



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101-3140

Reply to
Attn Of: OWW-131

1 8 SEP 2008

Kelly Susewind, Manager
Department of Ecology
Water Quality Program
PO Box 47600
Olympia, WA 98504-7600

Jim Pendowski, Manager
Department of Ecology
Toxics Cleanup Program
PO Box 47600
Olympia, WA 98504-7600

Re: EPA's Action on Washington's Revised Sediment Management Standards including the Marine Finfish Rearing Facility Provision (as amended in 1995).

Dear Mr. Susewind & Mr. Pendowski:

The U.S. Environmental Protection Agency has completed its review of Washington State's Sediment Management Standards (SMS) submitted to EPA on June 3, 1996. The SMS, a portion of Washington's water quality standards (WQS), are codified at WAC 173-204 *et. seq.* Under Sections 303(a)-(c) of the Clean Water Act (CWA), 33 U.S.C § 1313(a)-(c), states are required to establish water quality standards and submit them to EPA for approval or disapproval. Likewise, revisions to a state's water quality standard must also be submitted to EPA for approval or disapproval.

Water quality standards describe the desired condition of a waterbody and consist of three principle elements: (1) the "designated uses" of the state's waters, such as public water supply, recreation, propagation of fish, or navigation; (2) "criteria" specifying the amounts of various pollutants, in either numeric or narrative form, that may be present in those waters without impairing the designated uses; and (3) antidegradation requirements, providing for protection of existing water uses and limitations on degradation of high quality waters. EPA's regulations at 40 C.F.R. Part 131 describe the minimum requirements for each of these three elements of water quality standards.

BACKGROUND

In 1991, EPA approved Washington's SMS, which address three primary areas: (1) standards for assessing the nature and extent of sediment contamination, (2) procedures for cleanup of historical sediment contamination, and (3) procedures for preventing future sediment contamination from discharges.¹ On June 3, 1996, the Washington State Department of Ecology (Ecology) submitted to EPA revisions to WAC 173-204, which included minor revisions and the addition of a new section for Marine Finfish Rearing Facilities, WAC 173-204-412.

¹ Washington State Department of Ecology. "Sediment Cleanup Status Report." June 2005. Publication Number 05-09-092. <<http://www.ecy.wa.gov/pubs/0509092.pdf>>

2b: The provision underwent a non-substance revision since the meaning or application of the water quality standard previously approved by EPA has not been altered. For these revisions, EPA is not reassessing or re-approving the underlying, previously approved standard.

- WAC 173-204-100(7)
- WAC 173-204-200(2)
- WAC 173-204-200(21)
- WAC 173-204-200 [renumbering]
- WAC 173-204-315(1)(a)(i)
- WAC 173-204-315(1)(a)(ii)(B)
- WAC 173-204-315(1)(a)(ii)(C)
- WAC 173-204-315(1)(a)(ii)(D)
- WAC 173-204-315(1)(a)(ii)(E)
- WAC 173-204-315(1)(b)(i)
- WAC 173-204-315(1)(b)(iii)
- WAC 173-204-320(2)
- WAC 173-204-320(3)(c)
- WAC 173-204-415(1)(f)
- WAC 173-204-420(2)
- WAC 173-204-420(3)(c)(i)
- WAC 173-204-420(3)(c)(iii)
- WAC 173-204-520(2)
- WAC 173-204-520(3)(d)(i)
- WAC 173-204-520(3)(d)(iii)
- WAC 173-204-590(2)(a)

A detailed discussion of the rationale for today's action is included in the enclosed technical justification document. If you have questions concerning this letter, please feel free to contact me at (206) 553-7151 or Matthew Szelag, Water Quality Standards Coordinator, at (206) 553-5171.

Sincerely,



Michael F. Gearheard, Director
Office of Water and Watersheds

Enclosure

ENCLOSURE

WASHINGTON SEDIMENT MANAGEMENT STANDARDS 1996 REVISION PACKAGE

TECHNICAL JUSTIFICATION

This technical justification provides the Environmental Protection Agency's (EPA's) basis for today's action. Ecology submitted revised Washington Sediment Management Standards (SMS) to EPA on June 3, 1996 for review. The revisions included the addition of a new definition, WAC 173-204-200(13); a new section, WAC 173-204-412; and several other revisions to existing provisions contained in WAC 173-204.

EPA's action in this technical justification is organized into two major sections:

- Section 1: Revisions that are approved under section 303(c) of the CWA; and
- Section 2: Revisions on which EPA is taking no action under section 303(c) of the CWA.

Section 2 is sub-divided into two additional categories:

- Section 2.1: Provisions of Section 412 that are not water quality standards; and
- Section 2.2: Provisions outside of Section 412 which do not require EPA action under section 303(c) of the CWA.

1. REVISIONS THAT ARE APPROVED UNDER SECTION 303(C) OF THE CWA

EPA approves the following revisions to Washington's SMS:

- *WAC 173-204-200(13): Definition of marine finfish rearing facilities;*
- *WAC 173-204-315(1)(b)(ii): Juvenile polychaete chronic effects tests;*
- *WAC 173-204-315(2)(b): Larval performance standards for control and reference sediment biological test results;*
- *WAC 173-204-315(2)(d): Juvenile polychaete performance standards for control and reference sediment biological test results;*
- *WAC 173-204-320(3)(d): Juvenile polychaete biological effects criteria;*
- *WAC 173-204-412(2): Applicability of marine finfish rearing facilities;*
- *WAC 173-204-412(3)(a) and (3)(b): Sediment monitoring requirements of marine finfish rearing facilities;*
- *WAC 173-204-412(4), (4)(a), (4)(a)(i), (4)(a)(ii), (4)(b): Sediment impact zones for marine finfish rearing facilities;*
- *WAC 173-204-430(3)(c)(iv): Juvenile polychaete Puget Sound marine sediment impact zone maximum biological effects criteria; and*
- *WAC 173-204-520(3)(d)(iv): Juvenile polychaete Puget Sound marine sediment cleanup screening levels and minimum cleanup level biological criteria.*

EPA's approval rationale for each revision is described below. Strikeout and underlining is utilized to show deletions and additions to the 1991 SMS language.

WAC 173-204-200(13) *“Marine finfish rearing facilities” shall mean those private and public facilities located within state waters where finfish are fed, nurtured, held, maintained, or reared to reach the size of release or for market sale.*

EPA ACTION: EPA approves this new definition for marine finfish rearing facilities under Section 303(c) of the Clean Water Act (CWA) as it effects the implementation of Washington's Sediment Management Standards (SMS).

RATIONALE: The definition reasonably explains the use of this term in the context of WAC 173-204-412. There are eight existing marine netpen facilities, all of which are located in Puget Sound.

WAC 173-204-315(1)(b)(ii) *Juvenile polychaete: Twenty-day (~~biomass~~) growth rate of the juvenile polychaete *Neanthes arenaceodentata*; or*

EPA ACTION: EPA approves the revision to use growth rate instead of biomass as the metric for juvenile polychaete chronic effects tests.

RATIONALE: WAC 173-204-315 covers test methods related to the Sediment Management Standards. This provision has been changed to replace biomass with mean individual growth rate as the method to test juvenile polychaete to determine and monitor sediment quality. This alteration is consistent with the change in 315(2)(d), so that biological sediment tests can be compared to the reference sediment biological data. EPA has determined this change alters the level of protection of the sediment quality standards since this provision changes the juvenile polychaete endpoint determination to mean individual growth rate from biomass. Although the revised provision updates the metric, the overall function of the provision to compare test samples to reference samples is unchanged. Since Ecology's adoption of the SMS in 1991, the Puget Sound Dredged Disposal Analysis (PSDDA) and Puget Sound Estuary Program (PSEP) implemented this revised endpoint determination and bioassay test procedure.¹ As a result, this revision is an updated metric to identify a representative indicator of change for juvenile polychaete size to determine if growth has been inhibited by sediment quality. EPA has determined this change is within the State's discretion to choose an appropriate indicator based on best available science and is protective of uses. Therefore, EPA approves this revised provision.

WAC 173-204-315(2)(b) *Larval: The seawater control sample shall have less than (~~fifty~~) thirty percent combined abnormality and mortality (i.e., a (~~fifty~~) seventy percent normal survivorship at time-final).*

EPA ACTION: EPA approves the revision of a more stringent normal survivorship for larval performance standards in control and reference sediment biological test results.

RATIONALE: WAC 173-204-315 covers test methods related to the Sediment Management Standards. Specifically, this provision sets quality measures for larval bivalve seawater control and reference sediment biological samples. The seawater control sample for larval normal survivorship has been changed from 50% to 70%. EPA has determined this change alters the level of protection of the sediment quality standards since this provision makes the control sample larval mortality rate more stringent than the 1991 SMS. This revision is consistent with protocols and recommendations by the PSDDA in 1994 and PSEP in 1986, which are based on best available science.² EPA has determined this change is within the State's discretion and is protective of uses. Therefore, EPA approves this revised provision.

WAC 173-204-315 (2)(d) Juvenile polychaete: The control sediment shall have less than ten percent mortality and mean individual growth of ≥ 0.72 mg/ind/day per dry weight basis. The reference sediment shall have a mean ((biomass)) individual growth rate which is at least eighty percent of the mean ((biomass)) individual growth rate found in the control sediment. Control sediments exhibiting growth below 0.72 mg/ind/day may be approved by the department on a case-by-case basis.

EPA ACTION: EPA approves this revision which sets a mean individual growth rate for juvenile polychaete performance standards in control and reference sediment biological test results.

