the time constraints of the current rulemaking. Thus some alternative approach must be relied upon to make a reasonable estimate on the potential effects. In this analysis, general observations from fisheries research are used as the basis for making general statewide assumptions, and these assumptions are used in a simple step-wise model to examine how temperature effects fish over their various life stages.

Biological Effects:

The biological-effects assumptions used in this analysis are based upon the information and analyses provided in the discussion paper for establishing temperature criteria prepared by Ecology (Evaluating Standards for Protecting Aquatic Life in Washington's Surface Water Quality Standards: Temperature Criteria, 2002).

Number of Affected Streams:

Not all rivers and streams are currently at their assigned numeric criteria. Some are warmer and some are colder than their assigned temperature criteria. Where a stream is naturally warmer than the assigned criteria, the application of the proposed criteria would have no practical effect. Only those streams that are currently at or below the current water quality criteria for temperature would have the clear potential to materially benefit from the proposed change in temperature criteria. Streams warmed above the assigned criteria due to human sources would also materially benefit from any changes that assign lower criteria, but only after the sources of warming have been corrected. This can take very long time, and since many of these sources lack regulatory programs, the needed changes may not occur at all. For this analysis, the focus is placed on streams that are currently in a relatively healthy condition (streams meeting their existing criteria are uses as the surrogate), and on streams that support summer spawning fish stocks since these are believed to have the greatest potential to be harmed (or benefit) from proposed changes to summer temperature criteria or the inclusion of specific protection for spawning. It is important to recognize, however, that non-summer stocks and stocks from streams that can be cooled below current levels (even if they don't entirely attain the proposed criteria) would also likely benefit from any more protective temperature criteria. Their exclusion would tend to under-estimate the benefits of any criteria change. Thus the focus is on trying to estimate the number of summer spawning stocks that would occur in rivers that would currently be in compliance with the state temperature criteria. It is these rivers and stocks that would most likely be effected by a change in the summer maximum criteria assigned by the state.

To estimate the number of streams that may benefit, two sources of information were used together. Ecology ambient monitoring data was used to estimate the proportion of streams in a given class that are currently in compliance with their assigned temperature criteria (Hallock, 2003). And the Washington Department of Fish and Wildlife (WDFW) Salmon and Steelhead Stock Inventory (SASI) data base was used to obtain the number of streams have summer spawning stocks that are currently in each class of waters effected (Kolosseus, 2003). The SASI information is used as a surrogate for the total number of streams since more direct estimates are not available.

Average Run Size and Number of Spawning Females:

The number of fish in each run of salmon or steelhead is highly variable. Based on a qualitative review of the WDFW SASI data, an average run size appears to be well represented by 2,000 adult fish. Fish populations commonly have male to female ratios that approximate 50%, so it is assumed in this analysis that each run contains 2,000 adults and 1,000 of these fish are females (hens).

Incubation Survival Rates:

Survival rates in the gravel environment can be highly variable. Based on the general patterns observed in the literature, healthy streams are capable of incubation survival rates of 45-65%. This means that of every 1,000 eggs fertilized, 450-650 fry should successfully emerge from the gravels into the stream. For the purpose of this report, it will be assumed that 55% of the healthy fertilized eggs deposited in gravel redds will become viable fry.

Fry to Adult Survival Rates:

Most of the fish that emerge as fry will die before becoming adult fish. Information has not been found which clearly establishes a statewide survival rate. Survival rates reported by researchers varies from as high as 25% to as low as 0.01% for individual stocks; and in recent years coastal stocks off Oregon, Washington, and British Columbia have had 0.5-6% return rates (Dr. David Welch, 2003). The general trend in the literature reviewed seems to suggest that survival to adult rates of 0.1-0.5% are very common and would underestimate the returns of many stocks - thus it would be a conservative expectation. Therefore, in this report it is assumed that the survival to adult ratio ranges from only 0.1 to 0.5 percent even though it can be significantly better for individual stocks and individual years.

It is important to note that the above estimate seems to encompass the range of potential survivals rates reported both for survival from fry to returning adults, from smolt to returning adult, and from fry to oceanic adults. This reflects the great variability that exists between individual stream stocks and between years. Thus this factor, is also the one that perhaps causes the greatest uncertainty in being able to predict the potential biological effects of the proposed changes in temperature criteria statewide.

Number of Eggs per Female:

Female salmonids may carry from 2,500 to 7,000 eggs with the actual amount depends upon the species, stock, and size of the female. For the purpose of simplifying the analysis in this report, and out of recognition that a more detailed approach may not be feasible due to the complexity of statewide application of this assessment, the median estimate is used herein. In this report it is assumed that each adult hen salmon or steelhead is capable of depositing 4,750 viable eggs.

Areas of Uncertainty:

Conservative input values and assumptions were used throughout this analysis to try and avoid overestimation of either the benefits or losses to fish populations as a consequence of adopting the proposed criteria. While the input parameters may all be independently reasonable, making predictions of how all these factors will intersect on a statewide scale to affect salmon numbers is fraught with potential complications and unforeseen estimation errors. While this analysis produces quantitative estimates, the numbers are primarily useful for putting general bounds on the potential magnitude of the effects to coldwater fish populations. Some of the areas of variability and uncertainty that affect making statewide estimates include:

- While temperature effects all aquatic life, this analysis was restricted to estimating only the potential effects on salmon and steelhead, due to the lack of statewide population data for other cold water species.

- It is not known exactly how many rivers will actually be protected at the proposed criteria, or how many rivers are currently colder than the proposed criteria. The estimates used in this assessment are based upon the review of 143 monitoring stations where Ecology has collected water quality data. Many rivers are naturally warmer than both the existing and proposed criteria and would be maintained at that natural level, and many are naturally very cold and in areas that will not be at risk of human-induced temperature increases. Where this is the case no change in protection would occur in response to the change in the state standards.

- It is not known exactly where the potential benefits will accrue – which runs and which portion of those runs. Spawning in the summer in some systems may be heavily effected if we allow those streams to warm to either the existing or the proposed criteria at the time spawning occurs. To estimate the effect more accurately we would need to be able to compare the actual temperatures as they change over the entire spawning period to the spawning numbers during that same period. Such early spawning stocks are likely to be found predominately in systems that are colder than both the existing and proposed criteria. It is possible that very large portions of these early spawning stocks will be eliminated entirely if we allow current conditions in these rivers to warm. It is also possible many of these streams are protected by location and source water characteristics and would not suffer any increase in response to changing state standards. While the focus was on summer spawning stocks, late spring spawning trouts and early fall spawning salmon can also be at risk. The numbers used to assess risk to summer spawning stocks comes from the Washington State Department of Fish and Wildlife Salmon and Steelhead Stock Inventory program. All named streams that were identified as having spawning occurring in the months of either July or August were used to represent the number of summer spawner streams (Kolosseus, 2003).

- Due to the absence of available information, spring incubating stocks were not assessed in this analysis. The focus on fall spawning stocks would underestimate the benefits of cooler summer maximum temperature criteria. Even if fish population information were robust for the spring spawning stocks, Ecology does not have the continuous monitoring data necessary to conduct even a rudimentary risk analysis for spring spawners. This is because high spring flows make deploying and retrieving monitoring equipment risky during the spring period.

- Only the salmon and steelhead stocks included in the WDFW SASI report were included in this assessment. The SASI inventory does not represent a comprehensive examination of all the waters in the state and so underestimates the total stocks effected by some unknown amount.

- Temperatures can also affect the size of the fish at hatch. Very small fish may face a greater risk of loss due to predation or due to winter losses from having to hold over in

some rivers for an extra year to grow large enough to out-migrate, so there is some chance that the estimates on losses do not adequately account for the indirect losses.

- The actual ratio of juvenile fish that survive until becoming adults is not known so a very low success ratio was used. It is difficult to know how to factor in fisheries losses since the allowable harvest is tied directly to expected returns and yet that harvest is one of the benefits of the increased production even if it occurs in the open ocean.

- Individual stocks may have survival from fry to adult ratios of 0.01 to 25%. The use of the ratio of 0.1 to 0.5% was selected to be conservative. This may greatly underestimate the potential effects to individual stocks from changing allowable water temperatures and may overestimate the effects to other stocks. Return rates are generally unavailable statewide, and were it available it would be biased by the impact of the existing water temperatures. For example, a poor return rate from a warm river may be in part the result of the river being warm. Using the return rate to assess potential benefits of cooling the water would create bias.

- Where larger than average runs would be associated with waters that are currently colder than the existing criteria, the averaging used in this analysis would underestimate the benefits from reducing allowable water temperatures.

- Runs, stocks, and rivers are used interchangeably in the analysis although they are different. Multiple stocks may occur in the same river, and multiple runs may occur within the same stock. The existing data did not allow separating out these factors.

- Resident non-migratory species, migratory effects to char, and effects to migratory and non-migratory cutthroat trout were not included in this analysis due to a lack of critical stock data. This omission would result in underestimating the potential effects from changing allowable water temperatures.

- The focus of the analysis is on temperature, but oxygen concentrations are directly linked to temperature. Colder temperatures allow more oxygen to be held in saturation, and all life stages of fish and other aquatic life benefit from healthy oxygen levels. This important indirect benefit from maintaining cooler stream temperatures was not included in the analysis creating some underestimation of the potential benefits of maintaining cooler waters.

Review of Proposed Changes to the State Temperature Criteria:

Class AA Waters:

Overview of Class AA changes:

Waters currently classified Class AA will experience two opposing changes in the assigned temperature criteria.

1. For those Class AA waters where the designated use will be char spawning and early juvenile rearing the temperature criteria will change from a single daily maximum of 16°C to a 7-day average of the daily maximum temperatures of 12°C. A 7DADMax of 12°C would on average be equal to single daily maximum of 13°C, conversely, a single daily maximum of 16°C would on average be equal to a 7DADMax of 15°C. So, on average the change from Class AA to Char spawning protection would result in a 3°C reduction in the allowable temperature for these rivers.

2. For Class AA waters where the sensitive designated aquatic life use would be a combined use of salmonid (trout and salmon) spawning and rearing, the existing single daily maximum criteria of 16°C would be changed to a 7-Day average of the daily maximum temperatures of 16°C. On average this change would result in allowing an additional 1°C of warming in these Class AA waters.

Change from Class AA to Char Spawning:

As noted previously, this proposed change will on average result in a 3°C reduction in allowable summer temperatures in waters receiving the 12°C 7DADMax criteria. The current single daily maximum of 16°C is not believed to protect char spawning or to fully protect summer rearing. *The lack of specific population information on char makes estimating the effects of this change problematic, so while the benefits are considered very important, particularly given the threatened and endangered status of bull trout, they cannot be quantitatively estimated.* Thus the focus in the following estimate of potential changes in fish population only addresses salmon and steelhead, since these are the only species for which reasonable estimates on the size of the effected population can be made.

Fish Diseases:

Increased temperatures increase the risk of losses due to warm water fish diseases. To virtually eliminate the risk of losses from warm water diseases, water temperatures would need to be below a 7DADMax of 12.6-16.2°C (14.38°C is considered the best estimate for a threshold for this level of effect). To avoid serious rates of infection and mortality the 7DADMax would need to be below 15.6-19.2°C (17.38°C is considered the best estimate for a threshold for this level of effect). To prevent severe rates of infection and catastrophic outbreaks the 7DADMax temperature would need to be below 18.6-23.2°C (20.88°C is considered the best estimate for a threshold for this level of effect).

The existing Class AA temperature criteria is approximately equal to a 7DADMax of 15°C and the proposed change in temperature criteria would lower the target criteria to a 7DADMax of 12°C. Both the existing and proposed criteria are within the range of temperatures expected to completely eliminate losses associated with warm water diseases. Thus the proposed criteria can only be said with confidence to create some unspecifiable reduced risk of losses due to warm water diseases.

Prespawning Effects:

Adult salmonids ripe with eggs may experience direct losses in potential offspring if they are forced to hold or travel through warm waters. To avoid prespawning losses of eggs the highest 7DADMax temperature should not exceed 13.5-15°C in the week or two immediately prior to spawning. The existing Class AA criteria is a 1-day maximum of 16°C. On average this would be equal to a 7DADMax criteria of 15°C, thus the neither the existing or proposed temperature criteria (7DADMax of 12°C) would be likely to cause a measurable loss in potential offspring due to prespawning effects.

Incubation Effects:

The protection of incubating eggs and developing embryos is best described by having 7DADMax temperature below 12.5-14.0°C (median 13.2°C) at the time of fertilization for fall spawning stocks and by the point of emergence from the gravels for spring spawning stocks. Keeping lower summer temperatures (the proposed 7DADMax of 12°C versus the existing 1-day maximum of 16°C) would be expected to better protect spring and summer incubating stocks. Thus the potential increase in fish is the change that occurs in response to lowering the criteria from an approximate 7DADMax of 15°C to a 7DADMax of 12°C.

As noted in the introductory section, those streams that are at or below the current water quality criteria (1-day max of 16°C) have the greatest potential to significantly benefit from assigning a lower temperature criteria (7DADMax 12°C). Based on a review of Ecology's ambient monitoring program data approximately 77% of Class AA streams were in compliance with their assigned 16°C criteria. Thus a maximum of 77% of Class AA streams may be capable of benefiting (being cooler) from lowering the state criteria from 16°C to 12°C. Two opposing factors complicate the assessment of streams that may benefit from a change in water quality criteria. The first is that just because a stream is meeting 16°C does not mean that it can also meet 12°C – this factor would tend to suggest the 77% is an overestimation. The second is that the monitoring stations tend to be lower in the watershed where water would be expected to be warmer then where the 12°C is proposed for application – this factor would tend to suggest the 77% figure is unduly influenced by monitoring occurring at a greater proportion of warm sites. It is believed that the first factor is the most dominant source of potential estimation error, particularly because 12°C is uncharacteristically cold, and rivers would generally have a difficult time meeting this value at the furthest downstream point of the char use designation. To help avoid the risk of seriously overestimating the potential benefits, only 38% (approximately half) will be used in this analysis as the estimate of streams that may materially benefit from the reduction in stream temperature criteria to 12°C. It is important to note, however, that while

problematic to quantify due to the need to have data on the specific temperature regimes of the effected rivers, significant potential benefits would also occur at temperatures between 12-16°C.

Summer spawning stocks would be those that would most greatly benefit from the reduction in the allowable summer temperature. The WDFW SASI (Salmon and Steelhead Stock Inventory) data base identified 189 streams where summer (July and August) spawning stocks occur that would be changed from the Class AA to char spawning criteria under Ecology's proposal. Using the rough estimate that 38% of streams actually meet their assigned criteria, it appears reasonable to assume that 72 stocks (38% of 189 summer spawning stocks) may most likely benefit from lowering the temperature criteria in Class AA waters. The focus on the summer spawning populations is further supported by the fisheries research suggesting the summer-time criteria of 16°C would be fully protective of the rearing stage of salmon and steelhead.

Based on a statistical evaluation of continuous temperature monitoring data collected in Washington, 58% of all the assessed streams that currently meet the existing Class AA criteria (an average 7DADMax of 15°C) would meet the 13°C at the time of spawning initiation.

Therefore, thirty-eight (38%) of Class AA streams meet the existing summer criteria, and 58% of streams that meet the current Class AA criteria meet the spawning temperature target where and when needed. This information can be used to create a cautious estimate of the number of streams that would have the highest chance of benefiting from reducing the temperature criteria to 12°C. Thirty-eight (38%) of the total summer runs (189) would be 72 runs that would be potentially effected by the change in temperature criteria. Fifty-eight percent of these are likely to reach the 13°C spawning temperature at the time of spawning (42 runs).

While less than favorable conditions would exist for the stocks under the current temperature criteria (average 7DADMax 15°C), summer temperatures would be on a seasonally declining pattern beyond the peak summer period and many of the hens would be spawning in waters of temperatures around 14°C. It seems reasonable to assume that only 45% of each of the 42 runs would occur during warmest part of the summer. Thus it also seems reasonable to assume that 22.5% would occur between 14-15°C, and 22.5% between 13-14°C.

For this analysis, temperatures between 13-14°C will be assumed cause very minor (5%) incubation losses, even though based on the Ecology temperature criteria analysis this range has the potential to be fully protective of incubation. Temperatures between 14-15°C will be assumed to result in moderate (30%) losses. These assumptions seem to well represent the general patterns observed in the scientific literature.

Forty two runs with 1000 hens per run is 42,000 hens. Each hen would have 4,750 eggs each so the total eggs for these 42 runs would be 199,500,000 eggs. Forty-five percent of these would be potentially impacted by temperatures above 13°C (89,775,000) and 44,887,500 eggs would be deposited at each of the 1°C increments above 13°C. Thus 44,887,500 eggs would be deposited between 14-15°C and experience a 30% loss, and 44,887,500 eggs would be deposited between 13-14°C and experience a 5% loss. The above losses would represent the potential gains from maintaining stream temperatures at the proposed criteria rather than allowing summer maximum temperatures at the warmer existing criteria. This results in the estimate that 15,710,625 eggs

will be gained from the proposed change in temperature criteria. Only 55% percent of the eggs should be expected to successfully hatch (8,640,844) and only between 0.1 and 0.5% of the fry will likely survive until adults (8,640-43,204). Thus the change in criteria in Class AA waters are likely to result in the potential gain, or protection from loss, of between 8,640 to 43,204 adult fish statewide.

Again it is important to point out that this is a relatively conservative estimate of the gains that would occur during warmer climatic periods, and does not include the potential increase in fish species other than salmon. There would be similar expected improvements in other native fisheries, and this temperature change would be vital to the long-term health and viability of native char populations.

Summary Discussion

For the proposed change of Class AA waters to a char spawning and rearing use only the added protection for summer spawning populations resulted in quantifiable changes to adult fish numbers. Benefits to fish from reduced warm water diseases may be counterbalanced to some extent by increases in cold water diseases at these temperatures, however, neither can be estimated sufficiently enough to warrant inclusion in this analysis. Similarly, the reduction in temperature may reduce potential growth and cause juvenile salmon to hold over for an additional year prior to migrating to the sea. This could result in some losses, but the literature does not provide a ready basis for numerically estimating the potential effects nor to qualitatively say with any degree of certainty that losses would on balance be greater. The inability to quantitatively assess the improvements in protection to char species, which are the target species for the proposed change, is an unfortunate gap in the analysis. The benefits, however, would be significant to char populations by maintaining temperatures well below the existing class AA criteria.

Factor	Additional Adult Fish
Disease	No change expected
Prespawning	No changes expected
Incubation	8,640 to 43,204

Total Estimate Gains: 8,640 to 43,204

Change from Class AA to Core Salmonid Spawning and Rearing Waters:

As noted previously, this proposed change will on average result in a 1°C increase in allowable summer temperatures in waters receiving the proposed 16°C 7DADMax criteria. The change will also include adoption of a narrative criteria statement directing the protection of spawning and incubation where and when needed.

Fish Diseases:

Increased temperatures increase the risk of losses due to warm water fish diseases. To virtually eliminate the risk of losses from warm water diseases, water temperatures would need to be below a 7DADMax of 12.6-16.2°C (14.38°C is considered the best estimate for a threshold for

this level of effect). To avoid serious rates of infection and mortality, the 7DADMax would need to be below 15.6-19.2°C (17.38°C is considered the best estimate for a threshold for this level of effect). To prevent severe rates of infection and catastrophic outbreaks the 7DADMax temperature would need to be below 18.6-23.2°C (20.88°C is considered the best estimate for a threshold for this level of effect).

The existing Class AA temperature criteria is approximately equal to a 7DADMax of 15°C and the proposed change in temperature criteria would increase the target criteria to a 7DADMax of 16°C. Both the existing and proposed criteria are within the range of temperatures expected to completely eliminate losses associated with warm water diseases. Thus the proposed criteria can only be said with confidence to create some unspecifiable increased risk of losses due to disease.

Prespawning Effects:

Adult salmonids ripe with eggs may experience direct losses in potential offspring if they are forced to hold or travel through warm waters. To avoid prespawning losses of eggs the highest 7DADMax temperature should not exceed 13.5-15°C in the week or two immediately prior to spawning. The existing Class AA criteria is a 1-day maximum of 16°C. On average this would be equal to a 7DADMax criteria of 15°C. This would be unlikely to cause a measurable loss in potential offspring due to effects on ripe eggs. A 7DADMax temperature of 16°C, however, would be estimated to potentially result in as much as a 13% loss of eggs in ripe hen salmon.

Not all hens would be in a ripe condition at the time of maximum summer temperatures. Although no data is available to assist in making a specific estimate, the general patterns of spawning periods extending for several weeks to several months beyond peak summer temperature conditions suggests the proportion of fish exposed would be limited. For this assessment it is assumed that 20% of each summer fish run would expose ripe females to the maximum summer temperatures. The lack of available fisheries data on the numbers of fish that become ripe in the weeks immediately prior to spawning, and the use of a larger percentage of spawners in the considerations which follow on incubation effects, prompts the use of this assumed small percentage for prespawning risk. Further, since fish in a ripe condition would be close to their spawning times, the narrative criteria directing the department to provide healthy (13°C) spawning temperatures may further reduce the number of individual ripe females that would be exposed to temperatures above a 7DADMax of 15°C.

Summer spawning stocks would be those that would most greatly benefit from the narrative provision to protect spawning. The WDFW SASI (Salmon and Steelhead Stock Inventory) data base identified 285 streams where summer (July and August) spawning stocks occur that would be changed from the Class AA to a core salmon and trout spawning and use under Ecology's proposal. Using the rough estimate that 77% of streams actually meet their assigned criteria, it appears reasonable to assume that 219 stocks (77% of 285 summer spawning stocks) may most likely benefit from lowering the temperature criteria in Class AA waters.

If each of the 219 summer runs of fish contain 1,000 hens, each hen contains 4,750 eggs, and 20 percent of each run looses 13 percent of the potential eggs, then the total loss is 27,046,500 (1000 X 0.20 X 4,750 X 0.13 X 219) eggs lost due to prespawning effects. If 55 percent of the

eggs result in fry (14,875,575) and 0.1-0.5 percent of the fry survive until adults, then the increased loss in adults due to the change in temperature criteria would be 14,876-74,378 fish.

Incubation Effects:

The potential effects to spawning from increasing the summer criteria are offset in the proposed temperature criteria through the installment of a narrative criteria statement that directs that summer temperatures be maintained at temperatures that allow 13°C to occur at the commencement of salmon spawning (and at the time of fry emergence for the winter and spring spawning trouts). This provision is designed to protect the incubation period of salmonids that would not otherwise be fully protected by only relying upon the healthy summer temperature criteria of 16°C.

No fish losses should occur due to unhealthy spawning and incubation temperatures as a consequence of implementing the combination of the summer 7DADMax criteria of 16°C in concert with the narrative criteria on spawning and incubation protection. The insertion of the narrative criteria, has the effect of providing an increase in protection for these waters above what exists under the existing state standards. Summer spawning stocks would be those that would be those placed at greatest risk by the existing summer maximum temperature criteria.

The protection of incubating eggs and developing embryos is best described by having 7DADMax temperature below 12.5-14.0°C (median 13.2°C) at the time of fertilization for fall spawning stocks and by the point of emergence from the gravels for spring spawning stocks. Maintaining lower summer temperatures would be expected to better protect spring and summer incubating stocks.

As noted previously, only those streams that are at or below the current water quality criteria (1-day max of 16°C) have the potential to clearly benefit from assigning a lower temperature criteria (7DADMax 12°C). Based on a review of Ecology's ambient monitoring program data approximately 77% of Class AA streams were in compliance with their assigned 16°C criteria. Thus a maximum of 77% of Class AA streams may be capable of benefiting (being cooler) from implementing the narrative spawning criteria of 13°C. It is important to note, however, that while problematic to quantify due to the need to have data on the specific temperature regimes of the effected rivers, significant potential benefits would also occur at temperatures between 13-16°C.

Summer spawning stocks would be those that would most greatly benefit from the narrative provision to protect spawning. The WDFW SASI (Salmon and Steelhead Stock Inventory) data base identified 285 streams where summer (July and August) spawning stocks occur that would be changed from the Class AA to a core salmon and trout spawning and use under Ecology's proposal. Using the rough estimate that 77% of streams actually meet their assigned criteria, it appears reasonable to assume that 219 stocks (77% of 285 summer spawning stocks) may most likely benefit from lowering the temperature criteria in Class AA waters. The focus on the summer spawning populations is further supported by the fisheries research suggesting the summer-time criteria of 16°C would be fully protective of the rearing stage of salmon and steelhead.

Based on a statistical evaluation of continuous temperature monitoring data collected in Washington, 58% of all the assessed streams that currently meet the existing Class AA criteria (an average 7DADMax of 15°C) would meet the 13°C at the time of spawning initiation.

Therefore, seventy-seven (77%) of Class AA streams meet the existing summer criteria, and 58% of streams that meet the current Class AA criteria meet the spawning temperature target where and when needed. This information can be used to create a cautious estimate of the number of streams that would have a high chance of benefit from the narrative spawning criteria. Seventy-seven (77%) of the total summer runs (285) would be 219 runs that would be potentially effected by the change in temperature criteria. Fifty-eight percent of these are likely to reach the 13°C spawning temperature at the time of spawning (127 runs).

While less than favorable conditions would exist for the stocks under the current temperature criteria (average 7DADMax 15°C), summer temperatures would be on a seasonally declining pattern beyond the peak summer period and many of the hens would be spawning in waters of temperatures around 14°C. It seems reasonable to assume that only 45% of each of the 127 runs would occur during warmest part of the summer. Thus it also seems reasonable to assume that 22.5% would occur between 14-15°C, and 22.5% between 13-14°C.

For this analysis, temperatures between 13-14°C will be assumed to cause very minor (5%) incubation losses, even though based on the Ecology temperature criteria analysis this range has the potential to be fully protective of incubation. Temperatures between 14-15°C will be assumed to result in moderate (30%) losses. These assumptions seem to well represent the general patterns observed in the scientific literature.

One hundred and twenty seven (127) runs with 1000 hens per run is 127,000 hens. Each hen would have 4,750 eggs each. Forty-five percent of these would be potentially impacted by temperatures above 13°C (271,462,500) and 135,731,250 eggs would be deposited at each of the 1°C increments above 13°C. Thus 135,731,250 eggs would be deposited between 14-15°C and experience a 30% loss, and 135,731,250 eggs would be deposited between 13-14°C and experience a 5% loss. The above losses would represent the potential gains from maintaining stream temperatures using the proposed narrative criteria rather than allowing summer maximum temperatures at the warmer existing criteria. This results in the estimate that 47,505,937 eggs will be gained from the proposed change in temperature criteria. Only 55% percent of the eggs should be expected to successfully hatch (26,128,266) and only between 0.1 and 0.5% of the fry will likely survive until adults (26,128-130,641). Thus the change in criteria in Class AA waters are likely to result in the potential gain, or protection from loss, of between 26,128 to 130,641 adult fish statewide.