RATIONALE: WAC 173-204-315 covers test methods related to the Sediment Management Standards. Specifically, this provision sets quality measures for control and reference sediment biological testing. The provision now specifies a mean individual growth rate of ≥ 0.72 mg/ind/day for the juvenile polychaete control sediment, whereas biomass was the previous measurement endpoint determination used. This metric is also changed in 315(1)(b)(ii), 320(3)(d), 420(3)(c)(iv) and 520(3)(d)(iv). EPA has determined this change alters the level of protection of the sediment quality standards since this provision changes the control juvenile polychaete metric to a specified mean individual growth rate from biomass. Although the revised provision updates the metric, the overall function of the provision to compare test samples to reference samples is unchanged. Since Ecology's adoption of the SMS in 1991, the PSDDA and PSEP implemented this revised endpoint determination and bioassay test procedure.³ As a result, this revision is an updated metric to identify a representative indicator of change for juvenile polychaete size to determine if growth has been inhibited by sediment quality. In addition, the mean individual growth rate of ≥ 0.72 mg/ind/day is consistent with recommendations by PSDDA in 1995 and the U.S. Army Corps of Engineers Waterways Experiment Station in 1993.⁴ EPA has determined this change is within the State's discretion to choose an appropriate indicator based on best available science and is protective of uses. Therefore, EPA approves this revised provision.

WAC 173-204-320 (3)(d) Juvenile polychaete: The test sediment has a mean ((biomass)) individual growth rate of less than seventy percent of the reference sediment mean ((biomass)) individual growth rate and the test sediment ((biomass)) mean individual growth rate is statistically different (t test, $p \leq 0.05$) from the reference sediment ((biomass)) mean individual growth rate.

EPA ACTION: EPA approves this revision which changes the metric for juvenile polychaete from biomass to mean individual growth rate for biological effects criteria.

RATIONALE: This provision has been changed to replace biomass with mean individual growth rate as the method to test juvenile polychaete to determine and monitor sediment quality. This alteration is consistent with the change in 315(2)(d), so that biological sediment tests can be compared to the reference sediment biological data. EPA has determined this change alters the level of protection of the sediment quality standards since this provision changes the juvenile polychaete endpoint determination to mean individual growth rate from biomass. Although the revised provision updates the metric, the overall function of the provision to compare test samples to reference samples is unchanged. Since Ecology's adoption of the SMS in 1991, the PSDDA and PSEP implemented this revised endpoint determination and bioassay test procedure.⁵ As a result, this revision is an updated metric to identify a representative indicator of change for juvenile polychaete size to determine if growth has been inhibited by sediment quality. EPA has

determined this change is within the State's discretion to choose an appropriate indicator based on best available science and is protective of uses. Therefore, EPA approves this revised provision.

WAC 173-204-412(2) Applicability. Marine finfish rearing facilities and their associated discharges are not subject to the authority and purpose standards of WAC 173-204-100(3) and (7), and the marine sediment quality standards of WAC 173-204-320 and the sediment impact zone maximum criteria of WAC 173-204-420, within and including the distance of one hundred feet from the outer edge of the marine finfish rearing facility structure. Marine finfish rearing facilities are not subject to the sediment impact zone standards of WAC 173-204-415.

EPA ACTION: EPA approves section WAC 173-204-412(2) as a water quality standard that is protective of the designated uses of Washington marine waters as a whole. This provision alters the level of protection by making specific sections of Washington's SMS inapplicable for finfish rearing facilities. WAC 173-204-412(2) exempts marine finfish rearing facilities from the following sections of Washington's SMS:

- *WAC 173-204-100(3) and (7) Authority and purpose*⁶
- *WAC 173-204-320 Marine sediment quality standards*⁷
- *WAC 173-204-415 Sediment impact zones*⁸
- *WAC 173-204-420 Sediment impact zone maximum criteria*⁹

RATIONALE: EPA's analysis of WAC 173-204-412(2) is based on the size, number and distribution of netpen facilities known to currently and historically be located in Washington's marine waters. As the State of Washington has several other regulations, described later in this section, which govern the operation of these facilities, EPA's analysis assumes these will remain in effect. EPA views this as reasonable since this regulation has been effective under the CWA for the last eight years and there is no indication of upcoming changes. Furthermore, the number of netpen facilities in Washington marine waters has been declining during this time period.

EPA approves section WAC 173-204-412(2) based on the following findings:

1. The designated uses of Puget Sound are protected.

EPA's approval of WAC 173-204-412(2) is protective of the designated uses of Puget Sound as a whole. Washington's water quality standards found at WAC 173-201A must still be met since an area of mixing is not permitted in the water column. This includes Washington's narrative water quality criteria which limit the toxic, radioactive, or other deleterious material concentrations that a facility may discharge to levels below those which have the potential to adversely affect designated water uses, cause acute or chronic toxicity to biota, impair aesthetic values and adversely affect human health (WAC 173-201A-260(2)).

In 1997, several environmental groups challenged Washington's Pollution Control Hearings Board (PCHB) issuance of marine finfish rearing facility NPDES permits for compliance with the CWA and the State Environmental Policy Act (SEPA). At the time, the PCHB found that, "Permittees' facilities do not create unresolved conflicts with alternative uses of Puget Sound resources as contemplated by RCW 43.32C.030(2)(e). The existence of commercial salmon farms as permitted uses does not preclude other beneficial uses in Puget Sound, such as shellfish harvesting, commercial or sport fishing, navigation or recreational boating. Likewise, the existence of the salmon farms does not operate to the exclusion of available resources, such as native salmon runs, sediment and water quality, or marine mammals. In short, salmon farming in Puget Sound does not present the citizens of the State of Washington with an 'either/or' choice

with respect to other beneficial uses and important resources.”¹⁰ This decision was upheld in a PCHB final ruling in November 1998.

The allowance of a sediment impact zone for marine finfish rearing facilities is similar to the mixing zone concept in water quality standards. EPA issued guidance in 1986 and 1991 which sets forth general principles about when mixing zones can be established without compromising designated uses. Mixing zones allow Ecology to authorize surface water quality-based effluent limits in areas around a point of discharge. Both acute and chronic mixing zones may be authorized for pollutants. The approval of this section, which allows the establishment of a sediment impact zone by marine finfish rearing facilities, is consistent with EPA’s 1991 guidance (Technical Support Document for Water Quality Based Toxics Control) and EPA’s Water Quality Standards Handbook (Second Edition, 1994).¹¹ This guidance states that criteria in a mixing zone can be exceeded if the mixing zone does not impair the integrity of the waterbody as a whole, there is no lethality to organisms passing through the mixing zone, and the mixing zone is not associated with significant health risks considering likely pathways of exposure.

2. Netpen facilities have an insignificant impact on aquatic life in Puget Sound.

EPA’s approval of WAC 173-204-412(2) is expected to have no direct impact and only an insignificant indirect impact on the aquatic community of Puget Sound. Since the number of facilities and the overall area of netpen locations is 0.061 square miles (including the 100-foot sediment impact zones) and the total size of Puget Sound is 2,800 square miles, the amount of Puget Sound affected by netpen facilities is much less than 1%. As a result, the impact of the indirect effects is expected to be low. The insignificant impact of the netpens can also be used to demonstrate that the designated uses for Puget Sound are protected as a whole.

The following is an excerpt regarding the total area currently permitted, “In Washington now about 67.5 total hectares (ha) are leased by companies for commercial salmon net-pens, although not all the leased area is being used (WDNR 2001). The leased area extends to the perimeter of the anchoring system, so the actual area covered by floating structures is much less. The 10 commercial sites currently operational in Puget Sound have a total of 53 ha under lease from the State (ranging in size from 0.8 to 9.7 ha per site), with a total of 8.7 ha permitted for internal pen structures for all Puget Sound salmon farms combined.”¹² The sizes of the eight facilities currently in Puget Sound are listed in the table below.

Permitted Atlantic Salmon Netpen Facilities in Puget Sound.

Facility *	Netpen Area (in feet)	Square Feet	Square Feet of Netpen Area plus 100 foot SIZ	Minimum Water Depth at Site ^
Clam Bay	990 x 185	183,150	310,650	63 feet
Fort Ward	650 x 185	120,250	213,750	35 feet
Orchard Rocks	900 x 185	166,500	285,000	40 feet
Deepwater Bay #1	352 x 190	66,880	131,080	55 feet
Deepwater Bay #2	440 x 190	83,600	156,600	55 feet
Deepwater Bay #3	540 x 190	102,600	185,600	95 feet
Hope Island	440 x 120	52,800	118,800	60 feet
Ediz Hook	900 x 190	171,000	290,000	65 feet
Total		946,780 (8.79 hectares)	1,691,480 (15.7 hectares)	

*EPA's Approval of Washington's 1996 Sediment Management Standard Revisions
Technical Justification; September 18, 2008*

^ Depths are given at Mean Lower Low Water (MLLW). MLLW is defined as the average height of the lower low waters over a 19-year period. (Ecology)

Areas determined from Washington State Department of Ecology. NPDES Permit Factsheets for American Gold Seafoods, Inc. 2007.

Total area of Puget Sound: 2,800 square miles¹³ or 725,197 hectares.

Total area of netpens with sediment impact zone: 0.061 square miles.

The following types of facilities are not covered by this approval action since they are located in tribal waters or fresh water, not Washington's marine waters: (1) 'Short term' Tribal salmon rearing facilities (these facilities are hatcheries that raise Pacific salmon for three to four months than release them into the wild; there are approximately ten of these facilities) and 2) Pacific salmon hatcheries (in 2005, there were 72 of these facilities operated by WDFW and 12 by private industry).¹⁴

3. The effects on the benthic community are accounted for and monitored (including the determination of a baseline) and closure procedures of netpen facilities ensure the aquatic environment is restored to baseline levels.

WAC 173-204-412(2) allows for a 100 foot (approximately 30 meters) sediment impact zone allowed in each direction of the netpen facility. The major factors that affect solids accumulation are the water current, water depth, loading density, feeding rates, and the length of yearly operations – all of which are accounted for in the NPDES permits and siting regulations. This is also consistent with what is allowed in British Columbia and Maine. An EPA issued NPDES permit in 2002 for Acadia Aquaculture, Inc. in Maine calculated a 30 meter impact zone based on the site's average water depth, average current velocity, prevailing current directions and an established settling rate of feed pellets. As stated above, Washington's NPDES permits for netpen facilities account for similar factors in determining the 100 foot sediment impact zone. This distance accepts that benthic infaunal criteria likely cannot be met in that area, like a mixing zone.

Biological criteria for benthic infaunal abundance are important due to organics created by uneaten food and fish feces. These biological criteria are adequately addressed by the remaining requirements in WAC 173-204-412 that EPA approves and by the other applicable requirements in Washington's SMS. The goal of closure requirements is to return the sediment quality to baseline levels prior to a netpen facility's operation at a given location.¹⁵ Closure requirements exist to make sure certain impacts do not continue after the facilities are no longer operational as regulated according to WAC 173-204-412(3)(e). Finfish rearing facilities typically do not have a toxic impact on sediments since the main sediment impact is caused by organic materials from uneaten fish food and fish feces (as described in the next paragraph). As a result, sediment quality standards for netpen facilities based on total organic carbon values is an appropriate measurement to determine effects of the accumulation of organic materials on benthic infaunal abundance. This is described further in this document under EPA's approval rationale for sub-sections WAC 173-204-412(3)(a) and WAC 173-204-412(3)(b).

Two concerns that could affect closure involve heavy metals in the sediment below netpens: copper, which is used in marine anti-fouling compounds; and zinc from fish feed.¹⁶ Regarding copper, WDNR noted that chemical anti-fouling agents were not used in Washington, eliminating the associated risk related to copper.¹⁷ Zinc is considered an essential mineral element for salmon nutrition. However, its concentration in dry fish feed is routinely tested and the results have not exceeded criteria for metals.¹⁸ Furthermore, monitoring required by a NPDES permit for the

Ediz Hook location (which is representative of all facilities) found all copper and zinc data were below cleanup screening levels and sediment quality standards.¹⁹ Therefore, closure and cleanup is generally straightforward since toxics are not typically present in the sediment below the facilities.

4. The existing regulatory framework for netpens provides protection to surrounding habitat and other species.

EPA's approval of WAC 173-204-412(2) is based on the understanding that implementation of the sediment quality standards will be conducted through the NPDES permit process. The NPDES permits provide an extensive evaluation to ensure aquatic life in Puget Sound is protected. Ecology reviews and reissues NPDES permits every five years. The current NPDES permits for marine finfish rearing facilities in Puget Sound cover a variety of requirements including the following:²⁰

- Monitoring requirements
 - Monitoring schedule
 - Sediment sampling and analysis plan
 - Exceedance monitoring
 - Enhanced sediment quality monitoring
 - Dissolved oxygen profile (in summer)
 - Underwater photographic survey
 - Antibiotic resistance monitoring
- Reporting/Recordkeeping requirements
- Sediment impact zone closure requirements
- Operating requirements
 - General operating requirements
 - Disease control chemical use requirements
- Pollution prevention plan
- Fish release prevention and monitoring plan
- Accidental fish release response plan

In addition to the NPDES permits, several other state and local agencies play an important role in regulating the industry. For example, the Washington Department of Fish and Wildlife (WDFW) manages the disease control, salmon stocks and escape risks. The Washington Department of Natural Resources (WDNR) covers the permitting procedures for siting a netpen facility.²¹ WDNR requires extensive data, a thorough cost analysis and site specific information to evaluate a location's feasibility as an offshore farm. Although these important regulations do not appear in the marine finfish rearing facility provision itself, it is important to note that these elements are accounted for by agencies other than Ecology, and provide an extensive regulatory structure for netpen facilities in Puget Sound.

The regulatory structure of marine finfish rearing facilities includes federal, state and local agencies which cover a variety of regulations. The agencies and their authorities are described below:²²

- Washington State Department of Fish and Wildlife (WDFW): manages regulatory authority for commercial aquaculture disease control, escapement and stocks of fish reared in netpens.

- Washington State Department of Agriculture: develops regulations with WDFW for commercial aquaculture.
- Washington State Department of Ecology: regulates discharges from netpens by issuing NPDES permits that contain operational conditions to protect water quality and sediment standards.
- Environmental Protection Agency: approves or disapproves Ecology's water quality and sediment standards.
- Washington State Department of Natural Resources: leases aquatic lands for netpen facilities.
- Counties in Washington State (and sometimes local jurisdictions): issues shoreline permits.
- Tribes of Washington State: co-manages natural resources in Washington State and have input into aquaculture disease control regulations adopted by WDFW.
- National Marine Fisheries Service (NMFS): administers Endangered Species Act for anadromous salmonids and marine mammals.
- U.S. Department of Fish and Wildlife (USFWS): administers Endangered Species Act for bull trout in Puget Sound.
- Army Corps of Engineers: requires netpens to have a Section 404 navigation permit.

5. NOAA technical memorandums determine beneficial affects and low potential for negative effects.

EPA's approval of WAC 173-204-412(2) and its not likely to adversely affect (NLAA) determination for endangered and threatened species by the exceedances allowed in this section are supported by three NOAA reports:

- "Beneficial Environmental Effects of Marine Finfish Mariculture" J.E. Rensel and J.R.M. Forster. July 2007.
- "Review of Potential Impacts of Atlantic Salmon Culture on Puget Sound Chinook Salmon and Hood Canal Summer-Run Chum Salmon Evolutionarily Significant Units" F. William Waknitz. June 2002.
- "The Net-pen Salmon Farming Industry in the Pacific Northwest" Colin Nash. September 2001.

In addition, on June 9, 2008 NOAA concurred with EPA's determination made in a April 17, 2008 BE that this action is not likely to adversely affect listed species including local salmon.

6. The indirect effects of netpen facilities carry a low risk.

There are several other indirect effects which have been identified and commonly associated with netpen facilities. Although these indirect effects are admittedly problems in other areas of the world, the analogy cannot be readily applied to Washington's situation due to the particular regulatory framework in place there, site location restrictions and the small quantity of netpen facilities in Puget Sound. A 2007 NOAA report stated, "The popular media-distributed notion of fish farming habitats often suggests a biological wasteland, heavily impacted by fish feces, waste feed, antibiotics and chemicals. Nothing could be further from the truth for Washington State fish farms..."²³ While an examination of these effects could be considered outside the scope of WAC 173-204-412, EPA notes that NOAA reports do address these indirect effects, indicating that they present a low risk. The indirect effects include:

6a. Dissolved oxygen / Phytoplankton blooms

Dissolved oxygen monitoring is required in the NPDES permit for marine netpen facilities. NOAA assigned low risk to the physiological effect of low dissolved oxygen on other biota in the water column. Since salmon are sensitive to dissolved oxygen, a localized dissolved oxygen effect would first show up in the farmed salmon.²⁴ Another common concern related to netpen facilities is nitrate induced organic enrichment which may result in excessive phytoplankton growths or blooms in nutrient sensitive waters. In 1986, Ecology rated all subareas of Puget Sound for nutrient sensitivity and none of the commercial netpens are located in these waters.²⁵ There is no evidence of netpen facilities causing blooms in the Puget Sound area.²⁶ Furthermore, several studies have concluded that there is no measurable effect of phytoplankton production near salmon farms in Puget Sound.²⁷ NOAA states the likelihood of the enhancement of a harmful algal bloom caused by the inorganic nutrients discharged from netpen facilities in Puget Sound to be highly unlikely due to the natural atmospheric and geographical parameters of the Pacific Northwest.²⁸

6b. Disease transmission /Antibacterial usage / Sea Lice

An increased incidence of disease among wild fish in Puget Sound is considered a low risk by NOAA and there have been few documented cases of this actually occurring. NOAA states, "the specific diseases and their prevalence in Atlantic salmon stocks cultured in net pens in Puget Sound are not shown to be any different than those of the more numerous cultured stocks of Pacific salmon in hatcheries, which in turn are not known to have a high risk for infecting wild salmonids."²⁹ Furthermore, WDFW requires fish growers to report the presence of certain listed pathogens, permits the transfer of fish into netpens and requires review of the stock disease history.³⁰ Also, WDNR states that there is no risk of farmed fish transferring disease to shellfish since fish pathogens are distinct from invertebrate pathogens.³¹ NOAA also states that there is little risk that existing Atlantic salmon stocks will be a vector for the introduction of an exotic pathogen to Puget Sound.³²

Antibiotic usage in netpen facilities is regulated by the US Food and Drug Administration (USFDA) and WDFW. Antibacterial usage has been decreasing according to monitoring required by the NPDES permits.³³ NOAA notes that "there is little risk that the development of an antibiotic-resistant bacteria in netpen salmon farms or Atlantic salmon freshwater hatcheries will impact native salmonids, as similar antibiotic resistance often observed in Pacific salmon hatcheries has not shown to have a negative impact on wild salmon." Some of these compounds have been used in Washington for 40 years without adverse impacts.³⁴ In addition, "case studies show that some of these compounds can be detected in sediments close to the perimeter of netpen farms, but the levels resulting from their authorized use do not show significant widespread adverse effects on either pelagic or benthic resources."³⁵