Interference with Smoltification:

Once juvenile migratory salmonids become large enough they migrate to the ocean. While moderate temperatures may help them grow to sufficient size in a shorter period of time, water temperatures too warm can impair the ability of the smolts to live in salt water or prevent their migration altogether. To protect the smoltification capability of juvenile salmonids, the

7DADMax temperatures should not exceed 15.2-16.2°C prior to or in the early stages of out-migration. It is estimated that a 7DADMax of 18-19°C may prevent or stop smoltification entirely. Since many of the state's Class AA waters are used by the juvenile fish for rearing in preparation for their eventual seaward migration, this potential effect may be influenced by the proposed change in temperature criteria. Both the existing criteria of 15°C and the proposed criteria of 16°C fall within range of the estimate of temperatures that prevent any interference with out-migration. Therefore, while there is a slight increase risk of interference related to the proposed criteria being at the upper range of the estimated safe temperature regime, it is not amenable to a quantitative estimation of potential risks in fish populations.

Summary Discussion

For Class AA waters that would change to the proposed salmon and trout spawning and core rearing use, the life stages where quantifiable changes in protection occur are prespawning and incubation. While some losses are calculated during the period prior to spawning, much of this would likely be reduced through the full implementation of the narrative provision since it would be expected that ripe hens would often be in the spawning tributary protected by the narrative.

Factor	Additional Adult Fish
Disease	Unquantifiable Loss
Prespawning	-14,876 to -74,378
Incubation	26,128 to 130,641
Smoltification	Unquantifiable Loss.
Total Estimate Gains	11,252 to 56,263

Class A to Non-Core Salmonid Spawning and Rearing Waters:

Class A freshwater criteria will change from a one-day maximum temperature of 18°C to a 7-day average of the daily maximum temperatures of 17.5°C. Based on a review of existing state water temperature data, a 1-DADMax of 18°C is on average equal to a 7-DADMax temperature of 17°C. So in essence, the change is a 0.5°C increase in the allowable temperature. It is believed that this change in criteria is too small to quantitatively estimate any potential changes to the summer rearing health of fish populations. The proposed criteria also include a narrative statement that directs Ecology to maintain healthy water temperatures to support spawning and incubation where and when it occurs. The benefits of applying the narrative criteria protecting spawning come from preventing the warming of waterbodies that currently provide healthy spawning temperatures when and where spawning occurs, and from stimulating actions that will reduce temperatures to or approaching healthy spawning temperatures where such temperatures are not currently being met.

Spawning in Class A waters often occur well into the fall and winter seasons. This suggests more uncertainty exists as to the extent to which summer temperatures affect the ability of waterbodies to provide protective spawning temperatures then with the analysis for Class AA waters.

For this analysis, the focus is placed on the summer spawning stocks since these are believed to have the greatest potential to be harmed without the narrative criteria in place, but it is recognized that non-summer stocks would also likely benefit from the narrative criteria.

Fish Diseases:

Increased temperatures increase the risk of losses due to warm water fish diseases. To virtually eliminate the risk of losses from warm water diseases, water temperatures would need to be below a 7DADMax of 12.6-16.2°C (14.38°C is considered the best estimate for a threshold for this level of effect). To avoid serious rates of infection and mortality the 7DADMax would need to be below 15.6-19.2°C (17.38°C is considered the best estimate for a threshold for this level of effect). To prevent severe rates of infection and catastrophic outbreaks the 7DADMax temperature would need to be below 18.6-23.2°C (20.88°C is considered the best estimate for a threshold for this level of effect).

The existing Class A temperature criteria is approximately equal to a 7DADMax of 17°C and the proposed change in temperature criteria would increase the target criteria to a 7DADMax of

17.5°C. Both the existing and proposed criteria have essentially the same potential to allow serious rates of infection and mortality. The only added benefits of the proposal are those associated with maintaining existing cold waters through the use of the narrative criteria to protect spawning.

A 7DADMax temperature of 17°C is completely outside the probable range for temperatures that would eliminate warm water disease effects, and thus would have a high probability of allowing for some losses due to infections. The 7DADMax of 17°C closely aligns with the best estimate for a threshold criteria to avoid serious rates of infection and mortality. Thus the conclusion is that any mechanism that reduces the summer 7DADMax from 17°C to 16°C will prevent moderate rates of infection and mortality that would otherwise occur at the existing Class A temperature criteria. It is reasonable to assume that this modest level of improvement may occur through the implementation of the narrative statement to protect spawning when and where it occurs.

Based on the WDFW SASI (Salmon and Steelhead Stock Inventory) data base 139 streams have summer spawning stocks that are currently in Class A waters that would be assigned the 7DADMax temperature criteria of 17.5°C. Since 42% of streams are estimated to be in compliance with the existing Class A criteria, it is reasonable to assume that 42% of the 139 summer spawning streams may potentially benefit from lowering the existing Class A temperature criteria. This approach does not intend to suggest that a direct statistical relationship exists between the streams in compliance with summer criteria and those that meet spawning criteria where and when spawning occurs, but is only used as a tool to provide a reasonable boundary estimate for the benefits.

Using the above approach results in the estimate that 58 stocks would likely benefit (be maintained at cooler temperatures than would be allowed under the existing criteria) from the use of the narrative temperature criteria. It is assumed that these 58 stocks would have the greatest chance of being protected at summer maximum temperatures of 16°C or lower. Moderate mortalities in association with this estimate would be described as typical losses of 20-60%. It is therefore assumed that the change from 17 to 16°C may in some rivers prevent losses of at least 20% since 17°C is at the threshold above which serious rates of infections and losses appear most probable and 16°C is below that threshold and also within the probable range to prevent all losses due to warm water diseases. It is important to recognize that actual losses and risks are directly related to the type of disease and the virulence of the individual strains present, and considerable variability would be expected between rivers and years. Similarly, not all individuals in a stock are likely to be equally infected, or effected once infected. Infection rates can be both much higher and much lower in the natural environment, and in rivers where fish are crowded together disease transmission rates may be very high. To try and avoid overstating the risks and potential effects, it is assumed that only 30% of any stock is infected during the peak summer temperature period and experience losses of no more than 20%.

The average run of fish in our state consists of approximately 2,000 fish, with half of these fish (1,000) being females. If 30% of these fish were infected and that infection resulted in a 20% mortality it would reduce the number of fish by 120 individuals per run. Of these, 60 lost adults per run would be expected to be females. As noted previously it is estimated that 58 summer

runs may likely benefit from the addition of a narrative criteria to protect spawning in these Class A waters.

The potential loss due to disease would include both the loss of adult male and female fish plus the loss of potential adult offspring from the lost females. If 60 females per run may be harmed and each female is carrying 2,500-7,000 (4,750 median) eggs, then 285,000 (60 hens with 4,750 eggs per hen) potential eggs may be lost per run. If the temperature change would benefit 58 runs, then the change would potentially result in an additional 16,530,000 more eggs deposited for incubation. Survival rates through the incubation period in natural stream environments would generally be expected to be within the range of 45-65% (55% median). Thus the protection of temperatures through the use of the narrative criteria in waters supporting sensitive spawning stocks may prevent the loss of 9,091,500 fry. Although data on rates of survival until adulthood are not available, it is unlikely that more than 0.1-0.5% of fry will survive until becoming adults, so the potential loss in fish due to disease would be between 9,091 and 44,458 individuals from lost reproductive potential due to the loss of female reproduction.

Applying the estimated 30% infection rate and the 20% direct loss of infected adults to the average number of individuals per run (2,000) results in the estimate that 120 adults may be lost per run. With an estimated 58 runs of fish potentially affected by the change in temperature criteria, this produces the estimate that 6,960 adult losses may potentially be prevented.

The loss to juvenile fish that are rearing and out-migrating is not included in this assessment, but neither is the possibility that many of the severely effected female fish may successfully deposit their eggs before being overcome by disease. It is not known how well these two opposing factors counterbalance each other. The total potential gains from disease prevention ranges from 16,051 to 51,418 adult fish during warm years (when the temperature criteria would be in full effect as a protective tool).

Prespawning Effects:

Adult salmonids ripe with eggs may experience direct losses in potential offspring if they are forced to hold or travel through warm waters. To avoid prespawning losses of eggs the highest 7DADMax temperature should not exceed 13.5-15°C in the week or two immediately prior to spawning. High prespawning losses would be expected where 7DADMax temperatures are greater than 15.5-16°C just prior to spawning. Where spawning occurs at or during the summer peak temperature period, the proposed change from a estimated 7DADMax of 17°C to a 7DADMax of 17.5°C would be estimated to increase the risk of prespawning losses to ripe eggs. Information does not exist to estimate the number of adult fish that would be in a ripe condition during the summer maximum temperature period, but it would be expected to be quite low on a statewide basis. The percentage of Class A streams where spawning occurs in July and August can be estimated from the state Salmon and Steelhead Stock Inventory program database. These streams can be used as a good estimate of the number of streams where prespawning losses would be expected to change in response to the use of the narrative temperature criteria provision.

Temperatures (7DADMax) of 13.5-15°C are associated with the general absence of expected egg losses, and temperatures 1-2°C above this range are associated with moderate (13%) to high (45-50%) losses to eggs in ripe adults. To maintain a conservative analysis of the benefits of applying the narrative spawning provision, only a 13% increase in viable eggs will be assumed to occur for the summer spawning stocks.

Not all hens would be in a ripe condition at the time of maximum summer temperatures. Although no data is available to assist in making a specific estimate, the general patterns of spawning periods extending for several weeks to several months beyond peak summer temperature conditions suggests the proportion of fish exposed would be limited. For this assessment it is assumed that 20% of each summer fish run would expose ripe females to the maximum summer temperatures. The lack of available fisheries data on the numbers of fish that become ripe in the weeks immediately prior to spawning, and the use of a larger percentage of spawners assessed in the considerations which follow on incubation effects, prompts the use of this assumed small percentage for prespawning risk. Further, since fish in a ripe condition would be close to their spawning times, the narrative criteria directing the department to provide healthy (13°C) spawning temperatures may further reduce the number of individual ripe females that would be exposed to temperatures above a 7DADMax of 15°C.

If each of the 58 summer runs of fish contain 1,000 hens, each hen contains 4,750 eggs, and 20 percent of each run looses 13 percent of the potential eggs, then the total loss is 7,163,000 eggs lost due to prespawning effects (1,000 X 0.20 X 4,750 X 0.13 X 58). If 55 percent of the eggs result in fry and 0.1-0.5 percent of the fry survive until adults, then the increased in potential adults due to the use of the narrative temperature criteria in Class A waters would be 3,940-19,698 fish.

Potential Losses to Incubation:

The protection of incubating eggs and developing embryos is best described by having 7DADMax temperature below 12.5-14.0°C (median 13.2°C) at the time of fertilization for fall spawning stocks and by the point of emergence from the gravels for spring spawning stocks.

As noted previously it is estimated that 58 stocks would likely benefit from the change in state temperature criteria. It is reasonable to assume that total losses would not occur to these stocks even if they were warmed above the target spawning criteria. It is assumed that less than half (45%) of each stock would be impacted by any increase in temperature that would have been prohibited by the use of the proposed spawning criteria narrative. Of these, the egg losses are assumed to be 30%. Because the existing criteria is in the range expected to produce very high or complete lethality to newly fertilized embryos, assuming only a 30 percent loss may greatly understate the effects.

Based on the preceding, 58 runs, with 1000 females per run, and 45% of those females depositing 4,750 eggs under unfavorable temperatures and having 30% mortality of those eggs would result in a potential loss of 37,192,500 eggs. Of those eggs, only 55% would have likely resulted in fry and between 0.1-0.5% would likely survive until becoming adults. Thus the use

of the narrative spawning provision may result in the gain, or protection, of 20,456 to 102,279 adult fish statewide.

Reduction in Size and Condition:

Metabolic costs of warmer temperatures reduce ultimate size and market-condition (quality) of fish. Using the results from nine independent lines of evidence pertaining to juvenile rearing health, a healthy summer rearing temperature would be described as occurring within the range of 14.8-18.1°C with the median estimate of 16.5°C as a 7DADMax temperature having the highest probability of representing the best estimate. Since both 17.0°C and 17.5°C fall within the plausible fully protective range it is assumed for this analysis that the there is no practical difference in protection, and that any increased risk associated with the proposed criteria is unquantifiable.

Predation and Competition Losses:

Cool water and warm water species may displace and prey on coldwater species at excessive levels at warmer stream temperatures. It is estimated that as the 7DADMax temperature exceeds 17.6-18.1°C (median 17.89°C) coldwater species may begin to be displaced from the best habitats for feeding. The proposed criteria change would increase the allowable temperature from an average 7DADMax of 17°C to a 7DADMax of 17.5°C. Neither of these temperatures would clearly change the competitive relationship with salmon and trout and their warmer water loving competitors. No estimate of fish losses can be assigned directly to this category of concern, and it should be viewed as an unquantifiable increased risk of loss.

Interference with Smoltification:

Once juvenile migratory salmonids become large enough they migrate to the ocean. While moderate temperatures may help them grow to sufficient size in a shorter period of time, water temperatures that are too warm can impair the ability of the smolts to live in salt water or can prevent their migration altogether. To protect the smoltification capability of juvenile salmonids, the 7DADMax temperatures should not exceed 15.2-16.2°C prior to or in the early stages of out-migration. It is estimated that a 7DADMax of 18-19°C may prevent or stop smoltification entirely. Since many of the state's Class A waters are used by the juvenile fish for rearing in preparation for their eventual seaward migration, this potential effect may be influenced by the proposed change in temperature criteria. The exact proportion of Class A waters used for juvenile growth is unknown but would be expected to include most of the non-main stem tributaries covered under that class. Estimating the effects of the change in temperature criteria on smoltification is further complicated by the fact that most out-migration is completed well before the summer maximum temperatures are occurring in Washington's streams. Both the existing and proposed criteria are applied as summer maximum criteria. This then requires some estimate of the relationship of the summer maximum (7DADMax) condition to the temperatures experienced by out-migrating salmonids during the spring through early summer period. Based upon a review of the fisheries literature for Washington, there are very few streams that experience out-migration past June, and based upon examination of available stream temperature data there is typically at least a 1°C difference in temperatures that occur at the end of June and

those representing peak summer temperatures. There are occasions, however, when the peak summer temperature does occur in June, but insufficient information exists to correlate these occurrences with the out-migration patterns of smolts. Only best professional judgment can be used at this point in time to estimate the potential effects. It is reasonable to assume that only about 2-5% of the smolts statewide out-migrate during the late spring to early summer period when maximum temperatures can occur, and in any one river basin with late migrating stocks of fish only about 5-10% would still be migrating out of the upper tributary systems during potential peak temperature periods. Thus there is a small number of fish that may even have a reasonable potential of out-migration from their rearing tributaries during peak temperature periods. The change in temperature criteria from an approximate 7DADMax of 17°C to a 7DADMAx of 17.5°C needs to be considered in terms of this potential risk of smoltification interference. Both the existing and proposed criteria fall below the lower range of the estimate of temperatures that would completely stop out-migration, but fall above the range of temperatures estimated to prevent any interference with out-migration. The two criteria are too close to quantitatively estimate any differences in potential smolt migration interference, but it can be said that the proposed criteria creates an unmeasureable increased risk of interference. Similar to the evaluations on disease, and reproduction protection, the narrative criteria protecting spawning will be used to keep some rivers cooler than would otherwise be allowed using only a summer maximum criteria alone. Insufficient data exists, however, to either quantify or reasonably speculate on the numbers of fish that may be gained by the changes in risk to smoltification caused by adopting a slightly warmer summer criteria in combination with a narrative that protects spawning.

Summary Discussion

Potential gains in adult fish can essentially be considered cumulative between the factors of disease, prespawning, and incubation effects. Thus the potential gains from these three factors can be summed to produce a rough estimate of the numbers of adult fish that may be made available through the proposed temperature criteria. While this can result in some double accounting, this was allowed only for simplification purposes since the errors are potentially created are well within the tolerances of this analysis. This is particularly true given that conservative estimates are used throughout.

Factor	Additional Adult Fish
Disease	16,051 to 51,418
Prespawning	3,940 to 19,698
Incubation	20,456 to 102,279
Reduction in Size	Insufficient information
Predation/Competition	Insufficient information
Smoltification	Insufficient information
Total Estimate Gains	40,447 to 173,395

Change from Class A to Char Spawning and Rearing:

This proposed change will on average result in a 5°C decrease in allowable summer temperatures for the Class A waters receiving the 12°C 7DADMax criteria. These waters would also receive a narrative criteria statement directing the protection of char incubation. The current single daily maximum of 18°C is not believed to protect any life stage of char and if applied would be expected to typically eliminate spawning and rearing use. The lack of specific population information on char makes estimating and quantifying the effects of this change problematic. So while the benefits to char populations are very important they cannot be quantitatively estimated. Because of this lack of population information the focus in the following analysis only addresses salmon and steelhead, since these are the only species for which reasonable estimates on the size of the effected population can be made.

Only those streams that are at or below the current water quality criteria (1-day max of 18°C or approximately a 7DADMax of 15°C) would have the clear potential to significantly benefit from the assignment of a lower temperature criteria (7DADMax 12°C). Based on ambient monitoring data, 42% of Class A streams meet their assigned temperature criteria.

Summer spawning stocks would be those that would be those placed at greatest risk by the existing summer maximum temperature criteria. The WDFW SASI (Salmon and Steelhead Stock Inventory) data base identified 7 Class A streams where summer (July and August) spawning occurs that would be changed to the char spawning and rearing use.

Assuming the proportion of streams statewide in compliance with the Class A criteria is the same for the summer spawning streams in the char use type, then about three summer spawning stocks are most likely to benefit from the proposed change in the state temperature standards.

Prespawning Effects:

Adult salmonids ripe with eggs may experience direct losses in potential offspring if they are forced to hold or travel through warm waters. To avoid prespawning losses of eggs the highest 7DADMax temperature should not exceed 13.5-15°C in the week or two immediately prior to spawning. The existing Class A criteria is a 1-day maximum of 18°C which on average would be equal to a 7DADMax criteria of 17°C. This would likely cause considerable or even total losses in potential offspring in females with ripe eggs that spend

much time in waters at the existing criteria. A 7DADMax temperature of 12°C would, however, result in full protection against such prespawning losses. It would also allow spawning to commence upon arrival at the spawning areas, further maximizing the freshness and thus viability of the eggs.

Temperatures (7DADMax) of 13.5-15°C are associated with the general absence of expected egg losses, and temperatures 1-2°C above this range are associated with moderate (13%) to high (45-50%) losses to eggs in ripe adults. To maintain a conservative analysis of the benefits of applying the narrative spawning provision, only a 13% increase in viable eggs will be assumed to occur for the summer spawning stocks.

Not all hens would be in a ripe condition at the time of maximum summer temperatures. Although no data is available to assist in making a specific estimate, the general patterns of spawning periods extending for several weeks to several months beyond peak summer temperature conditions suggests the proportion of fish exposed would be limited. For this assessment it is assumed that 20% of each summer fish run would expose ripe females to the maximum summer temperatures. The lack of available fisheries data on the numbers of fish that become ripe in the weeks immediately prior to spawning, and the use of a larger percentage of spawners in the considerations which follow on incubation effects, prompts the use of this assumed small percentage for prespawning risk. Further, since fish in a ripe condition would be close to their spawning times, the narrative criteria directing the department to provide healthy (13°C) spawning temperatures may further reduce the number of individual ripe females that would be exposed to temperatures above a 7DADMax of 15°C.

If each of the 3 summer runs of fish contain 1,000 hens, each hen contains 4,750 eggs, and 20 percent of each run looses 13 percent of the potential eggs, then the total loss is 370,500 eggs lost due to prespawning effects (1000 X 0.20 X 4,750 X 0.13 X 3). If 55 percent of the eggs result in fry and 0.1-0.5 percent of the fry survive until adults, then the increase in potential adults due to the use of the narrative temperature criteria in Class A waters would be 204-1,019 fish.

Incubation Effects:

The protection of incubating eggs and developing embryos is best described by having 7DADMax temperature below 12.5-14.0°C (median 13.2°C) at the time of fertilization for fall spawning stocks and by the point of emergence from the gravels for spring spawning stocks. Keeping lower summer temperatures (the proposed 7DADMax of 12°C versus the existing 1-day maximum of 18°C) would better protect spring and summer incubating stocks.

Based on the available scientific literature, complete mortality (100%) would be likely to occur if incubation is initiated in a stream with a daily maximum temperature of 18°C. Incubation begun at the proposed criteria of 12°C (7DADMax) would be expected to experience no temperature induced mortality. Thus the proportion of eggs deposited during summer maximum conditions, which would otherwise perish under the existing criteria, would represent the benefits of the proposed criteria. It is assumed that 45% of the run would experience temperatures at the peak of summer.

As discussed previously, the chances are that only about three summer spawning stocks would clearly benefit from the proposed change from Class A to char spawning and rearing (more would likely benefit, but the summer spawning stocks occurring in waters that currently are colder than the existing criteria are a subset of waters that most clearly benefit and are thus used as a conservative estimate in this analysis).

Based on the preceding assumptions, 3 runs, with 1000 females per run, and 45% of those females depositing 4,750 eggs under unfavorable temperatures and having 100% mortality of those eggs would result in a potential loss of 6,412,500 eggs. Of those eggs, only 55% would have likely resulted in fry and between 0.1-0.5% would likely survive until becoming adults. Thus the lack of specific spawning temperature protection might result in a loss of 3,527 to 17,634 adult fish statewide.

Fish Diseases:

Increased temperatures increase the risk of losses due to warm water fish diseases. To virtually eliminate the risk of losses from warm water diseases, water temperatures would need to be below a 7DADMax of 12.6-16.2°C (14.38°C is considered the best estimate for a threshold for this level of effect). To avoid serious rates of infection and mortality the 7DADMax would need to be below 15.6-19.2°C (17.38°C is considered the best estimate for a threshold for this level of effect). To prevent severe rates of infection and catastrophic outbreaks the 7DADMax temperature would need to be below 18.6-23.2°C (20.88°C is considered the best estimate for a threshold for this level of effect).

The existing Class A temperature criteria is approximately equal to a 7DADMax of 17°C and the proposed change in temperature criteria would reduce the target criteria to a 7DADMax of 12°C. The proposed 7DADMax of 12°C would likely completely eliminate losses associated with warm water diseases.

A 7DADMax temperature of 17°C is completely outside the probable range for temperatures that would eliminate warm water disease effects, and thus would have a high probability of allowing for some losses due to infections. The 7DADMax of 17°C closely aligns with the best estimate for a threshold criterion to avoid serious rates of infection and mortality.

As discussed previously, it is estimated that three stocks will most benefit from proposed change in temperature criteria. Moderate mortalities associated with the existing criteria would be described as typical losses of 20-60%. It is therefore assumed that the change from 17 to 12°C may in some rivers prevent losses as much as 20% since 17°C is at the threshold above which serious rates of infections and losses appear most probable and 12°C is likely to prevent all losses due to warm water diseases. It is important to recognize that actual losses and risks are directly related to the type of disease and the virulence of the individual strains present, and considerable variability would be expected between rivers and years. Similarly, not all individual fish in a stock are likely to be equally infected or effected once infected. Infection rates can be both much higher and much lower in the natural environment, and in rivers where fish are crowded together disease transmission rates may be very high. To try and avoid

overstating the risks and potential effects, it is assumed that only 30% of each stock is infected during the peak summer temperature period and experience losses of no more than 20%.

The average run of fish in our state consists of approximately 2,000 fish, with half of these fish (1,000) being females. If 30% of these fish were infected and that infection resulted in 20% mortality it would reduce the number of fish by 120 individuals per run. Of these, 60 lost adults per run would be expected to be females. As noted previously it is estimated that 3 summer runs would most likely benefit from the change in criteria.

The potential loss due to disease would include both the loss of adult male and female fish plus the loss of potential adult offspring from the lost females. If 60 females per run may be harmed and each female is carrying 2,500-7,000 (4,750 median) eggs, then 285,000 (60 hens with 4,750 eggs per hen) potential eggs may be lost per run. If the temperature change would benefit 3 runs, then the change would potentially result in an additional 855,000 more eggs deposited for incubation. Survival rates through the incubation period in natural stream environments would generally be expected to be 55%. Thus the lower temperature criteria for waters supporting sensitive spawning stocks may prevent the loss of 470,250 fry. Although data on rates of survival until adulthood are not available, it is assumed that 0.01-0.05% of fry will survive until becoming adults, so the potential loss in fish due to disease would be between 470 and 2,351 individuals from lost reproductive potential due to the loss of female reproduction.

Applying the estimated 30% infection rate and the 20% direct loss of infected adults to the average number adults (2,000 adults per run) results in the estimate that 120 adults may be lost per run. With an estimated 3 runs of fish potentially affected by the change in temperature criteria, this produces the estimate that 360 adult losses may potentially be prevented. The losses of adults can be reasonably combined with the losses to potential offspring to get at the estimate of the total benefits from changing temperature criteria in these waters.

The loss to juvenile fish that are rearing and out-migrating is not included in this assessment, but neither is the possibility that many of the severely effected female fish may successfully deposit their eggs before being overcome by disease. It is not known how well these two opposing factors counterbalance each other. The total potential gains from disease prevention range from 830 to 2,711 adult fish during warm years.

Reduction in Size and Condition:

Metabolic costs of warmer temperatures reduce ultimate size and market-condition (quality) of fish. Using the results from nine independent lines of evidence pertaining to juvenile rearing health, a healthy summer rearing temperature would be described as occurring within the range of 14.8-18.1°C with the median estimate of 16.5°C as a 7DADMax temperature having the highest probability of representing the best estimate. Since 12.0°C falls well below the plausible fully protective range it is assumed for this analysis that there would be some reduction in size and condition in the waters maintained at the proposed 12°C. While 17.5°C also occurs above the best estimate of fully supported criteria for growth, there is probably a greater chance that growth will suffer more at a summer maximum of 12°C then 17.5°C. Insufficient information is available to quantify this difference, and it will likely depend upon the individual waterbody traits such as available forage supplies. If food is scarce then the lower temperature will be more beneficial and closer to optimum then if food is plentiful. At this point all that can be said is that there is likely to be a slightly lower growth potential for salmon and trout held in waters with summer maximums of 12°C as compared to 17.5°C.

Predation and Competition Losses:

Cool water and warm water species may displace and prey on coldwater species at excessive levels at warmer stream temperatures. It is estimated that as the 7DADMax temperature exceeds 17.6-18.1°C (median 17.89°C) coldwater species may begin to be displaced from the best habitats for feeding. The proposed criteria change would decrease the allowable temperature from an average 7DADMax of 17°C to a 7DADMax of 12°C. The proposed criteria would essentially eliminate the potential for salmonids to be displaced and preyed upon by cool water and warm water species. No estimate of fish losses can be assigned directly to this category of concern, but it should be viewed as an unquantifiable reduction in the risk of loss.

Interference with Smoltification:

Once juvenile migratory salmonids become large enough they migrate to the ocean. While moderate temperatures may help them grow to sufficient size in a shorter period of time, water temperatures that are too warm can impair the ability of the smolts to live in salt water or can prevent their migration altogether. To protect the smoltification capability of juvenile salmonids, the 7DADMax temperatures should not exceed 15.2-16.2°C prior to or in the early stages of out-migration. It is estimated that a 7DADMax of 18-19°C may prevent or stop smoltification entirely. Since many of the state's Class A waters are used by the juvenile fish for rearing in preparation for their eventual seaward migration, this potential effect may be influenced by the proposed change in temperature criteria. The exact proportion of Class A waters used for juvenile growth is unknown but would be expected to include most of the non-main stem tributaries covered under that class, and thus is likely to include those waterbodies that would experience the change in standards from Class A to the char spawning and rearing use. Estimating the effects of the change in temperature criteria on smoltification is further complicated by the fact that most out-migration is completed well before the summer maximum temperatures are occurring in Washington's streams. Both the existing and proposed criteria are applied as summer maximum criteria. This then requires some estimate of the relationship of the

summer maximum (7DADMax) condition to the temperatures experienced by out-migrating salmonids during the spring through early summer period. Based upon an overview of the fisheries literature for Washington, there are very few streams that experience out-migration past June, and based upon examination of available stream temperature data there is typically at least a 1°C difference in temperatures that occur at the end of June and those representing peak summer temperatures. There are occasions, however, when the peak summer temperature does occur in June, but insufficient information exists to correlate these occurrences with the out-migration patterns of smolts. Only professional judgment can be used at this point in time to estimate the potential effects. It is assumed that only about 2-5% of the smolts statewide out-migrate during the late spring to early summer period when maximum temperatures can occur, and in any one river basin with late migrating stocks of fish only about 5-10% would still be migrating out of the upper tributary systems during potential peak temperature periods. Thus there is a small number of fish that may even have a reasonable potential of out-migration from their rearing tributaries during peak temperature periods. The change in temperature criteria from an approximate 7DADMax of 17°C to a 7DADMAx of 12°C needs to be considered in terms of this potential risk of smoltification interference. Both the existing and proposed criteria fall below the lower range of the estimate of temperatures that would completely stop out-migration, The existing criteria falls above the range of temperatures estimated to prevent any interference with out-migration, but the proposed criteria would fall well below the threshold.

To avoid over-estimation of the benefits, it is assumed that 2% of outgoing smolts of the three summer spawning stocks (identified previously) will occur during the peak summer period. If 1,000 hens spawn in the 3 summer spawning streams, each hen deposits 4,750 eggs, and 55% of those eggs hatch, then there would be 7,837,500 fry produced. If temperatures were allowed to increase to the existing criteria all out-migration would likely be stopped, but to avoid overestimation it is assumed that the temperature only inhibits 30% of the out-migrants. If between 0.1% and 0.5% of successful out-migrants survive to become adults, then the loss of 2,351 to 11,756 potential adults may be gained, or protected from loss.

Summary Discussion

Due to the high existing temperature criteria for these waters, the potential fisheries gains from the lower proposed criteria are notable for the potentially effected runs.

Factor	Additional Adult Fish
Prespawning	204 to 1,019
Incubation	3,527 to 17,634
Disease	830 to 2,711
Reduction in Size	Insufficient information
Predation/Competition	Insufficient information
Smoltification	2,351 to 11,756
Total Estimate Gains	**6,912 to 39,472**

Change from Class B to Salmonid Rearing:

For those Class B waters the criteria is proposed to change from a single daily maximum temperature of 21°C to a 7-day average of the daily maximum temperatures of 17.5°C to 18°C, with the latter imposed if inland rainbow trout are the only salmonid present. A 1-day maximum temperature of 21°C would on average be equal to a 7-day average daily maximum of 20°C. So, on average the change from Class B to rearing-only protection would result in a 2-2.5°C reduction in the allowable temperature for these rivers.

Fish Disease Losses:

Increased temperatures increase the risk of losses due to warm water fish diseases. To virtually eliminate the risk of loss from warm water diseases, water temperatures would need to be below a 7DADMax of 12.6-16.2°C (14.38°C is considered the best estimate for a threshold for this level of effect). To avoid serious rates of infection and mortality the 7DADMax would need to be below 15.6-19.2°C (17.38°C is considered the best estimate for a threshold for this level of effect). To prevent severe rates of infection and catastrophic outbreaks the 7DADMax temperature would need to be below 18.6-23.2°C (20.88°C is considered the best estimate for a threshold for this level of effect).

The existing Class B temperature criteria is approximately equal to a 7DADMax of 20°C and the proposed change in temperature criteria would lower the target criteria to a 7DADMax of 17.5-18°C. A 7DADMax of 20°C is in the lower half of the range of temperatures predicted to allow for catastrophic outbreaks of warm water disease (18.6-23.2°C). The proposed criteria (7DADMax of 17.5-18°C) would be in a range that would be associated with a good chance of serious rates of infection. Thus, the conclusion is that decreasing the summer 7DADMax from approximately 20°C to 17.5-18°C will prevent catastrophic rates of infection and mortality that may otherwise be possible at the existing Class B temperature criteria. Moderate mortalities in association with this estimate would be described as typical losses of 20-60%. Catastrophic effects would be described as losses in the range of 60-100% in those infected populations. It is

therefore assumed that the change from a 7DADMax of 20°C to one at 17.5-18°C may in some rivers and stocks prevent losses as much as 40-80%, the difference in losses between serious and catastrophic rates of infections. It is important to recognize that actual losses and risks are directly related to the type of disease and the virulence of the individual strains present and considerable variability would be expected between rivers and years. Similarly, not all individuals in a stock are likely to be equally infected or effected once infected. Infection rates can be both much higher and much lower in the natural environment, and in rivers where fish are crowded together disease transmission rates may be very high. To try and avoid overstating the risks and potential effects, it is assumed that only 30% of any stock is infected during the peak summer temperature period and experience losses of as much as 40%. Since data is not available on rearing-only populations, no direct method can be devised to estimate the size of the potentially affected populations. To try and estimate the potential effect, however, it is assumed that summer rearing populations consist of at least 2,000 individuals in each of the 10 existing Class B waters. Studies have not been done to estimate the attainable temperatures for these10 streams so it is assumed they all may benefit from the change. This seems reasonable given their small numbers and the conservative estimates of fish populations used in this assessment.

Ten Class B streams having 2,000 rearing fish per stream yields a population of 20,000 rearing salmonids. If 30% of these fish are infected and 40% of the infected fish die as a consequence to their infections, then the total potential loss would be 2,400 fish. Thus lowering the criteria in Class B waters by 2-2.5°C has the potential to protect at least 2,400 fish that would otherwise be available.

Reduction in Size and Condition:

Metabolic costs of warmer temperatures reduce ultimate size and market-condition (quality) of fish. Using the results from nine independent lines of evidence pertaining to juvenile rearing health, a healthy summer rearing temperature would be described as occurring within the range of 14.8-18.1°C with the median estimate of 16.5°C (7DADMax) having the highest probability of representing the best estimate. Data is not available to estimate the effect on fish size from reducing summer temperatures to 17.5-18°C, however, this change would move the criteria into the range of healthy growth. Thus the change would result in an unquantifiable improvement in rearing conditions for salmonids.

Predation and Competition Losses:

Cool and warm water species may displace and prey on coldwater species at excessive levels at warmer stream temperatures. It is estimated that as the 7DADMax temperature exceeds 17.6-18.1°C (median 17.89°C) coldwater species may begin to be displaced from the best habitats for feeding. The proposed criteria change would reduce the allowable temperature from an average 7DADMax of 20°C to a 7DADMax of 17.5-18°C. The existing criteria is 2°C above the level determined to prevent excessive competition between salmon and trout and their warmer water loving competitors. Thus the proposed temperature would be much less likely to allow for predatory advantages in salmonid and trout habitat since salmonids would still be at their healthiest condition. Based on the technical literature it would be reasonable to assume that competition may result in up to a 20% reduction in growth production and, if temperatures

remain near the existing criteria for much of the summer, the displacement of salmonids from the best rearing/feeding habitats would be expected. Some of the displaced fish would be lost from the system due to crowding and intra-species competition in the remaining available habitat. Mean daily maximum temperatures of only 1°C higher than the existing Class B criteria have been associated with 50% reduction in production and serious restrictions in the distribution of salmonids. While the impacts and losses described above are reasonable to expect at the existing criteria level, they are not fully understood. To take a conservative approach it is assumed that there are only 2,000 individuals in the rearing population and that increased predation and competitive displacement will only result in the loss of 15% of that population. Ten streams with 2,000 individuals rearing in them experiencing a 15% loss would equal the potential loss of at least 3,000 individuals statewide. It should be noted that this evaluation is considering the presence of resident fish. Juvenile-to-adult survival ratios and population figures for resident salmonids are not available. Even if available they would incorporate the impact of predation and adverse competition. To try and avoid over-estimating the benefits, however, the small population estimate (2,000) is used along with an assumption that at least half will die before becoming adults through mechanisms other than temperature induced predation and competition. This results in the very conservative estimate that the proposed change in criteria will at least increase fish populations by 1,500 adults in Class B waters. Added to this would be the proportional benefits to any rearing-migratory salmonids (data did not exist with which to estimate how many rearing anadromous fish would occur in these Class B waters).

Interference with Smoltification:

Once juvenile migratory salmonids become large enough they migrate to the ocean. While moderate temperatures may help them grow to sufficient size in a shorter period of time, water temperatures that are too warm can impair the ability of the smolts to live in salt water or prevent their migration altogether. To protect the smoltification capability of juvenile salmonids, the 7DADMax temperatures should not exceed 15.2-16.2°C prior to or in the early stages of out-migration. It is estimated that a 7DADMax of 18-19°C may prevent or stop smoltification entirely. If Class B waters were established higher in the watershed then they are currently, there would be expected to be very significant effects. However, most of the state's Class B waters are at the terminus of major watersheds. Therefore, direct effects on smoltification would not be a serious risk under the existing criteria in most Class B waters. It is important to note that this optimistic assessment of the safety of the existing criteria is based upon the assumption that juvenile fish in these watersheds will be fully underway with their physiological adaptations and migrations prior to encountering the temperatures permitted currently in Class B waters. Where this assumption is not true, neither the existing or the proposed criteria would be considered fully protective, but the existing would be capable of stopping out-migration completely.

Summary Discussion

Potential gains in adult fish can essentially be considered cumulative between the factors of disease, size, competition, and smoltification effects. Thus the potential gains from these factors can be summed to produce a rough estimate of the numbers of adult fish that may be made available by reducing the Class B temperature criteria to a 7DADMax temperatures of 17.5-18°C from 20°C. .

Factor	Additional Adult Fish
Disease	2,400
Size and Condition	Unspecified Gain
Predation and Competition	1,500
Smoltification	Unspecified Gain
Total Estimate Gains:	3,900 (greater than 2,400)

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y://section/wm/mark/fish-numbers-temperature3b.doc

Appendix D: Economic Analysis for Bacterial

Viruses

- The gastroenteritis viruses[37] are often called the "stomach flu," although it is not caused by the influenza viruses. The main symptoms of viral gastroenteritis are watery diarrhea and vomiting. The affected person may also have headache, fever, and abdominal cramps ("stomach ache"). In general, the symptoms begin 1 to 2 days following infection with a virus that causes gastroenteritis and may last for 1 to 10 days, depending on which virus causes the illness. The model assumes 4.35 restricted activity days involving loss of work days or school days for the flu like symptoms.[38] Many different viruses can cause gastroenteritis, including rotaviruses, adenoviruses, caliciviruses, astroviruses, Norwalk virus, and a group of Norwalk-like viruses. Rotavirus infection is the most common cause of diarrhea in infants and young children under 5 years old. Adenoviruses and astroviruses cause diarrhea mostly in young children, but older children and adults can also be affected. Norwalk and Norwalk-like viruses are more likely to cause diarrhea in older children and adults. Most people who get viral gastroenteritis recover completely without any long-term problems. Gastroenteritis is a serious illness, however, for persons who are unable to drink enough fluids to replace what they lose through vomiting or diarrhea. Infants, young children, and persons who are unable to care for themselves, such as the disabled or elderly, are at risk for dehydration from loss of fluids. Immune compromised persons are at risk for dehydration because they may get a more serious illness, with greater vomiting or diarrhea. They may need to be hospitalized for treatment to correct or prevent dehydration. Viral gastroenteritis is contagious. The viruses that cause gastroenteritis are spread through close contact with infected persons (for example, by sharing food, water, or eating utensils). Individuals may also become infected by eating or drinking contaminated foods or beverages. Food may be contaminated by food preparers or handlers who have viral gastroenteritis, especially if they do not wash their hands regularly after using the bathroom. This model does not extrapolate additional secondary exposures from the individuals exposed through water based recreation.

- Bacterial gastrointestinal illness may include abdominal cramps, nausea, bloating, urgency, bloody stool, fever, and/or malaise. Sixteen percent of the reportable waterborne disease outbreaks of gastroenteritis associated with recreational water were *E.Coli* or shigella. The bacterial sources include Escherichia coli, Salmonella gastroenteritis, Shigellae, Campylobacter jejuni, Vibrio parahaemolyticus and less commonly Yersinia enterocolitica, Vibrio cholerae O1 and O139, non-O1 V. cholerae, Vibrio fluvialis, Aeromonas hydrophila and Plesiomonas shigelloides. Many of these are reportable infections and are not common here as they are in other parts of the world. If they are contracted here in the US, it is likely they were brought in from other countries.

[37] Most of the information in this bullet is copied directly from CDC data in the fact sheet at http://www.cdc.gov/ncidod/dvrd/revb/gastro/faq.htm.

[38] The number of days of illness is based on: Vital and Health Statistics: Current Estimates from the National Health Interview Survey, 1995, CDC Series 10 #199, Table 1, Table 16.

For example one of the more common reportable infections that can be acquired is Shigella. Shigella infections can also be acquired by swimming in contaminated water. Water may become contaminated if sewage runs into it, or if someone with shigellosis swims in it. About 18,000 cases of shigellosis are reported in the United States. Because many milder cases are not diagnosed or reported, the actual number of infections may be twenty times greater. Shigellosis is particularly common and causes recurrent problems in settings where hygiene is poor and can sometimes sweep through entire communities. Shigellosis is more common in summer than winter. Children, especially toddlers aged 2 to 4, are the most likely to get shigellosis. Persons with diarrhea usually recover completely, although it may be several months before their bowel habits are entirely normal. About 3% of persons who are infected with one type of Shigella, Shigella flexneri, will later develop pains in their joints, irritation of the eyes, and painful urination. This is called Reiter's syndrome. It can last for months or years, and can lead to chronic arthritis which is difficult to treat. Reiter's syndrome is caused by a reaction to Shigella infection that happens only in people who are genetically predisposed to it.[39] People may fight off the bacteria alone or they may require an antibiotic. A few will require other medical support.

Parasites

- Parasites, such as Giardia or amoeba may cause gastro enteritis like symptoms. Other common parasites cause rashes. Rare parasites such as Cryptosporidium parvum may cause more serious illness.
- Rashes[40] such as the common swimmers itch may appear within minutes to days after swimming in contaminated water, people may experience tingling, burning, or itching of the skin. Small reddish pimples appear within 12 hours. Pimples may develop into small blisters. Itching may last up to a week or more, but will gradually go away. The rash is caused by an allergic reaction to infection. Most cases do not require medical attention. Rashes can be treated with corticosteroid cream, cool compresses, bath with baking soda, baking soda paste to the rash, anti-itch lotion, Calamine lotion, colloidal oatmeal baths, and avoiding scratching. The model assumes 2.29 restricted activity days for rash related exposures.[41] The number of rashes is estimated based on a ratio of rashes to gastrointestinal outbreaks which were tracked by the CDC.

Numbers of infections from the change in bacterial measurement

The bacterial test of water quality is used as an indicator of the existence of a variety of viruses, bacteria and parasites. The change in the rule reduces the stringency of the criteria, to at least a small degree, in most areas and may create an increase in recreational exposure to parasites, viruses and bacteria.

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[39] Data is from the CDC fact sheet at: http://www.cdc.gov/ncidod/dbmd/diseaseinfo/shigellosis_g.htm#How do people catch Shigella.

[40] The information on rashes was taken from the CDC fact sheet at: http://www.cdc.gov/ncidod/dpd/parasites/schistosomiasis/factsht_cardmermatitis.htm. The numbers were extrapolated based on relative rates of reportable infection for nongastrointestinal and gastroenteritis water related exposures drawn from CDC data at: http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5108a1.htm.

[41] Vital and Health Statistics: Current Estimates from the National Health Interview Survey, 1995, CDC Series 10 #199, Table 1, Table 16.

Citizens of the state participate in water based recreation regularly. The IOC[42] indicates that there were 1.2 million visitor days per year where direct facial exposure to saltwater occurs and 3.9 million visitor days where direct facial exposure to salt water may occur. People surfing, swimming, wading, diving, floating on inner tubes, or on jet-skis, generally get water in their eyes and mouths. The model assumes that 100% of people in this recreation category have contact. People who are in fishing or camping in boats or fishing from shore, may or may not get water in their eyes and mouths. In this latter category, it is more likely that children will approach the water. The model assumes that only 20% of people in this category have contact.

The number of visitor days in the affected recreational areas is estimated based on the share of the lineal feet of waters in this category. Whether or not a change in exposure occurs depends on the areas of recreation and any change in bacterial or viral load in that area.

Frequency of Illness Given Visitor Days

The rates of illness are extrapolated based on EPA's estimates of acute gastroenteritis per 1000 people participating in water based recreation. For salt or marine water there will only be a shift in bacteria criteria in areas where there are no shellfish. The shellfish areas will continue to be regulated under a fecal coliform bacteria indicator. In marine water, the criteria for shellfish results in very low illness rates for swimmers (probably less than 1 illness per 1000 swimmers). In the current Class B there may be 7.3 additional exposures resulting in illness per 1,000 visitor days and in the current Class C recreational areas there may be an additional 3.7 exposures resulting in illness per 1,000 visitor days.

[42] Based on SCORP data from Interagency Committee for Outdoor Recreation, Jim Eyechaner, 12/26/02. Extrapolated based on 6 million population. SCORP data is in Appendix B.

Marine Water		
	Illnesses per 1000 people	Geometric Mean (of Fecal Coliform)
Current AA	<Shellfish>	14
Current A	<Shellfish>	14
Current B	15.33*	100
Current C	19*	200
	Illnesses per 1000 people	Geometric Mean
Proposed Primary Contact	<Shellfish>	14 fecal coliform
Proposed Secondary Contact	22.66	70 enterococci
* Approximations based on the following:		
The 1986 EPA guidance stated that the previous EPA criterion of fecal coliform at 200 cfu/100mL corresponds approximately 19 illnesses per 1000 swimmers.		
Therefore, the current Class C criterion risk rate is 19 illness per 1000 swimmers.		
The EPA proposed criteria of enterococci at 35 cfu/100mL was selected to also correspond to 19 illnesses per 1000 swimmers		
According the the 1986 EPA guidance, enterococci at 17.5 cfu/100 mL (1/2 the recommended criterion of 35) corresponds to 15.33 illnesses per 1000 swimmers		
The Class B criterion of fecal coliform of 100 cfu/100mL, is 1/2 of the previous EPA criterion of 200.		
Assuming that halving the fecal coliform criteria would have the same effect on illness rates as halving the enterococci criterion, the Class B criterion of fecal coliform at 100 cfu/100mL would also have an illness rate of 15.33 illness per 1000 swimmers.		
Change in illness rate for marine water		
AA --> Primary Contact	none	
A --> Primary Contact	none	
B --> Secondary Contact	7.3	
C --> Secondary Contact	3.7	

The rate of exposure to bacteria concentrations that result in illness may not change much in the short run because of institutional controls that are already in place for most treatment plants.

The salt water exposures would generate an additional 91 acute gastroenteritis cases per year. In addition to acute cases that are identified through medical attention, there will be more moderate cases and subclinical cases. The moderate cases may involve lost work or school days but not medical care. The subclinical cases may not involve lost work or school days, but the individual may not function as well as usual while they fight off the infection. These moderate and

subclinical cases are extrapolated from the acute cases.[43] The total annual estimated moderate and subclinical cases are 74 and 65 respectively. The number of rashes is estimated based on the share of shistosomes that generate reportable rashes relative to the number of gastroenteritis cases. This indicates there would be approximately 1 case of a rash per year.

Shift in Illness Due to Bacterial Test					
	Probability	Change in illness rate per 1000	Visitor Days	Dollar Values	Number of added illnesses
Salt Water	% shoreline [a]				
B --> Secondary Contact	2.53%	7.33	50,789		63
C --> Secondary Contact	0.09%	3.66	1,746		1
Weighted average		**0.19**	52,535		64
Total Cases					**64**
Assumption	Face exposure				
Water: face exposure with bacterial content possible	20%				
Based on Partial Data					
Probability that marine water is exceeding the current standard[a]	16.9%				
Relative frequency of non-gastrointestinal disease[a] dermatitis, meningoencephalitis, keratitis, leptospirosis and pontiac fever		0.34%			1
Probability of gastro intestinal illness developing	% Illnesses				
Subclinical *	32.0%				65
Moderate **	36.4%				74
Hospitalization or treatment **	31.6%				64
Annual cost of infective and parasitic illness**					
"Willingness to pay" QUALY basis****		Daily Value	Restricted Activity Days[c]	Dollars	
Mild food poisoning		$ 110	4.32	$ 476	
Severe food poisoning		$ 179	4.32	$ 774	
Severe rash		$ 110	2.29	$ 252	
Total annual value				$ 84,936	
Present Value of QUALY basis				$ 1,294,044	
Cost of Illness Basis****					
Per case medical expenditures**				$ 266	
Per case foregone earnings				$ 112	
Per case losses					
Total annual value				$ 56,664	
Present Value of Cost of Illness basis				$ 863,301	

Cost of illness

The cost of illness can be measured by changes in willingness to pay for quality of life (QUALY) changes or based on the direct cost of illness. The direct cost of illness includes only expenditures on medical care and foregone earnings. The QUALY literature places relative values on types of illness based on reduced quality of life for a period of time and based on our willingness to pay to avoid symptoms.

[43] The subclinical is based on: "Norwalk virus infection of volunteers: new insights based on improved assays," Graham DY, Jiang X, Tanaka T, Opekun AR, Madore HP, Estes MK, Journal of Infectious Disease, 1994 July: 170(1):34-43. Higher rates of 20 times the clinical cases are estimated for Shigella by the CDC: http://www.cdc.gov/ncidod/dbmd/diseaseinfo/shigellosis_g.htm#How do people catch Shigella.

Ecology selected mild and severe food poisoning as the basis for gastroenteritis costs.[44] Gastroenteritis caused by food poisoning is associated with essentially the same set of illnesses as gastroenteritis resulting from waterborne exposure to bacteria. Mild food poisoning is valued at $476 per case and severe food poisoning is valued at $774 per case. Although there are costs associated with mild illnesses, which never-the-less allow the person to go to work, no value was assigned for subclinical gastroenteritis. Rashes are valued at $252 per case. The annual value using the QUALY basis is $80,000.

Cost of illness can also be valued based on medical expenditures ($266 per case)[45] and foregone earnings ($112 per day).[46] Severe gastroenteritis and rashes are expected to generate both medical costs and foregone earnings. Moderate gastroenteritis is expected to generate only foregone earnings. Sub-clinical gastroenteritis certainly generates costs but no cost is assigned. The total annual cost of illness basis using only direct costs is $57,000.

The total expected present value of new illness, accrued over a 20-year time frame, ranges from $1.3 to $860,000.[47]

Note: These costs do not include the value of illness for tourists and visitors, who are not Washington citizens and are therefore not included in the SCORP.

Laboratory Costs

All secondary wastewater treatment facilities currently have a technology-based effluent limit for fecal coliform bacteria. This limit will not change for any wastewater facility. Nine of the facilities on salt water will also be evaluated to determine whether their effluent concentrations of enterococci could cause an exceedance of the new enterococci criteria in marine waters. If any of these facilities are near a shellfish bed their limit will continue to be based on fecal coliform, and not be evaluated for enterococci Counties may need to add testing of enterococci in recreational waters based on requirements in both the new rule. The cost of shifting from a fecal coliform test to an enterococci test is a function of the number of tests and the difference in the cost per test. The cost of the test is based, for consistency, on the relative cost of a membrane filter test for fecal coliform ($20) and enterococci ($29).[48] This cost estimate may overstate the cost because many facilities do their own testing.

Potentially affected salt water facilities				
Number of salt water B class facilities for entero change				9
Estimated average number of tests per year based on sample of Class B facilities				43
Estimated present value cost of tests based on sample of B facilities				$ 7,683
Total present value of cost				$ **69,145**

[44] Valuing Health for Policy: an economic approach, George Tolley, Donald Kenkel, and Robert Fabian, University of Chicago Press, 1994, Table 15.2, pg. 330
[45] Average gastroenteritis and salmonella costs for 49 cases covered by the Washington State Health Care Authority.
[46] Valuing Health for Policy: an economic approach, George Tolley, Donald Kenkel, and Robert Fabian, University of Chicago Press, 1994, Table 3.3, pg. 65.
[47] Present value is calculated based on a 3% discount rate.
[48] Estimated cost shift for bacteria based on Manchester Lab bids: PDF file Price List 10_99.pdf

Each wastewater facility has a different testing regimen, generally ranging from 1 test every 2 weeks to daily testing. For the random sample of facilities the number of tests required for each facility was used to calculate the 20 year present value of the cost of shifting to the new test for that facility.[49] These costs were extrapolated to the unsampled facilities. The nine facilities discharging to B classed salt water areas currently test their effluent for fecal coliform. The cost to these facilities is estimated at $70,000 over a 20 year period.[50]

Six counties have affected waters: Snohomish, King, Pierce, Thurston, Mason, Grays Harbor. The counties may also have costs if they add enterococci to their existing beach sampling plans or replace fecal coliform in their existing beach sampling plans. For water that moves between classed areas,[51] some counties believe they will need to do double testing, using both fecal coliform and enterococci. Other counties already do all three of the tests typically used by health officials as indicators (*E. coli*, fecal coliform and enterococci) for a variety of reasons.[52] Where the county feels required to use both tests to assure compliance due to the flow of the water, these added tests would cost $29 each. For special research products such as a TMDL the counties also expect to use both fecal coliform and enterococci. However, Ecology is likely to allow alternating tests rather than requiring double testing.[53]

The estimated present value of the cost for the counties is $38,000 each accrued over a 20-year period or a total of $230,000 over a 20-year period.