Although sea lice have been a major concern and topic of research in British Columbia and around the world, Puget Sound has not experienced the same sea lice issues, due in part to water salinity and temperature conditions there.³⁶ The characteristics of Puget Sound, mainly lower salinity and higher temperatures, are believed to lessen the impact of sea lice compared to areas elsewhere in the world with heavy infestation. NOAA findings support the lack of sea lice in Puget Sound: Pharmaceuticals has not been used to control sea lice in Washington State for over 15 years since there have not been significant problems.³⁷ Furthermore, NPDES permits were updated during this past renewal cycle to require sea lice checks and reporting to WDFW and Ecology.³⁸

6c. Escape / Hybridization / Competition

There has been only one escapement event in Puget Sound since 2000 as best management practices have helped prevent the unintentional release of Atlantic salmon from netpens. During the last permit cycle, all eight netpen sites in Puget Sound installed fish containment nets with a heavier nylon material. Therefore, the potential for another escape event has been greatly reduced by the actions of the permittee.³⁹

NOAA has found that there is little risk that escaped Atlantic salmon will hybridize with Pacific salmon.⁴⁰ In addition, there is no evidence of Atlantic salmon - Pacific salmon hybrids in nature.⁴¹ WDFW states that if such a rare event should occur in the wild, the offspring would be incapable of reproduction.⁴²

In regard to competition between escaped Atlantic salmon to native wild salmon, NOAA has determined low to little risk for the following:^{43 44}

- The risk that escaped Atlantic salmon will compete with wild salmon for food or habitat is low, considering their well-known inability to succeed away from their historic range.
- There is little risk that Atlantic salmon will colonize habitats in the Puget Sound Chinook salmon and Hood Canal summer-run chum salmon ESUs.
- There is little risk that escaped Atlantic salmon will prey on Pacific salmon.

These findings of low risk are also similarly supported by WDFW.⁴⁵

WAC 173-204-412(3)(a) Any person with a new facility shall identify a baseline sediment quality prior to facility operation for benthic infaunal abundance, total organic carbon and grain size in the location of the proposed operation and downcurrent areas that may be potentially impacted by the facility discharge;

WAC 173-204-412(3)(b) Any person with an existing operating facility shall monitor sediment quality for total organic carbon levels and identify the location of any sediments in the area of the facility statistically different (t test, $p \leq 0.05$) from the total organic carbon levels identified as facility baseline levels or statistically different from the applicable total organic carbon levels as identified in Table 1:

TABLE 1 - Puget Sound Reference Total Organic Carbon Values	
<i>Silt-Clay Particles (percent Dry Weight)</i>	<i>Total Organic Carbon (percent Dry Weight)</i>
<i>0-20</i>	<i>0.5</i>
<i>20-50</i>	<i>1.7</i>
<i>50-80</i>	<i>3.2</i>
<i>80-100</i>	<i>2.6</i>

EPA ACTION: EPA approves sub-sections WAC 173-204-412(3)(a) and WAC 173-204-412(3)(b) as water quality standards.

RATIONALE: WAC 173-204-412(3)(a) requires that new facilities determine a baseline for benthic infaunal abundance, total organic carbon and grain size. WAC 173-204-412(3)(b) requires existing facilities to establish a baseline for total organic carbon based on the values in Table 1. Since these baselines give reference levels that set sediment quality standards for new and existing facilities, they are water quality standards.

Determining a baseline of benthic infaunal abundance, total organic carbon and grain size is essential for protecting designated uses when a new netpen facility is permitted. For existing facilities, sediment quality monitoring must be close to the reference values for total organic carbon in Puget Sound or the baseline established when the facility was first permitted. If netpen facilities do not meet the baseline or reference values, additional source control and NPDES permitting will address non-compliance.

Due to the potential impact of bio-deposits from fish feces and uneaten food, benthic monitoring is an appropriate indicator to determine the environmental impact of netpen facilities and NPDES permit compliance. In accordance with WAC 173-204-412(3)(a), new facilities must determine a baseline of benthic infaunal abundance, total organic carbon (TOC) and grain size which is essential for protecting designated uses when a new netpen facility is permitted. Existing facility sediment quality monitoring data must be within a statistically significant range to the reference values for total organic carbon in Puget Sound or the baseline established when the facility was first permitted. These TOC values are listed in Table 1 of WAC 173-204-412(3)(b) and appear to be based on Ecology's "Puget Sound Ambient Monitoring Program 1992: Marine Sediment Monitoring Task." WDNR required sediment monitoring under the aquatic land leases from 1987 to 1996 and concluded that sediment grain size and water depth were primary in determining an undisturbed benthic infaunal community. In addition, they found that the "redox potential and health of the infaunal community associated with a particular sediment grain size distribution appears well correlated with the level of TOC in the sediments (Striplin Environmental Associates 1996, Goyette and Brooks, 1999)."⁴⁶ As a result, TOC reference values are an accurate and applicable manner to monitor benthic infaunal abundance. This is emphasized by NOAA, which states that "TOC is important because fish feces and wasted fish feed contain carbon that demand oxygen during bacterial and food web respiration and assimilation."⁴⁷ Therefore, if these TOC values are met, the protection of benthic infaunal abundance can be assumed.

Feeding is typically monitored by facility operations and the NPDES permits state that fish must be feed in a manner which maximizes ingestion, accounts for fish size and digestibility. Rearing density in Washington netpen facilities are from 1 to 1.5 pounds of fish per cubic foot.⁴⁸ This density average is about one-half to two-thirds less than typical Atlantic salmon farms.⁴⁹ The health of benthic communities near netpen facilities is heavily influenced by the amount of food that settles to the sea floor below netpens and the density of fish in the netpens. Further, NOAA states that there may be beneficial environmental effects associated with netpen farming in Puget Sound. A NOAA study from 2004-2006 found that netpens in Puget Sound support a diverse group of over 100 species of seaweeds and invertebrates which are important for the local food web and can be considered a beneficial effect of fish farming.⁵⁰

The impact on the benthic community can be significantly lowered through facility siting regulations. The major factors that affect solids accumulation are the water current, water depth, loading density, feeding rates, and the length of yearly operations – all of which are accounted for in the NPDES permits. Deep water sites and well-flushed sites can affect the accumulation of organic wastes in the sediment that can alter benthic abundance and diversity.^{51 52} At well-flushed sites with high current, the abundance and diversity of benthic organisms is positively

correlated with organic carbon, which suggests netpen facilities may even stimulate benthic communities.⁵³

WAC 173-204-412(4) Sediment impact zones. Marine finfish rearing facilities and their associated discharges that are permitted under a National Pollutant Discharge Elimination System permit are hereby provided a sediment impact zone by rule for any sediment quality impacts and biological effects within and including the distance of one hundred feet from the outer edge of the marine finfish rearing facility structure.

EPA ACTION: EPA approves section WAC 173-204-412(4) as a water quality standard since this provision alters the level of protection under the CWA. EPA approved Washington's sediment management standards in 1991 and WAC 173-204-412(4) modifies the protection given in the sediment standards regarding sediment impact zones. Therefore, this section changes the criteria set in the sediment management standards by allowing netpens to exceed certain sediment quality standards.

RATIONALE: This provision defines the parameters for an acceptable impact. As explained above in WAC 173-204-412(2), this section allows netpen facilities exemption from specific sediment management standard requirements for a sediment impact zone (the footprint of the facility plus one hundred feet outward in each direction). EPA approves this provision for the same reasons described in its approval rationale of WAC 173-204-412(2) as this provision simply reiterates that section.

WAC 173-204-412(4)(a) The department may authorize an individual marine finfish rearing facility sediment impact zone for any sediments beyond a distance of one hundred feet from the facility perimeter via National Pollutant Discharge Elimination System permits or administrative actions. The authorized sediment impact zone shall meet the benthic infaunal abundance requirements of the sediment impact zone maximum criteria, WAC 173-204-420(3)(c)(iii). Marine finfish rearing facilities that exceed the sediment quality conditions of subsection (3)(b) of this section beyond a distance of one hundred feet from the facility perimeter shall:

EPA ACTION: EPA approves sub-section WAC 173-204-412(4)(a) as a water quality standard since this provision alters the level of protection under the CWA.

RATIONALE: This sub-section allows Ecology discretion, under the NPDES program, to extend sediment impact zone beyond one hundred feet. If netpen facilities do not meet the baseline or reference values, additional source control and NPDES permitting addresses non-compliance. WAC 173-204-412(4)(a) makes the requirements more stringent for facilities that are authorized a sediment impact zone beyond 100 feet by applying additional criteria for benthic abundance. The benthic abundance criteria, WAC 173-204-420(3)(c)(iii), requires that sediment impact zone maximum biological effects level are established as that level below which any two of the biological tests in any combination exceed the criteria of WAC 173-204-320(3), or one of the following biological test determinations is made:

- the test sediment has less than 50% of the reference sediment mean abundance of any two of the following major taxa: Class Crustacea, Phylum Mollusca or Class Polychaeta; or
- the test sediment abundances are statistically different (t test, $p \leq 0.05$) from the reference sediment abundances.

As explained above in EPA's approval rationale for WAC 173-204-412(3)(a) and WAC 173-204-412(3)(b), benthic abundance monitoring is the appropriate method for determining the impact of sediment quality by netpen facilities. Extensive monitoring is required in NPDES permits for netpen facilities to ensure benthic impacts do not extend beyond the authorized sediment impact zone.

In addition, EPA's approval of this provision does not alter the protection of designated uses described in the approval rationale of WAC 173-204-412(2).