20 year - Monitoring Costs for Enterococci	
	Mid range
Category	Costs
Ambient program	
Number of sample sites for waters moving into Class B	8
Number of samples per year	6
Total Samples	48
Cost of duplicate Enterococci test	$ 29
Annual costs	$ 1,392
Number of possible TMDL sites	40
Number of events	8
Total Samples	320

[49] A 3% discount rate was used to obtain the present value.
[50] Comments from water suppliers in fresh water areas indicated a need for increased testing or the possibility of reduced testing because two tests were already being done. Given that there is no change to the fresh water criteria and that water supply is not generally drawn from salt water, this analysis does not incorporate these comments.
[51] One county indicated tributaries to the Class B area are sampled using Fecal. The testing for the Class B marine water would then be enterococci. As the water moves beyond the Class B area into a Class A shellfish area, they would again be sampling for fecal coliform. For nonpoint source forensics, such as an enforcement, they believe this would in practice require them to use both tests. For research such as a TMDL, they also believe it would require them to use both tests. One county indicated a concern, in that they have no baseline data for the enterococci and that they will need to get the lab certification to do the test.
[52] One county does E. coli for health compliance in areas with woodwaste, fecal coliform for shellfish compliance and enterococci for recreation purposes. Thus they expect no change from the amendment.
[53] One verbal comment indicated that for prosecutions this could also require double testing. However, this is not a requirement of the rule.

One time cost of TMDL	$ 9,280
Total Cost for TMDL Year	$ 10,672
Total Cost per Average Year	$ 1,392
20 year PV of single county costs	38,094
Total Cost for 6 Counties over 20 years	228,561

The total present value of the cost of the shift to a new lab test for both facilities and counties, extrapolated over a 20 year period may be as high as approximately $300,000.

Neutral Impacts

The new standards will not affect municipal permit compliance with limits for fecal coliform bacteria. Currently, most municipals have an effluent limit of 200 colonies/100 ml. This limit is technology-based. A treatment plant with a properly operated disinfection system can meet this limit. A water quality-based limit (based on dilution in the receiving water) for most facilities would be higher than 200 colonies/100ml.[54]

Benefits

Enterococci is a more reliable indicator of health effects than fecal coliform. Sometimes fecal coliform may overestimate actual risk of illness. Fecal coliform testing can enumerate *Klebsiellae* and thus could possibly overstate health risks, particularly of bathing in waters with a high wood waste component.

Benefits may accrue to some permitees in areas where the fecal coliform standard gives a false reading of human pathogens. For example, wood waste may contain high fecal measurements when no human pathogens are present. If fecal coliform is the most sensitive indicator in areas with wood waste pollution, then additional testing requirements for enterococci would not be needed.

Net Costs and Benefits

The bacterial portion of the rule is not expected to generate probable benefits that exceed the probable costs. However, the estimated cost of $1.1 million is less than the net benefits of the remaining parts of the rule amendment. These are estimated to range upward of $100 million.

[54] Gary Bailey, Department of Ecology, 3/27/03.

Appendix E: Public Comments on Draft CBA

The following comments were provided by the public on the draft Cost Benefit Analysis. They had a substantial impact on the considerations of the agency regarding net benefits and regarding the rule. Some of this is noted in the text of the CBA.

Comments on the Draft Cost Benefit Analysis
for the proposed changes to the Water Quality Standards (WAC 173-201A)
as of April 23, 2003 at 1:00pm

From: Kirk Mayer [mailto:kmayer@waclearinghouse.org]
Sent: Thursday, March 27, 2003 9:58 AM
To: Carruthers, Cathy
Subject: Water Quality Stds

Kathy,

Thank you for taking the time to visit with me via phone today on the Water Quality Standards. For your information I work for the Washington Growers Clearing House Assn. which is a grass roots Washington tree fruit growers association. The majority of our members are small family farmers, less than 60 acres each.

Economic Concerns--

Appendix C refers to "....potential disproportionate impact on small business. Cost minimizing features have been provided in the rule."

Appendix C on page 3 lists those cost mitigating measures as: 1.) Conservation Reserve Enhancement Program (CREP). and 2.) Environmental Quality Incentives program (EQIP). First tree fruit growers are not eligible for CREP funding, (even though we and the state have lobbied for that for three years). Second Tree Fruit growers have a very difficult time accessing EQIP funding. Case in point, I have a small grower member that has an overhead sprinkler system. He would like to replace that system with something more water efficient. EQIP has funds for irrigation improvements. However, the current EQIP priority rating system does not give him enough points to qualify for that funding, he has tried. Basically under EQIP his improvement is not environmentally significant enough to warrant funding. Yet under Clean Water/ESA he may be subject to either enforcement by DOE or a third party lawsuit under ESA. He can't use or sell his property for other uses since he is in a Growth Mgt. area of Agricultural Significance. Future buyers would face the same problem. Agricultural producers are being squeezed between the Clean Water Act, Growth Mgt. Act, ESA and DOE interpretation of those rules, to the point it is becoming economically impractical for an agricultural producer to exercise their water rights. Their needs to be a direct relationship between the various rules, funding and

enforcement.

Lastly, I would like clarification on the temperature requirements under past and the proposed rule.

1. If I am located on a Class A stream with a temperature requirement of 18 degrees C, and the natural temperature is 19 degrees C, is Human activity allowed to father influence the water temperature up to 19.3 degrees?

2. If I am located on a Class A stream with a temperature requirement of 18 degrees, the actual temperature at time of law enactment is 19 degrees, is the drainage required to take steps to reduce the human impacts to reach 18.3 degrees?

3. Under the proposed rule the way of measuring temperature is changing and will not be consistent with temperature information from the past. How will such discrepancies be taken into account?

4. I am very concerned that this temperature requirement will be used to require tree fruit growers to provide significant (no touch) buffer strips on all waterways including irrigation ditches which will result in significant loss of production area to the small family farmer, resulting in there no longer being a economically viable unit. The NRCS programs take economics into account but the water quality standards require a higher level of economic proof. How is a small grower ever going to prove that his survival is in the public interest or that his economic loss is significant loss to the state economy?

Thank you.

Kirk B. Mayer, Manager
Washington Growers Clearing House

Comment 2 – The Lands Council

Hello,

I would like to request and extention of the the Cost Benefit Analysis dead line.

Neil Beaver
Water Watch Coordinator
The Lands Council

423 West First, Suite 240
Spokane, WA 99210

Comment 3 – Heliotropics LLC

From: SolarRichard@aol.com [mailto:SolarRichard@aol.com]
Sent: Tuesday, April 01, 2003 5:42 PM
To: Carruthers, Cathy

Cc: Gildersleeve, Melissa
Subject: Re: Water quality standards - cost benefit analysis

Thank You Ladies,
I should be most happy to read over the www.ecy.wa.gov/programs/wq/swqs report and give you my feed back.

Very Respectfully Yours,
Richard Thompson
Heliotropics LLC
2037 South 7th Street
Tacoma, Washington
USA 98405-4013
1-253-572-9220
SolarRichard@Aol.Com
www.TacomaSolarTracking.com

Comment 4 – Rex McKee

From: Rex McKee [mailto:rexmckee@kalama.com]
Sent: Wednesday, April 02, 2003 10:08 AM
To: Carruthers, Cathy
Subject: Draft Cost Benefit Analysis

Thank you for the opportunity to read the draft of cost benefits analysis of the water quality standards.
I feel that the department has made a thorough evaluation.

Comment 5 – Nahcotta Oyster Farm

From: Larry Warnberg [mailto:warnberg@pacifier.com]
Sent: Saturday, April 05, 2003 6:08 PM
To: Carruthers, Cathy
Subject: water quality standards

Hello Cathy:
Thanks for the opportunity to comment on the cost-benefit analysis of the proposed water quality standards.
I farm oysters on Willapa Bay, where water quality issues are always important. My impression is that the mandate to conduct a cost-benefit analysis is an excercise in futility. The quantitative and qualitative benefits of high water quality should always outweigh the costs of eliminating threats to water quality. As you must surely know, the Clean Water Act was passed 30 years ago, but 40% of National surface waters still

do not meet the basic criteria of fishable and swimmable. In Puget Sound, 40% of the shellfish growing areas are restricted for harvest. Here in Willapa Bay, only 2% of growing areas are restricted, but there are several areas that are threatened.

There is a strong need for better protection of surface water quality. Economic arguments should not allow continued degradation. Please register my opposition to the use of cost-benefit calculations to weaken environmental protection.

Pacifically, Larry
warnberg@pacifier.com
Nahcotta Oyster Farm
POB 43, Nahcotta, WA 98637

Comment 6 – Patricia Williford

From: JFW8210918@aol.com [mailto:JFW8210918@aol.com]
Sent: Thursday, April 10, 2003 9:43 AM
To: Carruthers, Cathy
Subject: Surface Water Quality Standards - Cost-Benefit Analysis

Miss Carruthers

Your energy and efforts to keep Washington State waters clean is very much appreciated. I have no intelligence to offer to this effort but want you to know that I do support this agency's mission.

The effects of not having clean drinking water, safe bathing water, and water for use in hospitals is certainly evident in stories we hear and see from Basra.

Best wishes,

Patricia Williford
7155 NE 126th
Kirkland WA 98034

Comment 7 – John Ehrenreich

Hi
Added comment from John. The CB and the appendices are lettered or numbered with a disconnect. Plus Ag is addressed in the memo but the forestry piece is not - where the text indicates that both are covered.
Cathy

Phone (360) 407-6564
FAX (360) 407-6989
Email caca461@ecy.wa.gov

Comment 8 – Washington Growers Clearing House

From: Kirk Mayer [mailto:kmayer@waclearinghouse.org]

Sent: Tuesday, April 08, 2003 4:11 PM
To: Carruthers, Cathy
Subject: RE: Information you requested

Cathy,

Thanks for the information.

Question regarding statements in your e-mail attachment concerning the Wenatchee, Mission Creek, Methow, and Entiat Rivers.

In paragraph 3, beginning "Note 3" the statement is made "When a water body does not meet its assigned criteria due to natural conditions, the natural temperature of the water body, plus 0.3 degrees C for human activity, may become an alternative criteria target for a water body."

The chart shows the Entiat River "proposed standard" is 16 degrees C. The fourth paragraph states that the Entiat River temperature at the mouth is 24 degrees C.

What would the allowable Entiat water temperature be recognizing that the Entiat River Valley does have human activity?
What temperature do you add the 0.3 degrees C?

If the natural temperature of the Entiat River plus the .3 degree C allowance becomes the target yet the target is still say five degrees (for sake of discussion) below the temperature at the mouth (spawning area) of the Entiat River what happens?

Kirk B. Mayer, Manager
Washington Growers Clearing House Assn.

Comment 9 – Bill Sullivan

I just got a call from Bill Sullivan. He was giving me verbal comment on the cost benefit. He says that their later letter stands rather than the earlier one we quote. I have asked him to put his thoughts in writing but he may not have the time. I hope he provides written comment so my paraphrasing does not have to stand but here goes.

He says after 2 brief quotes we go right ahead and ignore the issue of tribal rights to fish. The fish losses (in the areas where losses are a concern) are a major issue. We go on for 85 pages and its hard to tell what the impact is. The document is too cumbersome to be of use. Any diminishment of fish and their habitat is unacceptable. We can't weigh their tribal right to the fish against business concerns and dollars. He feels that once again we are sacrificing their rights to the dollar. We don't even consider that some of the affected fish may be already endangered or will be in the future.

Cathy

Phone (360) 407-6564
FAX (360) 407-6989
Email caca461@ecy.wa.gov

Comment 10 – Oasis Fish Farming

From: Paul Gehl [mailto:pgstocks@msn.com]
Sent: Monday, April 21, 2003 12:45 PM
To: Gildersleeve, Melissa
Cc: Carruthers, Cathy
Subject: Comments on water quality standards

Dear Sirs,

This letter is in reply to your request for comments on: " The Department of Ecology is making the draft Cost Benefit Analysis on the proposed changes to the surface water quality standards (WAC 173-201A) available for public review prior to final rule adoption. "
Here are my comments on the matter.

The irrigation districts used deadly chemicals to remove aquatic weeds in the canals. Xyleen, Acrolein, and copper sulfate are deadly to humans, fish and animals. If the irrigation districts continue to use these methods all precautions should be required that early warning be given to farmers who use the water so that they can prevent contact with these chemicals which may harm their workers and crops. These chemicals require a NPDES permit for their use. Each farmer that receives water containing these chemicals should receive a notice when the chemicals will arrive what concentrations are expected and what damage they could do to human health, livestock, crops, equipment and land. With enough advanced notice the farmer could then decide to accumulate good water prior to use of the herbicide and shut off water during the herbicide being present and then start drawing water after the herbicide has passed by in the system.

Many irrigation districts have abandon the use of chemicals due to their cost. Imperial, Welton Mohawk, Central Arizona Project and Salton Sea use biological methods, fish, to achieve greater flow at lower cost. Some of these district supply water all year unlike our irrigation districts that dry the canals out and receive help from the de-watering process. They are also at lower latitudes which grow more plant matter due to higher temperatures and longer growing seasons. If they can do this economically, Washington state irrigation district can do this as well.

These chemicals can be and are release into ESA waters of the Columbia River. The death and decay of the aquatic weeds also creates BOD which is also released. The irrigation system is known to leak large percentages of the water carried into ground waters. The chemicals and decaying animal and plant matter can create deadly nitrites that pollute wells and can cause Blue Baby syndrome.

Dr. Bonar has done studies for the DOE. His studies concluded that triploid Grass Carp would eliminate all aquatic weeds if stocked in sufficient densities. This is the desired effect for the irrigation districts. Please attached his studies to this comment from your files.

If adequate notice is received or chemical use was eliminated the irrigation water could be used for Aquaculture prior to using the water for land crops.

This dual use of water is conservation and would create much needed jobs from existing resources. The solids and effluent is an excellent soil builder and fertilizer. Washington state has a heritage in the fish business. This system of Aquaculture could continue growth in the fish industry as limits are reached on wild caught stocks from the ocean.

Below is a collection of scientific papers documenting this Aquaculture system, the use of fish for weed control and the ecological and economic benefits.

Sincerely,

Paul Gehl
Oasis Fish Farming
17303 Spanaway Loop Rd. #46
Spanaway WA 98387
253-536-4951

10. SUPPORTING PAPERS:

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4) Riley, J.J., Fitzsimmons, K. M. and E. Glenn. 1997. Halophyte irrigation: An overlooked strategy for management of membrane filtration concentrate. Desalination 110:297-211.
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Regional Agricultural Engineering Service Publication No. NRAES - 105, Ithaca, NY.
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15) Fitzsimmons, K.M., 1992. Fertilizer value of aquaculture effluent and land disposal as a Best Management Practice. pp. 1-4. In: Proceedings of the National Extension Aquaculture Workshop. Ferndale, Ark..
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Comment 11 – Kittitas County Water Purveyors (see attachment)

Comment 12 – Washington State Department of Transportation

June 24, 2003

Ms. Cathy Carruthers
Department of Ecology
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Olympia, WA 98504-7600

Re: Washington State Department of Transportation Comments Concerning Ecology's Draft Cost Benefit Analysis for Proposed Changes to WAC 173-201A

Dear Ms. Carruthers:

The Washington State Department of Transportation (WSDOT) is pleased to have the opportunity to review and comment on the Cost Benefit Analysis for the proposed changes to Washington's water quality standards. This document allows WSDOT to better fully understand Ecology's decision-making process. There were a number of elements of the analysis that were unclear. The comments below should point out several areas of confusion and concern.

General comment- The document is difficult to understand. From a technical standpoint, there is very little benefit-cost analysis contained in the report. The overall report is more a qualitative analysis of how the proposed rule changes would affect business and individuals and less a quantitative analysis where benefits and costs are measured or estimated.

Specific comments- The following comments do not constitute an exhaustive list of concerns. They are merely examples of perceived ambiguity with or questions about the analysis.

1. Antidegradation - Ecology claims that the proposed antidegradation policy changes "are a form of cost reduction" or make implicit requirements explicit (pg 3).

   Comment: It is difficult to understand this statement when WAC 173-201A-300 details six pages of requirements for water quality analysis along with public involvement and intergovernmental coordination processes. The analysis alone would be expensive if not impossible due to the stringent nature of the criteria (i.e. pH change in 0.1 units, a turbidity increase of 0.5 NTU, or any *detectable* change of a toxic substance, etc). The criteria are more precise than existing technology can reliably model or measure.

2. Costs to Sectors - Ecology states that the proposed amendments will not impact non-point sources. *"Ecology's expectation is that the proposed changes to the standard will not require any substantive changes in currently accepted stormwater practices because the current practices represent the best available methods for managing urban stormwater."*

Comment: Does that mean Ecology presumes all regulated stormwater discharges from all facilities built to current standards will meet the proposed criteria? If so, does that mean Ecology will stop requiring permittees to monitor temperature, dissolved oxygen, pH, metals, and other parameters as conditions of 401 Certification and stormwater NPDES permits?

3. Agricultural water supply criteria - Ecology expects no impact, stating that out of the 367 individual permits only one discharger is exceeding proposed TSS standard, and it would be OK with moderate dilution (pg. 20).

   Comment: Why change a standard if it does not prompt significant changes in discharged water quality? How can there be a benefit if hardly anyone is affected?

4. Bacterial standards - Ecology states that probable costs will likely exceed probable benefits (pg 20).

   Comment: This standard should be rejected based on the above statement.

5. Dissolved Oxygen and Temperature
   - Ecology states that "impacts are unclear" (pg. 27) and that it "does not really know the cost of the rule to the permitees" (pg 29) yet estimates a statewide total facility cost at 13-45 million.
   - Ecology outlines 11 crucial information gaps (like number of streams in each class, number of streams meeting the criteria, number of streams with fish runs, etc.) and 4 natural variables that hinder them from estimating benefits (pg 34).
   - Ecology proposes that 12-26 facilities may be affected (that's 0.5-3.75 million dollars/ facility if estimated costs are 13-45 million).

   Comment: If Ecology can't estimate the benefits, on what basis are they proposing regulations that would cost permitees 0.5-3.75 million dollars each? How did Ecology estimate the number of affected permitees if they don't know how many streams are in each class?

6. The document claims in Table 10 that a criteria change will have wide-ranging benefits while simultaneously claiming that few people will be affected. A good example is the third paragraph on page 8. The paragraph is very confusing. It states *"based on…. temperature data collected in Washington , 42% of the assessed streams would not meet ….existing class AA criteria at the time of spawning and 68% would not meet…. the proposed criteria"*. It appears that the document then claims that the proposed criteria change would have a potential benefit to fish in 26% of streams because the standards would be more stringent in 26% of streams.

Comment: Ecology acknowledges that the existing temperature standard doesn't represent natural temperatures on 42% of streams and is proposing a new standard that they acknowledge will not represent natural temperatures on 68% of streams. How can making the criteria more out of touch with natural stream temperatures help fish? Changing the criteria does not change stream temperature. How can there be a potential benefit to 26% of Washington's streams when Ecology estimates that only 12-26 permitees will be affected?

For additional information please contact Richard Tveten at 360-570-6648.

Sincerely,

Mike Stephens
Water Quality and Haz-Mat Manager

MS:RT:dsm

cc: Ken Stone

Comment 13 – Puget Sound Action Team

From: Dohrmann, John
Sent: Tuesday, April 22, 2003 2:45 PM
To: Carruthers, Cathy
Subject: Comments on the Draft Cost-Benefit Analysis for Proposed Water Quality Standards

Thank you for the opportunity to comment on the draft cost-benefit analysis. As is noted in the document, this is not an easy assignment. And I am afraid my comments won't make it easier. As noted below, the challenge is in maintaining the difference between actual water quality conditions, which may have costs, the water quality standards, the focus of this document, and water pollution control requirements, which may have costs.

1. The analysis should provide a better description of the difference between the water quality standards and water pollution control requirements. The majority of water pollution control requirements are technology based. AKART is required regardless of the condition of the receiving water--and regardless of the water quality standard for the receiving water. Even when treatment requirements are added to address receiving water conditions, they tend to be major treatment increments (like installing nutrient removal or going from primary to secondary treatment) rather than fine increments that you would add or subtract if the water quality standard changed by a small amount. So in many cases, changing the water quality standard will have no effect on the technology requirement for major sources of water pollution.

2. The analysis also needs a better description of the difference between the water quality standards and actual water quality conditions. For some analyses you appear to assume that today all waters are exactly at the

current standards and would all be exactly at the new standards if they are adopted. Yet today most water bodies are cleaner than the current standards. On the other hand, we have hundreds of segments that fail to meet the existing standards, if only for one or two parameters. The obvious conclusion is that after new standards are adopted many water bodies will be cleaner than the new standards and others will still be more polluted than the standards. To the degree that the new standards are use based and better incorporate natural conditions, they may more accurately reflect whether the various water segments are meeting the requirement in the law to support beneficial uses.

3. The entire analysis of the costs of additional illnesses due to changing the bacterial standards as serious problems based on treating the standards as the year-around actual condition. You seem to assume that all waters are at the current standard every day and would be at the new standard every day. Yet bacterial levels are extremely variable at any location. Segments that currently don't meet the water quality standards (285 in the 1998 list) may only exceed a few times a year and when they exceed, they may be orders of magnitude above the standard. In addition, you mention later in the document that there is a body of science cited by Ecology and EPA that fecal coliform is not as good a predictor of infection as the proposed *E. coli* standard. Yet you treat the EPA infections per thousand numbers for various bacterial levels as solid numbers. Multiplying the SCORP annual visitor days times the approximate illnesses per thousand at the water quality standard is extremely unrealistic for current conditions and misleading for the future conditions. You also don't address the problem of the 285 segments on the 1998 list that currently exceed the bacterial standard.

4. As mentioned above, many water segments do not meet the standards today. Yet the cost analysis appears to assume that we would make the investments and incur the costs to meet the proposed new standards. If you are going to make that assumption, you need to be able to explain why we have not yet made the investments necessary to meet the current standards. Then you need to discuss why you think we would make the investments if we adopt new standards. And how do you determine how much of the estimated costs to meet revised standards are really deferred costs necessary to meet the current standards?

The real problem is that numeric water quality standards are neither treatment requirements nor the actual expected water quality condition. They are a quantitative way to consistently determine whether each water body can support the identified beneficial uses. This makes it very difficult to convert relatively small changes in the standards into costs or benefits.

John Dohrmann, Policy Director
Puget Sound Action Team
360-407-7305
360-407-7333 FAX

Comment 14 – Washington Growers Clearing House Association

From: Kirk Mayer [mailto:kmayer@waclearinghouse.org]
Sent: Tuesday, April 22, 2003 1:10 PM

To: Carruthers, Cathy
Subject: Comments on Draft Cost Benefit Analysis for DOE H20 Quality Stds.

Washington Growers Clearing House Association
PO Box 2207
Wenatchee Washington 98807
Phone: 509-662-6181; Fax: 509-664-6670
April 21, 2003

Cathy Carruthers
Department of Ecology
P. O. Box 47600
Olympia, WA. 98503
E:mail caca461@ecy.wa.gov

Subject: Draft Cost Benefit Analysis for the DOE's Proposed Water Quality Standards

Dear Cathy Carruthers:

The Washington Growers Clearing House Assn. (WGCHA) has approximately 2,200 Washington tree fruit grower members. As mentioned in earlier letters the Washington Growers Clearing House Association is opposed to DOE's proposed water quality standards.

DOE's decision to not analyze the economic impacts of the proposed rules is not acceptable. DOE states that they"....expects that the effect of the standards on agricultural lands will be minimal and there are mechanisms in place to mitigate the costs to land owners." Therefore there will be no economic analysis.

First the landowner mitigation tools mentioned are federal and federal state partnerships that are not able to fund those agricultural landowners that are currently eligible and have already applied for the funds. To further complicate matters, Governor Locke's 2003-05 current budget proposals provide less state money for such programs as EQIP and CREP than last year. Second, some agricultural commodity groups are not eligible to participate. Example: Washington tree fruit growers cannot access CREP funding which is listed as one of the mitigation tools. The Washington tree fruit industry, with the help of various State officials and departments, has "unsuccessfully" lobbied for tree fruit inclusion in that program for the last three years. The Washington State Congressional representatives have also failed in their efforts to include tree fruit growers in the CREP program.

Unfortunately, the various elements involved in the enforcement of environmental issues are not on the same page as those involved in the regulatory and funding processes. As a result, despite the good intensions of those that draft the regulations the landowner becomes liable for meeting the law without timely state or federal assistance. The smaller landowner can ill afford to address the financial responsibilities associated with current Washington water quality standards.

DOE needs to do a through "what if" analysis. For example, if an Eastern

Washington stream's water temperature exceeds the normal water temperature by five degrees beyond the allowable .3 degree human influence allowed. What is the regulatory impact of that differential? What is the economic impact to land owners in that drainage to reach and/or mitigate the temperature discrepancy? It would be very valuable to have a real life analysis of landowner costs associated with meeting the proposed temperature requirements etc. in such rivers as the Wenatchee and Entiat Rivers of Eastern Washington.

Thank you.

Sincerely,

Kirk B. Mayer, Manager

Comment 15 – Island County

From: Bill Oakes [mailto:BillO@co.island.wa.us]
Sent: Tuesday, April 22, 2003 11:08 AM
To: Carruthers, Cathy
Cc: Phil Bakke; Gwenn Maxfield; Shelton, Mike; Bill Byrd; Mac McDowell; Mac Mcdowell
Subject: Island County Comments on the Draft Cost Benefit Analysis for the proposed DOE water quality standard revisions

Good Day Cathy,

This e-mail is in response to your call for citizen interest in the draft cost benefit analysis of the DOE's proposed water quality standards.