WAC 173-204-412(4)(a)(i) Begin an enhanced sediment quality monitoring program to include benthic infaunal abundance consistent with the requirements of the National Pollutant Discharge Elimination System permit. The sediment quality monitoring program shall include a benthic infaunal abundance reference sediment sample as required in subsection (3)(a) of this section or a benthic infaunal abundance reference sediment sample in compliance with WAC 173-204-200(21); and

WAC 173-204-412(4)(a)(ii) Be consistent with the sediment source control general considerations of WAC 173-204-400 and the sediment quality goal and sediment impact zone applicability requirements of WAC 173-204-410, apply for a sediment impact zone as determined necessary by the department.

EPA ACTION: EPA approves sub-sections WAC 173-204-412(4)(a)(i) and WAC 173-204-412(4)(a)(ii) as a water quality standard since this provision alters the level of protection under the CWA. These sub-sections are water quality standards since the level of protection is altered due to more stringent requirements of the sediment management standards that are applicable to these facilities.

RATIONALE: Sub-sections 412(4)(a)(i) and (ii) describe the sediment management standards provisions that apply to facilities that exceed sediment quality conditions (exceedance of TOC reference values or TOC baseline) beyond a distance of one hundred feet from the facility perimeter. EPA's approval of these provisions ensures that designated uses are protected as described in the approval rationale of WAC 173-204-412(2).

Sub-section 412(4)(a)(i) is a NPDES permitting procedure that will address non-compliance of TOC values through an enhanced sediment quality monitoring program which will include the:

- baseline of benthic infaunal abundance as mandated in section 3(a);
- or, if the facility did not establish a baseline, they must establish a benthic infaunal abundance reference sediment sample in compliance with the Puget Sound Protocols and Guidelines Document⁵⁴ (WAC 173-204-200(21)).

Sub-section 412(4)(a)(ii) requires consistency with the sediment source control general considerations in WAC 173-204-400 and the sediment quality goal/sediment impact zone applicability requirements in WAC 173-204-410. These sections were previously approved by EPA in 1991, have not been revised, and were not exempted for netpen facilities in WAC 173-204-412(2).

WAC 173-204-412(4)(b) Administrative orders or permits establishing sediment impact zones for marine finfish rearing facilities shall describe establishment, maintenance, and closure requirements as determined necessary by the department.

EPA ACTION: EPA approves sub-section WAC 173-204-412(4)(b) as a water quality standard since this provision alters the level of protection under the CWA.

RATIONALE: EPA's approval of WAC 173-204-412(4)(b), allows for department (Ecology) discretion to give administrative orders or permits describing the establishment, maintenance and closure requirements of marine finfish rearing facilities. EPA believes this provision gives Ecology the authority to increase the stringency of its requirements if the department discovers designated uses are not being protected.

WAC 173-204-420 (3)(c)(iv) Juvenile polychaete: The test sediment has a mean ((biomass)) individual growth rate of less than seventy percent of the reference sediment mean ((biomass)) individual growth rate and the test sediment ((biomass)) mean individual growth rate is statistically different (t test, $p \leq 0.05$) from the reference sediment ((biomass)) mean individual growth rate.

EPA ACTION: EPA approves this revision which changes the metric for juvenile polychaete from biomass to mean individual growth rate for Puget Sound marine sediment impact zone maximum biological effects criteria.

RATIONALE: This provision has been changed to replace biomass with mean individual growth rate as the method to test juvenile polychaete to determine and monitor sediment quality. This alteration is consistent with the change in 315(2)(d), so that biological sediment tests can be compared to the reference sediment biological data. EPA has determined this change alters the level of protection of the sediment quality standards since this provision changes the juvenile polychaete endpoint determination to mean individual growth rate from biomass. Although the revised provision updates the metric, the overall function of the provision to compare test samples to reference samples is unchanged. Since Ecology's adoption of the SMS in 1991, the PSDDA and PSEP implemented this revised endpoint determination and bioassay test procedure.⁵⁵ As a result, this revision is an updated metric to identify a representative indicator of change for juvenile polychaete size to determine if growth has been inhibited by sediment quality. EPA has determined this change is within the State's discretion to choose an appropriate indicator based on best available science and is protective of uses. Therefore, EPA approves this revised provision.

WAC 173-204-520 (3)(d)(iv) Juvenile polychaete: The test sediment has a mean ((biomass)) individual growth rate of less than fifty percent of the reference sediment mean ((biomass)) individual growth rate and the test sediment ((biomass)) mean individual growth rate is statistically different (t test, $p \leq 0.05$) from the reference sediment ((biomass)) mean individual growth rate.

EPA ACTION: EPA approves this revision which changes the metric for juvenile polychaete from biomass to mean individual growth rate for Puget Sound marine sediment cleanup screening levels and minimum cleanup level biological criteria.

RATIONALE: This provision has been changed to replace biomass with mean individual growth rate as the method to test juvenile polychaete to determine and monitor sediment quality. This alteration is consistent with the change in 315(2)(d), so that biological sediment tests can be compared to the reference sediment biological data. EPA has determined this change alters the level of protection of the sediment quality standards since this provision changes the juvenile polychaete endpoint determination to mean individual growth rate from biomass. Although the revised provision updates the metric, the overall function of the provision to compare test samples to reference samples is unchanged. Since Ecology's adoption of the SMS in 1991, the PSDDA

and PSEP implemented this revised endpoint determination and bioassay test procedure.⁵⁶ As a result, this revision is an updated metric to identify a representative indicator of change for juvenile polychaete size to determine if growth has been inhibited by sediment quality. EPA has determined this change is within the State's discretion to choose an appropriate indicator based on best available science and is protective of uses. Therefore, EPA approves this revised provision.

2. REVISIONS ON WHICH EPA IS TAKING NO ACTION UNDER SECTION 303(C) OF THE CWA

This section describes the revisions of Washington's SMS on which EPA is taking no action under Section 303(c) of the CWA. The section is divided into two sub-sections:

- 2.1. Provisions of Section 412 which are not water quality standards. EPA's determination to take no action on these provisions is provided in more detail since these are new provisions added in 1996.
- 2.2. This chart describes the revisions, outside of Section 412, to Washington's SMS and EPA's determination for no action. EPA has determined either these revisions are to provisions that are not water quality standards or the revisions are non-substantive and thus do not require action under section 303(c) of the CWA.

2.1. Provisions of Section 412 which are not water quality standards.

EPA has determined the following provisions of Section 412 are not water quality standards under Section 303(c) of the CWA and therefore do not require EPA action. These provisions are:

- *WAC 173-204-412(1) Purpose; and*
- *WAC 173-204-412(3), (3)(c), (3)(d), (3)(e) Sediment monitoring requirements of marine finfish rearing facilities.*

On June 30, 1999, EPA notified Ecology of which sections of the SMS were applicable water quality standards subject to 40 CFR 131.21 (the Alaska Rule of 2000). EPA identified WAC 173-204-412 as a water quality standard at that time. Based on a more in-depth analysis, EPA has since determined that certain sub-sections of Section 412 are not water quality standards. Today's action alters the determinations made by EPA in 1999 regarding these provisions' status as water quality standards.

Water quality standards describe the desired condition of a waterbody and consist of three elements: (1) the "designated uses" of the state's waters, such as public water supply, recreation, propagation of fish, or navigation; (2) "criteria" specifying the amounts of various pollutants, in either numeric or narrative form, that may be present in those waters without impairing the designated uses; and (3) antidegradation requirements, providing for protection of existing water uses and limitations on degradation of high quality waters. 40 CFR 131.3(i), 131.12. The following provisions do not define or revise the designated use of a waterbody. The provisions do not establish water quality criteria or alter the level of protection afforded by water quality criteria. Finally, they do not establish or alter antidegradation policies. Rather, these provisions either give background and purpose or provide implementation procedures under NPDES and are therefore not water quality standards.

WAC 173-204-412(1) Purpose. This section sets forth the applicability of this chapter to marine finfish rearing facilities only. This section also identifies marine finfish rearing facility siting,

operation, closure and monitoring requirements to meet the intent of this chapter, as applicable.

EPA ACTION: WAC 173-204-412(1) covers the purpose of the marine finfish rearing facility provision in Washington's SMS and is not a water quality standard. Therefore, EPA acknowledges the addition of this provision but is not required to take an action on this provision under Section 303(c) of the CWA.

RATIONALE: This provision provides background on the applicability and function of the marine finfish rearing facility provision and is not a water quality standard. This provision is a general policy statement regarding the purpose of the marine finfish rearing facility provision and as such is not a water quality standard under Section 303(c) of the CWA.

WAC 173-204-412(3) Sediment monitoring. Sediment quality compliance and monitoring requirements for marine finfish rearing facilities shall be addressed through National Pollutant Discharge Elimination System or other permits issued by the department for facility operation. Marine finfish rearing facilities shall meet the following sediment quality monitoring requirements:

EPA ACTION: Section WAC 173-204-412(3) describes sediment monitoring procedures under NPDES and is not a water quality standard. Therefore, EPA acknowledges the addition of this provision but is not required to take an action on this provision under the CWA.

RATIONALE: Many State water quality standards regulations contain provisions that specify the terms of permits under the National Pollutant Discharge Elimination System (NPDES). These provisions allow for NPDES permitting to be adjusted incorporating specific knowledge and experience regarding compliance monitoring. Since these programs are related to the implementation, maintenance and protection of water quality, they are often included in state water quality standards. However, these provisions are beyond the scope of Section 303(c) of the Clean Water Act.

Provisions that describe the implementation (compliance, monitoring, closure, etc.) of NPDES permits necessary for the State to make an attainment decision and do not change a level of protection are not water quality standards although they may be methodologies under section 303(d). This section, unlike sections WAC 173-204-412(2) and WAC 173-204-412(4), does not alter the level of protection afforded by Washington's sediment management standards. Therefore, EPA is not acting on this language because it is not a water quality standard subject to review under Section 303(c) of the Clean Water Act.