I have several general comments. First, I question the nature of the document. If your intent was that the general public be able to easily understand and comment on this draft, you have significantly missed the mark. This document reads more like a thesis than a document intended for public comment. I know how difficult it is to gather public comment, but the technical and theoretical nature of this document makes public comment almost impossible. I request that the document be thoroughly revised and then be reissued for public comment.

Second, the document narrative admits that the antidegradation standard will impose costs on some entities, but is void of actual cost-benefit analysis of the antidegradation standard. The document also admits higher antidegredation regulation in upstream reaches will transfer ability to discharge to downstream areas. This key decision in the regulation of water quality in Washington State must be included in your analysis.

Third, Page 16 of your document states that "It is reasonable to assume that meeting the proposed new standards will require changes in how some economic activities are carried out, that some of those changes will be costly, and that these costs will be unevenly distributed even within the particular sectors affected." However, nowhere in the document does it clearly identify the costs for a given sector nor does it give any indication of the nature of this acknowledged uneven distribution.

Lastly, the costs and benefit numbers that are provided in the document are completely without support as to how they were calculated. In general the typical number is thrown out as being some millions of dollars without supporting documentation. The documentation behind each of the dollar values must be provided.

Any cost-benefit analysis of a regulation should do four primary things. Identify who will pay the cost of the each regulation and what that cost will be and identify who will benefit from each regulation and establish a value for that benefit. Your document, as it now stands, fails at these primary tasks.

Thanks,

Bill Oakes,

Public Works Director

Island County

Comment 16 – Washington Forest Protection Association

Washington Forest Protection Association
724 Columbia Street, N.W., Suite 250
Olympia, Washington 98501

April 20, 2003

Cathy Carruthers
Washington Department of Ecology
P. O. Box 47600
Olympia, WA 98504-7600

Subject: Draft Cost Benefit Analysis on Proposed Revisions to Water Quality Standards

Dear Dr. Carruthers:

The members of the Washington Forest Protection Association (WFPA) appreciates the opportunity to provide comments on the Department of Ecology's (Ecology) Cost-Benefit Analysis (CBA) on proposed water quality standard revisions. WFPA represents large and small private forest landowners who grow and harvest trees on 4.5 million acres in Washington State. WFPA has been an active participant in the revision of proposed water quality standards and has provided comment in every public phase of the ongoing revision to water quality standards. Therefore, WFPA and its members have a great interest in the outcome of this process.

The draft CBA addresses three parts, or sub-elements of the proposed water quality standard revisions: bacteria, temperature and dissolved oxygen, and irrigation water criteria. We understand that the requirements for the Administrative Procedures Act (APA) creates a clear legal obligation to select the least burdensome approach to protect beneficial uses and water quality to protect those uses RCW 34.05.328(1)(c). WFPA suggests that Ecology view the proposed water quality standards as one, holistic package for the purposes of cost-benefit analysis – similar to the scope of the Environmental Impact Statement under the State Environmental Policy Act and every other policy and discussion document prepared by Ecology concerning proposed changes to the water quality standards.

Generally, WFPA believes that the proposed water quality standards and related rule package as a whole, meet the legal standard of RCW 34.05.328(1)(c). Using the information provided in the CBA, we believe the complete package of proposed water quality standards passes the net benefit test. For our review (as described in the chart, below), we relied on the data and assumptions provided in the CBA to demonstrate that the quantifiable and qualitative benefits outweigh the costs. Further, the CBA states that the sub-elements are "inextricably linked together." If they are not separable, there can only be one CBA ratio and not three sub-ratios. Language in the CBA should reflect this and not give the impression that each sub-element must withstand the positive net benefits test on its own.

Given the Summary of Biological Consequences described on pages 37 through 50 of the Draft CBA, it is reasonable to assume that the proposed amendments will have a positive effect on fish populations. The one percent increase in fish populations discussed on page 51 of the Draft CBA is conservative and likely accurate.

As displayed in the chart below, it appears that a global CBA would conclude that probable benefits exceed probable costs. Lastly, we believe the CBA will benefit from a clear and concise summary of the (qualitative and quantitative) probable costs and benefits of the proposed water quality standards, such as the chart below. It would be advisable to have a clear, definitive statement clarifying that adoption of the proposed package of water quality standards is the least burdensome alternative and together, they pass the net benefits test.

PROBABLE COSTS (as determined in CBA)	PROBABLE BENEFITS (as determined in CBA)

• New illness rate increases (from 4/1000 to 7/1000) - $14-21mm (CBA - pg. 20) • New lab tests, switch from fecal coliform to e. coli measurement - $3.6mm (CBA - pg. 20) • TOTAL NET COSTS - $14-24mm (subtract – $500k property gain) (CBA - pg. 20) • Point source facilities (12-26 affected) - $13-45mm (CBA - pg. 27) (covers all three sections of proposal) • Change from Class AA to Salmon Spawning Waters negatively impacts some runs (CBA - pg. 9)	• Increased certainty – ecoli is a more reliable indicator than fecal coliform (CBA - pg. 27) • Delayed investment in new technology to meet relaxed bacteria standards. (CBA - pg. 21 • Increase in fish harvest due to stock abundance (CBA - pg. 53) • Willingness to Pay for 1% increase in population of Columbia Migratory Fish = $204mm (CBA - pg. 51) • Property value ranges from ($50k) - $1.9mm (Avg - $500k) (covers increased fish value and bacteria loss costs) (CBA - pp. 27 & 58) • Direct/acute mortality avoided (CBA - pg. 33) • Existence value of salmon (CBA - pg. 8) • Clean water & healthy ecosystem (cover letter) • Increased long-term ability to make innovative choices and adapt in future (CBA - pg. 13) • Decreased extinction risk for some char populations (CBA - pg. 9) • Increase in salmon sportsfishing days @ $61.27/day (CBA - pg. 54) All benefits from changing from a “class” of protection to a specific aquatic life “use” for protection in 5 situations (from prescriptive to outcome based rules) (CBA -- pp. 17 & 33)
BENEFIT - Anti-degradation does not allow water to be degraded, even if standards are lowered (CBA - pg. 17)	
Quantifiable Costs Range $27 - $69mm	**Quantifiable Benefits $204mm**

WFPA thanks you for the opportunity to comment. If you have any questions, please contact John Ehrenreich, Director of Forest Tax and Economics, at 360 705-9285.

Sincerely,

Ann Goos, Director of Environmental Affairs

Comment 17 – Rafter Seven Ranch

Rafter Seven Ranch
P.O. Box 1399
Chewelah, WA 99109-1399

Megan White, P.E., Manager
Water Quality Program, Dept of Ecology
P.O. Box 47600
Olympia, WA 98504-7600

Dear Ms White

As a Forest landowner and Agricultural commodity producer we have to take exception with two assumptions the Department made in the cost-benefit analysis on the new Water Quality Standards.

On page 21, the following statement was made "Ecology proposed bacteria criteria with less stringent than current standards for many water bodies is still more stringent than EPA's recommendations for what states should have". Because the Washington standards are higher and therefore more costly to comply with than other states, all Washington producers are automatically placed at an economic disadvantage in the market place. The net return from our product is reduced by our cost of compliance, be it in operating costs or in the required set-a-side of acres into a non-harvestable category.

The rewriting and expansion of rules have always added costs to Agricultural and Forestry production. The cost of meeting the temperature standard reduction from 16 to 13 degrees and 18 to 16 degrees on page 4 were not addressed for either forestry or agricultural producers. Over half of the private lands affected by the new rules are owned and operated by numerous marginally economic family farms producing timber, livestock and grain crops.

In Mr. Peeler's File Memorandum he indicates these affects are "minimal" and the CREP and EQIP federal cost share programs will mitigate the cost to AG producers. The number of acres covered by these programs which include a long-term land rent address less than 1% of the acreage affected in the state by the new regulations. There is just not enough federal money in the USDA budget to adequately compensate all producers.

Based on the above observations our family objects to the imposed mandatory regulated costs that place us in an unfair competitive position. This State regulatory reduction of income not required by Federal law, is an unfair taking of a streamside landowner's property.

Sincerely yours

Bob Playfair

Comment 18 – Washington State Potato Commission

From: Pat Boss [mailto:pboss@potatoes.com]
Sent: Monday, April 21, 2003 5:05 PM
To: Carruthers, Cathy
Subject: WSPC COMMENTS CONCERNING ECOLOGY'S DRAFT COST BENEFIT ANALYSIS FOR THE PROPOSED WATER QUALITY STANDARDS

April 21, 2003

Cathy Carruthers
Department Of Ecology
P.O. Box 47600
Olympia, WA 98503
e-mail - caca461@ecy.wa.gov

RE: COMMENTS CONCERNING THE DRAFT COST BENEFIT ANALYSIS FOR THE DEPARTMENT OF ECOLOGY'S PROPOSED WATER QUALITY STANDARDS

Dear Cathy Carruthers:

The Washington State Potato Commission (WSPC) represents 350 potato growers throughout Washington State. On March 7, the WSPC submitted comments concerning the proposed water quality standards by the Department of Ecology (DOE). As we indicated in the March 7 comments, the Washington State Potato Commission is strongly opposed to DOE's proposed water quality standards.

The WSPC also has significant concerns with the Department of Ecology's (DOE's) Draft Cost Benefit Analysis (CBA), as it strongly implies that there is no economic impact on agricultural practices. In fact, Ecology states that it "...expects that the effect of the standards on agricultural lands will be minimal and there are mechanisms in place to mitigate costs to land owners." The WSPC strongly disagrees on both of these points.

DOE's decision to not analyze the economic impact of it's Proposed Water Quality Standards on agriculture ensures its cost/benefit analysis will be inadequate

DOE has decided to not do not conduct an economic analysis of agricultural practices analysis of the impact of agricultural practices to their Water Quality Standards because it expects that the effect of the standards on agriculture lands will be minimal and there are mechanisms in place to mitigate costs to land owners. This assertion is simply unbelievable. As the proposed standards would generally reduce temperature standards for surface water throughout the state, the WSPC strongly believes that agriculture does have a high likelihood of being impacted by these changed temperature standards.

Ecology also attempts to claim that the Conservation Reserve Enhancement Program (CREP) and the Environment Quality Incentive Programs (EQIP) will mitigate for any impacts the agricultural community possibly feels from the water quality standards. Ecology's position that the CREP and EQIP programs will mitigate impacts on the agriculture community is misplaced. In the proposed 2003-05 Budget submitted by Governor Locke to the Legislature, there was not enough Capital Budget money allocated to the CREP program to pay for existing contracts, yet alone increase contracts into the future.

Additionally, the EQIP program is presently embroiled in a controversy concerning the allocation of some large contracts to a few land owners, rather than allocating a small amount of money to a large amount of land owners.

Since many of the mitigation measures proposed by Ecology are woefully inadequate, and the possible impact on agriculture is very significant, it is arbitrary and capricious for Ecology to simply conclude that it will perform no economic analysis of the impact of these water quality rules on the agricultural community.

DOE's lack of analysis on the possible impacts of the proposed water quality standards on agricultural water quantity issues is also arbitrary

Despite the fact that the Department of Ecology has been using water quality standards as a reason for reducing agriculture water supplies in the Methow Valley of North Central Washington, Ecology absolutely ignores that the new Water Quality Standards would have some impact on agricultural water quantity issues. Again, this lack of thorough analysis on the true cost/benefits of these proposed standards shows Ecology's cost benefit analysis to be not only inadequate, but arbitrary.

Thank you for your consideration of our comments concerning this matter. If you or your staff has any questions about our comments, please call me at 509-765-8845.

Sincerely,
Pat Boss
Patrick S. Boss
Executive Director
Washington State Potato Commission
108 Interlake Road
Moses Lake, WA 98837
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Comment 19 – Weyerhaeuser Company

Environment, Health & Safety

EC2-2C1
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April 21, 2003

Cathy Carruthers

Washington Department of Ecology
P. O. Box 47600
Olympia, WA 98504-7600

Subject: Draft Cost Benefit Analysis on Proposed Revisions to Water Quality Standards

Dear Ms. Carruthers:

Weyerhaeuser Company supports DOE's efforts to improve the state's water quality standards for surface waters and to prepare a Cost-Benefit Analysis (CBA) on the proposed WQS revisions. We know DOE has spent countless hours meeting with many stakeholders to develop those revisions. We will continue to advocate some additional changes, but it is important to recognize that the current proposal would provide significant environmental and other public benefits compared to continued use of the existing WQS. Therefore, we wish to provide constructive comments to help DOE prepare a more thorough and persuasive CBA.
This cover letter contains general comments on our suggested approach. An attachment contains more specific comments on particular items in DOE's draft CBA.
We suggest that the CBA begin with and be centered on a statement of the central roles of WQS under federal and state water pollution control laws. WQS establish goals for specific waters. They serve as a "measuring stick" to determine the adequacy of all other water pollution programs for both point and nonpoint sources. Where recurring failures to achieve the WQS occur, water segments are placed on the state's 303(d) list, total maximum daily loads are prepared, and steps are taken to implement those TMDLs through additional regulatory and non-regulatory measures. Thus WQS are key drivers in determining whether water quality programs are achieving satisfactory results, setting priorities for additional water quality protection efforts, and determining how much additional water quality improvement should be sought for particular forms of pollution in particular geographic areas.

The potential benefits of improved WQS stem directly from those roles. To the extent WQS more accurately describe reasonable and realistic goals for particular waters, the better they can help allocate scarce governmental and private resources in ways that will provide the greatest public benefits. Conversely, if WQS establish unreasonable or unrealistic goals, they can contribute to less efficient and less effective uses of government and private resources.

Therefore, the primary benefits of WQS depend on how well they perform the critical function of setting goals, measuring the adequacy of water quality protection programs, and identifying specific deficiencies that deserve further attention. Because WQS are goals and not directly enforceable legal mandates, the CBA should not assume they necessarily will be met, at least in the near future, or that the public and private sectors necessarily will spend whatever it takes to achieve them. In some cases, they may not be achievable at any cost. In other cases the cost may be prohibitive or our regulatory and non-regulatory programs may not be organized and funded in ways that will achieve them in the foreseeable future. But discrepancies between the WQS and actual water quality can and should have major impacts on how and where our society spends—and does not spend—scarce resources. This includes how and where DOE staff spend their time: WQS can provide substantial benefits if the successfully direct more DOE attention to particular water segments and pollutants where society will gain the greatest benefit from additional agency attention. Conversely, if they divert DOE attention from other work that

would provide greater public benefits, they will impose opportunity costs that could have been avoided by more appropriate standards. Further, the largest benefits and costs stem from their effects on behaviors of people outside of DOE, in various federal, state, and local agencies and public purpose districts and in the private sector. For example, if WQS are not being met in a particular water segment, large amounts of public funds may be spent to improve publicly owned treatment works, stormwater facilities, and other public and private facilities in efforts to eliminate gaps between current conditions and the WQS goals. Further, some existing public and private facilities may be closed and new public and private facilities may be located elsewhere in response to such gaps. If WQS are well designed for their intended purposes, these reallocations of public and private resources should be beneficial in spite of the economic costs involved. Conversely, if WQS are poorly designed, they could cause misallocations of resources in ways that do not provide social benefits offsetting their costs—and might even be harmful to water quality and other environmental values.

For example, money spent to upgrade sewage treatment plants and build new ones should be used where it will do the most good—removing the most important pollutants in the most important places at the lowest reasonable cost. The WQS can and should be the main driver in society's decisions on when and where to upgrade sewage treatment plants and build new ones, on what pollutants they should be designed to treat, on whether higher levels of treatment are needed beyond standard technology, and if so what levels of additional treatment. Better decisions on those issues could provide substantial public benefits. Better WQS could be a very important step toward such better decisions.

Although the connections are somewhat less direct, WQS also can have major impacts over other public facility decisions and many private land use decisions. Over time, WQS could have significant influences on where roads and houses are constructed, where jobs are located, and which communities experience economic growth and which experience economic declines. Again, better public and private decisions on those issues could provide substantial public benefits. Better WQS could be a very important step toward better decisions both in government and in the private sector.

We agree that the CBA should focus on incremental costs and benefits associated with differences between the current WQS and the proposed rule. The existing WQS will remain in effect unless and until modified or replaced by new standards approved or adopted by EPA. If the existing standards were found inadequate, EPA could notify the state that changes are needed and, if the state failed to respond, EPA could adopt new or revised WQS on behalf of the state. However, absent notice from EPA that it will withdraw its prior approval of existing WQS—as distinguished from requiring a triennial review that might or might not result in significant changes—we believe the existing EPA-approved WQS provide the appropriate baseline for the CBA. So, the primary objective should be to help decision makers and the public understand how much incremental improvement in allocations of public and private resources can be expected to result from the proposed WQS revisions compared to allowing the existing standards to remain in place.

Ultimately both the benefits and the costs of WQS standards will depend on how well they help improve a wide variety of resource allocation decisions. These are not easy to quantify or analyze. A CBA could never be precise on these issues, and of course there is room for disagreements as to how well proposed WQS will help resource allocation decisions.

Nevertheless, the goal should be to find meaningful ways to assess, at least on a non-quantified basis, how well proposed WQS can be expected to perform their central roles in water quality programs and in public and private resource allocation decisions affected by those programs.

We appreciate the opportunity to comment of the draft CBA. These general overarching comments are supplemented, and we hope clarified, by the more specific comments attached. For recurring issues, in most cases we comment on them only the first time they arise in the draft CBA or only in connection with a CBA section that focuses most directly on them. Thus, for suggestions DOE is willing to accept, conforming changes should be made in other places where the issue arises elsewhere in the CBA.

If you have any questions about these comments, or would like more information on any issues addressed in them, please contact us.

Sincerely,

Ken Johnson
Washington Regulatory Affairs Manager

Specific Comments on DOE's Draft Cost-Benefit Analysis for Proposed Changes to Water Quality Standards for Surface Waters

Page 1 of the "Draft Benefit-Cost Analysis for Public Comment." Net benefits for whole package versus individual components. The draft cost-benefit analysis (CBA) addresses 3 parts of the proposed WQS revisions: bacteria, temperature and dissolve oxygen, and irrigation water criteria. RCW 34.05.328(1)(c) directs agencies not to proceed with proposed rules if their CBA does not show net benefits. However, it does not clearly address the question of whether there must be net benefits for the rule package as a whole or for each of its constituent parts. We suggest that the final CBA state a DOE policy on that question. Generally, we believe that proposed rules meet the minimum legal standard of RCW 34.05.328(1)(c) if there are positive net benefits for the rule package as a whole, even if there are not net benefits for each individual component. However, that other APA provisions direct agencies to seek optimum solutions for issues being addressed through rulemaking, so particular components or provisions of proposed rules that do not individually provide net benefits can and should receive particular attention with the objective of seeking alternatives that might achieve a more favorable cost-benefit profile while still achieving the underlying statutory objectives.

1. Page 1. **Antidegradation.** The draft CBA asserts that the proposed changes in antidegradation standards either reduce costs or merely "make requirements that are implicit in the existing rules explicit," and therefore no costs were modeled. This is not a credible analysis. The DOE needs to make a reasonable, realistic assessment of what agency and non-agency behaviors are likely to be affected by the proposed changes, and analyze the likely costs and benefits of those behavior changes. Several comments illustrate this need. First, it is inconceivable that the proposed –320 Tier II regulation will "reduce costs." The CBA does not offer any analysis to support this conclusion. Our experience indicates that significant new costs

will be incurred by both project proponents and Ecology. It is very likely the proposed –320 Tier II rule language would require most proponents of "actions" to retain environmental, engineering and economic consultants to accomplish the analyses specified in –320(2) and (4). Few proponents will have staff expertise to satisfy the detailed technical, socio-economic, and extra-AKART evaluations demanded by the proposed rule. Similarly, Ecology staff must review this information, make regulatory judgments, and document in writing those decisions. Ecology staff has not typically done this in the past. For the purposes of this CBA the agency could estimate the number of "actions" likely to trigger the Tier II analysis (based on historic permitting volumes), and then develop a typical cost for a proponent to develop the required information and for Ecology to review and develop the decision record. Based on the low evaluation thresholds in the proposed –320 regulation language we could imagine 20-40 hours of information development time for even the simple projects, and 8-16 hours of Ecology review time. Second, a need also exists for Ecology to quantify the benefits of the proposed antidegradation regulatory provisions. What are the water quality benefits which Ecology believes will accrue from implementation of the proposed regulatory language compared to implementation of the existing WAC 173-201A (which includes AKART, reasonable potential analyses, water quality-based permitting, 303(d) listing and TMDL's, etc.)? What different agency decisions (compared to existing WAC 173-201A) will be made in a permitting action as a result of the proposed –320 Tier II process, and what are the benefits to water quality? Ecology is obliged to provide an analysis on the costs and benefits of its proposal.

2. Page 1. **Use based format.** We have supported the general idea of moving to use based WQS, within certain parameters. However, the recent court decision in *Northwest Environmental Advocates v. EPA and NMFS*, (9th Cir. #CV-01-510-HA, 3/31/2003) raises questions as to whether DOE has sufficient information as to the times and places when and where various uses occur in particular water segments. It may be that the transition to use-based WQS should be postponed or phased to allow adequate documentation as to when and where various uses are known to occur. The need for more credible data on times and places where uses occur will involve some additional costs for DOE and the private sector.

3. Page 2. **Benefits of revised temperature standards.** The draft CBA suggests that the temperature standards are significant only for reaches "where (1) the stream does not naturally exceed the current standard and where (2) the proposed temperature standard is lowered." This statement focuses only on areas where additional costs are likely to be incurred. It is equally important to note that both public and private costs may be lower in areas where the temperature standard is raised. Effect should be to reallocate additional agency resources to water segments that are failing to achieve the revised standard, and to allocate fewer scarce agency resources to water segments that are achieving the revised standard. With respect to public and private investment decisions, there should be incrementally more investments in water quality protection measures (POTWs, stormwater systems, etc.) in areas that do not meet the revised standards, but incrementally more economic development in areas that do meet the revised standards. Thus the revised standards should result in reduced costs for DOE water quality programs and public infrastructure investments in areas that do comply with the revised standards (but might not comply with the current standards) and some shift in economic development patterns toward increased housing, jobs, commercial and industrial activities in those areas. To the extent that the revised WQS "steer" public and private resources into more appropriate areas, the revised WQS should produce net public benefits.

4. Page 6. **Key legal foundations.** We agree that the key substantive legal foundations are the state statutes, federal CWA and associated EPA rules, and treaty law. However, we suggest that the CBA also mention that the WQS are significant legislative rules subject to RCW 34.05.328, other rulemaking procedures under the state APA, Ch. 34.05 RCW, and to the policies and procedures of SEPA, Ch. 43.21C RCW. Although the APA and SEPA requirement are primarily procedural, most legal challenges to agency rules raise procedural issues, so it may be helpful to explicitly recognize that these additional legal requirements apply to this rulemaking.

5. Page 7. **Role of WQS—Need for "Compliance."** We do not disagree with the statement at the top of page 7, but suggest that it would be more accurate and useful in the CBA context to reference "costs to industries and others for complying with water quality programs designed to achieve the proposed rules" than the current language which could be misinterpreted as assuming that industries and others are required to "comply" with the WQS directly. For point sources, the regulatory "chain" from WQS to water quality based effluent limitations can be quite short and direct—but still individual industrial dischargers must comply with effluent limitations and other permit conditions designed to achieve the WQS rather than be subject to direct legal remedies for failing to achieve the WQS themselves. For nonpoint sources, the connections between WQS and best management practices may be more complex and there may be heavier reliance on non-regulatory strategies as part of larger programs designed to achieve WQS to the extent practicable. But in both cases—for point and nonpoint sources—the WQS are used to measure the adequacy of regulatory and non-regulatory programs, and to identify geographic areas and particular pollutants and forms of pollution deserving additional attention and resources. The economic and legal significance of WQS comes from their intended (and unintended) effects on water quality protection programs and other resource allocation decisions—not from direct enforcement of WQS against individual pollution sources.

6. Page 7, Note 1. **Discount rate or "social rate of time preference."** The draft CBA generally uses a discount rate of 1.6% per year for future costs and benefits, based on current (or recent) rates on inflation-protected government bonds. Because interest rates are at historic lows, it seems unlikely that this 1.6% rate will remain credible over the time frame that the WQS are likely to remain in effect. It might be more appropriate to use a higher rate reflecting historic average interest rates over a significant time period, e.g. 10 years, or to display results under two or more alternative discount rates so that the effects of discount rate assumptions becomes more transparent. We do not believe that use of a higher discount rate or alternative discount rates are likely to change the conclusions, but suggest that they might make the CBA more useful to decision makers and less subject to potential criticisms.

7. Page 8. **Forest practices.** We agree that the proposed WQS will not require any substantive changes in the current "Forests and Fish" forest practices rules. However, one benefit of the proposed WQS for temperature should be more accurate identification of areas where the forest practices rules do and no not provide suitable thermal conditions for various fish species. In most if not all cases, we believe the current forest practices rules will provide sufficient shade for forested stream segments to avoid anthropogenic temperature increases harmful to salmonid fish or other beneficial uses. Before any additional regulatory requirements are imposed, there should be clear understandings on which water segments are not achieving those goals, why they are not, and what practical measures could be taken to better achieve those goals. Carefully thought out WQS could make critically important contributions toward reaching those understandings.

8. Page 9. **Extinction risk.** The draft CBA says that: "Extinction was not considered in this document because . . . " and "changes in the Class AA to Salmon Spawning waters appear to impact some runs." These and similar statements could be quoted out of context as "evidence" that the DOE personnel responsible for WQS do not care about potential extinctions of threatened or endangered species. Of course that is not true. It would be more accurate and preferable to start with the latter part of the 1st sentence: "The proposed amendments by themselves are unlikely to either cause or eliminate the possibility of extinctions," and then go on to explain that the WQS revisions are intended and expected to influence and improve allocations of how public and private resources in ways that should help reduce extinction risks. The current WQS do not optimize government and private decisions relating to water quality protection programs and land use activities that can have adverse or beneficial effects on water quality and thus on ESA-listed salmonids. The proposed changes are intended to help achieve more focused, effective, efficient water quality protection, which in turn should make significant contribution to recovery of threatened and endangered aquatic species.

9. Page 12. **Cost estimation.** The draft CBA contains an accurate list of ways in which environmental protection costs sometimes can be overestimated or unrecognized. However, to be more balanced the final CBA should contain an analogous list of ways environmental protection costs sometimes are underestimated or unrecognized, including:

- Hidden costs of economic adjustments, such as premature scrapping of facilities that otherwise would have significant remaining useful lives, under-utilization of public infrastructure and private investments (including housing stock) in areas that become less able to compete in world markets and concentrating large amounts of economic growth in areas that obtain competitive advantages
- Meeting local consumer needs with production in more distant locations, increasing transportation costs and adverse environmental impacts associated with longer transportation distances
- Reducing competition by substantially increasing the size of facilities capable of meeting environmental standards, and concentrating production in a relatively few very large facilities owned by a relatively few competitors
- Indirect social costs, including increased physical and mental health care needs, alcohol and drug related social problems, etc. associated with pockets of unemployment and economic declines.