WAC 173-204-412(3)(c) The locations and frequency of monitoring for total organic carbon, benthic infaunal abundance and other parameters shall be determined by the department and identified in the applicable National Pollutant Discharge Elimination System permit;

WAC 173-204-412(3)(d) Antibacterials. Reserved: The department shall determine on a case-by-case basis the methods, procedure, locations, and frequency for monitoring antibacterials associated with the discharge from a marine finfish rearing facility;

WAC 173-204-412(3)(e) Closure. All permitted marine finfish rearing facilities shall monitor sediments impacted during facility operation to document recovery of sediment quality to background levels. The department shall determine on a case-by-case basis the methods, procedure, locations, and frequency for monitoring sediments after facility closure.

EPA ACTION: Sub-sections WAC 173-204-412(3)(c),(d),(e) describe implementation procedures under NPDES and are not water quality standards. Therefore, EPA acknowledges the addition of these provisions but is not required to take an action on these provisions under the CWA.

RATIONALE: Many State water quality standards regulations contain provisions that specify the terms of permits under NPDES. Sub-sections WAC 173-204-412(3)(c),(d),(e) allow for NPDES permitting to be adjusted incorporating specific knowledge and experience regarding monitoring, antibacterials and closure. Since these programs are related to the implementation, maintenance and protection of water quality, they are often included in state water quality standards. However, these provisions are beyond the scope of Section 303(c) of the Clean Water Act.

Provisions that describe the implementation (compliance, monitoring, closure, etc.) of NPDES permits necessary for the State to make an attainment decision and do not change a level of protection are not water quality standards although they may be methodologies under Section 303(d). This section, unlike sections WAC 173-204-412(2) and WAC 173-204-412(4), does not alter the level of protection afforded by Washington's sediment management standards. Therefore, EPA is not acting on this language because it is not a water quality standard subject to review under Section 303(c) of the Clean Water Act.

Additionally, it should be noted that requirements regarding the use of antibacterials and chemicals for disease control at marine finfish rearing facilities are covered extensively in Washington's Wastewater Discharge Standards and Effluent Limitations, WAC 173-221A-110(4)(b)(ii).

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2.2 Provisions outside of Section 412 which do not require EPA action under section 303(c) of the CWA.

EPA has determined either these revisions are to provisions that are not water quality standards or the revisions are non-substantive and thus do not require action under section 303(c) of the CWA.

Categories for no action:

- a. The provision revised is not a water quality standard within the scope of CWA section 303(c). (*indicated by shading*)
- b. The revision is non-substantive since it does not alter the meaning or application of the water quality standard previously approved by EPA.

New or revised language is underlined and deleted language is struck out.

REVISION	REASON FOR NO ACTION
<p>WAC 173-204-100 (7) This chapter establishes and defines a goal of minor adverse effects as the maximum level of sediment contamination allowed in sediment impact zones under the provisions of Part IV, Sediment source control standards and as <u>the cleanup screening levels for identification of sediment cleanup sites</u> and as the minimum ((degree of)) <u>cleanup levels</u> to be achieved in all cleanup actions under Part V, Sediment cleanup standards.</p>	<p>The revision describes the authority and purpose of the Sediment Management Standards which provides a goal of sediment quality standards. The minor editorial revision to further explain the goal of the sediment quality standards does not substantially change the meaning or application of the standards. Therefore, EPA is not acting on the changes to this provision.</p>
<p>WAC 173-204-100 (8) [Updated notes section to identify Ecology's new mailing address.]</p>	<p>The revision describes the authority and purpose of the Sediment Management Standards regarding local ordinances and is not a water quality standard. EPA acknowledges this revision but is not acting on it since the provision is not a water quality standard. The revision updates a mailing address.</p>
<p>WAC 173-204-130 (8) [Reference to section (7) corrected to section (6)]</p>	<p>The revision describes an administrative policy regarding public involvement and education and therefore is not a water quality standard. EPA acknowledges this formatting revision but is not acting on it since the provision is not a water quality standard.</p>
<p>WAC 173-204-200 (2) "Amphipod" means crustacean of the Class Amphipoda, e.g., <u>Rhepoxynius abronius, Ampelisca abdita, or Eohaustorius estuarius.</u></p>	<p>The revision is a minor editorial change which gives examples of two additional species for Amphipod. EPA acknowledges this change to the definition but is not acting on it since it does not substantially alter the meaning of the definition.</p>
<p>WAC 173-204-200 (21) "Puget Sound protocols" means Puget Sound Estuary Program. 1986. ((Updated in 1989.)) <u>As amended.</u> Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound, U.S. Environmental Protection Agency, Region 10, Seattle, WA (looseleaf) ((,as amended)).</p>	<p>The revision is a non-substantive formatting change which replaces "updated in 1989" with "as amended" to make the most current version of the Puget Sound protocols in effect. EPA acknowledges this change to the definition but is not acting on it since it does not substantially alter the meaning of the definition.</p>

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REVISION	REASON FOR NO ACTION
WAC 173-204-200 [Renumbering of definitions (13) – (26) due to additional definition of “Marine finfish rearing facilities”]	EPA acknowledges this non-substantive formatting change which renumbers definitions 13-26, but is not acting on it since it does substantially change the meaning or application of the standards.
WAC 173-204-315 (1)(a)(i) Amphipod: Ten-day mortality sediment bioassay for the Amphipod, i.e., <u>Rhepoxynius abronius</u> , <u>Ampelisca abdita</u> , or <u>Eohaustorius estuarius</u> .	The minor editorial revision to include two additional example Amphipod species for testing is a revision which does not substantially change the meaning or application of the standards. Therefore, EPA is not acting on the changes to this provision.
WAC 173-204-315 (1)(a)(ii)(B) <u>Mytilus (edulis) galloprovincialis</u> , i.e., Blue mussel;	The minor editorial revision to reflect current scientific taxonomic nomenclature is a revision which does not substantially change the meaning or application of the standards. Therefore, EPA is not acting on the changes to this provision.
WAC 173-204-315 (1)(a)(ii)(C) Strongylocentrotus purpuratus, i.e., Purple sea urchin; ((or))	The minor editorial revision which removes the word “or”, is a revision which does not substantially change the meaning or application of the standards. Therefore, EPA is not acting on the changes to this provision.
WAC 173-204-315 (1)(a)(ii)(D) <u>Strongylocentrotus droebachiensis</u> , i.e., Green sea urchin; or	The minor editorial revision to add green sea urchin as a species that can be used for larval mortality/abnormality sediment bioassays is a revision which does not substantially change the meaning or application of the standards. Therefore, EPA is not acting on the changes to this provision.
WAC 173-204-315 (1)(a)(ii)(E) [Renumbering]	The non-substantive formatting revision which renumbers the provision does not substantially change the meaning or application of the standards. Therefore, EPA is not acting on the changes to this provision.
WAC 173-204-315(1)(b)(i) Benthic infaunal abundance: Abundance of the following major taxa: <u>Class Crustacea</u> , <u>Class Polychaeta</u> , and <u>Phylum Mollusca</u> .	The minor editorial revision to reflect current scientific taxonomic nomenclature is a revision which does not substantially change the meaning or application of the standards. Therefore, EPA is not acting on the changes to this provision.
WAC 173-204-315(1)(b)(iii) Microtox saline extract: Decreased luminescence from the bacteria ((Photobacterium phosphoreum)) <u>Vibrio fisheri</u> after a fifteen minute exposure.	The minor editorial revision to reflect current scientific taxonomic nomenclature is a revision which does not substantially change the meaning or application of the standards. Therefore, EPA is not acting on the changes to this provision.
WAC 173-204-320 (2) <ul style="list-style-type: none"> • [Removed footnotes of Table I and placed them in subsection (2). • Restated footnote 1 – detection limit criteria – for consistency with current scientific methods. • Restated footnotes 3 and 4 LPAH and HPAH summing procedures respectively for clarity and consistency with current scientific methods. • Removed header “Chemical Parameter” from Table I.] 	The chemical criteria in the Table have not been revised. However, the footnotes have been updated to clarify testing methods and laboratory analysis of sediment samples as well as updated for consistency with other sections of WAC 173-204-320. The revision regarding the chemical summing method clarifies protocols regarding detection limits and reporting. ⁵⁷ EPA is not acting on this minor editorial revision since the changes do not alter the meaning of the provision and do not substantially change the meaning or application of the standards. This revision also includes a formatting change by removing the footnotes and putting them as text in the provision and removing a header in the table.