This the economic and social changes needed to achieve water quality objectives may have positive net benefits in spite of these kinds of costs, but where wrenching changes are being considered often there can be net economic and social benefits from allowing reasonable times for adjustments to occur in more orderly and efficient ways and to rely on incentives for early action as well as penalties for unacceptable delays.

10. Page 13. **Antidegradation as a tool to improve resource allocation.** We question the assumption that the proposed antidegradation language effectively "ensures that the assimilative capacity of the state's waters is allocated to higher value economic activities or sustained long-term economic development." The antidegradation provisions may convert some economic decisions that historically have been driven largely by consumer demand—"the invisible hand"—to adjudicative decisions made by public officials on the basis of administrative records reflecting input from passionate advocates who may purport to speak for the "public" but in fact

represent particular narrow segments of the general population. Of course market forces do not always result in decisions that most people would consider optimal. However, a large and growing body of evidence suggests that government agencies do not always make wise decisions either; on the contrary, excessive government regulation often stifles and slows desirable economic changes, including development and commercialization of new technologies that better serve consumers at lower environmental costs. The CBA can and should address the question of what decisions are best made by government officials and what decisions are best left to market forces within a regulatory framework designed by government officials. However, the assumptions regarding the proposed antidegradation rules seem to be unduly optimistic about the wisdom of government adjudications regarding particular proposed projects as the appropriate "tool" for allocating assimilative capacity among competing uses and alternative consumer products and amenities.

11. Page 15. **Economic losses.** Generally we agree with the point that actual economic losses from environmental protection measures often are less than dire predictions made by some advocates during the process of developing new regulations, sometimes because new technology becomes available in response to regulatory pressures and sometimes because other economic adjustments soften (or at least mask) pessimistic scenarios. However, we do not consider the Niemi/Whitelaw/Johnson paper, *The Sky Did Not Fall*, the best available reference to support this point. That paper is an advocacy piece sponsored by two environmental groups, Earthlife Canada Foundation and Sierra Club of British Columbia. It was published early in 1999, using data through 1996; since then the Pacific Northwest has suffered a great deal of economic hardship, particularly in rural areas. We believe that report is not an objective and credible economic analysis. Dramatic reductions in federal timber sales in fact create economic and social hardships in many rural communities in western and central Washington and Oregon. There were other factors, of course, but reduced federal timber sales are one contributing cause of the "urban/rural divide" in this region. Other studies show that fewer job opportunities, lower incomes, and declining property values in many rural areas have caused increased physical and mental health problems, alcohol and drug abuse, domestic violence, etc., and may be contributing to environmental problems. Citing the Niemi/Whitelaw/Johnson paper in this context could be misinterpreted as an endorsement by DOE of the controversial position that major reductions in timber harvests do not cause significant economic or social hardships. Again, we do not disagree with the fundamental point that economic costs of regulatory changes often are less than predicted by the regulated community. However, DOE should find other, more credible citations to support its point. The references related to air emission trading (pp. 15, 16) are examples of more credible support for the point DOE is making.

12. Page 17. **Temperature dissipation.** The draft CBA makes a valid point that for some pollutants WQS can set an assimilative capacity which must be shared among competing "users," so that "Losses may be imposed on downstream users [or upstream] as the permittees have to share the capacity." However, the particular example used, "downstream losses to permitees from upstream use of temperature capacity," was not well chosen. Water temperatures tend to move quite rapidly toward ambient air temperatures at the water surface. At one time it was generally believed that heat (or solar radiation) inputs particular locations or stream segments had continuing impacts far downstream. More recent studies show that water/air temperatures equilibrate within relatively short distances, so that thermal inputs dissipate and approach background rather quickly as the water moves downstream. A more persistent form of pollution could better illustrate the point DOE is trying to make.

13. Pages 21-26. **Cost estimates for bacteria standards.** The cost estimates seem to be based on worst-case assumptions that all waters will be degraded from the current standards to the proposed new standards. This is unduly pessimistic because: (1) many, perhaps most, affected water segments probably will experience no measurable change in bacteria levels, particularly AA waters not impacted by point sources, because the change in WQS is not likely to be a driving factor for land use or pollution control changes likely to increase nonpoint sources of bacteria, (2) some water segments that do not meet the current bacteria standards could not reasonably be expected to reach those standards in the near future or, in some cases, in the foreseeable future, notwithstanding preparation of TMDLs and other measures intended to bring them into compliance with current standards, and (3) major new concentrations of bacteria discharges will be subject to antidegradation reviews which in most cases should be expected to result in substantially the same effluent limitations and other protective measures under the proposed new standards as under the existing standards.

14. Pages 27-43. **Cost and benefit estimates for temperature standards.** The draft CBA focuses on costs for point sources to meet the proposed standards, as if there were no existing standards, rather than costs "associated with differences between the current water quality standards rule and the proposed rule" (see 3/24/2003 cover letter) for both point and nonpoint sources. Although we do not have sufficient information to document this, it seems likely that the proposed new standards probably will not impose significant additional costs for POTWs and industrial point sources except, perhaps, in a few cases where point sources may discharge into waters that will have cooler criteria because of their use by char. The changes in temperature and DO standards probably will be more important as they relate to stormwater and nonpoint sources. For those discharges, the proposed change from an instantaneous maximum to a 7DADMax approach could be important, both in reducing costs and in focusing attention on control measures that are more likely to provide real benefits to salmonids. Stormwater and nonpoint sources of heat very seldom, if ever, reach short-term lethal levels for salmonids. The 7DADMax is a more meaningful criterion to identify situations where salmonids can benefit from measures to reduce heat inputs to surface waters.

15. Pages 37-42. **Potential benefits to salmonid and char growth from moderately warmer water temperatures.** The CBA seems to assume that warmer water always is harmful to salmonid and char fish and cooler water always beneficial. We believe the relationships between water temperatures and the health and sustainability of fish runs are more complex. In some cases warmer waters can have higher risks of fish diseases and predation, and if combined with low food supplies can reduce growth rates by raising metabolic rates above optimal growth levels. However, in many and perhaps most cases incremental increases in water temperatures are likely to increase both food supply and juvenile fish growth rates. Further, increased juvenile growth rates are associated with greater survival during outmigration and may be associated with larger adult body size, and egg counts per female spawner are correlated with adult body size. Thus, within limits, somewhat warmer waters during times of juvenile salmonid rearing could contribute to recovery of depressed runs. Finally, salmonid food supply and growth rates correlate with average water temperatures over considerably longer periods than seven days. Thus if temperatures standards reflect "optimum" levels during the warmest 7 days, they probably will be sub-optimum over the full rearing season and over the times when increased primary and secondary productivity could increase salmonid food supplies. In recent years there has been much more attention paid to the risks than the benefits of higher water temperatures,

but the CBA should acknowledge that small increments in water temperatures might have potential benefits as well as potential risks for fish under some circumstances.

16. Pages 51-52. **"Willingness to pay" studies.** Public opinion surveys on "willingness to pay" for environmental amenities can provide useful information but should be used with caution because they often overstate the "value" the public really is willing to pay if asked for actual cash contributions or additional taxes. For example, public opinion polls consistently show strong support for improved education, even in areas where school levies fail or pass only by narrow margins. Similarly, where large numbers of people are given convenient opportunities to make voluntary contributions or elect to pay higher rates for popular environmental causes, e.g. wildlife protection or renewable, the percentage of people who actually elect to make additional contributions usually is considerably smaller than the number who express support for those causes in public opinion polls. We suggest that the CBA put its use of "willingness to pay" surveys into context by mentioning these phenomena and citing studies on the limitations of such surveys.

Pages 55-59. **Land values.** It is true, of course, that "The value of land can be limited by poor water quality." [p. 55]. However, we believe that the proposed WQS should increase rather than reduce land values in many areas. The reason is that the proposed revisions will make the WQS a more accurate and useful tool to identify areas where additional water pollution and land use regulations and non-regulatory water pollution control measures can be cost effective in achieving environmental goals. For example, as mentioned, changing from instantaneous maximums to 7DAMax criteria for temperature will make the WQS substantially more useful and effective with respect to stormwater and nonpoint contributions to thermal pollution. If the current WQS remain in effect, they are likely to result in TMDLs that would be neither practicable nor cost effective. Over time, that could result in litigation and regulatory confusion that could depress land values in many areas. The state needs to have clear, reasonable, and cost-effective water quality management programs sufficiently stable and predictable for investment decisions to be made in reliance on them. Improved WQS are a very important step in that direction. Again, we do not agree with all of the criteria and provisions being proposed, and we will continue to advocate additional changes. However, we believe it is important to recognize that DOE is proposing to move in the right directions on a number of issues, and that its proposed revisions would significantly improve the WQS as compared to the current version.

- Public Comment -

The Department of Ecology's Draft Cost Benefit Analysis on
the Proposed Changes to the Surface Water Quality Standards (WAC 173-201A)

On page 6 of the draft Cost Benefit Analysis reads the following *(in italics):*

> *General Elements of Analysis*
>
> *Weighing Benefits Against Legal Mandates*
>
> *Three key legal foundations paramount in setting targets for state water quality standards:*
> *• State Law (Chapter 90.48 RCW and Chapter 90.54 RCW);*

• Federal Law (Clean Water Act and associated federal rules at CFR part 131); and
• Treaty Law (Obligations to protect resource use created by the federal agreement).

All three of these legally binding doctrines create complimentary obligations for the state Department of Ecology when establishing water quality standards:
• The highest attainable level of protection for uses and water quality are to be supported by state standards;
• Viable and robust populations of all indigenous species must be maintained or restored where feasible; and
• Surplus fish for human use should be ensured.

While the above obligations are complimentary and directive, so is the need to consider how the standards affect human industry. State standards must be set so that they accomplish the above objectives with the least excess costs and impacts to human activities. This requires careful balancing and is reflected through measures such as:
• Avoiding the imposition of criteria more stringent then determined appropriate to meet legal obligations and meet project objectives;
• Avoiding duplicative monitoring requirements or more costly sampling and analysis requirements;
• Selecting the least burdensome implementation procedures; and
• Tempering corrective actions to the urgency and conditions appropriate to individual circumstances.

In setting or revising water quality standards these factors combine to create a clear legal obligation to: select the least burdensome approach to fully protect beneficial uses (e.g., recreation in and on the water, fish and wildlife) and the water quality that maintains those uses.

My objection to the wording of this section is as follows: the earth is a closed system. Our water source is a closed system. There is a finite amount of it and we don't know how to create more. Water is a source of life on this planet. Living organisms cannot exist without it.

The population of this planet is not bounded and in fact is continuing to expand. One hundred years from now, those of us living today will not recognize this planet. As population growth continues, even at the rate it is growing today, living conditions will be much different. Population growth stresses those systems that support life, water being one of them. Policy governing the use of those support systems will be different; the penalties for misuse will be different; the value placed on these resources will be different; the nature of how we interact with other living organisms will be different. And those that will be living in those conditions will be our children.

We are the ones responsible for the inheritance our children will live with. So how we care for and use our resources is important. One of our most valued resources right now must be water - while we still have time to preserve life on this planet. And I am sad to say that the value

we place on water does not remotely approach its importance in our lives. We treat water as if it is a limitless resource. We must transform our perspective of water. This is key to our existence and survival.

The key ingredients to purify polluted water is time and a filtering system that removes toxins. We possess man made filtering systems, but they are only a very small part of the overall system that purifies our water. How many toxins can we place in the filtering system before the filter needs to be replaced? How many natural filtering systems (eco-systems) are we routinely and successfully replacing? (The answer is none - we are using them up). How do we replace them? (The answer to this is we haven't come up with a way to do that effectively).

Another key ingredient to this discussion is that we don't know when the consumption of drinkable water will exceed the filtering system's ability to purify it. At that point, living organisms on this planet are in trouble. People share this finite water supply with all other living organisms. All of this makes up our quality of life. Have we come to that point and don't even know it or won't acknowledge it?

To suggest that we should be avoiding the imposition of criteria more stringent then determined appropriate to meet legal obligations and meet project objectives implies that we possess the knowledge to make an informed decision. Reality is - we don't. To suggest that we should be avoiding duplicative monitoring requirements or more costly sampling and analysis requirements implies there is agreement that those sampling and analysis requirements are adequate. Reality is - we can't even agree on how much water there is. To suggest that we should be selecting the least burdensome implementation procedures and tempering corrective actions to the urgency and conditions appropriate to individual circumstances implies that we know what the impact of an individual circumstance is. Reality is that individual circumstances are not isolated. Individual circumstances impact the whole organism. It's not OK to think on less than global terms when we are discussing the health and well being of the organism that supports our existence. It’s not OK to treat the resources that sustain life on this planet as if they are limitless. It is not OK to exclude other living organisms in favor of human use. We must transform our way of thinking about these resources and our relationship to other living organisms.

So - yes, please change the wording on this page. I suggest the following changes:

CHANGE - *Viable and robust populations of all indigenous species must be maintained or restored where feasible*

TO READ - ***Viable and robust populations of all indigenous species must be maintained or restored.***

CHANGE - *Surplus fish for human use should be ensured*

TO READ - ***Surplus fish should be ensured.***

CHANGE -

While the above obligations are complimentary and directive, so is the need to consider how the standards affect human industry. State standards must be set so that they accomplish the above objectives with the least excess costs and impacts to human activities. This requires careful balancing and is reflected through measures such as:

• Avoiding the imposition of criteria more stringent then determined appropriate to meet legal obligations and meet project objectives;
• Avoiding duplicative monitoring requirements or more costly sampling and analysis requirements;
• Selecting the least burdensome implementation procedures; and
• Tempering corrective actions to the urgency and conditions appropriate to individual circumstances.

In setting or revising water quality standards these factors combine to create a clear legal obligation to: select the least burdensome approach to fully protect beneficial uses (e.g., recreation in and on the water, fish and wildlife) and the water quality that maintains those uses.

TO READ -

The above obligations are complimentary and directive. The need to consider how the standards affect human industry must take the impact of the eco-system into account. Maintaining and improving water (and air) standards is the stated goal and objective of the State of Washington. State standards must be set so that they accomplish the above objectives without excess costs and minimize impacts to all living organisms. This requires careful balancing and is reflected through measures such as:

• Maintaining criteria that ensures good stewardship of the resources entrusted to us so that future generations can enjoy high quality of life;
• Putting in place monitoring requirements of the highest standards available; avoiding duplicative monitoring requirements; selecting the most cost effective sampling and

analysis requirements;
• Selecting the least burdensome implementation procedures; and
• Enforcing the standards and employing corrective actions consistent to the urgency of the situation and current conditions - our life giving resources are not limitless and must be treated according to their importance in our survival. Conduct research and encourage investment into enhancing the way we remove toxins from these resources.

In setting or revising water quality standards these factors combine to create a clear legal obligation to: select the best approach to fully protect beneficial uses (e.g., recreation in and on the water, fish and wildlife) and to fully protect the water quality that maintains those uses.

In short, this Cost Benefit Analysis will almost certainly demonstrate that it costs less to avoid imposing criteria more stringent then determined appropriate and meet project objectives. Why? Because the phrase "criteria more stringent then determined appropriate" is just a fancy way of saying "lower water quality standards."

Please don't lower water quality standards – no matter how much this Cost Benefit Analysis demonstrates that it will cost less by lowering the standards. Please continue to serve the best interests of the public you are appointed to serve. Please don't sell out to special interests. Our children's quality of life depends on that. Thank you.

Fred Suter
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APR 2 2 2003

Reply To
Attn Of: OW-131

Cathy Carruthers
Department of Ecology
P.O. Box 47600
Olympia, Washington 98503

Dear Cathy:

Thank you for the opportunity to review and provide comments on the draft cost-benefit analysis, prepared to support the State's forthcoming rule-making on water quality standards. We have not done a thorough review of the entire document, as this is not a necessary component for our Clean Water Act review. However, we have focused on reviewing the draft cost-benefit analysis for the revisions to the bacterial criteria, as the analysis has found that these revisions are unlikely to meet the net benefits requirement. The bacterial revisions are a national EPA water quality standards priority, and therefore we have solicited input from the EPA Headquarters office in responding to your draft analysis.

Ecology is proposing revising its current bacterial criteria, which use fecal coliform bacteria as an indicator, to *E. coli* for freshwater and enterococci for marine water. This revision follows EPA's national 304(a) criteria guidance recommendations. A key point that the draft cost-benefit analysis misses is the distinction between fecal coliform and *E. coli*/enterococci as indicators of illness. While fecal coliform is an indicator of illness, and the study from which the original federal recommendation was derived was based on a threshold of gastrointestinal illness, **the fecal coliform indicator does not correlate to specific illness rates**. E. coli and enterococci **do** correlate well with illness rates.

The enclosed graphs from EPA's Water Quality Standards Academy training module on bacterial indicators illustrate this point. The graphs are based on the original freshwater study showing the correlation of the three indicators to illnesses. They illustrate that fecal coliform does not show a strong correlation with illness rate. Therefore, the cost-benefit analysis needs revision to take into account two points: 1) the improved ability of the new indicators to predict illness rates, and 2) the difficulty in accurately estimating illness rates at fecal coliform levels *other than* the EPA criteria recommendations (i.e. in the current WA water quality standards this would include marine waters, lakes and Class AA waters). This difficulty in predicting current illness rates with the fecal coliform indicators means that it cannot be assumed that the shift to the new indicators will result in increased illnesses, let alone a specific calculation of illnesses. For example, the assumption on page 23 that halving the EPA marine fecal coliform criterion would be equivalent to the illness rate from halving the enterococci criterion, has no basis.

At the top of page 24 of the analysis, there is a conclusion from review of TMDL study data, that "on average, 90 - 100% of fecal coliform is *E. coli*. An EPA microbiologist examined a random subset (64 pairs) of data from an Ecology study of Nisqually River data. The data set examined is from November/December 2002. This TMDL study data set was examined because it includes the most valid approach for this kind of comparison – single aliquot samples that were membrane filtered and then incubated first in a growth medium for fecal coliform and subsequently in a growth medium for *E. coli*. From this limited data set *E. coli* ranged from 15% to 100% of the fecal coliform numbers, with an average of 80.95%.

The second paragraph on page 24 contains some important assumptions that are hard to understand without some further discussion. From conversation with Ecology staff we understand that one 12% refers to waters not now meeting criteria, which may not have TMDLs developed until the new criteria are in place, and therefore would meet a more relaxed criterion. We understand that the second 12% refers to allowable degradation of high quality waters following tier 2 antidegradation analysis. If this is the correct interpretation, it might be easier to understand than broad statements referring to "rivers that would also be impacted negatively by *E. coli*."

In sum, the increase in illness rates incorporated into Table 3 rests on the unsupported assumptions regarding the illness rates at the current fecal coliform criterion levels and assumptions regarding the relationship between fecal coliform and *E. coli* concentrations that may not hold true.

An additional point not included in the cost-benefit analysis is the risk of using fecal coliform as the assessment indicator in marine shellfish areas despite having the enterococci criterion in place as a bacterial indicator criterion for primary contact recreation. EPA's comments on Ecology's draft water quality standards (March 7, 2003) raise this concern on pages 9 - 10, based in part on a review of marine monitoring data, which shows no consistent relationship between the two indicators. EPA's recommendation is that Ecology conduct additional studies including monitoring of both indicators before any decision to relinquish monitoring for enterococci in marine shellfish areas.

If you have any questions regarding these comments, please feel free to contact me at (206)553-0176.

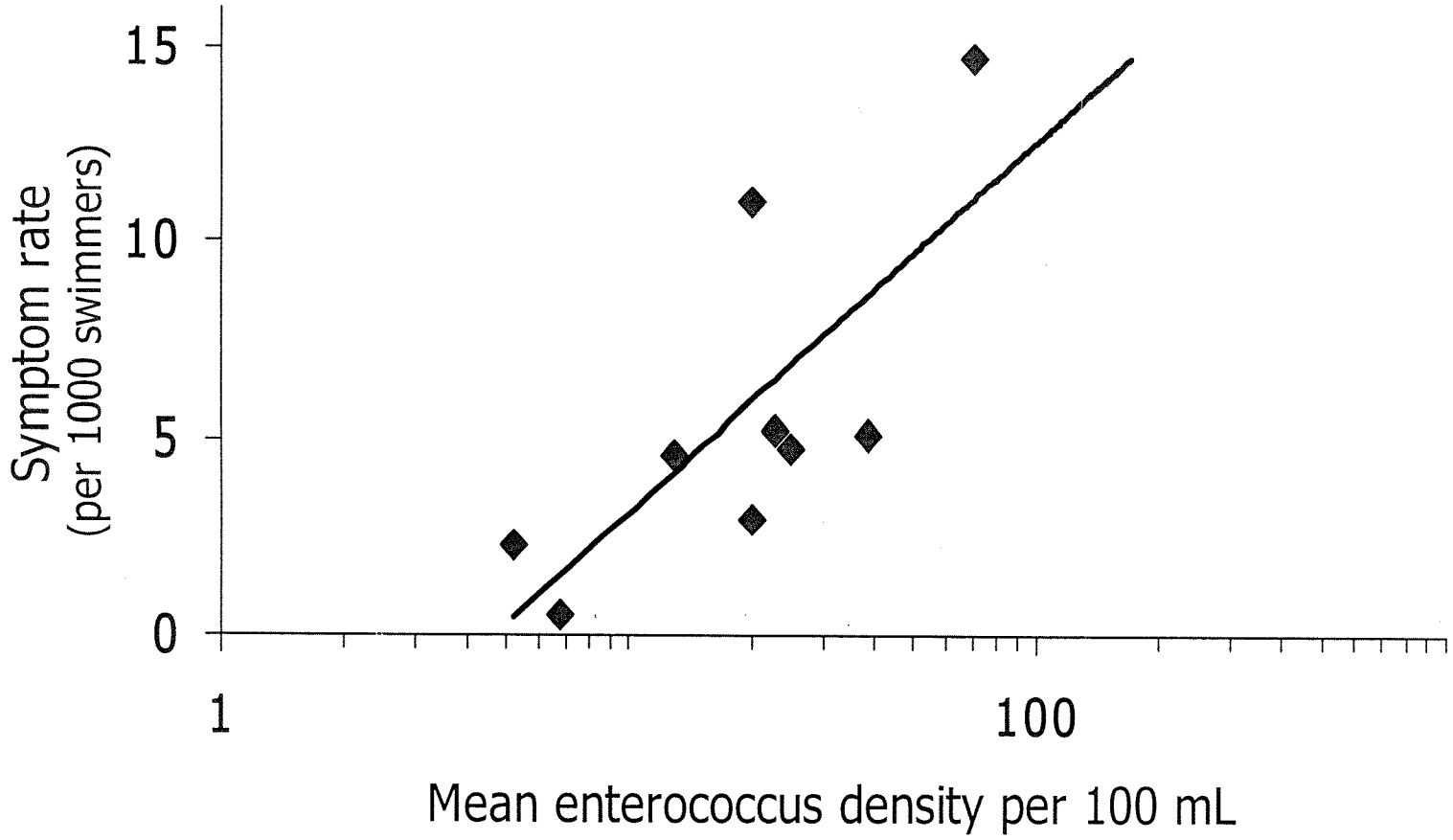
Sincerely,

Marcia Lagerloef

Marcia Lagerloef
Water Quality Standards Coordinator

Enclosures

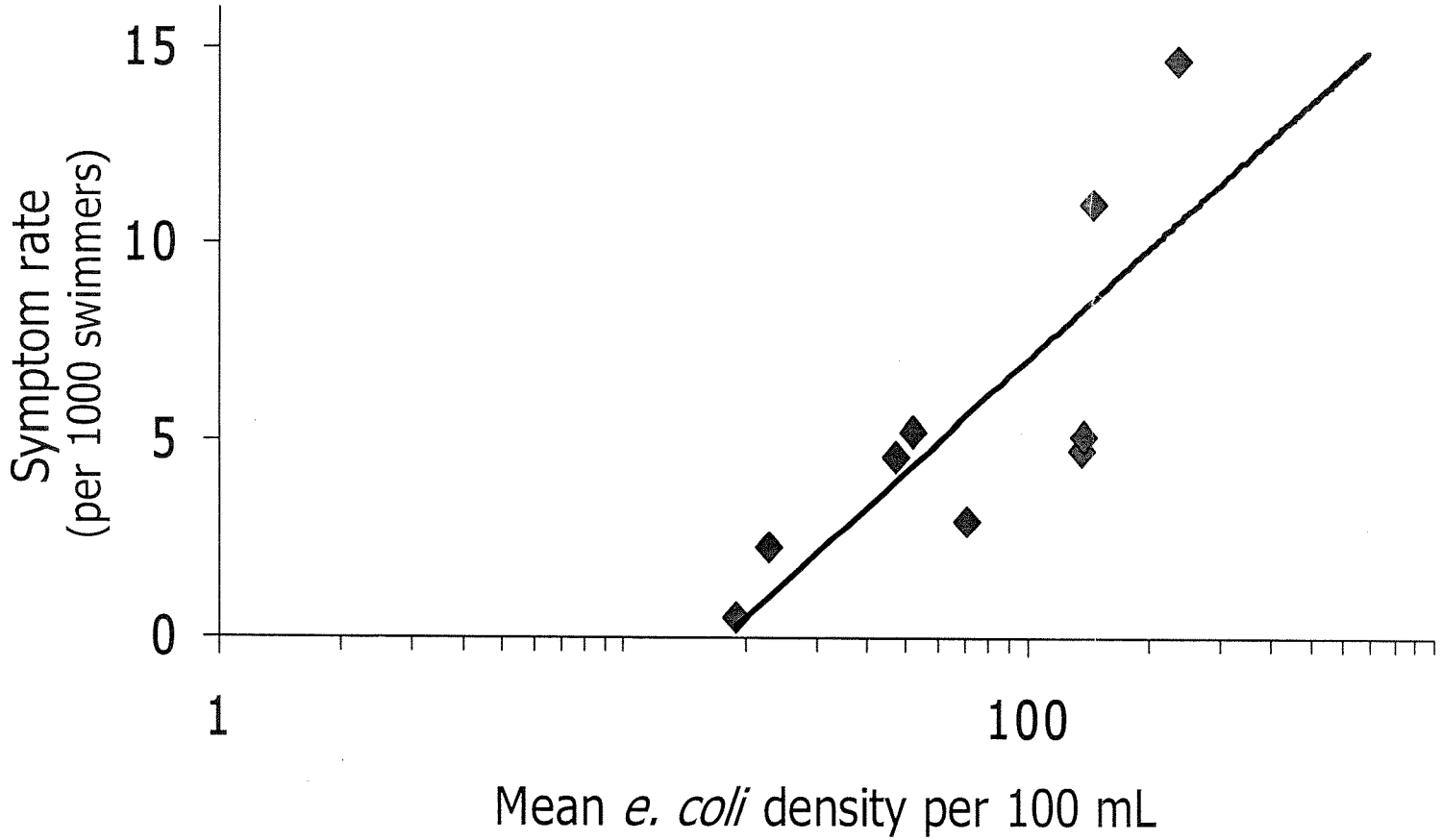
Enterococci and Illness Rates



Source: "Health Effects Criteria for Fresh Recreational Waters", EPA 1984

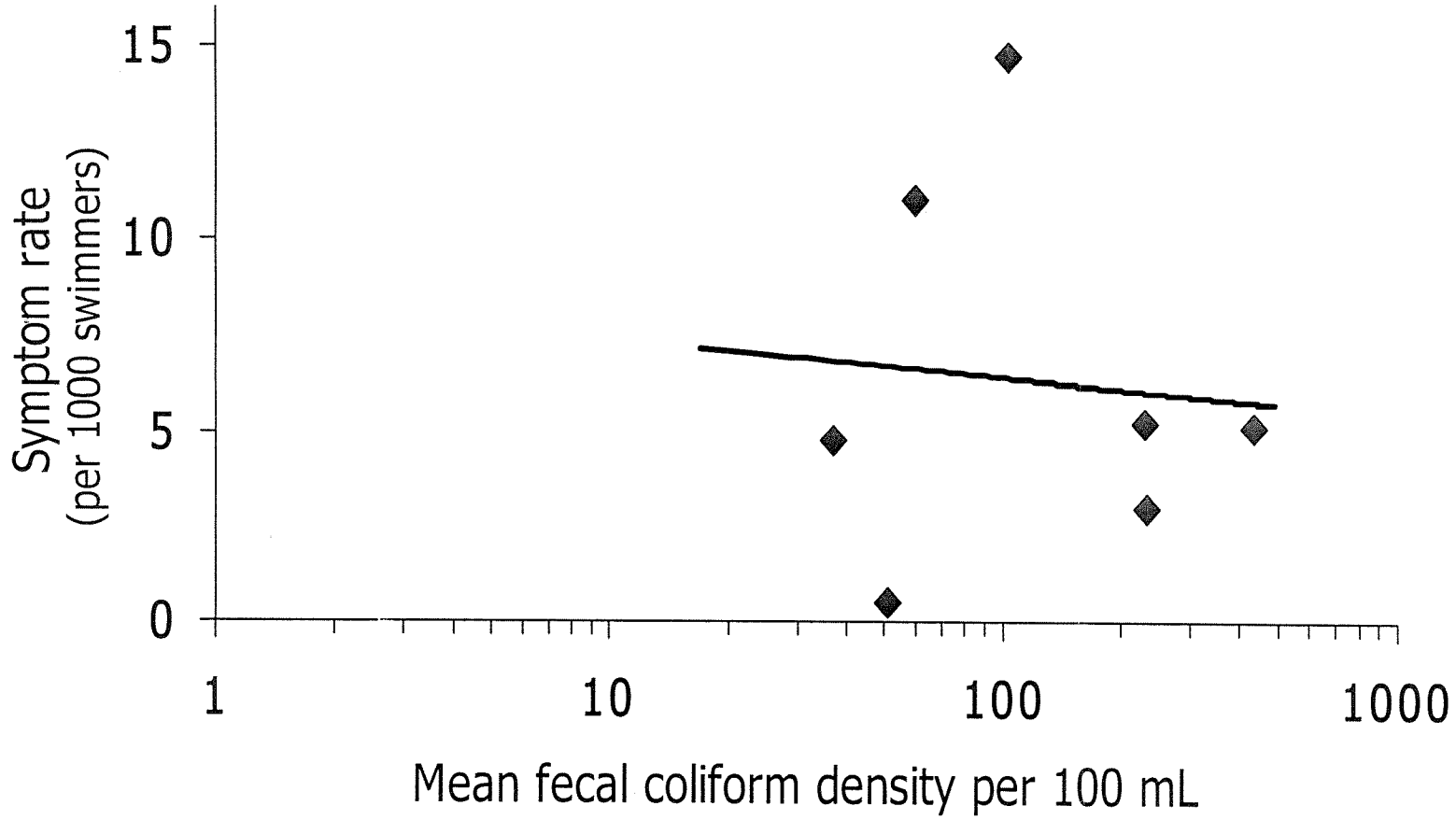
Water Quality Standards

E. Coli and Illness Rates



Source: "Health Effects Criteria for Fresh Recreational Waters", EPA 1984

Fecal Coliform and Illness Rates



Source: "Health Effects Criteria for Fresh Recreational Waters", EPA 1984

WASHINGTON STATE
FARM BUREAU

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Olympia, Washington 98507

(360) 357-9975
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April 22, 2003

Cathy Carruthers
Department of Ecology
P.O. Box 47600
Olympia, WA 98504-7600

RE: COMMENTS ON THE DRAFT COST BENEFIT ANALYSIS FOR THE PROPOSED WATER QUALITY STANDARD REVISIONS

Dear Ms. Carruthers:

On behalf of the more than 33,000 Washington Farm Bureau members, I thank you for the opportunity to provide comments. Farm Bureau is a general farm organization representing farmers, ranchers and member families across Washington State. Agriculture is extremely important to the economy of Washington from Pullman to the Pacific.

Washington State produces more than 200 crops and is second only to California in the number of commodities grown. Farm Bureau members help feed their neighbors, the nation and the world. Washington is a major exporter of food and fiber products.

Farm Bureau strives to protect the economic viability of farmers and ranchers. Agriculture generates $5.6 billion of farmgate value with an estimated $28 billion impact to the state's economy. Agriculture is a major driver of jobs both in rural and urban Washington when you consider the ports and the agrifood complex. Compared to other state industry-group sectors, agriculture ranks fifth in producing direct income.

Despite agriculture's contribution to the state's economy, farmers are in a precarious position. Most producers are experiencing extremely low prices while operating costs continue to rise. Increased regulations, like these proposed water quality standards, are part of these increasing operating costs.

It is never good policy to increase regulations or standards based on incomplete or bad science. The Competitiveness Council and the Governor have called for a more streamlined regulatory process. These proposed standards are an increase in regulations, put fish before people, and are not based upon best available science. We also do not

believe that the Department of Ecology (DOE) has complied with the Regulatory Fairness Act.

The stated intent of DOE is to return all water bodies to their best and natural functions. However, the reality is that through these restrictive use-based standards, DOE will be able to require farmers to change naturally occurring stream conditions into laboratory defined "optimal" conditions, even if those conditions have **never** been present in that waterbody.

DOE has also stated that the purpose of these standards is to **fully protect** species and their life stages. The documentation states: "Ecology has a high degree of confidence that temperatures identified fully protect species and life stages." DOE's goal of full protection exceeds the requirements of the Endangered Species Act, which addresses the need to avoid jeopardy when a species is threatened by extinction and to achieve recovery. DOE's target for protection goes beyond avoidance of jeopardy and the goal of recovery. DOE's target is based on achieving optimal growth conditions. There is no legal precedent for regulating for a species according to attain its optimal growth conditions, which are beyond what nature provides.

Washington farmers and ranchers cannot remain competitive nationally and internationally with these increased regulations. The current standards are working. It is time for the state to stop promulgating rules that are beyond federal standards, that are not based upon best available science, and that do not comply with the Regulatory Fairness Act. DOE is not required to change to use-based standards. Farm Bureau opposes these standards, and DOE should not adopt the proposed rules as written.

COST BENEFIT ANALYSIS

DOE is required to determine that the probable benefits of the proposed changes to the water quality standards are greater than the probable costs of these changes prior to adopting the rule. (RCW 34.05.l328(1)(c)). DOE has provided a draft of this analysis that is woefully lacking because it is based upon false assumptions and it fails to accurately analyze the benefits or the costs of the proposed rules. Due to these major faults, DOE has acted in an arbitrary and capricious manner.

DOE's determination that the proposed standards would not be a cost to agriculture is extremely lacking. In a note to the file, Dave Peeler from DOE states that because the average elevation of agricultural activities in Eastern Washington is at 1800 feet, the rules will not have an impact on agricultural activities. In that same memo, Peeler also states that the temperature standards will require 100 percent shade for class A streams below 1800 feet.

It is preposterous to determine that an average of agricultural land is less than 1800 feet of elevation. What about the cattle and sheep ranchers who graze their livestock in forests? What about some of the orchards that are in the Okanogan? There are agricultural activities that are conducted on land higher than 1800 feet and these

farmers and ranchers deserve to have DOE follow the law to determine how much these new standards will cost them. If DOE is going to be mandating shade on streams using the wrong scientific assumption that this will decrease the temperature, there will most likely be a high cost to agriculture. These costs need to be determined in order for DOE to comply with the Administrative Procedures Act.

Also, DOE assumes that CREP and EQUIP will provide mitigation to the costs of the water quality standards. Again, this is a false assumption. CREP has been under-funded, and at a time when all state funding is at question, it is foolish to bank on these limited dollars to be available for agriculture. Additionally, all farmers are not eligible for CREP dollars. As for EQUIP, the federal government is also having funding problems, and not everyone qualifies for the limited amount of EQUIP dollars can be selected for payment. These programs simply will not provide enough money and are not available to all who will be negatively impacted by the cost of the water quality standards.

Lastly, DOE's use of its water quality standards to take away water quantity in the Methow should be included in the analysis of the costs of these proposed standards. DOE has failed to comply with the law in its proposed standards in this cost benefit analysis.

CONCLUSION

These one-size-fits-all—West and East—rules will not work on the ground and will have large unintended consequences of a tremendous negative impact on agriculture. Under the use-based standards, many eastside streams will violate the temperature standards in the summer, some by as much as 15 degrees C. However, westside streams will seldom be in violation. Air temperature mostly controls the seasonal patterns of temperature in streams and lakes; therefore, streams on the westside of the Cascades have a smaller range of temperatures than occurs in eastside streams. The difference in compliance between the westside and eastside streams is almost wholly a result of the natural temperature pattern. Yet the uses will be regulated, which will negatively impact farmers and ranchers who contribute largely to the economy of Washington State.

The cost of compliance with the rules should not be unnecessarily stringent relative to the societal and economic cost of compliance. Farm Bureau challenges the standards because there is an imbalance of cost vs. benefit. There has been no quantitative estimate of the benefit. This analysis is needed prior to adopting rules that would have such a negative impact on agriculture. DOE has largely ignored quantitative assessments of the potential benefit of its actions.

The Regulatory Fairness Act (RCW 19.85) was enacted to safeguard against the "disproportionate impact on the state's small businesses." We believe that the cost benefit analysis is important to determine whether there is "disproportionate impact" on farmers and ranchers and to determine the methods to reduce that impact as required by law. To date, DOE has not accurately completed the cost benefit analysis. We believe

this is a violation of the Regulatory Fairness Act and that the public is at a great disadvantage to provide public comment without this information.

These proposed rules are not in compliance with the Competitiveness Council Report, are not based on credible or best available science, will have a large negative impact on the agriculture sector of the economy, and have been promulgated in violation of the law. Therefore, Farm Bureau opposes these rules and requests that DOE not adopt rules until they have fully complied with the law, followed credible sound science, and responded in accordance with the Governor's recommendations and the Competitiveness Council Report.

Sincerely,

Hertha L. Lund
Assistant Director of Government Relations
Washington Farm Bureau

Lewis County

Community Development Department

Divisions:
Administration
Code Compliance
Building & Fire Safety
Permit Center • Planning
Solid Waste Utility

350 N. Market Boulevard • Chehalis, WA 98532-2626 • (360) 740-1146 • Fax: (360) 740-1245 • TDD: (360) 740-1480 • www.co.lewis.wa.us

Date: April 22, 2003

To: Cathy Caruthers
Department of Ecology
P.O. Box 47600
Olympia, WA. 98503

Re: Comments for the Draft Cost Benefit Analysis for the Proposed Changes in the Water Quality Standards

Thank you for allowing the public to comment on the Draft Cost Benefit Analysis. Lewis County's comments are listed below; please take them into consideration in your review.

1. How will monitoring be implemented for agricultural practices and other non-point pollution sources? Will funding be available to agricultural producers and governmental departments to address any additional water monitoring?

2. The CBA addresses additional temperature monitoring equipment. Will state funding be provide for up-grades for the new equipment and will training on the use of the new temperature equipment be funded and provided?

3. How will funding for laboratory costs to change from the current fecal coliform testing to E.coli testing be addressed? Will the state fund the cost of changing associated lab equipment and provide training, as needed to city and county water departments?

Please let me know the response to the above questions as soon as possible, if you have any questions please contact me at (360) 740-1487, thank you.

Lewis County Community Development

Craig W. Swanson
Senior Planner/Water Resources

CC: Director/Planning Dept.
BOCC

WFPA
Washington Forest Protection Association
724 Columbia Street, N.W., Suite 250
Olympia, Washington 98501

April 20, 2003

Cathy Carruthers
Washington Department of Ecology
P. O. Box 47600
Olympia, WA 98504-7600

Subject: Draft Cost Benefit Analysis on Proposed Revisions to Water Quality Standards

Dear Dr. Carruthers:

The members of the Washington Forest Protection Association (WFPA) appreciates the opportunity to provide comments on the Department of Ecology's (Ecology) Cost-Benefit Analysis (CBA) on proposed water quality standard revisions. WFPA represents large and small private forest landowners who grow and harvest trees on 4.5 million acres in Washington State. WFPA has been an active participant in the revision of proposed water quality standards and has provided comment in every public phase of the ongoing revision to water quality standards. Therefore, WFPA and its members have a great interest in the outcome of this process.

The draft CBA addresses three parts, or sub-elements of the proposed water quality standard revisions: bacteria, temperature and dissolved oxygen, and irrigation water criteria. We understand that the requirements for the Administrative Procedures Act (APA) creates a clear legal obligation to select the least burdensome approach to protect beneficial uses and water quality to protect those uses RCW 34.05.328(1)(c). WFPA suggests that Ecology view the proposed water quality standards as one, holistic package for the purposes of cost-benefit analysis – similar to the scope of the Environmental Impact Statement under the State Environmental Policy Act and every other policy and discussion document prepared by Ecology concerning proposed changes to the water quality standards.

Generally, WFPA believes that the proposed water quality standards and related rule package as a whole, meet the legal standard of RCW 34.05.328(1)(c). Using the information provided in the CBA, we believe the complete package of proposed water quality standards passes the net

benefit test. For our review (as described in the chart, below), we relied on the data and assumptions provided in the CBA to demonstrate that the quantifiable and qualitative benefits outweigh the costs. Further, the CBA states that the sub-elements are "inextricably linked together." If they are not separable, there can only be one CBA ratio and not three sub-ratios. Language in the CBA should reflect this and not give the impression that each sub-element must withstand the positive net benefits test on its own.

Given the Summary of Biological Consequences described on pages 37 through 50 of the Draft CBA, it is reasonable to assume that the proposed amendments will have a positive effect on fish populations. The one percent increase in fish populations discussed on page 51 of the Draft CBA is conservative and reasonable.

As displayed in the chart below, it appears that a global CBA would conclude that probable benefits exceed probable costs. Lastly, we believe the CBA will benefit from a clear and concise summary of the (qualitative and quantitative) probable costs and benefits of the proposed water quality standards, such as the chart below. It would be advisable to have a clear, definitive statement clarifying that adoption of the proposed package of water quality standards is the least burdensome alternative and together, they pass the net benefits test.

PROBABLE COSTS (as determined in CBA)	**PROBABLE BENEFITS (as determined in CBA)**
• New illness rate increases (from 4/1000 to 7/1000) - $14-21mm (CBA - pg. 20) • New lab tests, switch from fecal coliform to e. coli measurement - $3.6mm (CBA - pg. 20) • TOTAL NET COSTS - $14-24mm (subtract – $500k property gain) (CBA - pg. 20) • Point source facilities (12-26 affected) - $13-45mm (CBA - pg. 27) (covers all three sections of proposal) • Change from Class AA to Salmon Spawning Waters negatively impacts some runs (CBA - pg. 9)	• Increased certainty – ecoli is a more reliable indicator than fecal coliform (CBA - pg. 27) • Delayed investment in new technology to meet relaxed bacteria standards. (CBA - pg. 21 • Increase in fish harvest due to stock abundance (CBA - pg. 53) • Willingness to Pay for 1% increase in population of Columbia Migratory Fish = $204mm (CBA - pg. 51) • Property value ranges from ($50k) - $1.9mm (Avg - $500k) (covers increased fish value and bacteria loss costs) (CBA - pp. 27 & 58) • Direct/acute mortality avoided (CBA - pg. 33) • Existence value of salmon (CBA - pg. 8) • Clean water & healthy ecosystem (cover letter) • Increased long-term ability to make innovative choices and adapt in future (CBA - pg. 13) • Decreased extinction risk for some char populations (CBA - pg. 9) • Increase in salmon sportsfishing days @ $61.27/day (CBA - pg. 54) All benefits from changing from a "class" of protection to a specific aquatic life "use" for protection in 5 situations (from prescriptive to outcome based rules) (CBA -- pp. 17 & 33)
BENEFIT - Anti-degradation does not allow water to be degraded, even if standards are lowered (CBA - pg. 17)	
Quantifiable Costs Range $27 - $69mm	**Quantifiable Benefits $204mm**

WFPA thanks you for the opportunity to comment. If you have any questions, please contact John Ehrenreich, Director of Forest Tax and Economics, at 360 705-9285.

Sincerely,

Ann Goos, Director of Environmental Affairs

Yakima River Basin Commodity Coalition

301 W Prospect Place ♦ P O Box 1207 ♦ Moxee, Washington 98936
Phone: 509-453-4749 ♦ Fax: 509-457-8561
Email: steve@wahops.org

April 22, 2003

Cathy Carruthers
Department of Ecology
P.O. Box 47600
Olympia, WA 98503

RE: Comments Concerning the Draft Cost Benefit Analysis for Ecology's Proposed Water Quality Standards

Dear Ms. Carruthers:

The Yakima River Basin Commodity Coalition (YRBCC) is made up of several of the larger agricultural commodities grown in the Yakima Basin. Our basin produces over $1 billion in agricultural goods each year. This activity translates into over 20,000 seasonal and full time jobs that fuel our local and state economies. Those involved with our coalition account for over half of the agricultural economic activity in the Yakima Basin. Our membership includes the following producers: fruit, grapes, hops, mint, potatoes, hay, and dairy. It also includes our local Farm Bureau organization and other individual and business entities.

Earlier this year, we submitted comments and a professional review of the proposed standards to Ecology. This review identified many shortcomings of your proposal, with little potential positive outcomes for either Washington State citizens or our environment. We strongly oppose the department's proposal.

Enclosed is a copy of comments regarding your economic analysis of the proposed standards from the Washington Potato Commission. Our organization strongly supports the Washington Potato Commission comments regarding your cost analysis.

In addition, we fully support the position that new standards could reduce the amount of irrigation water available for our crops. This is a huge issue in the Yakima Basin as we have been subject to several devastating droughts, the most recent in 2001, and are again below normal amounts of precipitation this year. An analysis our organization commissioned by Darryl Olsen, Ph.D., Regional Planner and Resource Economist, documented that the 2001 drought had up to a $200 million dollar negative impact on agricultural producers and their employees (copy enclosed).

In conclusion, we feel your cost benefit analysis was very deficient in its undertaking and final output. The proposed standards will have negative impacts on producers and families in this state.

Thank you for allowing us to provide our input. Please feel free to contact me if you have any questions.

Sincerely,

Steven E. George
Administrator

April 21, 2003

Cathy Carruthers
Department Of Ecology
P.O. Box 47600
Olympia, WA 98503
e-mail - caca461@ecy.wa.gov

RE: **COMMENTS CONCERNING THE DRAFT COST BENEFIT ANALYSIS FOR THE DEPARTMENT OF ECOLOGY'S PROPOSED WATER QUALITY STANDARDS**

Dear Cathy Carruthers:

The Washington State Potato Commission (WSPC) represents 350 potato growers throughout Washington State. On March 7, the WSPC submitted comments concerning the proposed water quality standards by the Department of Ecology (DOE). As we indicated in the March 7 comments, the Washington State Potato Commission is strongly opposed to DOE's proposed water quality standards.

The WSPC also has significant concerns with the Department of Ecology's (DOE's) Draft Cost Benefit Analysis (CBA), as it strongly implies that there is no economic impact on agricultural practices. In fact, Ecology states that it "...expects that the effect of the standards on agricultural lands will be minimal and there are mechanisms in place to mitigate costs to land owners." The WSPC strongly disagrees on both of these points.

DOE's decision to not analyze the economic impact of it's Proposed Water Quality Standards on agriculture ensures its cost/benefit analysis will be inadequate

DOE has decided to not do not conduct an economic analysis of agricultural practices analysis of the impact of agricultural practices to their Water Quality Standards because it expects that the effect of the standards on agriculture lands will be minimal and there are mechanisms in place to mitigate costs to land owners. This assertion is simply unbelievable. As the proposed standards would generally reduce temperature standards for surface water throughout the state, the WSPC strongly believes that agriculture does have a high likelihood of being impacted by these changed temperature standards.

Ecology also attempts to claim that the Conservation Reserve Enhancement Program (CREP) and the Environment Quality Incentive Programs (EQIP) will mitigate for any impacts the agricultural community possibly feels from the water quality standards. Ecology's position that the CREP and EQIP programs will mitigate impacts on the agriculture community is misplaced. In the proposed 2003-05 Budget submitted by Governor Locke to the Legislature, there was not enough Capital Budget money allocated to the CREP program to pay for *existing* contracts, yet alone increase contracts into the future.

Additionally, the EQIP program is presently embroiled in a controversy concerning the allocation of some large contracts to a few land owners, rather than allocating a small amount of money to a large amount of land owners.

Since many of the mitigation measures proposed by Ecology are woefully inadequate, and the possible impact on agriculture is very significant, it is arbitrary and capricious for Ecology to simply conclude that it will perform no economic analysis of the impact of these water quality rules on the agricultural community.

DOE's lack of analysis on the possible impacts of the proposed water quality standards on agricultural water *quantity* issues is also arbitrary

Despite the fact that the Department of Ecology has been using water quality standards as a reason for reducing agriculture water supplies in the Methow Valley of North Central Washington, Ecology absolutely ignores that the new Water Quality Standards would have some impact on agricultural water quantity issues. Again, this lack of thorough analysis on the true cost/benefits of these proposed standards shows Ecology's cost benefit analysis to be not only inadequate, but arbitrary.

Thank you for your consideration of our comments concerning this matter. If you or your staff has any questions about our comments, please call me at 509-765-8845.

Sincerely,

Pat Boss

Patrick S. Boss
Executive Director
Washington State Potato Commission
108 Interlake Road
Moses Lake, WA 98837
Phone: 509-765-8845
Fax: 509-765-4853
Email: pboss@potatoes.com

Overview Analysis: Yakima River Basin Irrigated Agriculture Regional Economic Impacts

Analysis and Presentation
Prepared By:

Darryll Olsen, Ph.D.
Regional Planner/Resource Economist
The Pacific Northwest Project
3030 W. Clearwater, Suite 205-A
Kennewick, WA 99336
509-783-1623

Prepared For:

Yakima River Basin Commodity Coalition
Yakima, WA
509-453-4749

January 2003

Pacific Northwest Project
Technical Memorandum

DATE: January 18, 2003

TO: Mr. Steve George, Administrator
Yakima River Basin Commodity Coalition

FROM: Darryll Olsen, Ph.D.
Regional Planner/Resource Economist

SUBJECT: OVERVIEW ANALYSIS: Yakima River Basin Irrigated Agriculture Regional Economic Impacts

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The attached analysis and presentation materials provide an estimate of potential economic impacts resulting from water supply curtailments to irrigated agriculture, within the Yakima River Basin. The curtailments would be caused by low water-year conditions, with accompanying prorated water-use restrictions for the larger irrigation districts.

For the Yakima Basin area—Benton, Kittitas, and Yakima Counties—agriculture's baseline contribution to annual household income is *conservatively estimated* to be about $1.4 billion (2000$). This reflects the direct and indirect effects of the combined agricultural production, agricultural services, and food processing sectors (the "agricultural industry"). For Yakima County, the agricultural industry generates about 35-40% of all industry-service sector income, and in Benton and Kittitas Counties roughly under 10% of industry-service sector income.

Under prorated water conditions, such as occurred in 1993, 1994, or 2001, it is estimated that annual income impacts would likely be within the $100-200 million range. The extent of impact depends primarily on affected crop types and water restriction timing, farm-gate prices for specific years, and district or farm-level mitigation strategies available.

To be sure, the duration of the income impacts can "linger-on" for several years, if severe crop damage occurs or if established markets are disrupted. Also, individual producers can sustain economic losses leading to diminished capital improvements and O&M expenditures, that can further reduce secondary income levels for several years.

As a summary observation, it can be readily estimated that significant prorated water reductions will likely erode Yakima River Basin annual income by at least $100-200 million.