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REVISION	REASON FOR NO ACTION
<p>WAC 173-204-320 (3)(c) Benthic abundance: The test sediment has less than fifty percent of the reference sediment mean abundance of any one of the following major taxa: <u>Class</u> Crustacea, <u>Phylum</u> Mollusca or <u>Class</u> Polychaeta, and the test sediment abundance is statistically different (t test, $p \leq 0.05$) from the reference sediment abundance.</p>	<p>The minor editorial revision to reflect current scientific taxonomic nomenclature does not substantially change the meaning or application of the standards. Therefore, EPA is not acting on the changes to this provision.</p>
<p>WAC 173-204-400 (11) Wastewater dilution zones. Water quality mixing zones authorized by the department pursuant to chapter ((173-204)) 173-201A WAC, Water quality standards for surface waters of the state of Washington, do not satisfy the standards of WAC 173-204-415, Sediment Impact Zones.</p>	<p>EPA is not acting on this revision since this provision is not a water quality standard. The revision renames the regulatory citation for Washington's Water Quality Standards.</p>
<p>WAC 173-204-410 (6)(d)(i) The department shall issue sediment impact zone authorizations with requirements for application of best management practices stipulated by the department on an approved time schedule. ((The sediment impact zone maximum criteria of WAC 173-204-420 shall not be applicable during the approved time schedule authorized by the department.))</p>	<p>EPA is not acting on this revision since this provision is not a water quality standard. The removal of this sentence was eliminated for clarification purposes since it was repetitive.</p>
<p>WAC 173-204-415 (1)(f) [Corrected typographical error from 5 to 4 to correctly reference the design requirements subsection of section 415.]</p>	<p>EPA acknowledges this non-substantive formatting change which renumbers the provision, but is not acting on it since it does not substantially change the meaning or application of the standards.</p>
<p>WAC 173-204-415 (4), (4)(a)(iii), (4)(b), [Included "PLUMES" as a sediment monitoring tool and eliminated the number 4 after WASP.]</p>	<p>EPA is not acting on this revision since this provision is not a water quality standard. The addition of the PLUMES monitoring tool provides another option based on best available science to meet sediment monitoring requirements.</p>
<p>WAC 173-204-415(5)(c)(i) [Included "PLUMES" as a sediment monitoring tool and eliminated the number 4 after WASP.]</p>	<p>The minor editorial change to add another sediment monitoring tool, PLUMES, does not substantially change the meaning or application of this provision. Therefore, EPA is not acting on the changes to this provision.</p>
<p>WAC 173-204-420 (2)</p> <ul style="list-style-type: none"> • [Removed footnotes of Table II and placed them in subsection (2). • Restated footnote 1 – detection limit criteria – for consistency with current scientific methods. • Restated footnotes 3 and 4 LPAH and HPAH summing procedures respectively for clarity and consistency with current scientific methods. • Removed header "Chemical Parameter" from Table II.] 	<p>The chemical criteria in the Table have not been revised. However, the footnotes have been updated to clarify testing methods and laboratory analysis of sediment samples as well as updated for consistency with other sections of WAC 173-204-420. The revision regarding the chemical summing method clarifies protocols regarding detection limits and reporting.⁵⁸ EPA is not acting on this minor editorial revision since the changes do not alter the meaning of the provision and do not substantially change the meaning or application of the standards. This revision also includes a formatting change by removing the footnotes and putting them as text in the provision and removing a header in the table.</p>

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Technical Justification; September 18, 2008*

REVISION	REASON FOR NO ACTION
<p>WAC 173-204-420 (3)(c)(i) Amphipod: The test sediment has a higher (statistically significant, t test, $p \leq 0.05$) mean mortality than the reference sediment and the test sediment mean mortality is ((more than thirty percent higher)) <u>greater than a value represented by the reference sediment mean mortality</u> ((on an absolute basis)) <u>plus thirty percent</u>; or</p>	<p>This formatting revision clarifies the language of the provision. EPA is not acting on this revision since the changes do not alter the meaning of the provision and do not substantially change the meaning or application of the standards.</p>
<p>WAC 173-204-420 (3)(c)(iii) Benthic abundance: The test sediment has less than fifty percent of the reference sediment mean abundance of any one of the following major taxa: <u>Class Crustacea</u>, <u>Phylum Mollusca</u> or <u>Class Polychaeta</u>, and the test sediment abundance is statistically different (t test, $p \leq 0.05$) from the reference sediment abundances; or</p>	<p>The minor editorial revision to reflect current scientific taxonomic nomenclature does not substantially change the meaning or application of the standards. Therefore, EPA is not acting on the changes to this provision.</p>
<p>WAC 173-204-510 (2) A station cluster is defined as any number of stations from the inventory of WAC 173-204-350 that are determined to be ((contiguous)) <u>spatially and chemically similar</u>. [Continue previous language.]</p>	<p>EPA is not acting on this revision since this provision is not a water quality standard. This revision clarifies a definition contained in the provision.</p>
<p>WAC 173-204-520 (2)</p> <ul style="list-style-type: none"> • [Removed footnotes of Table III and placed them in subsection (2). • Restated footnote 1 – detection limit criteria – for consistency with current scientific methods. • Restated footnotes 3 and 4 LPAH and HPAH summing procedures respectively for clarity and consistency with current scientific methods. • Removed header “Chemical Parameter” from Table III.] 	<p>The chemical criteria in the Table have not been revised. However, the footnotes have been updated to clarify testing methods and laboratory analysis of sediment samples as well as updated for consistency with other sections of WAC 173-204-520. The revision regarding the chemical summing method clarifies protocols regarding detection limits and reporting.⁵⁹ EPA is not acting on this minor editorial revision since the changes do not alter the meaning of the provision and do not substantially change the meaning or application of the standards. This revision also includes a formatting change by removing the footnotes and putting them as text in the provision and removing a header in the table.</p>
<p>WAC 173-204-520 (3)(d)(i) Amphipod: The test sediment has a higher (statistically significant, t test, $p \leq 0.05$) mean mortality than the reference sediment and the test sediment mean mortality is ((more than thirty percent higher)) <u>greater than a value represented by the reference sediment mean mortality</u> ((on an absolute basis)) <u>plus thirty percent</u>.</p>	<p>This formatting revision clarifies the language of the provision. EPA is not acting on this revision since the changes do not alter the meaning of the provision and do not substantially change the meaning or application of the standards.</p>

*EPA's Approval of Washington's 1996 Sediment Management Standard Revisions
Technical Justification; September 18, 2008*

REVISION	REASON FOR NO ACTION
<p>WAC 173-204-520 (3)(d)(iii) Benthic abundance: The test sediment has less than fifty percent of the reference sediment mean abundance of any two of the following major taxa: <u>Class Crustacea</u>, <u>Phylum Mollusca</u> or <u>Class Polychaeta</u>, and the test sample abundances are statistically different (t test, $p \leq 0.05$) from the reference abundances.</p>	<p>The minor editorial revision to reflect current scientific taxonomic nomenclature does not substantially change the meaning or application of the standards. Therefore, EPA is not acting on the changes to this provision.</p>
<p>WAC 173-204-530 [Title] Hazard assessment and site identification.</p>	<p>EPA is not acting on this revision since this provision is not a water quality standard. This revision provides a minor modification to the title of the subsection.</p>
<p>WAC 173-204-530 (2)(b) ((Identifying and characterizing)) <u>Identify and characterize</u> the present and historic source or sources of contamination.</p>	<p>EPA is not acting on this revision since this provision is not a water quality standard. This revision provides a minor modification to the wording of the provision.</p>
<p>WAC 173-204-530 (2)(c) ((Identifying)) <u>Identify</u> the location of sediment impact zones authorized under WAC 173-204-415.</p>	<p>EPA is not acting on this revision since this provision is not a water quality standard. This revision provides a minor modification to the wording of the provision.</p>
<p>WAC 173-204-530 (2)(d) ((Identifying)) <u>Identify</u> sensitive resources in the vicinity of the station cluster of potential concern.</p>	<p>EPA is not acting on this revision since this provision is not a water quality standard. This revision provides a minor modification to the wording of the provision.</p>
<p>WAC 173-204-530 (2)(e) ((Providing)) <u>Provide</u> other information as determined necessary by the department for ranking sites under WAC 173-204-540.</p>	<p>EPA is not acting on this revision since this provision is not a water quality standard. This revision provides a minor modification to the wording of the provision.</p>
<p>WAC 173-204-560 (4)(c)(i) [Previous language.] ((Properties)) <u>Recontamination potential</u> of sediments which are likely to influence the type and rate of contaminant migration, or are likely to affect the ability to implement alternative cleanup actions shall be characterized;</p>	<p>EPA is not acting on this revision since this provision is not a water quality standard. This revision provides a minor modification to the wording of the provision.</p>
<p>WAC 173-204-560 (4)(f)(ii)(A) The time period during which a sediment recovery zone is projected to be necessary based on source loading and net environmental recovery processes <u>determined by application of the department's sediment recovery zone computer models "CORMIX," "PLUMES," and/or "WASP," or an alternate sediment recovery zone model(s) approved by the department under WAC 173-204-130(4) as limited by the standards of this section and the department's best professional judgment;</u></p>	<p>EPA is not acting on this revision since this provision is not a water quality standard. The language revision about methods for determining appropriate sediment recovery does not substantially alter the meaning or application of the provision.</p>

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Technical Justification, September 18, 2008*

REVISION	REASON FOR NO ACTION
<p>WAC 173-204-590 (2)(a) <u>The sediment recovery zone shall be determined by the application of the department's sediment recovery zone computer models "CORMIX," "PLUMES," and/or "WASP," or an alternate sediment recovery zone model(s) approved by the department under WAC 173-204-130(4) as limited by the standards of this section and the department's best professional judgment.</u></p>	<p>The revision to include language about methods for determining appropriate sediment recovery does not substantially alter the meaning or application of the standards and EPA is not acting on the changes to this provision. This provision reiterates the test methods that have been provided earlier in assessment and allows for future models to be used based on the best professional judgment of the department.</p>

Endnotes:

- ¹ Betts, Brett. Washington State Department of Ecology Triennial Review of Sediment Management Standards (SMS) Rule. Chapter 173-204 WAC. "Review of New Scientific Information and Proposed Modification to the SMS Rule – Juvenile Polychaete Bioassay." May 1995.
- ² Sparks-McConkey, Pamela. Washington State Department of Ecology Triennial Review of Sediment Management Standards (SMS) Rule. Chapter 173-204 WAC. "Review of New Scientific Information and Proposed Modifications to the SMS Rule – Larval Bioassay." May 1995.
- ³ Betts, Brett. Washington State Department of Ecology Triennial Review of Sediment Management Standards (SMS) Rule. Chapter 173-204 WAC. "Review of New Scientific Information and Proposed Modification to the SMS Rule – Juvenile Polychaete Bioassay." May 1995.
- ⁴ Betts, Brett. Washington State Department of Ecology Triennial Review of Sediment Management Standards (SMS) Rule. Chapter 173-204 WAC. "Review of New Scientific Information and Proposed Modification to the SMS Rule – Juvenile Polychaete Bioassay." May 1995.
- ⁵ Betts, Brett. Washington State Department of Ecology Triennial Review of Sediment Management Standards (SMS) Rule. Chapter 173-204 WAC. "Review of New Scientific Information and Proposed Modification to the SMS Rule – Juvenile Polychaete Bioassay." May 1995.
- ⁶ 173-204-100(3) provides a regulatory and management goal for the quality of sediments throughout the state. 173-204-100(7) establishes and defines a goal of minor adverse effects as the maximum level of sediment contamination allowed in sediment impact zones.
- ⁷ 173-204-320 identifies sediment quality standards that will result in no adverse effects, including no acute or chronic adverse effects on biological resources and no significant health risk to humans.
- ⁸ 173-204-415 sets forth the standards for establishment, maintenance, and closure of sediment impact zones.
- ⁹ 173-204-420 establishes minor adverse effects as the maximum chemical contaminant concentration, maximum health risk to humans, maximum biological effects level, maximum other toxic, radioactive, biological, or deleterious substance level, and maximum nonanthropogenically affected sediment quality level allowed within authorized sediment impact zones due to an existing or proposed discharge.
- ¹⁰ Washington State Department of Ecology. NPDES Permit Factsheets for American Gold Seafoods, Inc. 2007.
- ¹¹ EPA Water Quality Standards Handbook. Second Edition. 1994.
<<http://www.epa.gov/waterscience/standards/handbook/>>
- ¹² Waknitz, F.W., et al. NOAA Fisheries Technical Memorandum. "Review of Potential Impacts of Atlantic Salmon Culture on Puget Sound Chinook Salmon and Hood Canal Summer-Run Chum Salmon Evolutionarily Significant Units." NFMFS-NWFSC-53. June 2002.
<<http://www.nwfsc.noaa.gov/publications/techmemos/tm53/tm53.pdf>>
- ¹³ Puget Sound Action Team. About Puget Sound. Accessed online March 7, 2008.
<http://www.psat.wa.gov/About_Sound/AboutPS.htm>
- ¹⁴ Washington State Department of Ecology. "Upland Fin-Fish Hatching and Rearing NPDES General Permit Fact Sheet." June 1, 2005.
<http://www.ecv.wa.gov/programs/wq/permits/permit_pdfs/upland_fin_fish/FinFishHatchery_Factsheet.pdf>
- ¹⁵ Washington State Department of Ecology. NPDES Permit Factsheets for American Gold Seafoods, Inc. 2007.
- ¹⁶ Nash, C.E. NOAA Fisheries Technical Memorandum. NFS-NWFSC-49. 2001.
- ¹⁷ Washington Department of Natural Resources. Technical Report. 1999.
- ¹⁸ Washington State Department of Ecology. Response to Comments for the 2007 Netpen Draft NPDES Permits. 2007.
- ¹⁹ Washington State Department of Ecology. NPDES Permit Factsheets for American Gold Seafoods, Inc. 2007.
- ²⁰ Washington State Department of Ecology. NPDES Permits for American Gold Seafoods, Inc. 2007.
<http://www.ecv.wa.gov/programs/wq/permits/northwest_permits.html>

- ²¹ Washington State Department of Natural Resources. Aquaculture Leasing Statutory and Regulatory Framework. Revised Code of Washington (RCW). Accessed online March 10, 2008.
<http://www.dnr.wa.gov/Publications/aqr_aqua_rcw_wacs.pdf>
- ²² Washington State Department of Ecology. NPDES Permit Factsheets for American Gold Seafoods, Inc. 2007.
- ²³ Beneficial Environmental Effects of Marine Finfish Mariculture” J.E. Rensel and J.R.M. Forster. July 2007.
- ²⁴ Nash, C.E. NOAA Fisheries Technical Memorandum. NFS-NWFSC-49. 2001.
- ²⁵ Washington State Department of Ecology. NPDES Permit Factsheets for American Gold Seafoods, Inc. 2007.
- ²⁶ Washington Department of Natural Resources. Technical Report. 1999.
- ²⁷ Waknitz, F.W., et al. NOAA Fisheries Technical Memorandum. NFMFS-NWFSC-53. 2002.
- ²⁸ Nash, C.E. NOAA Fisheries Technical Memorandum. NFS-NWFSC-49. 2001.
- ²⁹ Nash, C.E. NOAA Fisheries Technical Memorandum. NFS-NWFSC-49. 2001.
- ³⁰ Washington State Department of Ecology. Response to Comments for the 2007 Netpen Draft NPDES Permits. 2007.
- ³¹ Washington Department of Natural Resources. Technical Report. 1999.
- ³² Waknitz, F.W., et al. NOAA Fisheries Technical Memorandum. NFMFS-NWFSC-53. 2002.
- ³³ Washington State Department of Ecology. Response to Comments for the 2007 Netpen Draft NPDES Permits. 2007.
- ³⁴ Waknitz, F.W., et al. NOAA Fisheries Technical Memorandum. NFMFS-NWFSC-53. 2002.
- ³⁵ Nash, C.E. NOAA Fisheries Technical Memorandum. NFS-NWFSC-49. 2001.
- ³⁶ Beneficial Environmental Effects of Marine Finfish Mariculture” J.E. Rensel and J.R.M. Forster. July 2007.
- ³⁷ Nash, C.E. NOAA Fisheries Technical Memorandum. NFS-NWFSC-49. 2001.
- ³⁸ Washington State Department of Ecology. Response to Comments for the 2007 Netpen Draft NPDES Permits. 2007.
- ³⁹ Washington State Department of Ecology. Response to Comments for the 2007 Netpen Draft NPDES Permits. 2007.
- ⁴⁰ Waknitz, F.W., et al. NOAA Fisheries Technical Memorandum. NFMFS-NWFSC-53. 2002.
- ⁴¹ Nash, C.E. NOAA Fisheries Technical Memorandum. NFS-NWFSC-49. 2001.
- ⁴² Washington State Department of Fish and Wildlife. Fact Sheet. 2001.
- ⁴³ Nash, C.E. NOAA Fisheries Technical Memorandum. NFS-NWFSC-49. 2001.
- ⁴⁴ Waknitz, F.W., et al. NOAA Fisheries Technical Memorandum. NFMFS-NWFSC-53. 2002.
- ⁴⁵ Washington State Department of Fish and Wildlife. Fact Sheet. 2001.
- ⁴⁶ Washington State Department of Ecology. “Response to Comments for the 2007 Draft Marine Salmon Netpen NPDES Permits for American Gold Seafoods, Inc.” Northwest Regional Office. October 22, 2007.
<http://www.ecy.wa.gov/programs/wq/permits/permit_pdfs/american_gold/clam_bay/AmGoldSea_ResponseSummary.pdf>
- ⁴⁷ Rensel, J.E. and J.R.M. Forster. “Beneficial Environmental Effects of Marine Finfish Mariculture.” NOAA. 2007.
- ⁴⁸ Washington State Department of Ecology. NPDES Permit Factsheets for American Gold Seafoods, Inc. 2007.
- ⁴⁹ American Gold Seafoods, Inc. Accessed online March 4, 2008.
<<http://www.americangoldseafoods.com/index.html>>
- ⁵⁰ Rensel, J.E. and J.R.M. Forster. “Beneficial Environmental Effects of Marine Finfish Mariculture.” Prepared for NOAA National Marine Fisheries Service. NOAA Award # NA04OAR4170130. July 22, 2007.
- ⁵¹ Nash, C.E. NOAA Fisheries Technical Memorandum. NFS-NWFSC-49. 2001.
- ⁵² Washington Department of Natural Resources. Technical Report. 1999.
- ⁵³ Nash, C.E. NOAA Fisheries Technical Memorandum. NFS-NWFSC-49. 2001.
- ⁵⁴ Revised in 1997; <http://www.psat.wa.gov/Publications/protocols/protocol.html>

⁵⁵ Betts, Brett. Washington State Department of Ecology Triennial Review of Sediment Management Standards (SMS) Rule. Chapter 173-204 WAC. "Review of New Scientific Information and Proposed Modification to the SMS Rule – Juvenile Polychaete Bioassay." May 1995.

⁵⁶ Betts, Brett. Washington State Department of Ecology Triennial Review of Sediment Management Standards (SMS) Rule. Chapter 173-204 WAC. "Review of New Scientific Information and Proposed Modification to the SMS Rule – Juvenile Polychaete Bioassay." May 1995.

⁵⁷ Brangdon-Cook, Kathryn. Washington State Department of Ecology Triennial Review of Sediment Management Standards (SMS) Rule. Chapter 173-204 WAC. "Review of New Scientific Information and Proposed Modifications to the SMS Rule – Chemical Summing for LPAH, HPAH, Benzofluoranthenes and Total PCB's Groups." May 1995.

⁵⁸ Brangdon-Cook, Kathryn. Washington State Department of Ecology Triennial Review of Sediment Management Standards (SMS) Rule. Chapter 173-204 WAC. "Review of New Scientific Information and Proposed Modifications to the SMS Rule – Chemical Summing for LPAH, HPAH, Benzofluoranthenes and Total PCB's Groups." May 1995.

⁵⁹ Brangdon-Cook, Kathryn. Washington State Department of Ecology Triennial Review of Sediment Management Standards (SMS) Rule. Chapter 173-204 WAC. "Review of New Scientific Information and Proposed Modifications to the SMS Rule – Chemical Summing for LPAH, HPAH, Benzofluoranthenes and Total PCB's Groups." May 1995.