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509-783-1623, FAX 509-735-3140, E-Mail DolsenEcon@AOL.com

Pacific Northwest Project-- "Overview Analysis"

- *Yakima River Basin/Project Area.*
  - *Benton, Kittitas, Yakima Counties.*
- *Regional Economic Impacts.*
  - *Water Supply Impacts to Irrigated Ag.*
  - *Regional (RED) Impacts (Not NED).*
  - *What Economic Value At Risk?*
- *"Off-the-Shelf" Data/Analyses Sources--Summarize Impacts.*

"Overview Analyis"-- Data/Analyses Sources

- *IMPLAN Model (RED Economic Model)*
- *Model Analyses:*
  - *Pacific NW Project (1998).*
  - *GEI Consulatants/PNP (2002).*
  - *IRZ Consulting/PNP (1998).*
  - *U.S. Army Corps (2000).*
  - *NW Economic Assoc. (1994).*
  - *NW Economic Assoc. (1997).*

"Overview Analyis"-- Data/Analyses Sources

- *WA Ag. Statistics/NASS.*
- *Census of Agriculture, 1997.*
- *U.S. Bureau of Economic Analysis-*
  - *Regional Acounts Data.*
  - *Local Area Personal Income.*
- *USBR Yakima Project--Comprehensive Basin Operating Plan (2002 Draft).*

"Overview Analyis"-- Project Operations Affected Areas

- *Yakima Project--Key Proratable Districts.*
  - *Kittitas, 336,000 acre-ft. (100%)*
  - *Yakima-Tieton, 34,835 acre-ft. (31%)*
  - *Wapato, 350,000 acre-ft. (53%)*
  - *Roza, 375,000 acre-ft. (100%)*
  - *SVID, 142,684 acre-ft. (31%)*
  - *KID, 91,275 acre-ft. (?)*
- *Total Proratable: 1,329, 794 acre-ft.*

"Overview Analysis"--What Is At Risk? Yakima River Basin Annual Ag. Income

	Direct Income $ x1,000,000	Indirect Income $ x1,000,000	Total Income $ x1,000,000	Income Multiplier
NW Econ. Assoc. (1993-95 Data)	$1,340	$1,000	$2,340	1.7
GEI-PNP Consults. (2000 Data)	$767	$617	$1,384	1.8

Note: Differences in the above estimates reflect different assumptions in the economic sectors included under "direct income," and the different commodity prices received by farm operators given different years. GEI-PNP consultants' direct income includes only farm production, ag. services, and food processing economic sectors.

"Overview Analysis"-- Irrigated Ag. Impact Assumptions

- *Key Proratable acre-ft.: 1,329,000.*
- *Potential Max. Irrigated Acres: 332,000-426,000 @3-4 acre-ft./acre.*
- *9 in Last 31 Years Prorated.*
- *1994, 2001 Prorated at About 37%.*
- *1993, Prorated at 67%.*
- *Potential Max. Total Acres Affected 209,000-268,000 @37% Prorated.*
- *Potential Max. Total Acres Affected 109,000-141,000 @67%.*

"Overview Analysis"-- Potential Economic Impact Range

Scenario #1 Est. Acres Affected	141,000
Scenario #2 Est. Acres Affected	109,000
Est. Total Annual Regional Income Per Irrigated Acre* (Mid-Range Estimate)	$1,900-3,000
Scenario #1 Est. Annual Income Impact @ 50% Value**	$133-211 (x1,000,000)
Scenario #2 Est. Annual Income Impact @ 50% Value**	$104-164 (x1,000,000)

* Based on Corps (2000) report and GEI-PNP Consultants (2002).

** Assumes operational changes to limit impacts.

NOTE: NEA (1997) impact estimate for 35% proratable is $165M.

"Overview Analysis"-- Critical Assumptions Affecting Economic Impact Values (Regional Income)

- *Geographical Area, Water-Use Sector, Crop Type, and Timing within Basin.*
- *Year-Prices Received by Farm Operators.*
- *Farm Management and Alternative Water Supplies (District or On-Farm Mitigation).*
- *Total Actual Acreage Being Directly Affected.*
- *Other Compensating Economic Factors--Economic Sector Trade-Offs.*

Appendix F: Memo on the Social Rate of Time Preference

April 24, 2003

TO: The File
FROM: Cathy Carruthers
SUBJECT: Social Rate of Time Preference (SRTP)

The social rate of time preference used to discount pure consumption tradeoffs over time is much discussed in the literature. This memo lays out a method for handling two issues.

1. When do we use a general SRTP?
2. What is the SRTP?
3. What do we do about discounting when there is a mix of consumption dollars and investment dollars.
4. How do we handle risk?

Using the SRTP:

The analyst can use a different rate when there is an indication that a different rate should be used.
Example 1: if the rule will require and affect investment only and will not generate any consumption benefits, then an investment related interest rate could be used.
Example 2: the I bond rate below is for 30 year bonds. It is possible that a different interest rate should be used when the consumption shift takes place in a very short time.

The SRTP ≈ 2.9%:

The best indication of risk free, inflation adjusted SRTP for regulatory work would be an inflation adjusted government security. The table below indicates the range of rates for I Bonds[55] over the last 5 years, where bonds are purchased directly from the Department of Treasury. This would tend to indicate the SRTP for this period ranges between 1.6% and 3.6% with an average rate of 2.9%.

[55] http://www.publicdebt.treas.gov/sav/sbirate2.htm

Department of Treasury Data on I Bond Rates					
			INFLATION	Annual	Return on
DATE	FIXED RATES*	DATE	RATES*	Inflation	I Bonds
1-Nov-02	1.60%	1-Nov-02	1.23%	1.51%	4.08%
1-May-02	2.00%	1-May-02	0.28%		2.56%
1-Nov-01	2.00%	1-Nov-01	1.19%	2.65%	4.39%
1-May-01	3.00%	1-May-01	1.44%		5.90%
1-Nov-00	3.40%	1-Nov-00	1.52%	3.46%	6.46%
1-May-00	3.60%	1-May-00	1.91%		7.46%
1-Nov-99	3.40%	1-Nov-99	1.76%	2.64%	6.95%
1-May-99	3.30%	1-May-99	0.86%		5.03%
1-Nov-98	3.30%	1-Nov-98	0.86%	1.49%	5.03%
1-Sep-98	3.40%	1-Sep-98	0.62%		4.64%
		*semiannual rates			
Mean Rate	2.90%			2.35%	5.25%

Mixed consumption and investment rates without risk:

The following formula will allow the foregone consumption due to reduced investment to be factored into present value calculations.

$$\sum_{t=0,n} \frac{k_t}{(1+s)^t} = \frac{k(1+s)}{s}$$

Where k_t is return on capital in time t and s is the social rate of time preference and n is infinite, this yields the following multipliers for year 0 investment requirements in a rule.

Return on capital	Multiplier using SRTP
5%	1.77
6%	2.13
7%	2.48
8%	2.84
9%	3.19
10%	3.55
11%	3.90
12%	4.26
13%	4.61
14%	4.97
15%	5.32
16%	5.68
17%	6.03
18%	6.39
19%	6.74
20%	7.10

If the expected time horizon for reinvestment is not long the formula could be substituted for the table.

Corporate bonds for a sector, with ratings of A or above could generally be regarded as relatively risk free.

Risk that the expected environmental result will not occur:

Interest rates used to be adjusted to reflect probable risk. Risk of failure of environmental investment (such as a lack of and expected impact on a fishery) should be modeled directly by using ranges rather than through imbedding risk in the interest rate. This is now easy to do using a Monte Carlo or other sensitivity test.

Appendix G: Survey of Counties

MEMORANDUM

To: File
From: Dave Reich
Date: June 10, 2003
Subject: County Agricultural Buffer Notes

Asotin County
Contact: Karst Rogers (509)243-2020
Date: 6/6/03
Agricultural Buffers: They have no requirements for agricultural buffers in Asotin County. They operate under the SMP along the Snake, Grande Ronde, Asotin and others and have a draft CAO. The majority of shoreline jurisdiction is not agriculture anyway.
Existing/ New: N/A
Conversion from one type of agriculture to another: N/A
Miscellaneous: They have not yet adopted their CAO and he cannot recall any specific details about buffers. He thinks they will have on the order of 100-200 foot buffers (type 1-5 classification). A majority of creeks have good riparian buffers by choice. The area is very low density. There is a little along the Crickson. There is not much in the way of agricultural applications in Asotin County. Much is residential or agriculture in pasture like hay fields.

Chelan County
Contact: Karen Peele (509)667-6225
Date: 5/20/03
Agricultural Buffers: Generally, the buffer requirements depend on the environment designation and the intensity. Shorelines include Natural 250'/200' (High intensity/Low intensity), Conservancy (250'/200'), Rural (150'/100') and Urban (100'/75'). All other water bodies are by type; type 1 (250'/200'), type 2 (250'/200'), type 3 (200'/150'), type 4 (150'/100') and type 5 (50'/50'). However, the regulations are "silent on agriculture". They mostly deal with structures and you can farm up to the edge of a water body.
Existing/New: No buffers required.
Conversion from one type of agriculture to another: Whether an orchard or a vineyard, no buffer required.
Miscellaneous: For an example buffer; a "natural designation" in SSS is 250 feet. A residential buffer is 200 feet. In small lots, you can get closer (e.g. lots less than 400 feet deep). Chelan County has a right to farm ordinance.

Clallam County
Contact: Bruce Emery (360) 417-2358

Date: 5/22/03
Agricultural Buffers: New agriculture must provide buffers per their CAO/SMP (See "Puget Sound CAO Matrix" (PSCAO). Buffer requirements for existing and on-going agriculture are currently tied up in Superior Court. In general, if you receive the Farm and Agricultural tax exemption, have been shown to be profitable and you have an approved SCS management plan, then you are exempt for the CAO requirements. However, the GMA board said this should be limited to land designated for agriculture and should not have been applied to all agriculture. There is significant agricultural land outside designated agricultural areas. You have to have been enrolled in the tax exemption before 1992 and then use the SCS BMP's. Bruce felt the SCS buffer requirements were less than the buffers they would require. SCS doesn't allow manure ponds close to water and have increased soil erosion standards. They require a 50 foot buffer for stream corridors.
Existing/New: See Above.
Conversion from one type of agriculture to another: Buffer requirements for conversion from one agricultural use to another would depend on if they were still in the tax program. If not, then it would be considered a change in use or if they were outside the tax program for a period of time and they would be required to comply.

Clark County
Contact: Terri Brooks (360)397-2375, Ext. 4885
Date: 5/22/03
Agricultural Buffers: Their SMP requires feedlots to be out of the 100 year floodplain. For agriculture in general, it states a buffer "should be maintained." It should be wide enough to reduce erosion but there is no specific buffer.
Existing/New: If you are currently farming in the buffer, you are exempt from the ordinance. New agricultural uses must comply.
Conversion from one type of agriculture to another: If converting from one type of agricultural use to another, there would be no change in the buffer requirements.
Miscellaneous: She can't remember an application for agriculture. Habitat buffers are 150 feet to 300 feet. Much is under habitat ordinance. Applications are case by case. Habitat ordinance is 250 feet on shorelines stream. If they won't negatively impact they can get closer or mitigate. If it's a legal lot, they must be able to build. SMA is supplanted by the habitat ordinance. Buffers include a 40 foot + 8 foot setback. You must remain 50 feet from all mapped landslide areas (although 20 feet with a geotechnical report). RMZ stream 250 foot for type 1 per DNR, Type 3 are 200 feet. 150 feet for 4 and 5 waters. No new agriculture in the buffer zones. The buffer must be of sufficient width, depth, etc.

Columbia County
Contact: Clark Posey (509)382-4676
Date: 5/27/03
Agricultural buffers: They have a 200 foot buffer for Agriculture/ Residential/Commercial.
Existing/New: Existing agriculture is not required to get out of the buffer areas if they are already in. In general, farmers have been pretty good about voluntarily backing away from the water. Feedlots have pulled back, but in general their farmers are "a heads up group."

Conversion from one type of agricultural use to another: If farmers converted they generally wouldn't know, but in general they would consider it the same use so no change in buffer requirements.
Misc.: SCS standards have no requirements for buffers.

Cowlitz County
Contact: Sheldon Somers (360) 577-3020
Date: 5/21/03
Agricultural buffers: There are no agricultural buffer requirements. The SMP has not been revised since the 70's. Structures require a 10 foot setback from the river. There is a 50 foot setback requirement per the CAO for steep slopes. However, you can farm up to the riverbank.
Existing/New: No buffers required
Conversion from one type of agriculture to another: No buffers required
Misc.: The minimum setback is 10 feet no matter what. 50 for steep slopes unless you get a geotech. Residential/commercial can go to 10 feet of the bank. They respond to complaints but rely on DOE for enforcement.

Garfield County
Contact: Don Brigham (509) 758-9646
Date: 6/6/03
Agricultural Buffers: Right now they don't require buffers, but buffer zones are in their draft CAO. Existing farms can farm up to the shoreline. Shorelines are limited to a few seasonal streams. For any stream of significance, the water drops 5-8 feet vertically right down to the water with no native vegetation. Any significant water bodies are not in agricultural zones or they have willows or alders along stream banks. SMP dictates no buffers.
Existing/New: No new farming, but many do change hands frequently. There are no new requirements under current regulations.
Conversion from one type of agriculture to another: If land is converted from rangeland to cropland, no enforcement would likely occur-looking for built objects.
Misc.: They are in the process of developing their CAO. Two rivers are Two Cannon and the Snake. They expect the new CAO in 2004.

Jefferson County
Contact: Josh Peters (360) 379-4450
Date: 5/22/03
Agricultural Buffers: SMP balances the goals of the SMA w/agricultural uses. Freshwater new agricultural uses would be subject to F&W buffers of 50-150 feet (class 1 or 2-150 feet, class 3 or 4 is 100 feet and class 5 is 50 feet. Marine setbacks are 30 feet, so 30 feet would be the buffer in marine agricultural areas. See PSCAO.
Existing/New: Existing Agriculture is an exempt-legal non-conforming use. They just finished a settlement agreement as part of their CAO amendments. This limits the requirements on existing/on-going agriculture for F&W buffers. They try to work with farmers on a voluntary basis. Farming only occurs in certain zoning (1-10,10-20).
Conversion from one type of agriculture to another: Switching among agriculture would not be an issue unless it involved an intensification of land use.

Misc: Studies show water quality is unaffected by Dairy farms in Chimacum Creek.

Kitsap County
Contact: Renee Beam (360) 337-4967
Date: 5/22/03
Agricultural Buffers: CAO has buffers; Most of the shoreline is built out. 99% of the shoreline is rural residential. Agricultural land is supposed to have a 100 foot buffer for either agricultural land or feedlots per the SMP. See PSCAO
Existing/New: This applies to new uses only unless they're doing an obvious no-no.
Conversion from one type of agriculture to another: Switching to agricultural uses would be broadly "grandfathered-in".
Misc. Residential buffer are 35 foot with a 15 foot setback (you can have landscaping and lawn in this area.)

Kittitas County
Contact: Jan Share (509) 962-7506
Date: 5/27/03
Agricultural Buffers: They regulate the shorelines through the CAO and SMP. The buffers are based on water typing. The CAO provides for a range of buffering. Type 1 is 50 feet and type 4 is 20 feet. They do not regulate farmers and they can farm up to the edge. Many farmers are doing voluntary things to improve water quality. She said they don't have jurisdiction on farming activities. In 5-1/2 years she hadn't seen a permit for agricultural use in the shoreline.
Existing/New: No buffer required.
Conversion from one type of agriculture to another: No buffer required.
Misc: Their SMP is based on environment designations. Exemptions are provided for some applications. Jan doesn't think there are any buffers spelled out in the SMP. She says that they have been requiring natural buffers of 50 feet in the upper part of the county. A typed creek would be required to have a setback via the CAO. They check with Brett Renfro of F&W to see if they need to be concerned. Type 5 waters are probably unregulated, but there are very few. They use their CAO and SMP together to regulate.
Agricultural structures in type 2 shorelines would be exempted from floodplain development permits throughout the code. In general, things are on a permit by permit basis. Agriculture is exempted in a riparian zone. A barn would not be buffered. The CAO relies on ARCVIEW and has information such as the National Wetlands Inventory.

Klickitat County
Contact: Brian Frampton (800) 765-7239
Date: 5/20/03
Agricultural Buffers: A new agricultural use would be required to have a buffer of 50 feet but this is not actively enforced. Environment designations include urban, rural, conservancy and natural. Use regulations apply and permits are required. Type 2-5 waters are not regulated. If not subject to the SMA, they do not regulate.

Existing/New: An existing farm is non-conforming and does not have to meet the requirements. If you change from agriculture to residential, you must follow the setback requirements (min. 50 feet and max of 100 feet).
Conversion from one type of agriculture to another: If you change from existing agriculture to a new agricultural activity, you would still be a non-conforming use and not required to have buffers if they are not already required.
Misc.: Setbacks are dependent on use; 15 foot for structures. They are a complaint driven county.

Lewis County
Contact: Craig Swanson (360)740-1487
Date: 6/6/03
Agricultural Buffers: Agricultural buffers are addressed in the SMP. In the conservancy designation, no buffers are addressed but in general they have been asking for 25 foot buffers in passive agricultural land and pastoral areas. A rural designation has a minimum of 10 feet between cultivated land and water. Manure pits and feedlots require 50 feet. Urban designation-nothing said, but feedlots and dairy need 50 feet too. CAO's in general require no buffers as agriculture is exempt, but in practice they have required a 25 foot buffer. The CAO will be updated by 2005 and will likely have some new buffer requirements. Typically type 1-5 streams get 25 feet. Other than type 1 waters a 25 foot buffer is required.
Existing/New: Existing farms are exempt from any requirements-there are no CAO requirements and there is no monitoring. New farms would generally require a 25' buffer.
Conversion from one type of agriculture to another: Conversion would not trigger additional requirements.
Misc.:

Mason County
Contact: Bob Fink (360) 427-9670
Date: 5/27/03
Agricultural Buffers: New agriculture is subject to their CAO requirements; type 1-3 are 150 feet with 15 foot setback, 4 is 100 feet with 15 foot setback, 5 is 75 feet with 15 foot setback. Setbacks don't apply for agriculture. Marine waters and type 1 lakes, conservancy areas are 100 feet. See PSCAO.
Existing/New: Existing agriculture is broadly grandfathered in. Existing activities must comply with NRCS BMP's. He thinks NRCS has variable buffers depending on conditions.
Conversion from one type of agriculture to another: Conversion of Ag land would not be an issue as long as they follow the NRCS standards.

Okanogan County
Contact: Don Motes (509) 422-7160
Date: 5/20/03
Agricultural Buffers: They use their SMP for any water body. Info not covered in shorelines is in the CAO and water typing buffers for class 1 = 200 feet, 4 = 50 feet and for 5=0. The shorelines program does not apply to pre-existing uses. New uses are required to use setbacks (buffers). Buffer width depends on shoreline designation.
Rural shoreline (100 foot vegetated-minimize disturbances for animal feedlots)
Suburban/conservancy/urban = 0.

80% of the land is rural land in Okanogon County, 10-12% is conservancy, natural is for 3 lakes, and urban is 1.5%.
Existing/New: Pre-existing uses are not required to comply with the buffer requirements
Conversion from one type of agriculture to another: Conversion to residential would be required to have a 50 foot setback. Conversion of crops from one to another would not be considered a change in use. Pre-existing uses in buffer if modified must be moved.
Misc.: Setbacks include 25' (suburban), 50 feet for conservancy. 25 foot view corridor or access corridor exists. Currently there is not a lot of development occurring. (Parcels must be 20 acres, 4 or fewer lots it can be smaller).

Pend-Oreille County
Contact: Neil White (509)447-4821
Date: 6/9/03
Agricultural Buffers: Agricultural activities are exempt from buffer requirements under both the SMP and the CAO.
Existing/New: N/A
Conversion from one type of agriculture to another: N/A
Misc.: The SMP is the primary regulatory instrument on the shoreline. 1992 CAO requirements vary per stream type and type of use. They separated it into high and low intensity.

Pierce County
Contact: Mike Erkinnen (253)798-2705
Date: 5/27/03
Agricultural Buffers: Certain types of agricultural uses require buffers under shorelines. Feedlots, retention ponds, etc. require a 200 foot setback from OHW or the 100 year floodway. Otherwise, a 25 foot buffer shall be maintained between soil and water edge. See PSCAO.
Existing/New: If they predate the SMP (1970s) use is grandfathered in. However the CAO also applies. This requires a 35 foot buffer for streams and rural lakes. You must meet the stricter of the two. The CAO applies to all waters class 1-5. Some specific rivers and lakes have stricter buffer requirements (see handwritten notes).
Conversion from one type of agriculture to another: You must meet the new requirements if you are a new agricultural use. If you are existing, you would not be required to change since it is similar use.

Skagit County
Contact: Daniel Downs (360) 336-9410
Date: 5/28/03
Agricultural Buffers: Their SMP doesn't regulate agriculture per se. Their CAO does however. See the PSCAO for more information.
Existing/New: Existing agriculture is exempt from the CAO buffer requirements. New agriculture would be subject the CAO.
Conversion from one type of agriculture to another: If farmers change uses, they would not be required to meet new requirements.

Skamania County
Contact: Charlie Boyd (509)427-9458

Date: 5/21/03
Agricultural Buffers: They have a 50 foot setback for structures and a 100 foot no touch buffer. You can get a variance, but you must show there are no alternatives (i.e. that it is necessary).
Existing/New: Existing agricultural uses are not required to get out of the buffer area if currently utilizing it. If you're currently in the buffer, you can expand up to 100% the size of the current area within the buffer up to 50 feet within the shoreline. If it's a new use, you're required to stay out of the 100 foot no-touch buffer.
Conversion from one type of agriculture to another: If you change use from one type of agriculture to another, then it would be considered the same existing use and you would not be required to provide a buffer. If you change use to agriculture from another use, then you must provide the 100 foot buffer.
Misc.: You must get a variance to expand a structure in the buffer area.

Snohomish County
Contact: Randy Middaugh (425)388-3311
Date: 5/28/03
Agricultural Buffers: The CAO would apply to anyone needing any kind of County permit. See PSCAO for CAO requirements. However, there are exemptions for grading for agriculture such that permit requirements are generally eliminated. Shorelines requirements depend on the designation. Rural = 50 feet.
Existing/New: In general, existing situations already in the buffer do not have to meet the requirements of the CAO for buffers. New uses would to the extent they need a permit.
Conversion from one type of agriculture to another: Conversion would not be considered an issue if they are just changing crops.
Misc.: When they require a buffer it is recorded with the auditor and becomes part of the property.

Spokane County
Contact: Bill Moser (509)477-7154
Date: Taken from SMA survey, 3/03
Agricultural Buffers: No buffers for agriculture are currently required.
Existing/New: N/A
Conversion from one type of agriculture to another: N/A
Misc.: In general, protection of native vegetation is not required, especially for single family development, except new plats. There are setback requirements, but few buffer requirements.

Stevens County
Contact: Jenny Anderson (509)684-2401
Date: 6/09/03
Agricultural Buffers: Buffers are only regulated under the CAO. The CAO exempts existing agriculture from any buffers. Anything in a buffer is a pre-existing use. Buffers for wetlands are: type 1=200, 2=100, 3=50, 4=25 and for streams: 1&2=100, 3=75, 4=50, 5=25. Their SMP is overridden by their CAO.
Existing/New: A new farm does not need a permit, so you will not know. Technically they should be conforming to the buffer requirements. But it is difficult to know if they are conforming.

Conversion from one type of agriculture to another: They would never know and existing agriculture is exempt.
Misc.: Some buildings are exempt. Unless someone complains you won't know. They used to have a common line setback in the old CAO-new one got rid of that. Old buffer requirements are in file. Everything is being challenged to GMA hearings board.

Whatcom County
Contact: Jeff Chalfan (360) 676-6907
Date: 5/29/03
Agricultural Buffers: Farmers can farm within the County's buffer if they have an approved "Farm Plan" from the conservation district. These programs are farm specific and adjust buffer requirements and encourage other BMP's. Their CAO is available through MRSC and see PSCAO.
Existing/New: Existing or new; the County will defer authority to the conservation district to develop a farm plan. It will be on file with the County and they can enforce it.
Conversion from one type of agriculture to another: All that would be required would be for the farmer to revise the farm plan with the district.
Misc.: In general their CAO requires 100 foot buffers for streams, wetlands and marine shorelines. A 50 foot buffer may be provided in those waterways where not utilized by salmonid fish populations and which do not directly flow into such waterways. If a non-salmonid stream feeds to a salmonid stream it should have a 100 foot buffer.

Yakima County
Contact: Dean Patterson (509) 574-2230
Date: 5/27/03
Agricultural Buffers: New development must meet the requirements of the CAO. CAO requires 200 foot buffers for class 1, 25 feet for class 5. CAO can be found at MRSC. Wetland buffers are 10'-200'.
Existing/New: Existing Agriculture uses are grandfathered in. New uses must provide buffers based on their CAO and the CAO is linked to water type (i.e. class I, class II).
Conversion from one agricultural use to another: Generally they don't know if agricultural conversion occurs and no idea when farmers switch crops. Grandfathering under the SMP is over 30 years old. Most grandfathering occurred under the CAO.

Walla Walla County
Contact: Connie Krueger (509) 527-3285
Date: 5/27/03
Agricultural Buffers: Confined animal operations (not free range) must meet the 200 foot buffer and the other shoreline requirements. Other agriculture (wheat, orchards etc.) are not covered.
Existing/New: Existing Agriculture uses (see above). New Agriculture - The animal operations above would be covered as indicated above but not other agriculture. There is very little conversion into agriculture due to the landscape. The issue doesn't come up for them.
Conversion from one agricultural use to another: Farmers switch crops all the time and seasonally. Not covered.

Franklin County

Contact: Planner (509)545-3521
Date: 6/12/2003
Agricultural Buffers: No buffers for agriculture are currently required.
Existing/New: N/A
Conversion from one type of agriculture to another: N/A

King County
Contact: Jon Sloan 206-296-7158
Agriculture Buffer: Class 1: 100 feet Class 2A: 100 feet Class 2B: 50 feet Class 3: 25 feet.
Existing/New: exemption for ongoing agricultural use, but if the existing agricultural use fallowed for more than 5 years, it will lose the exemption.
Conversion from one type of agriculture to another: N/A

Grant County
Contact: Jon: Kent Ziemer 509-754-2011
Agriculture Buffer: Category 1: 100 feet Category 2: 75 feet Category 3: 50 feet Category 4: 25 feet.
Existing/New: exemption for ongoing agricultural use.
Conversion from one type of agriculture to another: They think it is Ok if changing from grazing to crops.

Adams County
Contact: Jon: Greg Hall 509-488-9441
Agriculture Buffer: The SMA was adopted in the 1970's, and at that time there is no concept of buffer. For Corp land there are 25 feet setback requirement.
Existing/New: N/A
Conversion from one type of agriculture to another: N/A

Lincoln County
Contact: Jim 509-725-7041 Available on Monday.
Agriculture Buffer: No buffer requirement now.
Existing/New: No buffer requirement for both.
Conversion from one type of agriculture to another: See above.
Misc.: there are 100 feet buffer requirement for all others except agriculture around wetland or along streams.

Whitman County
Contact: Mark Bordsen 509-397-4622—Planning department
Agriculture Buffer: CAO: Category 1: 200 feet; Category 2: 100 feet; Category 3: 50 feet; Category 4: 25 feet. All these buffer requirements are for wetland. If streams are not associated with wetland, no buffer is required.

Existing/New: Both existing and new agricultural developments are not subject to buffer requirement except in the wetland shoreline.
Conversion from one type of agriculture to another: N/A

Misc.: They think shoreline buffer will make farmers lose flexibility.